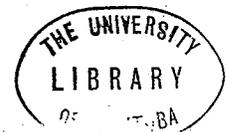The Design Of A Data Base For
The Canadian Grain Trade

A Thesis
Presented to
The Faculty of Graduate Studies and Research
The University of Manitoba

In Partial Fullfillment
of the Requirements for the Degree
Master of Science in Computing Science

by
Donald B. Fast
September, 1969

ABSTRACT

In recent years software designers have directed more attention to the use of the computer-centered data base for generalized information systems. The research reported in this thesis involves the development of a data base which crosses corporate boundaries within the Canadian Grain Trade in order to facilitate the acquisition and dissemination of information. A quantitative study has been conducted on the overhead incurred by the data base handler when the data accessing function is separated from the problem program. Previous work on information privacy has been extended to better satisfy the needs of a data base system.

ACKNOWLEDGMENTS

I wish to express my appreciation to my thesis supervisor,

Professor B. E. Clark, for his advice and criticism which has been so

helpful to me in this research.

I wish to thank Dr. H. F. Bjarnason and Professor J. M. Wells

for their time spent in reading this thesis, and for their helpful comments

and criticisms.

I wish to thank The Canadian Wheat Board, especially

Mr. M. H. Head, Director Data Processing Division, for the encourage-

ment, suggestions, and financial support given me in this research.

I also wish to thank The Board of Grain Commissioners for

Canada, The United Grain Growers Limited, and The Canadian Pacific

Railway for allowing me to study certain aspects of their systems and

for the assistance given me in this respect.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

The Data Base and Information Systems

1.1 Introduction

Although powerful machines exist for dealing with large masses of business data, it is becoming increasingly evident that few organizations are using this potential resource to its full capabilities. The early pioneering dream of the computer as the nerve center of the business complex quickly gave way to the more immediately feasible and economically viable realities of data processing.

Information system development efforts have essentially utilized a direct approach in which an eventual user identified his requirements and system designers developed a system to meet these needs. Unfortunately the information that management requires varies according to its current needs. It is only through use that the limitations and deficiencies of a system are discovered and only then that new requirements and new applications become apparent.

In general, the data files associated with an information system are oriented to specific functional areas within the organization. Because each data file was specifically designed to satisfy the needs of the applications it served, the same items of information can often be found in numerous files and in differing formats. This variance in the format of common data means that applications programs must be

tailored to specific data organizations.

This approach to data management requires that each program in the system contain a description of the information files and fields to be processed in addition to a description of the processing required. As soon as the slightest change occurs, even the movement by one position of a single item of information, the affected programs, and perhaps many others in the system, require programmer attention prior to incorporating the change. Thus in order to satisfy management's dynamic requirements for information, applications programs often are in an almost perpetual state of change, adding appreciably to the overall cost of information processing.

In recent years the advent of less expensive terminal equipment and direct access storage devices has revived the concept of the computer as the nerve center of the business. System designers are adopting an on-line interactive approach to information systems through which the user himself can query his data files.

The prime goal in designing an on-line management information system is to make available, on request, any fact or combination of facts about the business. Conventional information systems are unable to provide this generalized facility because their files have been specifically organized for data processing.

With the aim of reducing many of the problems associated

with the development and maintenance of on-line information systems

a new class of information systems, known as computer-centered data

base systems, has been evolving and is finding application in

commercial environments.

A data base can be regarded as an interrelated collection

of data items in which duplication is kept to a minimum. The data

base provides the foundation upon which the information system is

built. This approach tends to ignore the functional boundaries within

an organization and provides for the integration, or sharing, of

common data between all applications.

As depicted in figure 1.1 below, applications programs

are interfaced with the data base by a data base handler with the

result that data accessing is no longer a function of each individual

application program.
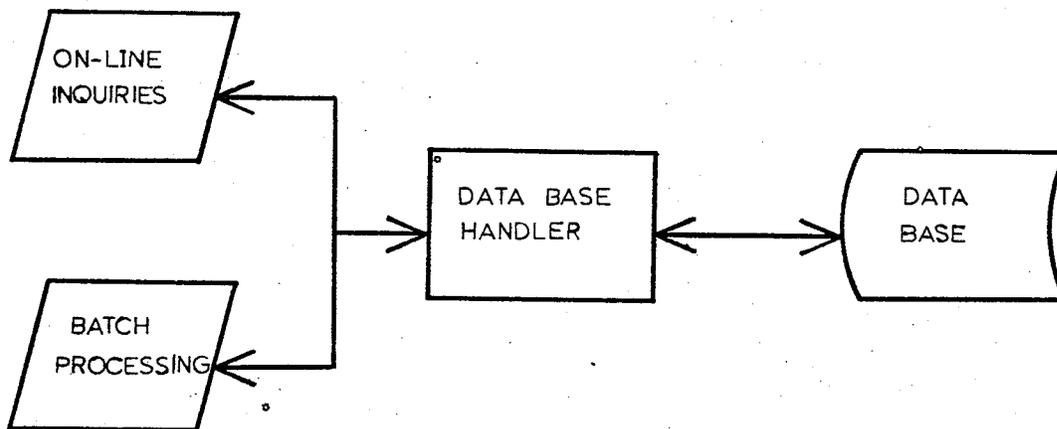
fig.1.1 ACCESSING THE DATA BASE

The data base handler is comprised of access methods, which are used to read or write data in the data base, and directories, or indices, which are used to map the logical data name to its physical storage location. Normally a request for information would be received in the form of a parameter list. The data base handler would use its directories to convert the parameter list into a record address and would then select the appropriate access methods to read, or write, the desired data.

The computer-centered data base system is the result of applying this concept to an information system. Since data accessing is handled by the system, rather than by each individual application program, these programs are rendered independent of the data base. Thus, alterations can be made to the structure of the data base, or to individual application programs, without adversely affecting the overall information system.

The ability to handle general purpose on-line inquiries is inherent in the data base approach because the inquiry handling facility must only translate the request into an appropriate parameter list and the data base handler looks after locating the desired information.

1.2 Information Systems that Cross Corporate Boundaries

Since every business firm is involved in constant inter-connection and intercommunication with other organizations, an

individual firm's information system can be considered as being only one part of a much larger overall system. In many cases a given functional area of a business is more involved with activities pertaining to outside organizations than with other areas of its own organization.

Traditionally business has used paper documents as the medium to transmit information and to provide evidence of a transaction. This has necessitated the production of the document as output from one system and the transcription to some more usable form by the receiving system.

It is becoming increasingly necessary for management to consider new possibilities for disseminating data outside their own corporate boundaries. Many organizations are now communicating by means of punched cards or magnetic tape.

Depending on the extent to which a group of independent organizations are involved in processing and exchanging common information, it is possible to define a data base system which ignores the corporate boundaries as well as the functional boundaries within each organization. The Canadian Grain Trade is one industry group in which member companies depend heavily on each other.

1.3 The Canadian Grain Trade

The Canadian Grain Trade is composed of a number of organizations each of which has its own distinct function to perform

in the movement of grain from the producers to the market. For the

purposes of this thesis the term "grain trade" refers only to those

organizations involved in the grain movement from the producer to

a terminal location. Figure 1.2 portrays this grain movement.

PRODUCER   GRAIN   RAILWAY   TERMINAL.   SHIPMENT
            COMPANY   COMPANY   TO MARKET
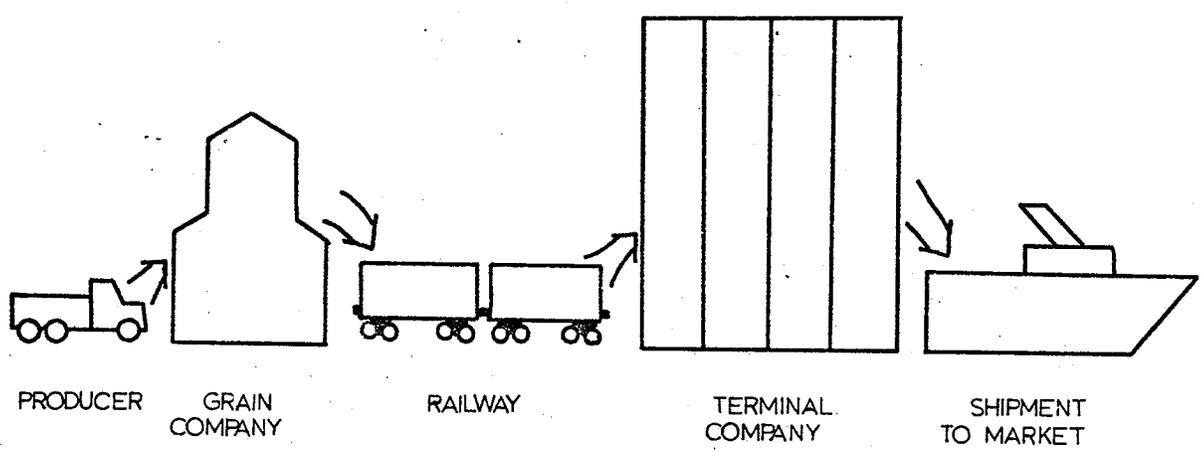
fig.1.2 FLOW OF GRAIN

Associated with this physical handling of grain there is

an interaction of these organizations and two government agencies

on an information handling basis in order to make this movement

possible through the provision of the necessary information for

accounting, control, and planning purposes.

The organizations making up the Canadian Grain Trade

and their functions are:

1.3.1 The Canadian Wheat Board

The Canadian Wheat Board is an agency of the federal government representing the interests of the producers. It is responsible for the interprovincial and foreign marketing of wheat, oats and barley. In addition it attempts to give equitable delivery opportunities to grain producers through a quota system and at the year end, through a system of pooling, distributes the profits from each grain among its producers.

1.3.2 Grain Companies

The grain companies are private or cooperative entities which own and operate the approximately 5,000 country grain elevators in Western Canada. Their function is to purchase grain from the producers and store it for later shipment to terminal locations. For transactions involving wheat, oats, or barley these companies act as agents of The Canadian Wheat Board.

1.3.3 Terminal Companies

The terminal companies are private, cooperative, or governmental entities which operate the terminal grain elevators. Their function is to clean and store grain while awaiting shipment to its final destination. In many cases terminal companies are owned by grain companies.

1.3.4 The Board of Grain Commissioners

The Board of Grain Commissioners is an arm of the

Federal Department of Agriculture, which, in addition to carrying

out grain research, performs three functions for the grain trade.

a) The certification of the grade and weight of grain primarily at

   terminal locations but also to some extent at country locations.

b) The registration of warehouse receipts for grain stored at

   terminal locations.

c) The compilation of statistical reports on grain inventories and

   movements.

1.3.5 The Railways

The railways are responsible for the movement of grain

from the country elevator locations to the terminal elevator locations

and, to a lesser extent, from one terminal location to another. This

movement of grain represents the railways largest single commodity

movement constituting approximately 30% of their ton-miles.

1.4 Organization of the Thesis

As a means to clarify the interrelationships between

information requirements and sources, a model of the present informa-

tion flow through the grain trade has been developed and is presented in

chapter 2. Chapter 3 is a discussion of what information items should

be part of a common data base. A qualitative discussion of how this

proposed data base could be used to better satisfy the requirements

for information within the grain trade is presented in chapter 4. The

results of a study of the internal workings of a data base handler

capable of managing this proposed data base is presented in chapter 5.

Chapter 6 examines the problem of information privacy within the

data base and proposes methods of shielding it from unauthorized

examination.   The thesis terminates with a summary, conclusions,

and suggestions for further research in chapter 7.

CHAPTER 2

The Flow of Information Through the Grain Trade

2.1 Introduction

A business data processing system can be defined as being the procedures by which data is gathered and transformed into the information required to adequately carry out the functions and operations of the business. All businesses, whether large or small, have their own data processing systems either systematically designed, or evolved over time. Through these systems data is collected, analyzed and organized into the information required by accounting, control, and planning functions.

Each of the organizations making up the Canadian Grain Trade has its own system through which its unique information requirements are satisfied. Since much of this information must be passed on to other organizations within the trade, the overall system is a collection of these many smaller systems.

In the analysis of such a system, the intricacy of the inter-relationships among the many components makes the use of some modelling technique necessary. The most popular such technique, that of charting, has as its purpose the consolidation of that information in a form such that correlations and sequential flow can be readily observed.

For the purposes of this thesis, an integrated procedures flow chart has been used to depict the flow of documents through the grain

trade. Since these documents are the carriers of information, such a flow chart serves as a vehicle for connecting information requirements with information sources.

The flow chart was found to be insufficient in itself but the inclusion of tables, graphs, and narrative description provided much more meaning to the overall model.

2.2 A Chart of the Information Flow

In figure 2.1 a procedures flow chart is presented which depicts the major flow of information through the grain trade. Appendix A described the mechanics of this type of chart and appendix B contains samples of the more important documents referred to.

This chart is by no means a detailed model of the information flow within each organization but is sufficient to show the reporting between organizations and the major functions within each organization.

2.3 Highlights of the System

The overall information system in use in the grain trade can be segmented into five distinct areas.

2.3.1 Grain Companies

The grain companies, through their country elevator systems, deal directly with the producers to purchase grain or take it into storage, subject to Wheat Board quota restrictions. In addition advances can be issued to producers if they meet the Wheat Board requirements. Grain is shipped by the grain companies to terminal elevators when they are

country elevator

fig. 2.1 FLOW OF INFORMATION THROUGH THE GRAIN TRADE

instructed to do so by the Wheat Board.

On a daily basis, a country elevator manager completes reports on each phase of the days business, summarizes these on his daily grain letter, and forwards it to his head office.

The head office verifies these reports, as well as the reports of grain unloaded at terminal elevators, and consolidates them to obtain an overall picture of the days business. Transactions involving Wheat Board grain are reported to the Wheat Board on a daily basis. Once a week a report on country operations is issued to the Board of Grain Commissioners.

Each country elevator manager maintains a detailed record of his current stock position and a copy of this is also maintained in the head office. In addition, the head office maintains records, based on transactions received, on the stocks purchased, shipped and delivered to terminal elevators to ensure control over their whole operation.

2.3.2 Terminal Companies

The terminal companies, on a daily basis, receive reports from the Board of Grain Commissioners on grain received at, and grain shipped from, their terminal elevators. This information is summarized and consolidated to produce current stock records. Unloads are reported to the appropriate grain companies and shipments to the Wheat Board. Once a week a summary of the weeks operations is issued to the Board of Grain Commissioners.

2.3.3 The Canadian Wheat Board

Based on reports received from the grain and terminal companies the Wheat Board maintains records on grain purchased from producers, grain delivered to terminals, and grain shipped from terminals so that country and terminal stock positions can be produced and evaluated. Detailed records are also maintained on each producer's deliveries so that final payments can be issued at the end of the crop year.

Delivery quotas are issued on the basis of available space in the country, and shipping orders are issued to grain companies on the basis of terminal requirements and country stocks.

2.3.4 The Railways

Through the use of Wheat Board shipping orders and statement of car requirements, the railways move boxcars to the country points. While a car is in transit control is maintained over it through their car tracing systems. When a car is unloaded at a terminal elevator the official weight is obtained from the Board of Grain Commissioners and freight expense invoices are issued to the terminal companies.

2.3.5 The Board of Grain Commissioners

The Board of Grain Commissioners inspects grain entering and leaving terminal elevators in order to assign official weights and grades to it. Records are maintained of these transactions for use in

registering and cancelling warehouse receipts. Once a month terminal companies are invoiced for inspection, weighing, and registration services.

The weekly reports received from the terminal and grain companies covering their past week's operations are used in the preparation of statistical reports.

2.3.6 Summary of Information Requirements

Table 2.1 summarizes the information requirements of the various members of the grain trade.

2.4 Reporting Delay

Since there are widespread physical distances between many of the elements making up the grain trade, extensive use is made of the surface mail system to move information through it. Inherent in this reporting mode is a delay which is a function of the distance the mail must travel and the quality of service given these various areas. Coupled with this is a further delay while information is being processed prior to being released to its next recipient.

Figure 2.2 * relates the percentages of the documents received with the number of days delay required to distribute these documents through the grain trade. It is to be noted that even after eight days have elapsed 6.4% of the documents are still outstanding.

---

* Based on information contained in Interim Report of the Task Force on Carload Grain Shipment Reporting, MIS Committee of the Grain Transportation Technical Group, February 1968.

Table 2.1   Information Requirements

Record Type	Grain Company	Terminal Company	Wheat Board	Railway	Board of Grain Commissioners
Country Receipts	Daily		Daily		
Country Stocks	Daily		Daily		Weekly
Country Shipments	Daily		Daily	Daily	Weekly
In Transit	Daily		Daily	Daily	Weekly
Terminal Unloads	Daily	Daily	Daily	Daily	Daily
Terminal Stocks		Daily	Daily		Weekly
Terminal Shipments		Daily	Daily		Daily

fig.2.2 REPORTING DELAY

DELAY (IN DAYS) BETWEEN AN EVENT AND RECEIPT OF DOCUMENTS
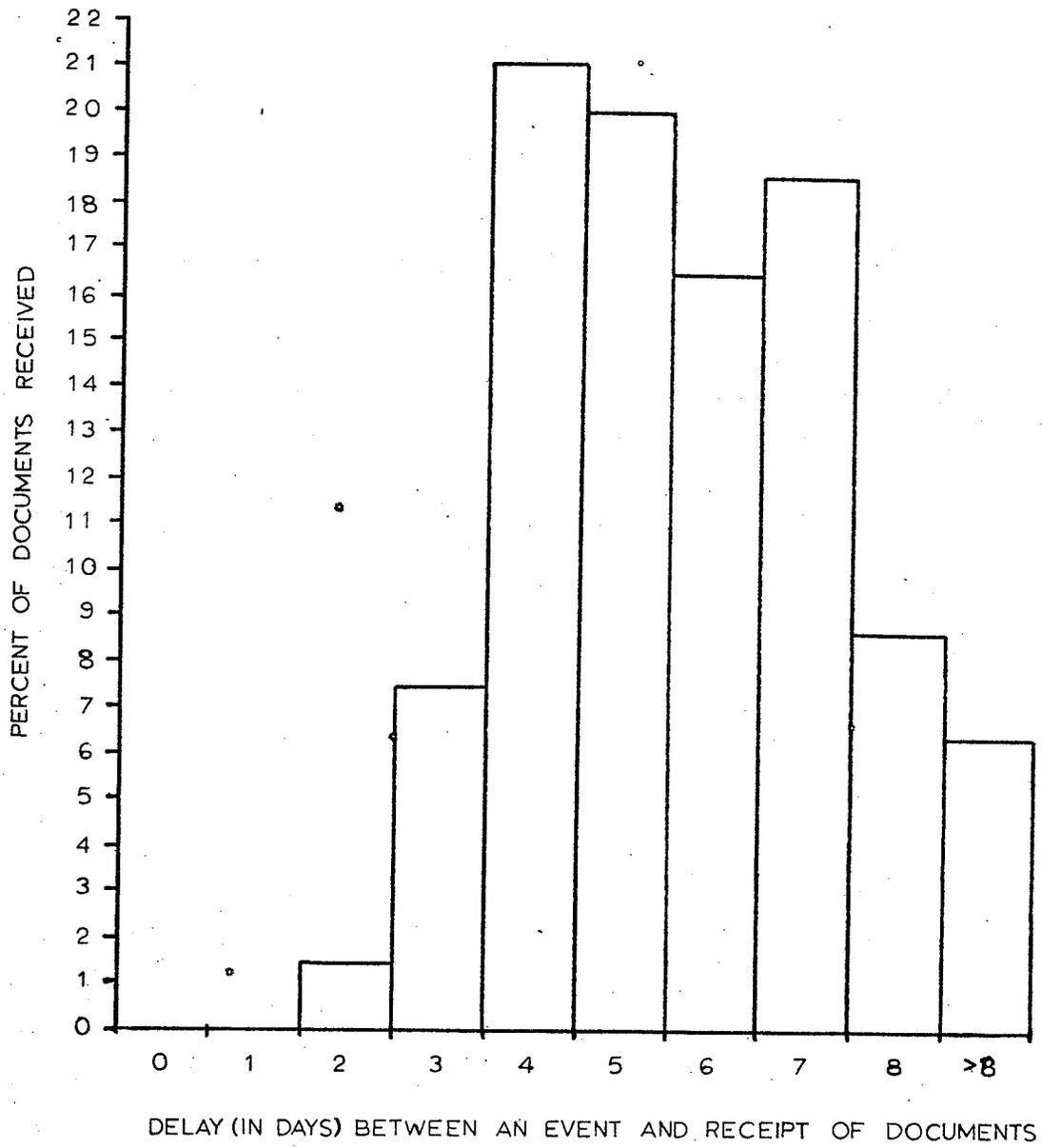
On the average between five and six days transpire before the information needs corresponding to a days business are satisfied.

2.5 Data Volumes With Respect to Seasonal Fluctuations

In general, there are four principle events which are of interest to the grain trade — receipts at country elevators, shipments from country elevators, receipts at terminal elevators, and shipments from terminal elevators. The seasonal volumes of these events were investigated and although they are highly dependent on crop conditions in the country and world market conditions, there are definite seasonal fluctuations.

Figure 2.3 plots average grain deliveries to country elevators with time and figure 2.4 plots average unload rate at terminal elevators with time. The time coordinate is measured in units of weeks into the crop year where the crop year begins on August first.

Shipments from country elevators follows the same path that the terminal unloads do except a shipment would preceed an unload by approximately 1.5 weeks. Detailed information on terminal shipments was not available but here again the plot would be very closely related to the terminal unload plot.

2.6 An Analysis of the Content of Transactions

An investigation was conducted into the grains to which transactions pertain and the results of this study are summarized in table 2.2. This study was based on the grain trade as a whole. In actual fact there are slight regional differences throughout the country.

fig.2.3 AVERAGE GRAIN DELIVERIES
(1965-1967 CROP YEARS)

WEEK NUMBER (IN CROP YEAR)
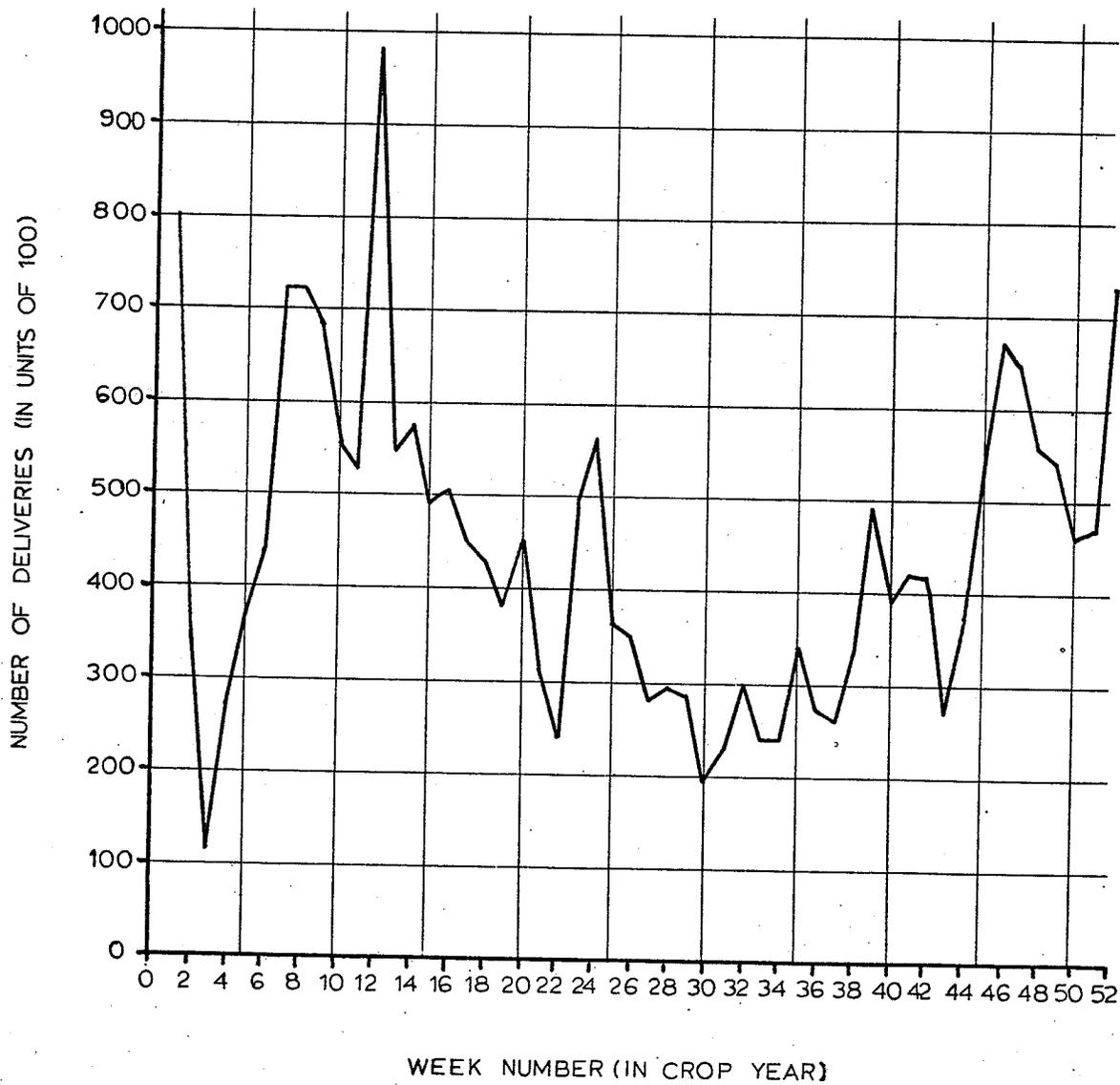
fig.2.4 AVERAGE UNLOAD RATE
(1966-1967 CROP YEARS)

NUMBER OF UNLOADS (IN UNITS OF 100)

WEEK NUMBER (IN CROP YEAR)
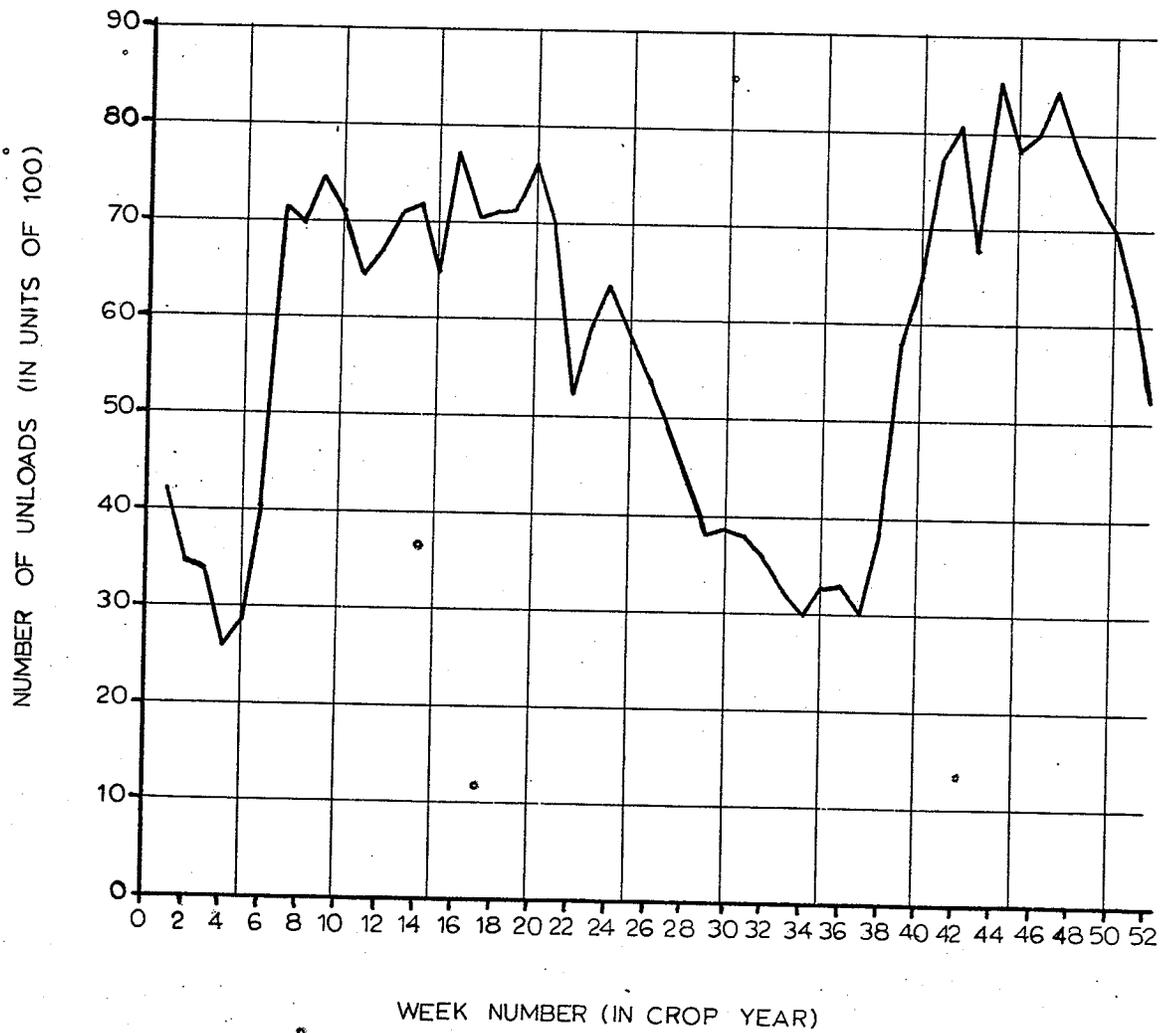
Table 2. 2 .

Frequency of Usage of Grains.

Grain	% of Transactions
Wheat	76
Barley	12
Oats	4
Durum	3
Flax	2
Rapeseed	2
Rye	1

This analysis was extended to determine, for each grain, the

relative importance of its various grades and the results are summarized

in table 2. 3.

In the case of individual grades not only are there regional

differences to consider but also crop conditions. This table is an

average of the 1963 to 1967 crop years. Thus, depending on the weather

conditions the grades of grain produced in a given year will not

necessarily match this table. Only those grades whose volumes were

greater than 5% of the transactions for a given grain were reported in

this table.

Table 2.3 Frequency of Usage of Grades

Grain	Grade	% of Grain
Wheat	2 Northern	33
	3 Northern	24
	4 Northern	11
	Tough	11
	1 Northern	10
	Others	11
Barley	1 Feed	50
	3 CW 6 Row	15
	Tough	14
	2 Feed	10
	Others	11
Oats	1 Feed	40
	Ex 3 CW	28
	Ex 1 Feed	18
	Others	14
Durum	3 CW	36
	Ex 4 CW	20
	2 CW	17
	4 CW	9
	1 CW	6
	Others	12
Flax	1 CW	84
	Tough	10
	Others	6
Rapeseed	1 Cr	94
	Others	6
Rye	3 CW	43
	2 CW	42
	Others	15

CHAPTER 3

The Composition of the Data Base

3.1 Introduction

In order to be reasonably sure of being able to satisfy a need for information, the data base should contain that information which is most often encountered in daily processing and decision making. It would be uneconomic for the data base to contain all of the information required in daily processing because the inclusion of seldom used data items can significantly increase the overall size of the data base. It is still possible for a system to operate on conventional files at the same time as it is using the data base and in this way the data base can be regarded as a generalized master file serving many applications areas.

When a data base is extended to cross corporate boundaries, the problem of what information items should be part of the data base and which ones should be maintained by the individual participants becomes complex due to the greater number of requirements which must be satisfied. It is necessary to select only those items of information which will be of greatest value to the largest number of users.

In the case of the grain trade, there is a need for information for accounting and control purposes and another need for information for planning purposes. Although the required data

originates at the same sources, separate reporting schemes exist

depending on its ultimate use. Throughout the grain trade the

accounting and control applications vary significantly. Basically,

the maintenance of planning information is the same through the trade.

This need for such similar information for planning

purposes is reflected in the data base which is oriented towards this

function and leaves the maintenance of the accounting applications to

the individual users. 'If the data base was to contain information more

closely related to the needs of the accounting applications, the benefits

would not be commensurate with the increased complexity resulting

from the more diverse requirements of the accounting applications.

Because the information systems of the various members

of the grain trade can be considered as being made up of three distinct

application areas -- the country elevator system, the terminal elevator

system, and the in-transit system -- so also does the data base. In

addition, since all members make use of the same basic transactions,

the philosophy adopted here was to provide facilities in the data base for

the collection of this data and its later dissemination to those who have

a need for it.

3.2 The Country Elevator Sector

The country elevator segment of the data base contains

information to be used in evaluating the current situation in the

country elevator system. This segment contains, for each country

elevator, the current stock status, the year-to-date receipts, and the

year-to-date shipments for each of the twenty-two most frequently

used grades and grains outlined in section 2.6, in addition to this same

information in summary form for each of the seven grains. Provision

is made for an overflow area in which information pertaining to any of

the less common grades can be stored. If future activity warrants it,

permanent provision must be made in the base for some of these

grades, possibly at the expense of some now considered as being

permanent. Fields are also provided for the elevator capacity, the

present stocks on hand, and the estimated stocks still in the producers'

possession. This same record format is repeated in summary form

at the station level, the company level and for the overall country

operation.

Within the data base it is necessary that the records

comprising this segment of the data be organized in such a manner

that it is possible to sequentially access every record, every station

record, or every record corresponding to a given company in

addition to being able to directly access any record given its station

and company.

3.3 The Terminal Elevator Sector

The terminal elevator segment of the data base contains

information to be used in evaluating the current situation in the

terminal elevator system.   The field structure of records in this segment makes use of the same information items as do the records in the country sector with the exception that there is no estimate of stocks to be delivered.   This record format occurs for each terminal elevator and is repeated in summary form at the terminal location level and at the company level within each location.

It is necessary that the records making up this segment of the data base be organized in such a manner that it is possible to sequentially access every record, every terminal location record, every company record, or every elevator record in addition to being able to directly access any record given the location, company, and elevator corresponding to it.

3.4   The In-Transit Sector

The in-transit sector of the data base contains information to be used in the evaluation and control of grain movements from the country elevator system to the terminal elevator system.   For each boxcar of grain these records provide fields for information items describing the railway, the boxcar number, the shipping company, the station of origin, the date loaded, the destination, the grain, grade, and weight of the shipment.   In addition space is provided for information describing the present location of each boxcar.

It is necessary that the records making up this segment of the data base be organized in such a manner that it is possible to

sequentially access every transit record, every record corresponding
to a given company, to a given destination, or to a given shipping order
number and to directly access any record given the number of the boxcar
corresponding to it.

3.5 The Transactions Sector

The transactions segment of the data base provides a
facility in which to accumulate transactions information prior to
updating the other segments and disseminating it to the grain trade.
Because there are five different transaction types there are five
different formats for these records. It is necessary that the records
comprising this segment be organized in such a manner that it is
possible to sequentially access every record, every record of a given
type, or every record of a given type for a given company.

3.5.1 Country Receipts

The country receipts records contain summary information
pertaining to the acquisition of grain from producers at a country
elevator. Within these records fields are provided for recording the
date, company, station, grain, grade, and weight of grain received.
In updating the data base these records increment the appropriate
records in the country segment.

3.5.2 Country Shipments

The country shipments records contain information
pertaining to the shipment of grain from a country elevator. Within

these records fields are provided for recording the date, company, station, grain, grade, weight of grain shipped, railway, boxcar number, destination and shipping order number. In updating the data base these records reduce the appropriate records in the country segment and initiate the establishment of a record in the in-transit segment covering each shipment.

3.5.3 Boxcar Locations

The boxcar location records contain information describing the current location of each of the boxcars presently in transit. These records have fields for recording the railway, boxcar number, shipping company, and the present location of the car and are used to update the present location field of the transit records.

3.5.4 Terminal Receipts

Terminal receipt, or unload, records contain information pertaining to the unloading of a boxcar at a terminal elevator. Within these records fields are provided for recording the date, terminal company, terminal elevator, grain, grade, weight of grain, shipping company, station of origin, railway, boxcar number, the percent dockage and the percent moisture found in the grain at the time of unloading. In updating the data base these records are used to increment the appropriate records in the terminal segment and to delete the appropriate records from the in-transit segment.

3.5.5 Terminal Shipments

Terminal shipment records contain information
pertaining to the loading of a vessel at a terminal elevator for shipment
to market. Within these records fields are provided for recording the
date, terminal company, terminal elevator, grain, grade, weight of
grain shipped, name of the vessel, and destination of the shipment.
In updating the data base these records reduce the appropriate records
in the terminal segment.

3. 6 A Formal Definition of the Data Base

The following four pages contain a formal definition of
this data base such as might be presented to a processor from which
the data base handler would be automatically constructed. Because
specifications could not be obtained for any available systems of
describing data bases, the one presented here is hypothetical but yet
sufficient to describe the data base. Appendix C describes the terms
used and their usage in describing the data base.

```
START DATA BASE DEFINITION
DATA BASE NAME IS GRAIN-TRADE

 1 SEGMENTNAME IS COUNTRY
    STRUCTURE IS SEQUENTIAL BY COMPANY BY STATION
    STRUCTURE IS INDEXED ON COMPANY AND STATION
    STRUCTURE IS LIST(FORWARD)
     2 RECORD IS COUNTRY-TOTAL
        RECORD OCCURES ONCE IN COUNTRY
        LINKED TO STATION(NEXT)
         3 GRAIN-DATA
            4 STOCKS
               5 WHEAT
                     6 ALL        SIZE 9 NUMERIC
                     6 1N         SIZE 9 NUMERIC
                     6 2N         SIZE 9 NUMERIC
                     6 3N         SIZE 9 NUMERIC
                     6 4N         SIZE 9 NUMERIC
                     6 TOUGH      SIZE 9 NUMERIC
                  5 DURUM
                     6 ALL        SIZE 9 NUMERIC
                     6 1CW        SIZE 9 NUMERIC
                     6 2CW        SIZE 9 NUMERIC
                     6 3CW        SIZE 9 NUMERIC
                     6 4CW        SIZE 9 NUMERIC
                     6 EX4CW      SIZE 9 NUMERIC
                  5 OATS
                     6 ALL        SIZE 9 NUMERIC
                     6 1FEED      SIZE 9 NUMERIC
                     6 EX1FEED    SIZE 9 NUMERIC
                     6 EX3CW      SIZE 9 NUMERIC
                  5 BARLEY
                     6 ALL        SIZE 9 NUMERIC
                     6 1FEED      SIZE 9 NUMERIC
                     6 2FEED      SIZE 9 NUMERIC
                     6 3CW6ROW    SIZE 9 NUMERIC
                     6 TOUGH      SIZE 9 NUMERIC
                  5 RYE
                     6 ALL        SIZE 9 NUMERIC
                     6 2CW        SIZE 9 NUMERIC
                     6 3CW        SIZE 9 NUMERIC
                  5 FLAX
                     6 ALL        SIZE 9 NUMERIC
                     6 1CW        SIZE 9 NUMERIC
                     6 TOUGH      SIZE 9 NUMERIC
                  5 RAPESEED
                     6 ALL        SIZE 9 NUMERIC
                     6 1CR        SIZE 9 NUMERIC
            OVERFLOW AREA
               5 GRAIN           SIZE 1 NUMERIC
```

```
                6 GRADE        SIZE 5 NUMERIC
                6 QUANTITY     SIZE 9 NUMERIC
            4 RECEIPTS   COPY STOCKS
            4 SHIPMENTS   COPY STOCKS
            4 ELEVATOR-CAPACITY   SIZE 9 NUMERIC
            4 ELEVATOR-SPACE-USED   SIZE 9 NUMERIC
          3 ESTIMATED-TO-COME   SIZE 9 NUMERIC
      2 RECORD IS COMPANY-TOTAL
        REPEATING GROUP IN COUNTRY-TOTAL     -
        LINKED TO COMPANY(SAME)
          3 COMPANY                 SIZE 2 NUMERIC
          3 GRAIN-DATA  COPY GRAIN-DATA IN COUNTRY-TOTAL
      2 RECORD IS STATION-TOTAL
        REPEATING GROUP IN COUNTRY-TOTAL
        LINKED TO STATION(NEXT)
          3 STATION                 SIZE 6 NUMERIC
          3 GRAIN-DATA  COPY GRAIN-DATA IN COUNTRY-TOTAL
      2 RECORD IS COMPANY-TOTAL
        REPEATING GROUP IN STATION-TOTAL
        LINKED TO COMPANY(SAME)
          3 COMPANY                 SIZE 2 NUMERIC
          3 GRAIN-DATA  COPY GRAIN-DATA IN COUNTRY-TOTAL

1 SEGMENTNAME IS TERMINAL
  STRUCTURE IS SEQUENTIAL BY ELEVATOR BY COMPANY BY LOCATION
  STRUCTURE IS INDEXED ON ELEVATOR AND COMPANY AND LOCATION
  STRUCTURE IS LIST(FORWARD)
    2 RECORD IS LOCATION-TOTAL
      REPEATING GROUP IN TERMINAL
      LINKED TO LOCATION(NEXT)
        3 LOCATION                 SIZE 6 NUMERIC
        3 GRAIN-DATA  COPY GRAIN-DATA IN COUNTRY-TOTAL
    2 RECORD IS COMPANY-TOTAL
      REPEATING GROUP IN LOCATION-TOTAL
      LINKED TO COMPANY(NEXT)
        3 COMPANY                 SIZE 2 NUMERIC
        3 GRAIN-DATA  COPY GRAIN-DATA IN COUNTRY-TOTAL
    2 RECORD IS ELEVATOR-DETAIL
      REPEATING GROUP IN COMPANY-TOTAL
      LINKED TO ELEVATOR(NEXT)
        3 ELEVATOR                 SIZE 2 NUMERIC
        3 GRAIN-DATA  COPY GRAIN-DATA IN COUNTRY-TOTAL

1 SEGMENTNAME IS TRANSIT
  STRUCTURE IS UNORDERED
  STRUCTURE IS INDEXED ON CAR-NUMBER
  STRUCTURE IS LIST(FORWARD,BACK)
    2 RECORD IS TRANSIT-DETAIL
      REPEATING GROUP IN TRANSIT
      LINKED TO TRANSIT-DETAIL(NEXT)
```

```
        LINKED TO COMPANY(SAME)
        LINKED TO DESTINATION(SAME)
        LINKED TO SHIPPING-ORDER(SAME).
          3 RAILWAY                 SIZE 1 NUMERIC
          3 CAR-NUMBER              SIZE 6 NUMERIC
          3 COMPANY                 SIZE 2 NUMERIC
          3 STATION                 SIZE 6 NUMERIC
          3 DATE-LOADED             SIZE 4 NUMERIC
          3 LAST-LOCATION           SIZE 6 NUMERIC
          3 DESTINATION             SIZE 6 NUMERIC
          3 GRAIN                   SIZE 1 NUMERIC
          3 GRADE                   SIZE 5 NUMERIC
          3 WEIGHT                  SIZE 5 NUMERIC
          3 SHIPPING-ORDER          SIZE 4 NUMERIC

1 SEGMENTNAME IS TRANSACTIONS
    STRUCTURE IS UNORDERED
    STRUCTURE IS LIST(FORWARD)
      2 TRANSACTION-TYPE           SIZE 1 NUMERIC
        VALUE 1 RECORD IS COUNTRY-SHIPMENTS
        VALUE 2 RECORD IS COUNTRY-SHIPMENTS
        VALUE 3 RECORD IS TERMINAL-RECEIPTS
        VALUE 4 RECORD IS TERMINAL-SHIPMENTS
        VALUE 5 RECORD IS CAR-LOCATIONS
      2 RECORD IS COUNTRY-RECEIPTS
        RECORD OCCURES RANDOMLY
        LINKED ON TRANSACTION-TYPE(SAME)
        LINKED ON TRANSACTION-TYPE(SAME) AND COMPANY(SAME)
          3 DATE                    SIZE 4 NUMERIC
          3 COMPANY                 SIZE 2 NUMERIC
          3 STATION                 SIZE 6 NUMERIC
          3 DETAIL                  REPEATING GROUP
            4 GRAIN                 SIZE 1 NUMERIC
            4 GRADE                 SIZE 5 NUMERIC
            4 WEIGHT                SIZE 5 NUMERIC
      2 RECORD IS COUNTRY-SHIPMENTS
        RECORD OCCURES RANDOMLY
        LINKED ON TRANSACTION-TYPE(SAME)
        LINKED ON TRANSACTION-TYPE(SAME) AND COMPANY(SAME)
          3 DATE                    SIZE 4 NUMERIC
          3 COMPANY                 SIZE 2 NUMERIC
          3 STATION                 SIZE 6 NUMERIC
          3 GRAIN                   SIZE 1 NUMERIC
          3 GRADE                   SIZE 5 NUMERIC
          3 WEIGHT                  SIZE 5 NUMERIC
          3 RAILWAY                 SIZE 1 NUMERIC
          3 CAR-NUMBER              SIZE 6 NUMERIC
          3 DESTINATION             SIZE 6 NUMERIC
          3 ORDER-NUMBER            SIZE 4 NUMERIC
      2 RECORD IS TERMINAL-RECEIPTS
```

```
      RECORD OCCURES RANDOMLY
      LINKED ON TRANSACTION-TYPE(SAME)
      LINKED ON TRANSACTION-TYPE(SAME) AND COMPANY(SAME)
        3 DATE                      SIZE 4 NUMERIC
        3 COMPANY                   SIZE 2 NUMERIC
        3 TERMINAL                  SIZE 4 NUMERIC
        3 GRAIN                     SIZE 1 NUMERIC
        3 GRADE                     SIZE 5 NUMERIC
        3 WEIGHT                    SIZE 5 NUMERIC
        3 SHIPPER                   SIZE 2 NUMERIC
        3 STATION                   SIZE 6 NUMERIC
        3 RAILWAY                   SIZE 1 NUMERIC
        3 CAR-NUMBER                SIZE 6 NUMERIC
        3 DOCKAGE                   SIZE 3 NUMERIC
        3 MOISTURE                  SIZE 3 NUMERIC
   2 RECORD IS TERMINAL-SHIPMENTS
      RECORD OCCURES RANDOMLY
      LINKED ON TRANSACTION-TYPE(SAME)
      LINKED ON TRANSACTION-TYPE(SAME) AND COMPANY(SAME)
        3 DATE                      SIZE 4 NUMERIC
        3 COMPANY                   SIZE 2 NUMERIC
        3 TERMINAL                  SIZE 4 NUMERIC
        3 GRAIN                     SIZE 1 NUMERIC
        3 GRADE                     SIZE 5 NUMERIC
        3 WEIGHT                    SIZE 5 NUMERIC
        3 VESSEL                    SIZE 10 ALPHABETIC
        3 DESTINATION               SIZE 10 ALPHABETIC
   2 RECORD IS CAR-LOCATIONS
      RECORD OCCURES RANDOMLY
      LINKED ON TRANSACTION-TYPE(SAME)
      LINKED ON TRANSACTION-TYPE(SAME) AND COMPANY(SAME)
        3 COMPANY                   SIZE 2 NUMERIC
        3 RAILWAY                   SIZE 1 NUMERIC
        3 CAR-NUMBER                SIZE 6 NUMERIC
        3 LOCATION                  SIZE 6 NUMERIC
END DATA BASE DEFINITION
```

CHAPTER 4

Employment of the Common Data Base

4. 1 Introduction

The functional requirements of an item of informa-

tion determine the relative importance of the factors to be

considered in acquiring it. Information which is used for planning

purposes stresses timeliness at the expense of accuracy, while

information which is used for accounting functions stresses accuracy

at the expense of timeliness. The requirements for control informa-

tion fall somewhere between those for planning and accounting with

more emphasis placed on detail. In general, the resources

expended in acquiring information reflect the priorities placed upon

these factors.

Since the information which is contained in this data base

will be primarily used for operational planning, and to a lesser

extent for control purposes, the timeliness factor must take

precedence over all others. As reported in Chapter 2, there is a

considerable delay in gathering data because of the utilization of

the surface mail system and the fact that data is delayed in

processing prior to being passed on to its next recipient.

Information which is available for planning and control

purposes in the grain trade does not now reflect the current

situation. It is imperative that the data which is used to update

the data base be acquired with a minimum of delay. In order to achieve this end, telecommunications facilities must be exploited.

It is to be noted that many of the transactions which are used to update the data base are complete and accurate enough that they can also be used for accounting applications, or at least to initiate accounting procedures. By gathering data at the close of business each day, the data base will never reflect a situation more than one working day old and basic transactions can be made available for accounting purposes during the morning of the day after the transaction occurred.

There are five types of transactions which must be acquired in order to make full use of the data base.

4.1.1 Country Receipts

It would be necessary for each elevator manager to report, in summary form, his daily receipts. Because of the large number of country elevators and the relatively small change produced in the country stocks by each days receipts, a report every two days would possibly be more suitable. Beyond updating the data base this transaction would be of little value for accounting purposes.

4.1.2 Country Shipments

Every day during which an elevator manager loads a boxcar of grain for shipment, it would be necessary for him to

report the details of the transaction. Besides updating the data base, this transaction would be of considerable value for accounting purposes.

4.1.3 Terminal Receipts

At the close of business each day, it would be necessary for each terminal company to complete a report on each boxcar of grain that was unloaded into their facilities. The data provided by this transaction could be utilized in accounting applications in addition to updating the data base.

4.1.4 Terminal Shipments

Every day during which grain from a terminal elevator is loaded into a vessel for shipment it would be necessary for the terminal company to report the details on this transaction. In addition to its utility as far as the data base is concerned, terminal shipment information would also be of considerable value for accounting purposes.

4.1.5 Boxcar Locations

The railways presently have available daily reports concerning the locations of their freight cars. This transaction would merely consist of making this information available to the data base. Although of immense value to the intransit segment of the data base, this information would be of no value to accounting procedures.

4.2 Data Collection Media

The telecommunications facilities which are used to gather the data to update the data base must be geared to the volume of data which will be collected at any given point in the network.

For data originating at country elevators, namely the country receipts and shipments, there are two feasible methods by which this data could be sent to the data base. Since the volume of data which any given elevator would be sending is rather low, the elevator manager could telephone his report to some data gathering center from which telex or teletype facilities could be used to transmit the reports. Through the use of the touch-tone telephone, it would be possible for each manager to transmit his own report from his elevator.

For data originating at terminal elevators, namely the terminal receipts and shipments, the volume of data would be large enough to warrant the use of telex or teletype facilities at each terminal location, if not in each terminal elevator.

The data concerning boxcar locations is already received by railway offices through a telecommunications network and acquiring it for the data base would require selecting the pertinent records and transcribing them to magnetic tape or punched cards.

4.3 Possible Data Base Configurations

The number of possible ways of configuring the data

base is unlimited.   Three increasingly sophisticated data base

configurations, all of which presuppose a comprehensive data

gathering network, are proposed with differences lying only in the

manner by which the data base is accessed.   It is assumed that

features shown to be present in any one of the configurations could

be combined with features found in some other.

4.3.1 Accessing Data Through Hardcopy Reports

This configuration, which is illustrated in figure 4.1,

uses the data base as a report generating medium.   Once the data

base has been updated reports can be produced for each user

concerning the aspect of the data base which interests him.   The

transactions can also be drawn off in the form of punched cards,

magnetic tape, or hardcopy listings for use in accounting procedures.

These reports and transactions could conceivably be released to their

recipients each morning.

4.3.2 Accessing Data Through On-line Inquiries

Figure 4.2 illustrates this configuration.   Through their

own terminal devices the users of the system would be able to

directly query the data base in order to obtain the information that

they require rather than being forced to utilize a somewhat inflexible

hardcopy report.   The transactions however, would continue to be
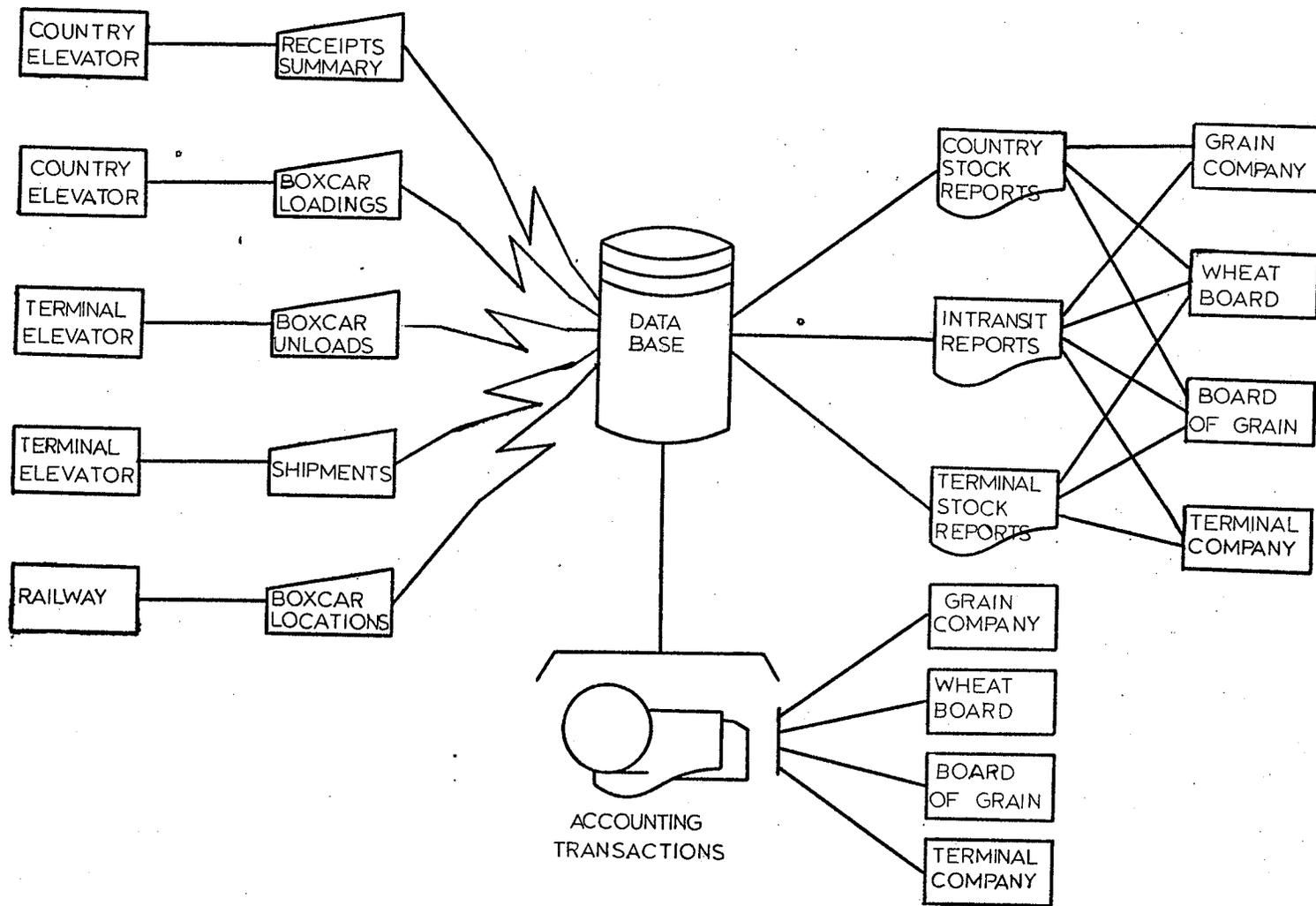
fig. 4.1 DATA BASE PRODUCING REPORTS
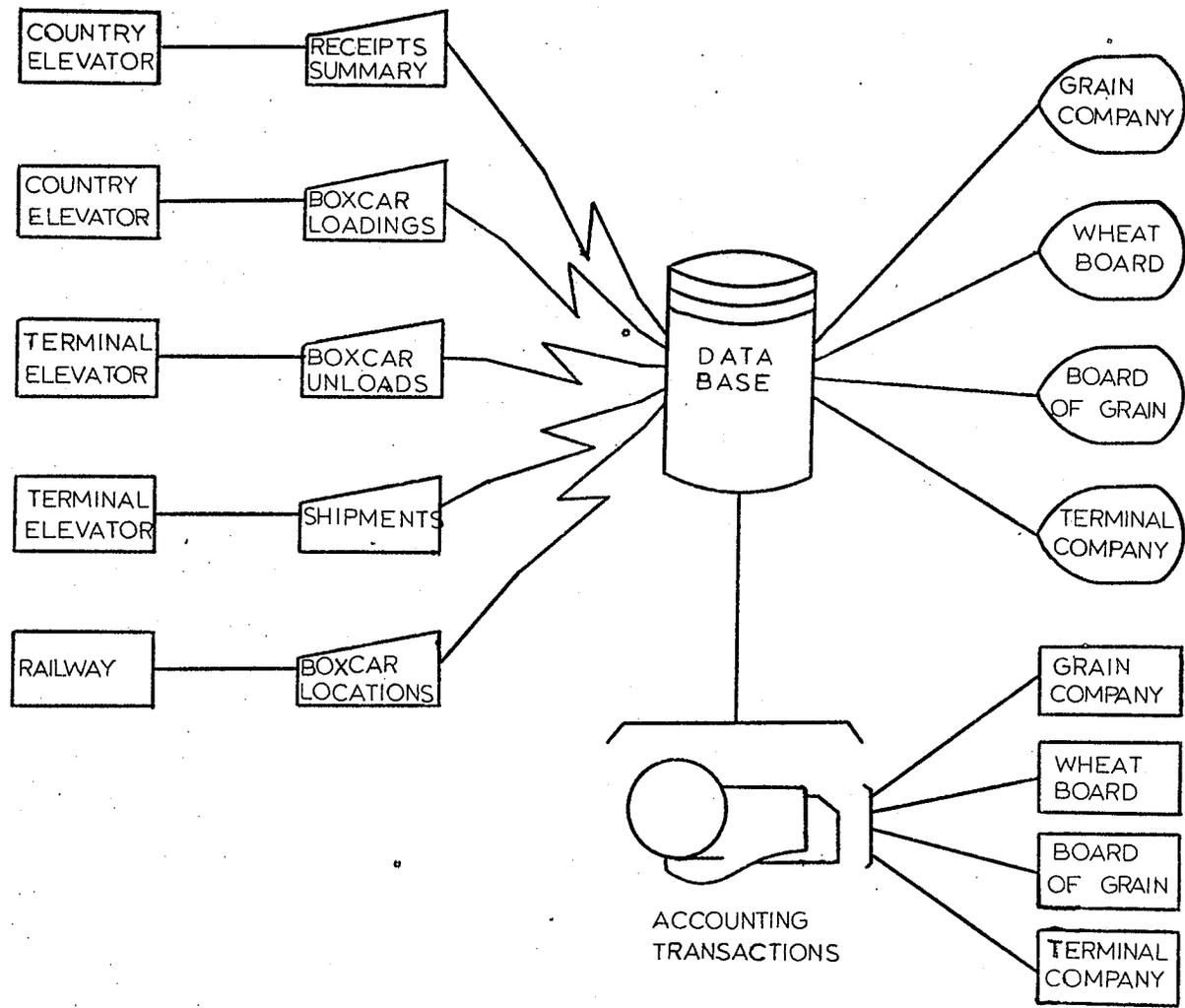
fig. 4.2 DATA BASE ANSWERING INQUIRIES
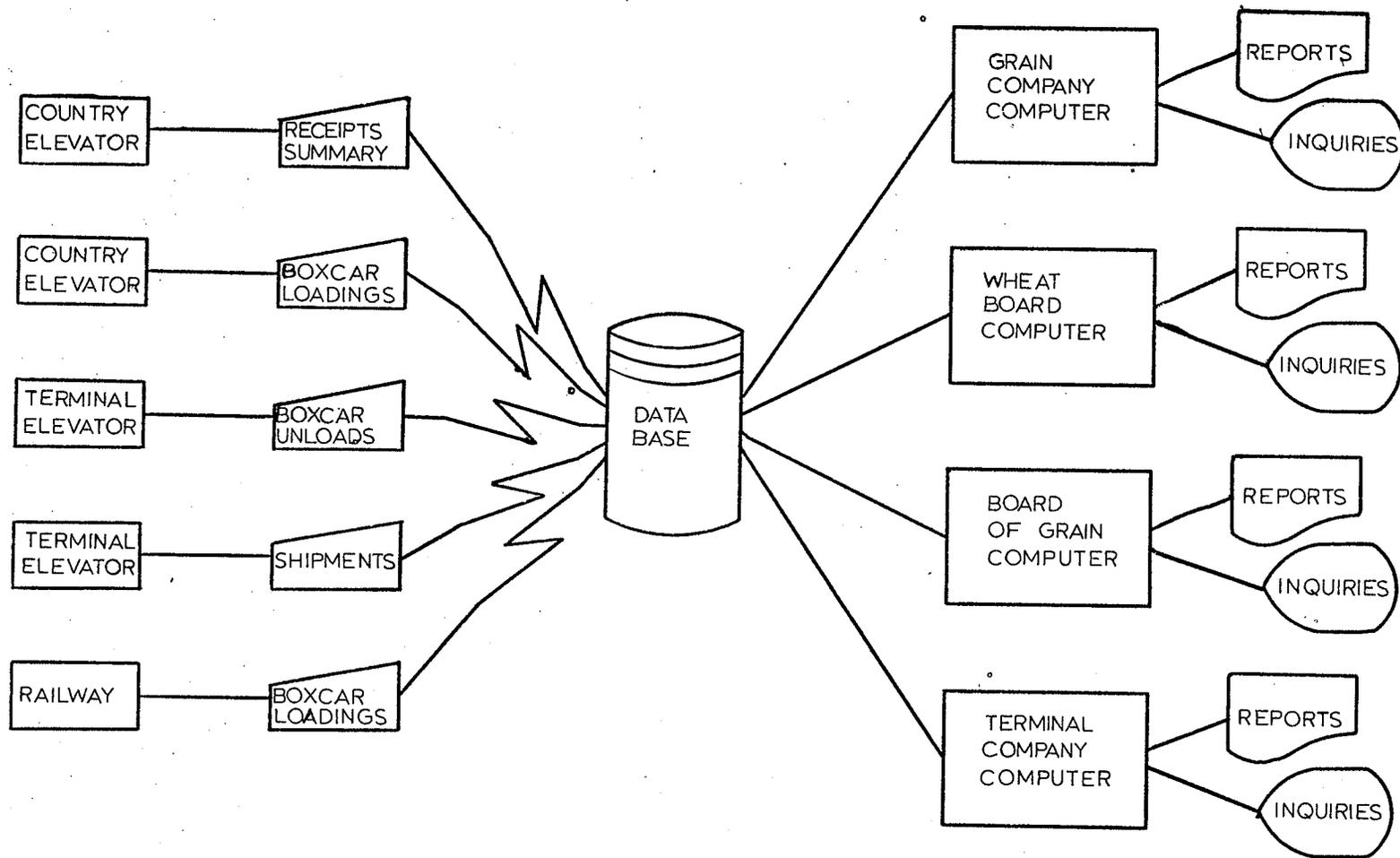
fig.4.3 DATA BASE FEEDING USER COMPUTERS

released in the form of punched cards, magnetic tape, or hardcopy reports as required by each user. This configuration raises the possibility of using the computer associated with the data base as a time-sharing facility through the on-line entry of simple commands from the remote terminals.

4.3.3 Accessing Data Through Computer Communications

This configuration, which is illustrated in figure 4.3, permits a user's computer to communicate directly with the data base. On-line inquiries would be permitted either directly to the data base, or through the user's own computer. The need to reproduce transactions could be eliminated by directing them straight into a user's accounting routines as they are required. Through the use of this type of configuration, the possibility of sharing workloads between computers is brought forth.

4.4 Accuracy in the Data Base

Although accuracy is not the prime requisite of information used for planning purposes, it must nevertheless be taken into consideration. Although slight errors in the reporting of a single day's business would be inconsequential in themselves, over a period of time they would create an extremely erroneous base upon which to make decisions. Furthermore, since many of the transactions used in updating the data base will be later used in accounting applications, every effort must be taken to ensure the

accuracy of transaction data.

It is possible for errors to arise during the transmission of transaction data either through human error in operating the keyboard of the terminal device or through machine errors arising during the transmission of the signal. Since the data base will only be updated once a day after having received the day's transactions, an editing operation can be invoked to filter off the erroneous ones.

The transactions editor can be used to check the codes representing the company, station, terminal, grain, grade and other descriptive information to ensure that they are legitimate. It can perform checks for reasonableness to ensure that the quantitative data in each transaction falls within certain predetermined limits. The editor can also be used to accumulate the values of specific fields in a record, or in a batch of records, in order to balance them to some control total received as part of the transmission.

In order to satisfy the needs of the editor, control information must be produced in the same manner in which the editor will later check it. Thus, in the transmission of terminal receipts and shipments, the control data would consist of the grain code, grade code, and total received or shipped for each grain and grade at each terminal. In the transmission of country receipts and shipments, where it is unlikely that there will be more than

one item of information associated with each grain and grade, the

transmission of control data for each country elevator would amount

to an almost complete retransmission of the whole record. This

difficulty could be overcome by using a longitudinal check consisting

of a single digit representing the units position of the sum of some,

or all, of the digits in the record. While not eliminating 100% of

the errors, this technique will draw attention to the majority of

them. Since the data pertaining to car locations will have undergone

editing operations prior to being released by the railways, it can be

considered as being free of errors.

Periodically it will be necessary to compare the contents

of the data base to the real situation and reconcile any differences

in order to ensure as high a degree of accuracy as possible. The

users of the data base must be provided with a facility which will

enable them to make adjustments to the contents of the data base

when errors are detected.

CHAPTER 5

Organization of the Data Base

5.1 Introduction

The file which has been structured for data processing does not have the flexibility required by a data base system. It provides the simplest possible way of retrieving that file by itself but it lacks an efficient means of locating individual data in any combination or in any other sequence. A data base, in addition to satisfying the needs of data processing, must also provide for the efficient retrieval of individual data.

In order to provide such flexibility it is necessary to maintain the data base in a direct access storage, rather than in a sequential access storage as is usually the case in data processing applications. In general, data in a direct access storage can be organized in one of four data structures.

5.1.1 Unordered Structure

Each logical record is stored in a position relative to the other records in order of its arrival in the computing system. This type of organization has no unique control identification and therefore must be accessed serially, front to back. An unordered structure facilitates the handling of relatively large and highly volatile data bases.

5.1.2 Sequential Structure

Each logical record is stored in a position relative to the other records according to a specified sequence, the basis of which is some attribute, or set of attributes, of the record. In order to retrieve any given data element, the entire file must be accessed serially, starting at the beginning until the desired record is found. A sequential data structure facilitates the data processing applications of a data base.

5.1.3 Indexed Structure

An indexed structure is used in conjunction with an unordered or a sequential data organization as a means to locate specific records without searching the whole data base. An index, or directory, is maintained which contains the key of every record along with the record address. In order to access any given record, the directory must be searched in order to obtain the address of the record from which the desired information can be retrieved directly. This organization lends itself readily to a rather stable data base of somewhat limited size because of the necessity of maintaining the directories as well as the data records.

5.1.4 List Structure

A list structure is also used in conjunction with an unordered or a sequential data organization. Pointers, or links, which are stored as part of the data records, are used to chain

together data records which are logically related without altering the physical location of the records. Through the use of multiple pointers it is possible to define multiple logical relationships independent of the physical arrangement. A list structure deals effectively with the problem of multi-key access to a chain of related records in a data base.

5.2 The Data Base Structure

In reality, the structure assigned to the components of the data base is not limited to any one of the structures outlined in section 5.1 but rather, is a hybrid of two or more of these systems. Since this data base can be considered as being made up of four components — country records, terminal records, transit records, and transaction records — different structures have been assigned to each component in order to provide the greatest overall flexibility.

5.2.1 Structure of Country Records

As shown in figure 5.1, the country records make use of the sequential, indexed, and list structures. Sequentially, the first record is an overall record for the country component and is followed by overall records for each company. This group is followed, in station sequence, by similar groups which are made up of a station record followed by company records for each company active at that station.

STATION	COMPANY	RECORD
⋮	⋮	⋮
⋮	⋮	⋮

COUNTRY RECORD INDEX

COUNTRY RECORD

COMPANY RECORD

STATION RECORD

COMPANY RECORD

LINK TO
NEXT STATION
RECORD

LINK TO NEXT
RECORD FOR
THIS COMPANY

COUNTRY DATA RECORDS
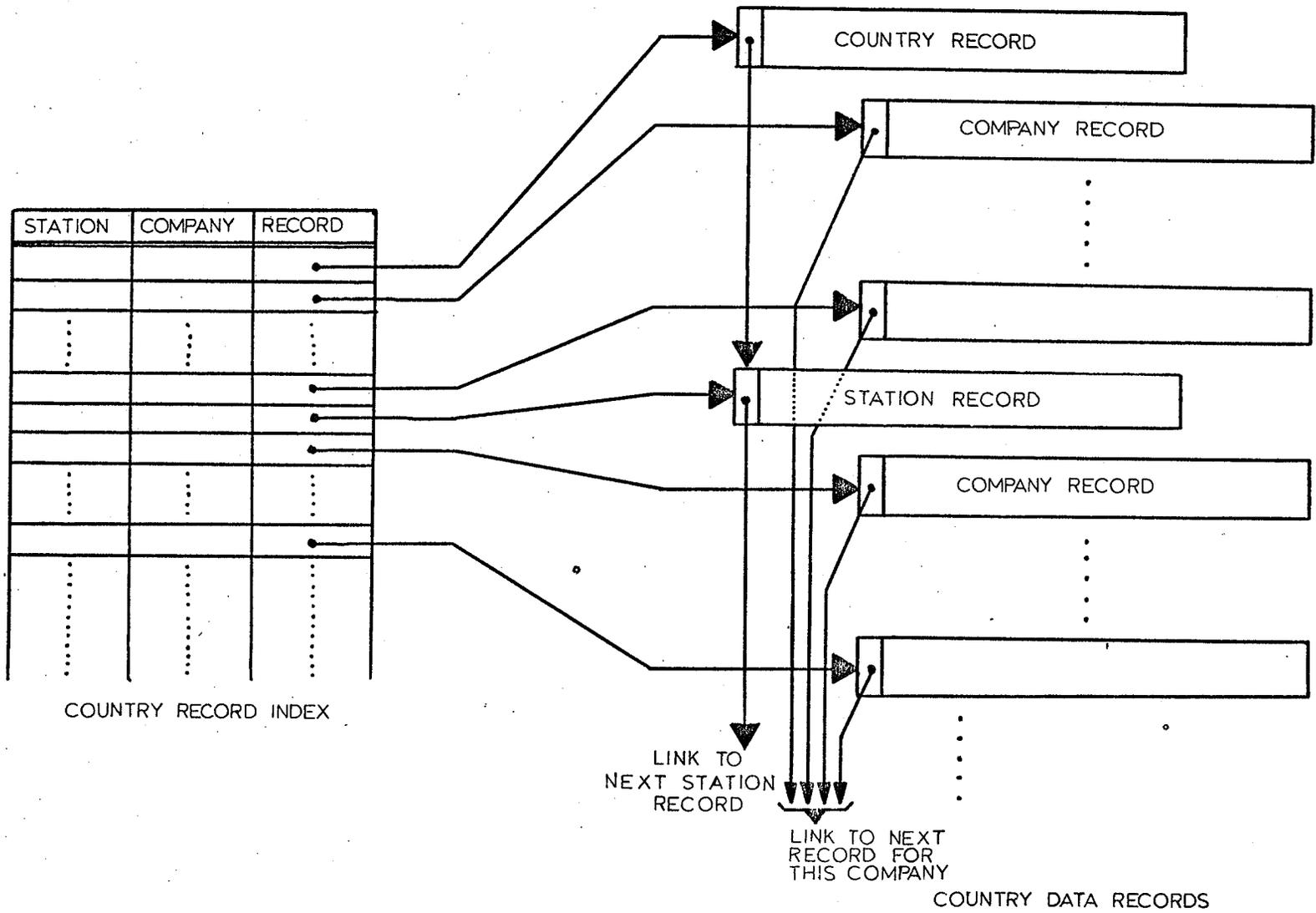
fig. 5.1 STRUCTURE OF COUNTRY RECORDS

A country record index is maintained which can be searched by station and/or by company to yield the address associated with the desired record.

Every record contains a link to some logically related record further ahead in sequence. The overall country record is linked to the first station record and each station record is linked to the next sequential station record. Each overall company record is linked to the first company record corresponding to that company and these in turn are linked to the next sequential record for that company.

Using this structure it is possible to sequentially access all records in the country segment of the data base, all station records, or all records corresponding to a given company and to directly access the record corresponding to a given company at a given station.

5.2.2 Structure of Terminal Records

As shown in figure 5.2 the terminal records also make use of the sequential, indexed, and list structures. Records are grouped by terminal location. Sequentially, the first record of a group is an overall record for the given terminal location and contains a pointer to link it to the next terminal location record. Within each terminal location group there are records corresponding to each company active at that location. These company records are

LOCATION	COMPANY	ELEVATOR	RECORD

TERMINAL RECORD INDEX

LOCATION RECORD

COMPANY RECORD

ELEVATOR RECORD

LINK TO NEXT ELEVATOR RECORD
LINK TO NEXT COMPANY RECORD
LINK TO NEXT LOCATION RECORD
TERMINAL DATA RECORDS
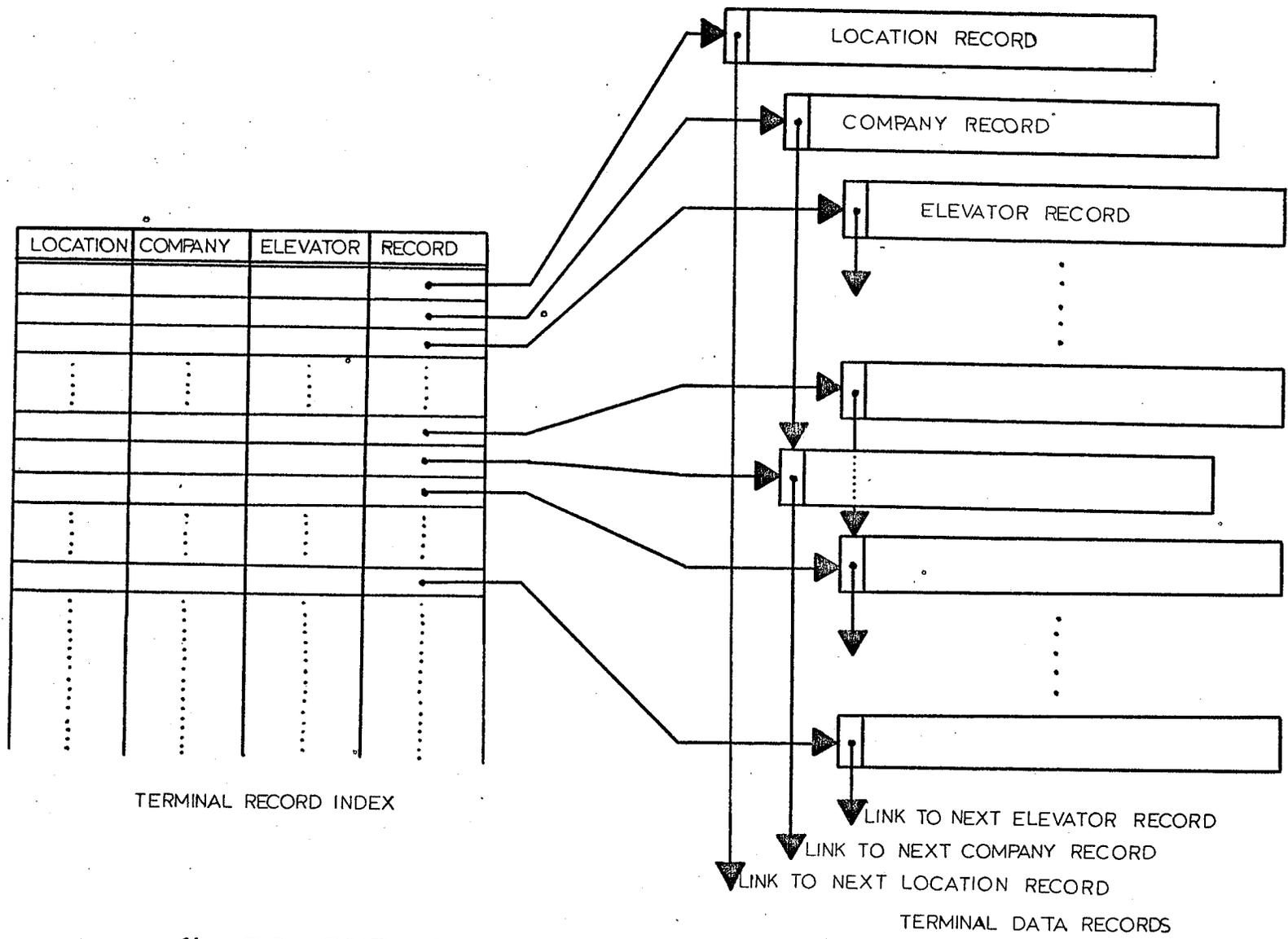
fig. 5.2 STRUCTURE OF TERMINAL RECORDS

50

also linked together. Associated with each company record is a group of records, one for each terminal elevator operated by the given company. These elevator records are also linked together.

A terminal record index is maintained which can be searched by terminal location and/or by company and/or by elevator to yield an address associated with the desired record.

By using this structure it is possible to sequentially access all terminal records, all terminal location records, all company records, or all elevator records and to directly access the records corresponding to a given elevator of a given company at a given terminal location.

5.2.3 Structure of Transit Records

As shown in figure 5.3 the transit records make use of the unordered, indexed, and list structures. Each transit record is placed in the data base in the order in which it was created. A car record index is maintained to permit the direct location of the record corresponding to a given boxcar.

The transit component of the data base is not of a relatively constant size as are the country and terminal components and this is reflected in the more complex list structure it uses. Each transit record contains four pairs of pointers. These pointers occur in pairs so that a link back as well as ahead can be maintained. This is necessary so that on completion of a shipment the record
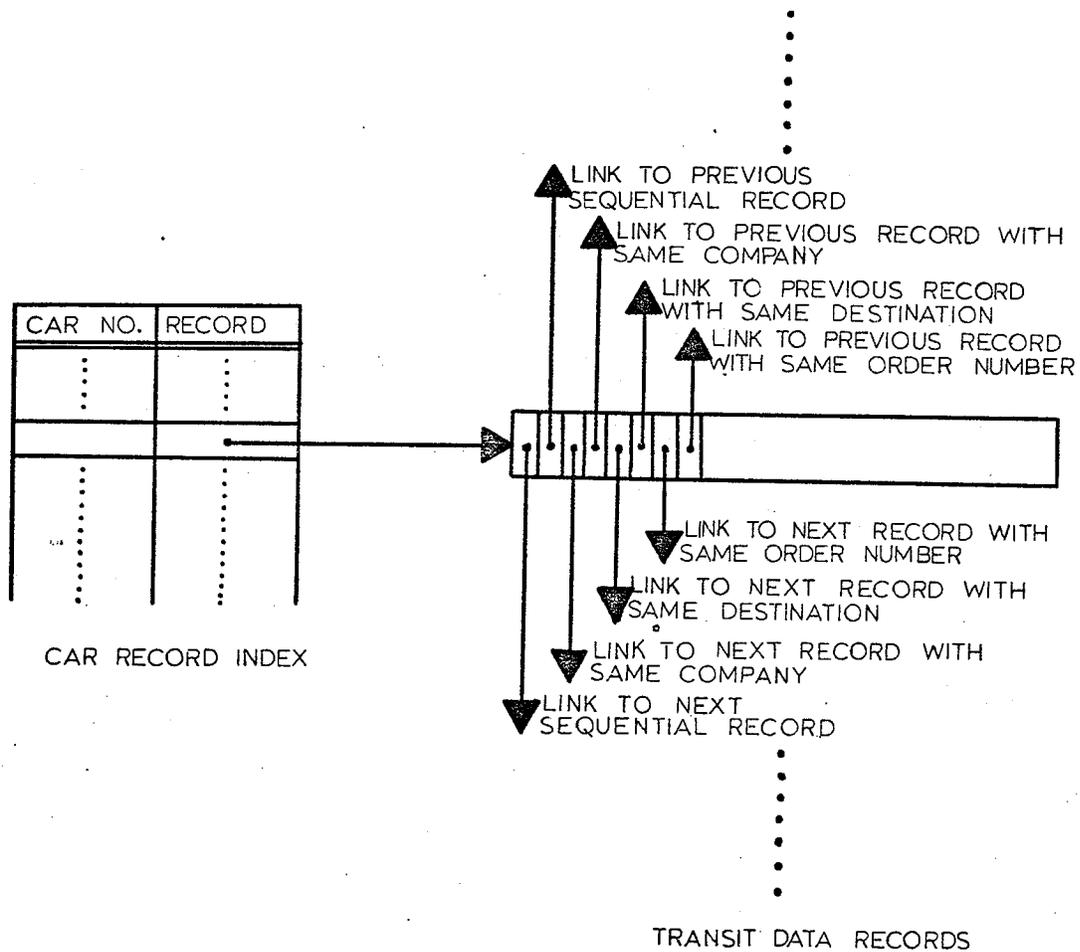
fig.5.3 STRUCTURE OF TRANSIT RECORDS

ORDER CHAIN INDEX

COMPANY CHAIN INDEX

DESTINATION CHAIN INDEX

fig.5.4 TRANSIT CHAIN ENTRY INDICES

corresponding to it can be deleted and the back lines used to adjust the forward links in previous records so that a bridge is constructed across the gap. A garbage collector will be required to keep track of these unused spaces.

One pair of pointers is used to chain all transit records together. A second pair of pointers is used to chain together the records corresponding to a given company. All records corresponding to the same destination are chained together by a third pair of pointers. A fourth pair of pointers is used to chain together all records corresponding to the company destination, and shipping order chains.

Through the use of this structure it is possible to sequentially access every transit record, every transit record corresponding to a given company, to a given destination, or to a given shipping order as well as to directly access any transit record given the number of the boxcar corresponding to it.

5.2.4 Structure of Transaction Records

As shown in figure 5.5, the transaction records make use of the unordered and list structures. Each transaction record is placed in the data base in the order in which it is received by the system. This segment of the data base is extremely volatile as it is used to accumulate the days transactions and store them until the data base is updated and facsimiles of these transactions are dispersed to those in the grain trade who require them.

TRANS. TYPE	COMPANY	START	END

LINK TO NEXT TRANSACTIONS RECORD
OF THE SAME TYPE FOR THE
SAME COMPANY

LINK TO THE NEXT TRANSACTIONS
RECORD OF THE SAME TYPE

TRANSACTION CHAIN INDEX

TRANSACTIONS DATA RECORDS
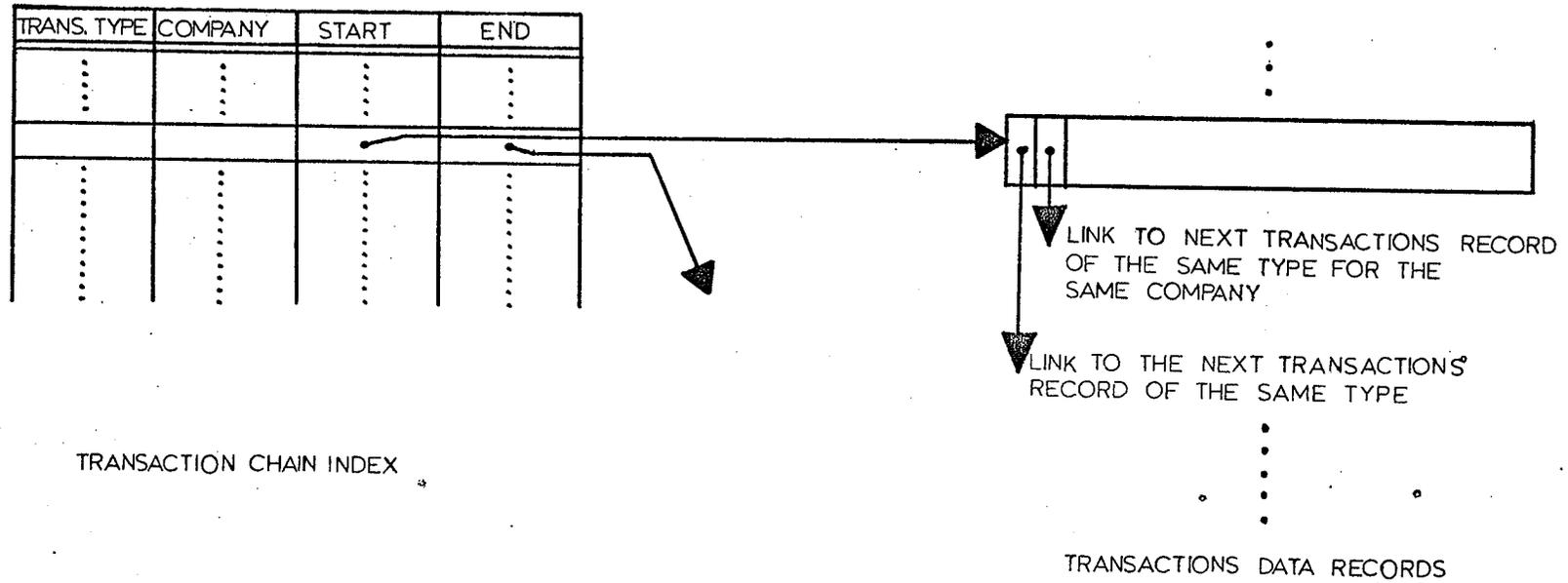
fig.5.5 STRUCTURE OF TRANSACTION RECORDS

Every transaction record contains two links. The

first points to the next transaction of the same type while the

second points to the next transaction of the same type for the same

company. An index is maintained giving the first and last members

of a specific chain type.

By using this structure, it is possible to sequentially

access every transaction record, every transaction record of a

given type, or every transaction record of a given type for a given

company. It is not anticipated that there will be any desire to

directly access specific transaction records.

5.3 Structure of the Data Base Handler

Because this data base has not been organized

specifically for data processing the accessing of its members is

not as simple and straightforward as in a conventional information

system. For this reason, in addition to the desire to maintain

applications programs independent of the data base, a data base

handler is used to interface the data base with the applications

programs.

In figure 5.6 the composition of the data base handler

is shown. The record directories, which have been described in

more detail in section 5.2, are used by the data base handler logic

to find the address of the desired record, or the address of the start

of the desired record chain. The access methods are program
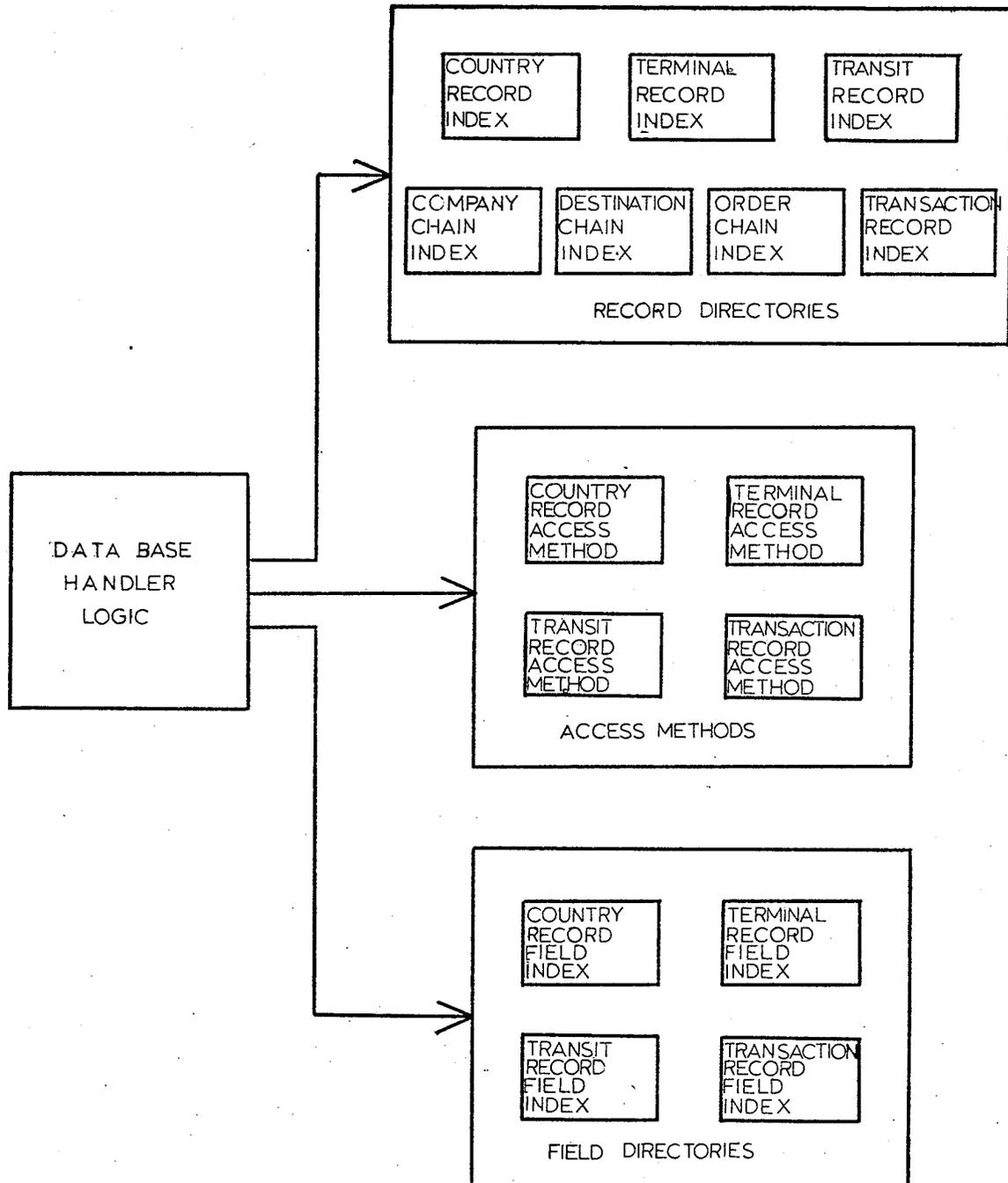
fig.5.6
COMPOSITION OF THE DATA BASE HANDLER

modules, one for each record type, which when supplied with the record address will read or write the desired information. The field directories, a sample of which is shown in figure 5.7, provide a tabular encoding of the field description of each record. Once the record has been read into the processing unit, the data base handler can access any desired field of information by adding its relative address to the starting location of the record. The format entry provides the handler with information as to how the data is stored and the length entry provides it with the length of the field.

The logic of the data base handler, which is presented in figure 5.8, consists of four parallel sets of operations — one for each component of the data base. In order to find an element of data the data base handler uses the appropriate record directory to find the address of the desired record, uses the appropriate access method to retrieve the desired record, and the appropriate field directory to locate the desired data element, or elements. If more of a chain of records is desired the field directories are used to locate the link to the next logical record, which is then accessed. When completed, control is returned to the calling program.

In writing a record, the field directory is used to format the record prior to searching the record directory for the record address, and the access method writes rather than reads the record.

FIELDNAME	FORMAT	LENGTH	POSITION

FIELD DIRECTORY
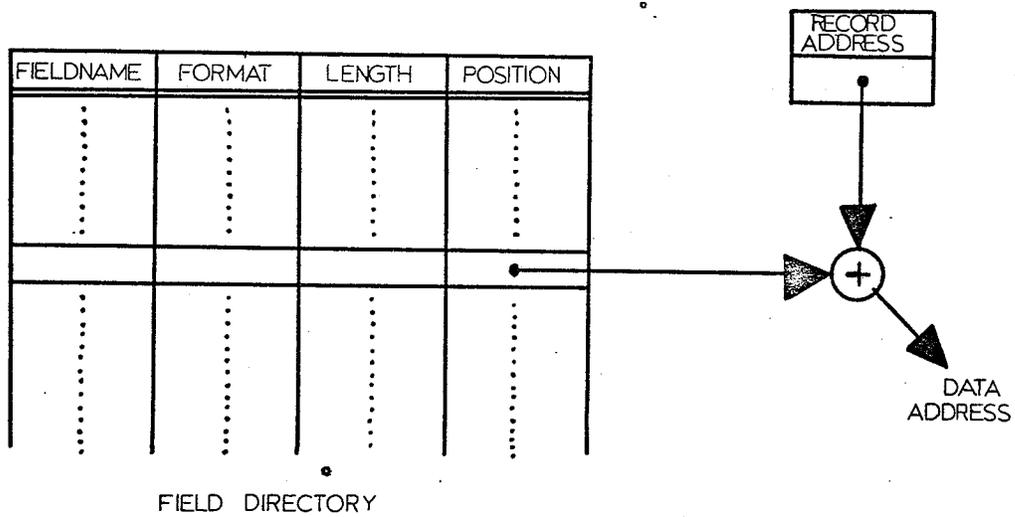
fig.5.7 DETERMINING DATA ADDRESSES
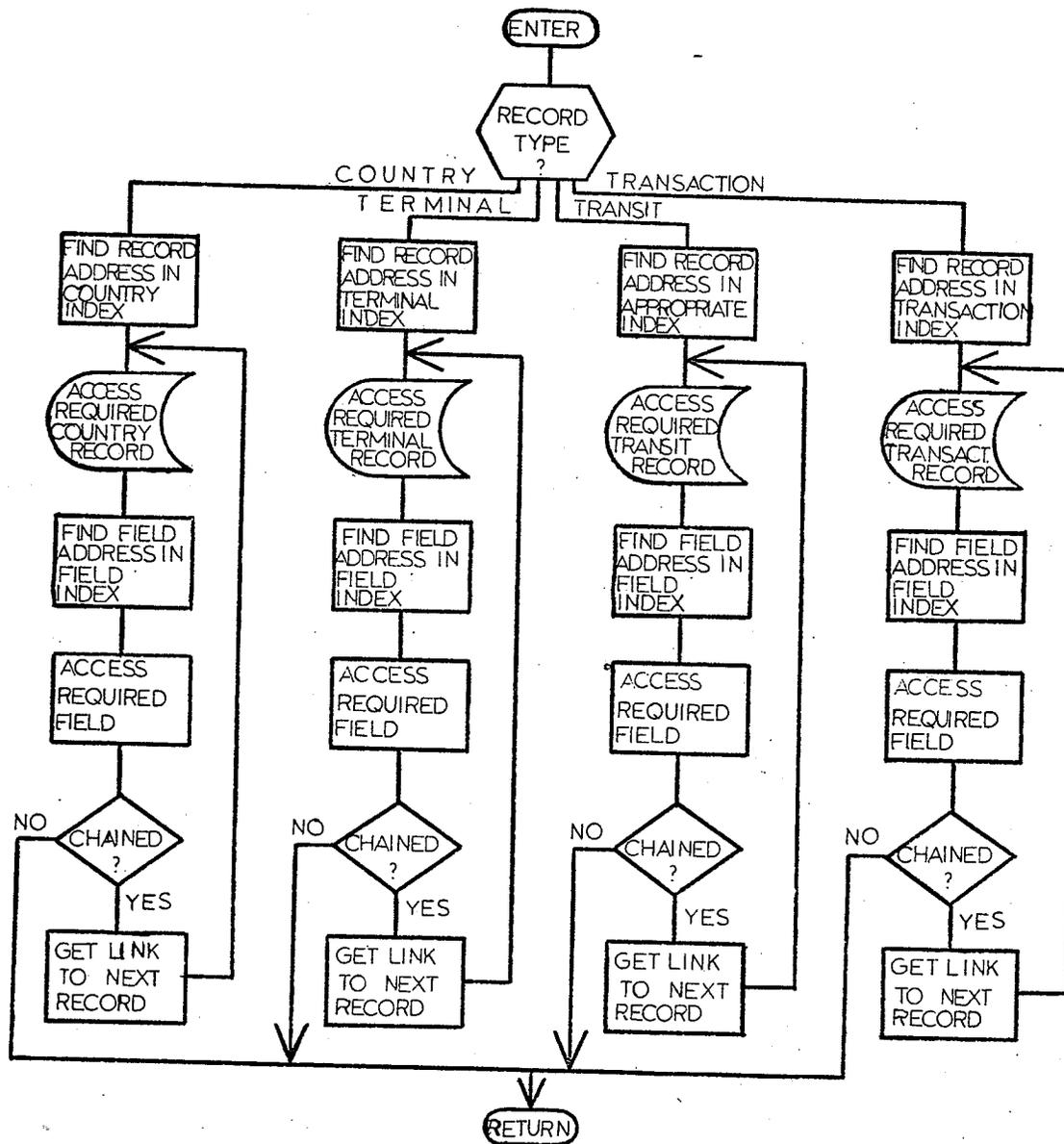
fig. 5.8 DATA BASE HANDLER LOGIC

5.4 Performance of the Data Base Handler

A small but representative data base consisting of a total of five companies operating a total of fourty-one country elevators at thirteen country stations, a total of twelve terminal elevators at two terminal locations, and twenty-nine boxcars in transit was created through the use of a random number generator. The transactions aspect of the data base was ignored in this study because it was felt that its structural features have been demonstrated by the other components of the data base.

Using the logic of figure 5.8, the data base handler was implemented on an IBM System 360/40 using the FORTRAN programming language. The data base was stored on an IBM 2314 disk storage unit.

A series of requests were presented to this handler in order to study its performance. These requests assumed the form of a series of parameters describing the application area, the record or records, and the fields desired as would be used in a crude information retrieval language. A representative number of these requests and the data retrieved by the data base handler is presented in appendix D.

Because these requests were received in an English-like format it was necessary to convert them into an internal numerical form for ease of use by the data base handler. An average of 14 milliseconds with a standard deviation of 2 milliseconds was

consummed by this translation process. It must be noted that in a real situation this translation time would only be incurred when answering on-line inquiries because requests received from applications programs would already be in the required numerical form.

An average of 16 milliseconds with a standard deviation of 3 milliseconds was required by the data base handler to convert these parameters into record and field addresses. It must be noted here that this conversion time is only incurred when a request is received and does not apply to every record when a chain is asked for because the address of the next member in the chain is obtained from the current one.

In accessing these records it was found that an average of 36 milliseconds with a standard deviation of 1 millisecond was required to bring the desired information into main storage. The data base occupied only 3 consecutive cylindars of the disk. If it had been spread further across the pack this average time would be greater because of the greater distance traversed by the disk access arm.

Thus when answering an on-line request for information the data base handler would provide this information in less than one second which is well within a user's tolerance level. When acting as an interface between an application program and the data base a certain amount of time is consummed in determining where the desired information is located. However, this is a function which is normally

handled by each application program.

CHAPTER 6

The Problem of Information Privacy

6. 1 Introduction

The term information privacy refers to information which

is isolated, or free, from unauthorized observation and in the context

of this thesis pertains to the limitation of access to information stored

within a data base to only those individuals authorized to have such

access.

As the number of computing systems which share their

resources among several users increases, so also does the risk that

information pertaining to one user will be revealed, either accidentally

or deliberately, to another user.

In a commercial environment a great deal of information

is considered to be company-confidential because it relates to the

success, failure, or state-of-health of the company. Such private

information will always have some value to an outside party, and it

must be expected that unauthorized access will be attempted on

computing systems handling such information. Thus it is assumed

that, at least in principle, the problem of information privacy exists

and that measures must be taken to ensure the integrity of the system.

At present privacy is not a problem to the members of the

grain trade because their private information does not leave their

premises unless they allow it to. Outsiders desiring access to any of this information now must obtain permission to do so or else acquire it illegally. However, if this information was to be stored in a common data base to which all concerned have access it most definitely would be necessary to implement protective facilities to ensure that the users do not obtain information which they are not entitled to have.

In providing such a protective facility the prime consideration is that the computing system establish the identity of the person with whom it is conversing and verify his right to have access to the areas of the data base he has requested. Of lesser importance is the consideration that the computer room staff be prevented from disclosing information from the data base or providing details on system workings.

Babooram [10] studied the problem of information privacy in shared resource computing systems and presented several methods of providing protection. This work has been used as a basis for outlining a privacy facility for the data base and the reader is referred to it for specific details.

6.2 Verifying the User's Right to Access the Data Base

Under the system developed by Babooram, every user is assigned a user number through which the computing system can identify who is conversing with it. When a communication is

initiated the identity of the terminal operator is verified as being

legitimate by finding a directory record corresponding to this user.

The hardware address of the terminal is obtained and a check is

made with information in the user's directory record to ensure that

the given user is allowed to use the terminal.   Once checked out,

this user is only allowed to access records which are linked to his

directory record.

The logic of Babooram's control system was modified

so as to better satisfy the requirements of the data base problem.

This modified method makes use of two tables which are shown in

figure 6. 1.   The device list pointer table provides, for each terminal

device associated with the system, a starting and an ending address

of the device list corresponding to each terminal.   The device list

table contains the user number and a corresponding security code

for each user allowed to use any given terminal device.

The logic of this modified method is diagrammed in

figure 6. 2.   When a communication is initiated the hardware

address of the terminal is used to locate, through the device list

pointer table, the list of user numbers corresponding to the

authorized users of the given terminal.   This list is searched to

determine whether the terminal operator is authorized to use this

terminal and if so, his security code is acquired.
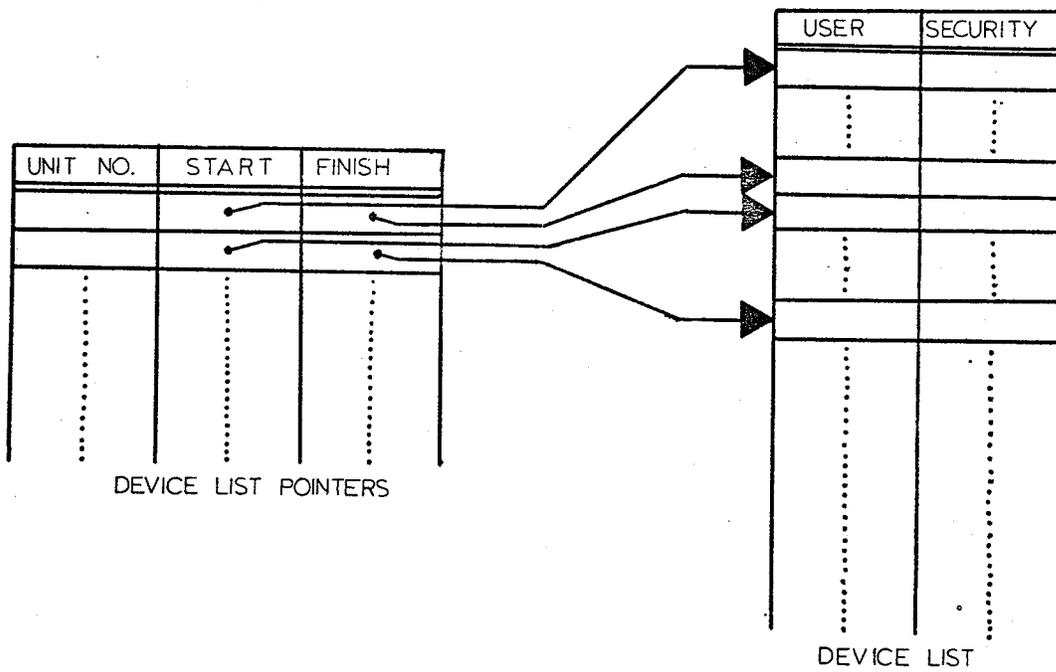
fig. 6.1 SECURITY TABLES
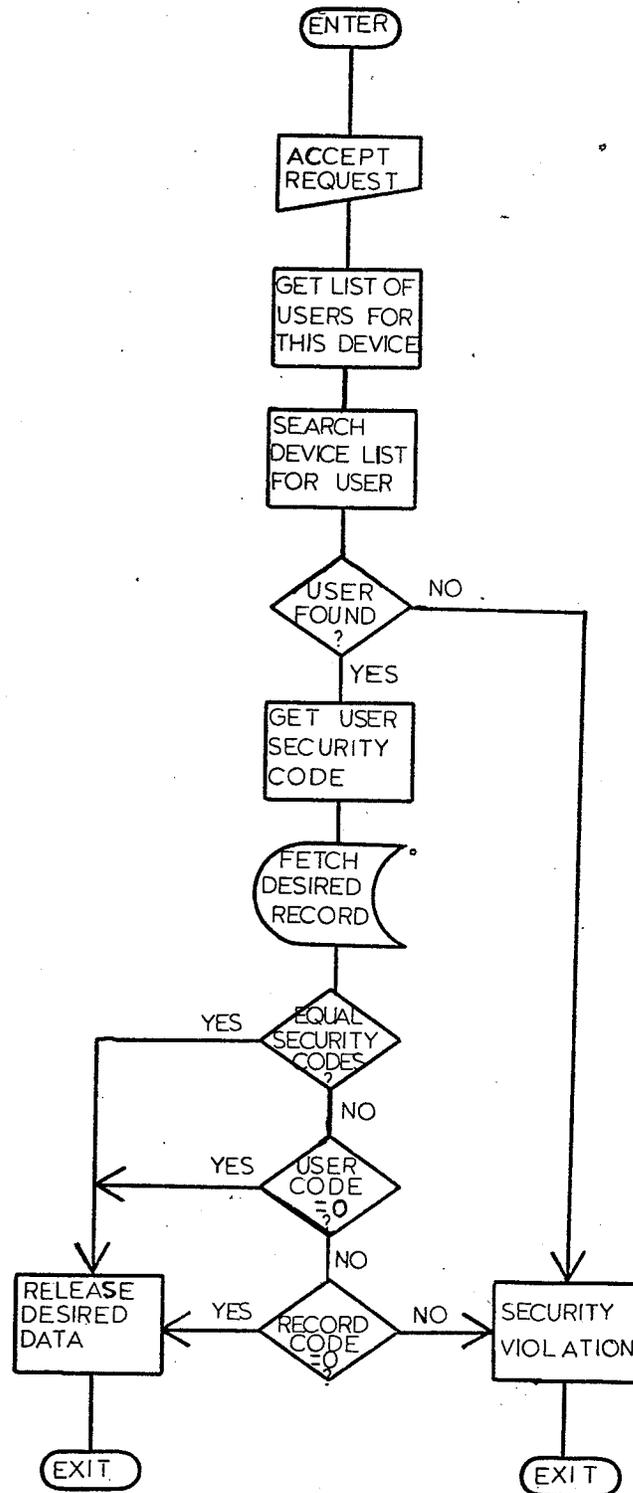
fig. 6.2 ACCEPTANCE LOGIC

Every record making up the data base is also assigned

a security code, and this is stored as part of the record. Once the

user has been verified as being legitimate he may then ask to see

any record in the data base but is only allowed access to those

records in which the security code is equal to his own.

In addition, this control system provides for two

exceptional cases. If a record has been assigned a security code of

zero then it may be accessed by any user and hence is available

to anyone allowed to use the system.

Using this control system companies are allowed full

access privileges to their own data but may obtain only selected

information from the remainder of the data base.

6.3 Results of a Test of Access Authorization

In order to demonstrate the capabilities of this access

control system a series of nine requests for information were

presented to it and the resulting system actions printed out and

presented as exhibit 6.1.

In communication 1 (of exhibit 6.1) the user was not

allowed access to the data base because he was not recognized as

being authorized to use the terminal. In all other cases, the

terminal operators were recognized as authorized users of the

terminals and were allowed to proceed.

In communications 2, 6, and 8 the authorized users were

1 INQUIRY RECEIVED FROM USER **G1 AT TERMINAL UNIT 202
  THIS USER IS NOT AUTHORIZED TO USE THIS TERMINAL
  SECURITY VIOLATION - DESIRED INFORMATION CAN NOT BE RELEASED
  COMMUNICATION CANCELLED

2 INQUIRY RECEIVED FROM USER IHE. AT TERMINAL UNIT 203
  USER MAY PROCEED USING SECURITY CODE   18
  REQUEST IS FOR INFORMATION IN RECORD NUMBER 37
  SECURITY CODE FOR THIS RECORD IS   88
  SECURITY VIOLATION - DESIRED INFORMATION CAN NOT BE RELEASED
  COMMUNICATION CANCELLED

3 INQUIRY RECEIVED FROM USER A*B/ AT TERMINAL UNIT 201
  USER MAY PROCEED USING SECURITY CODE   99
  REQUEST IS FOR INFORMATION IN RECORD NUMBER   7
  SECURITY CODE FOR THIS RECORD IS   99
  SECURITY CHECK SATISFIED - DESIRED INFORMATION CAN BE RELEASED

4 INQUIRY RECEIVED FROM USER 2C67 AT TERMINAL UNIT 203
  USER MAY PROCEED USING SECURITY CODE   0
  REQUEST IS FOR INFORMATION IN RECORD NUMBER 25
  SECURITY CODE FOR THIS RECORD IS   99
  SECURITY CHECK SATISFIED - DESIRED INFORMATION CAN BE RELEASED

5 INQUIRY RECEIVED FROM USER V&Q* AT TERMINAL UNIT 202
  USER MAY PROCEED USING SECURITY CODE   88
  REQUEST IS FOR INFORMATION IN RECORD NUMBER 46
  SECURITY CODE FOR THIS RECORD IS   0
  SECURITY CHECK SATISFIED - DESIRED INFORMATION CAN BE RELEASED

EXHIBIT 6.1A

```
6 INQUIRY RECEIVED FROM USER 8-86 AT TERMINAL UNIT 201
    USER MAY PROCEED USING SECURITY CODE    72
    REQUEST IS FOR INFORMATION IN RECORD NUMBER  49
    SECURITY CODE FOR THIS RECORD IS    9        .
    SECURITY VIOLATION - DESIRED INFORMATION CAN NOT BE RELEASED
    COMMUNICATION CANCELLED
```

```
7 INQUIRY RECEIVED FROM USER 8-86 AT TERMINAL UNIT 201
    USER MAY PROCEED USING SECURITY CODE    72
    REQUEST IS FOR INFORMATION IN RECORD NUMBER  27
    SECURITY CODE FOR THIS RECORD IS  72
    SECURITY CHECK SATISFIED - DESIRED INFORMATION CAN BE RELEASED
```

```
8 INQUIRY RECEIVED FROM USER 8-86 AT TERMINAL UNIT 202
    USER MAY PROCEED USING SECURITY CODE     9
    REQUEST IS FOR INFORMATION IN RECORD NUMBER  27
    SECURITY CODE FOR THIS RECORD IS  72
    SECURITY VIOLATION - DESIRED INFORMATION CAN NOT BE RELEASED
    COMMUNICATION CANCELLED
```

```
9 INQUIRY RECEIVED FROM USER 8-86 AT TERMINAL UNIT 202
    USER MAY PROCEED USING SECURITY CODE     9
    REQUEST IS FOR INFORMATION IN RECORD NUMBER  49
    SECURITY CODE FOR THIS RECORD IS     9
    SECURITY CHECK SATISFIED - DESIRED INFORMATION CAN BE RELEASED
```

EXHIBIT 6.1B

not allowed access to the information they had requested because the security code of the record containing that information did not correspond to their own security codes.

In communications 3, 7, and 9 the authorized users were allowed access to the requested information because it was part of a record in which the security code corresponded to that of the user.

Communication 4 is an example of a user who is permitted to access any information in the data base because his security code is zero.

Communication 5 is an example of a record which is available to every authorized user because its security code is zero.

Communications 6 through 9 demonstrate that it is possible for one user to be authorized to use more than one terminal and also that the information which he has access to does not necessarily have to be the same for each terminal.

6.4 Ensuring Computer Room Protection

Although sophisticated protection schemes can be developed to guard against unauthorized data acquisition, the possibility always exists that computer room personnel could be enticed into using stand alone utility software to copy, or print out, the data base in order to assertain its contents or develop an understanding of its internal workings.

In order to circumvent this weakness Babooram demonstrated how critical data, such as is used for identification purposes, can be stored in a scrambled form and if nefariously printed out would be devoid of meaning unless the infiltrator was able to break the code.

For the purposes of this data base problem this scrambling concept has been extended to take into consideration the internal structure of the IBM System /360 in order to provide a scrambled code which is extremely unintelligible when printed out but which yields the added benefits of retaining the collating sequence and providing storage savings of up to 25% on the fields that are scrambled. Using this approach would enable scrambled information to be operated upon in this form within the computing system. Only when a new input is received in character format or when an output is desired in character format is a conversion necessary.

If the lower case alphabetics are ignored, the character set of the IBM System /360 is made up of 63 members each represented by a unique combination of 8 binary digits, or bits. Since a field of 6 bits can be in any one of 64 unique states it is possible to translate each member of the character set from an 8 bit binary number in the range 74 to 249 into a 6 bit binary number in the range 0 to 63. The result is that the contents of four

System /360 character positions, or bytes, can be scrambled and compressed into three bytes.

Under this scrambling system it is virtually impossible to break the code even if the scrambled data is printed out in hexadecimal form because it does not respect the byte boundaries of the 360. Thus, depending on where a given character is located, and what characters are located on either side of it, the printed format changes.

6.5 Results of a Test of this Scrambling Technique

In order to study the performance of this scrambling technique a passage of textual information was scrambled and then unscrambled. Exhibit 6.2 shows, at the top of the page, the original passage printed in character format and, at the bottom of the page, the same passage printed in hexadecimal format. Exhibit 6.3 shows the same passage after being processed by the scrambling algorithm. It is to be noted how devoid of meaning it is and the extreme difficulty encountered in relating it to the original. After being operated on by an unscrambling algorithm the original character configuration was obtained demonstrating that information is not adversely affected by these operations.

It was observed that a character string of length M, when compressed in this manner, results in a storage saving of N characters where

FOURSCORE AND SEVEN YEARS AGO OUR FATHERS BROUGHT FORTH UPON
THIS CONTINENT A NEW NATION, CONCEIVED IN LIBERTY, AND DEDIC
ATED TO THE PROPOSITION THAT ALL MEN ARE CREATED EQUAL. NOW
WE ARE ENGAGED IN A GREAT CIVIL WAR, TESTING WHETHER THAT NA
TION, OR ANY NATION SO CONCEIVED AND SO DEDICATED, CAN LONG
ENDURE. WE ARE MET ON A GREAT BATTLE-FIELD OF THAT WAR. WE H
AVE COME TO DEDICATE A PORTION OF THAT FIELD AS FINAL RESTIN
G-PLACE FOR THOSE WHO HERE GAVE THEIR LIVES THAT THAT NATION
MIGHT LIVE. IT IS ALTOGETHER FITTING AND PROPER THAT WE SHO
ULD DO THIS. BUT IN A LARGER SENSE WE CANNOT DEDICATE, WE CA
NNOT CONSECRATE, WE CANNOT HALLOW THIS GROUND. THE BRAVE MEN
, LIVING AND DEAD, WHO STRUGGLED, HAVE CONSECRATED IT FAR AB
OVE OUR POWER TO ADD OR DETRACT. THE WORLD WILL LITTLE NOTE
NOR LONG REMEMBER WHAT WE SAY HERE, BUT IT CAN NEVER FORGET
WHAT THEY DID HERE. IT IS FOR US THE LIVING, RATHER, TO BE D

C6D6E4D9E2C3D6D9C54DC1D5C44DE2C5E5C5D54DF8C5C1D9E24DC1C7D64D
D6E4D94DC6C1E3C8C5D9E24DC2D9D6E4C2C8E34DC6D6D9E3C840E4D7D6D5
E3C8C9E24DC3D6D5E3C9D5C5D5E34DC14DD5C5E64DD5C1E3C9D6D5684DC3
D6D5C3C5C9E5C5C44DC9D540D3C9C2C5D9E3E86B4DC1D5C44DC4C5C4C9C3
C1E3C5C44DE3D640E3C8C540D7D9D6D7D6E2C9E3C9D6D5473E3C8C1E34DC1
D3D34DD4C5D540C1D4C54DC3D5C5C1E3C5C44DC5D8E4C1D34840D5D6E64D
E6C54DC1D9C54DC5D5C7C1C7C5C44DC9D540C14DC7D9C5C1E34DC3C9E5C9
D34DE6C1D96B4DE3C5E2E3C9D5C74DF6C8C5E3C8C5D940E3C8C1E340D5C1
E3C9D6D56B4DD6D940C1D5E84DD5C1E3C9D6D540E2D640C3D6D5C3C5C9E5
C5C44DC1D5C44DE2D640C4C5C4C9C3C1E3C5C46B4DC3C1D540D3D6D5C740
C5D5C4E4D9C54840F6C54DC1D9C54DD4C5E340D6D540C14DC7D9C5C1E340
C2C1E3E3D3C56CC6C9C5D3C44DD6C6C40E3C8C1E34DE6C1D94B4DE6C540C8
C1E5C540C3D6D4C54DE3D640C4C5C4C9C3C1E3C540C14DD7D6D9E3C9D6D5
4DD6C640E3C8C1E340C6C9C5D3C44DC1E24DC6C9D5C1D34DD9C5E2E3C9D5
C7bDD7D3C1C3C540C6D6D940E3C8D6E2C54DE6C8D64DC8C5D9C540C7C1E5
C54DE3C8C5C9D940D3C9E5C5E24DE3C8C1E340E3C8C1E340D5C1E3C9D6D5
4DD4C9C7C8E340D3C9E5C54B4DC9E340C9E24DC1D3E3D6C7C5E3C8C5D940
C6C9E3E3C9D5C740C1D5C44DD7D9D6D7C5D94DE3C8C1E34DE6C540E2C8D6
E4D3C44DC4D6C40E3C8C9E24B4DC2E4E340C9D540C14DD3C1D9C7C5D940E2
C5D5E2C54DE6C540C3C1D5D5D6E340C4C5C4C9C3C1E3C56B4DE6C540C3C1
D5D5D6E340C3D6D5E2C5C3D9C1E3C56B4DE6C540C3C1D5D5D6E340C8C1C3
D3D6E640E3C8C9E24DC7D9D6E4D5C44B4DE3C8C5C540C2D9C1E5C540D4C5D5
6B4DC3C9E5C9D5C74DC1D5C44DC4C5C1C4B4DE6C8D6D40E2E3D9E4C7C7C3
C5C4EB4DC8C1E5C540C3D6D5E2C5C3D9C1E3C5C44DC9E340C6C1D940C1C2
D6E5C540D6E4D940D7D6E5C5D940E3D640C1C4C440D6D940C4C5E3D9C1C3
E34B40E3C8C540E6D6D9D3C440E6C9D3D340D3C9E3E3D3C540D5D6E3C540
D5D6D940D3D6D5C740D9C5D4C5D4C2C5D940E6C8C1E340E6C540E2C1E840
C8C5D9C56B40C2E4E340C9E340C3C1D540D5C5E5C5D940C6D6D9C7C5E340
E6C8C1E340E3C8C5E840C4C9C40C8C5D96B40C9E340C9E24DC6D6D940E4
E4E24DE3C8C540D3C9E5C9D5C76B40D9C1E3C8C5D96B40E3D640C2C540C4

EXHIBIT 6.2

```
B$%5-%@FY8. AO %b%4F/U& OH$OX%4G%W&S&HZ2Y‡#‡YOY A-YOO S $BG1
BF,&-‡A-Y580@ T IT1#,% $/  @Y¤,X B‡ OX‡‡&‡WQ,&- OW,A9WB7YA#
A$ ,X AO ,-‡S* EO$1O SO/@ T E‡FG$8GTB9‡E#‡BX OO/CQ OX%BY$8&$
OOY &%AO3BF,&- b-¤WG  G AO B- 97TS# 9 ¤,‡WWH #G 1O‡EO$1OX# Z
 F‡FG$8G$OZ OH R Z‡.S, 1,‡‡EOS G‡bR B‡ 97TS# AO‡W.TW‡Z‡.S, -
%9 A# BO$Q. bYYO‡W P‡B$ O‡ @¤SUH 1O/ G‡OXTOITA# OW,BY$8&$OOY
B8/& W GBB#‡&-$-‡/#Y OHTOYYDFY8&%WX%BY$8¤ BQZ#X‡O-,&#BA.,BO
%I$2P%BPY5O1@G$S&,AX %O,@ 1@G$S&,A-Y57%,X-CP‡5OYW S,ZZD.S&-/
2‡Y8-,1O*1@ B7Y IT8O/AO AX‡9 18- O./EX H$AO¤W. bF,@ T8H$OF*
XG‡W# ‡* O.ZA7 B$ 9#% $BBY C-%R 18Z‡-#,ROYWX‡S$ --/BGX#7 O¤S
, 1@.$¤H 14 2##& ¤,‡Y G%B&%E#‡FW,BY ¤GT8H 1O‡& T4HZO. BY BYO
&H‡BF,I#‡B‡ 1O
```

```
829BECB5DAbC7CObF878OB5FC1FAOOCDFbEC84ObE1A4OAbF8OO81BBA27EC
B4O72CAbF&b2b8O829B2E&8OBEAAb&BA2&EDO1DAb8BA3A1FA2EO1BO287F1
O2&bEE8E9A1OO1DAb875F8FO7DEO23AOO9A371FB2ECDOO1BA1EO1E7DE8CD
bEE7DEO2EA4OBA27COAACAbAAbD&EE8E9AOOBA2bEEO184AbO277E&O1B81F
O1OB1FbEE7DES1FAEFbEbO8OA29C4OC5FO1BB1FO1FA21bE17DEO23AOObCO
8bC7OBB8O7b3C2398OC5BB1OO2E7EDBA3A21O3189FBA27ECO2E89B88OA1B
BA3Ab84OOAbCO1BA33O22bEE8E9AOOB&9O1DAb875F8FO7DEO1BA1EO2DA4O
79F7A375BB9F79OO1DbF8O2bAb88407E87AFB1FO8OC5FO1BB1FO277EEO29
AOObCO8bC7OBB8O71bBAE99F3AO8DF99EO298OO8A2bEEO31bECO8OC5FO22
bFO7CO7b99DFO2EA4O79F7A375BB9FO1BO2AAbCBA3Ab8O298OOBA2bEEO2O
8DF99EO1B84O823A1B98OB1FB6&8Eb84EAAbDO7CO829BOOBA2AbD7COCb2
A4O89FB1FO21bFO7COBA27E38OO9A3C1FB4OBA2bEEO2E89B8bOA1BBA3Ab8
O278E18AEO2b&FO7C2O23B8O8EDO1B9AEAb17EE89FBOO823BAE8E884ObE8
78OAACAbA7ECO2E89BB8OC5FO2D8A9&b78O7A9O2E8A3B42O1CBEEO23ACO
bCO99BB217ECO2O7E8B5FO317CO75BA28AbEO1E7DE8DDbEE7DOO317CO75B
A28AbEO1DAb8B5F7bCbEE7DOO317CO75BA28AbEO22bEb9A9C4OBA28EDO21
BE9BE&78202E83FO1CB18C1FO277EE4OO9A3C23A21O1BA1EO1E7DB79OO31
8A9O2DBACBE18bb7DE4OO89BC1FO1DAb8B5F7bCbEE7DEO23B8O81BBOObOC
A7O7COAbFBOOAA9C5FBOOBA9O1B79EO29BOO79FBACbDOB8202E89FO31AbC
99EO318Eb98O9A3BAE99FO2&AbE7CCA29BOO9A9A21O2C7E77E771FBOOCb2
bEEO317COB5BCCO89FB1F4OO72FB8O8EEO1DbE8O287FO7ECO2OAbC85FB8O
Cb2bEEO2E89FCCO7A378O89FB1FO8O&EEO238CO829BOOBEDO2E89FO2b8FO
8E8b5OO2CbEE89FB1OO2EA4O71FO1EOO
```

EXHIBIT 6.3

$$N = (M+3)/4 \qquad \dots (i)$$

Logically this is so because, in order to synchronize the scrambled characters with the internal 360 byte structure, it is necessary to compress the contents of four bytes into three.

It follows that the storage saving can be related to the size of the original character string by the relationship

$$4N \leqslant M \leqslant 4N+3 \qquad \dots (ii)$$

The cost C, in microseconds of System /360 Model 40 processor time, associated with scrambling a character string of length M is given by

$$C = 204M \qquad \dots (iii)$$

where 204 is the time required to scramble one character

By combining relations (ii) and (iii), the scrambling cost can be related to the resultant storage saving through the relationship

$$814 \leqslant C \leqslant 816N+612 \dots (iv)$$

Thus, when used as a storage saving technique, relations (i) and (iv) can be used to evaluate the trade-offs between processor time and storage savings that are possible with this scrambling method.

CHAPTER 7

Summary, Conclusions, and Recommendations for Further Research

7.1 Summary

A model was developed of the basic flow of information through the grain trade and based upon this model a common computer-centered data base, made up primarily of information used for planning and control purposes, was proposed. Three methods, each of increasing sophistication, of utilizing this proposed data base were outlined.

A data base handler, which was designed to access specific information in the data base when provided with a few parameters defining the desired information, was developed. A small, but representative, data base was generated in order to evaluate the performance of the data base handler.

The problem of information privacy in the data base was investigated. Procedures which were conceived for restricting access to the data base and for scrambling critical information in the data base were proposed and evaluated.

7.2 Conclusions

It was concluded that information which is used for planning and control purposes in the grain trade, as well as the basic transactions associated with this information, can be maintained in a common data base and through the implementation of appropriate security measures, which were demonstrated as being feasible, there should be no fear of

one company's confidential data being revealed to another company.
Although this security system was implemented at the organization level,
there is no reason why it could not be extended to provide similar
protection at the individual level if so desired.

The adoption of a common computer-centered data base updated
through a comprehensive telecommunications data gathering network would
enable the members of the grain trade to have an up-to-date reservoir of
information for planning and control purposes as well as access to basic
accounting transactions no later than one day after their occurrence.

It was found that the separation of the data accessing from the
application programs through the use of a data base handler does not
appreciably degrade a system's performance. While it is true that the
address computation function does consume some time, this operation
must be performed either by the data base handler or by the applications
program. Therefore, if the benefits of having programs independent of
the data base are also taken into consideration, the use of a data base
handler will enhance the overall system performance.

It was concluded that the scrambling of information, in addition
to its security implications, is a practical and, in many cases, a highly
desirable vehicle for reducing the size of a data base.

7.3 Suggestions for Futher Research

The research reported in this thesis, while useful in itself, is
not terminal. In the following paragraphs several additional areas of

investigation, related to data base systems in general and the grain trade in particular, are proposed.

In the area of implementing a common computer-centered data base system in the grain trade there are two areas of research which will demand attention.

The first is in the area of developing a comprehensive telecommunications network to gather data for the data base and would involve a simulation study of various telecommunications equipment and configurations in order to obtain a system which maximizes benefits and minimizes costs.

The second is in the area of computer-computer interfaces and would involve the development of hardware and/or software means to interface the various computers in the grain trade to the data base so that any given computer could communicate directly with the data base.

In the area of generalized data base systems there are three areas of research in which more work is required.

The first is in the area of software for establishing data bases. A data description language is required which would enable a system designer to describe his data base in familiar terms and a processor is required to use the data description language to produce the data base complete with linkages, directories, and access methods.

The second area of research involves the development of methods by which programs, written in high level languages, can

access members of the data base by supplying the name of the desired

data element.

The third area of research would involve the development of

a generalized inquiry facility which would enable a user to pose questions

to his data base in an English-like language, rather than as an unmeaningful

and somewhat inflexible parameter list.

BIBLIOGRAPHY

1. Proceedings of the Second Symposium on Computer-Centered Data Base Systems, System Development Corporation, Santa Monica, California, TM-2624/100/00, (December, 1965)

2. Buckles, G. A., Lt., USAF, and S. B. Carpenter, Lt. USAF, Computer-Centered Data Base Systems, ESD-TR-66-499, Directorate of Computers, Deputy for Engineering and Technology, Electronic Systems Division, Air Force Systems Command, United States Air Force, L. G. Hanscom Field, Bedford, Mass., (October 1966).

3. "Cobol Extensions to Handle Data Bases", Report to the Codasyl Cobol Committee, Data Base Task Group, (January 1968).

4. System /360 Generalized Information System (Basic) Application Description Manual, IBM Corporation, White Plains, New York, H20-0521, (1968).

5. System /360 Information Management System Application Description Manual, IBM Corporation, White Plains, New York, H20-0542, (1968).

6. Withers, D., "Elements of a Generalized Information System", IBM Systems Bulletin, Region I Field Systems Centre, Toronto 12, Ontario, (December, 1968).

7. Gellman, H. S., "Improving Management Information Systems", Cost and Management, (Sept. - Oct. 1968)

8. Vorhaus, A. H., and R. D. Wills, The Time-Shared Data Management System: A New Approach to Data Management, System Development Corporation, Santa Monica, California, SP-2747, (Feburary, 1967)

9. Kaufman, F., "Data Systems That Cross Company Boundaries", Harvard Business Review, (Jan.-Feb. 1966)

10. Babooram, R. J., A Study of Control Systems for Highly Confidential Data Accessible from Terminals at Remote Points, University of Manitoba, (May 1969).

11. Petersen, H. E., and R. Turn, System Implications of Information Privacy, The RAND Corporation, Santa Monica, California, (April, 1967)

12. Disk File Organization Techniques, The Burroughs Corporation, Detroit, Michigan, (1968)

13. Franks, E. W., "A Data Management System for Time-Shared File Processing Using a Cross-Index File and Self-Defining Entries", Proceedings of AFIPS 1966 Spring Joint Computer Conference, Spartan Books, (April, 1966)

14. Henry, W. R., "Hierarchical Structure for Data Management", IBM Systems Journal, No. 1, (1969)

15. Zimmerman, B., D. Lefkovitz, and N. S. Prywes, "The Naval Supply Office Inventory Retrieval System - A Case Study in File Automation", Management Science, No. 3, (April, 1964).

16. System /360 Principles of Operation, IBM Corporation, White Plains, New York, A22-6821-3, (1966).

APPENDIX A

The Procedure Flow Chart

A.1 Introduction

In describing a procedure, charts provide one of the most effective means of communication because through the adoption of representative symbols, pages of written description can be eliminated. The procedure flow chart is a symbolic, or pictorial, representation of the flow of information through an organization.

A.2 The Symbols

Four basic symbols are used in the procedure flow chart.

○ Operation — Indicates that some action is taking place. There are two major actions which warrant special refinements to this basic operation symbol.

◎ — Indicates the origin or creation of a record.

⊘ — Indicates information being added to a record.

○ Transporation — Indicates the movement of information from one place to another.

▽ Storage — Identifies an inactive point, either permanent or temporary, in the information flow.

☐ Document — Represents the document which is the bearer of the information.

A. 3 Using the Symbols

The sequence of events affecting a given document are connected by a straight line and the direction of flow is from left to right. A document or record can not change lines unless it joins another document or record.

Originating a Record
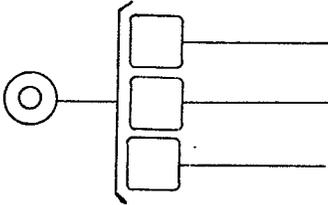
Identifies the creation of a multipart document. The lines indicate the direction that each part will take.

Effect on another Record
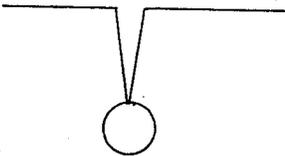
Identifies an operation in which one record is used in the creation, updating, or modification of another record.

Simultaneous Action
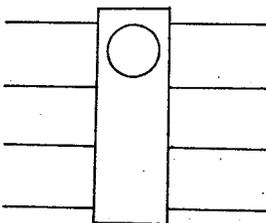
Identifies an operation which is simultaneously performed on each of the records passing through the rectangular box.

By-pass
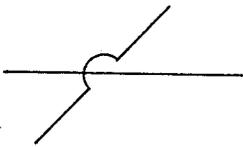
Indicates that one of the records is by-passing another without affecting it.

A.4 Reading the Chart

Figure A.1 is a trivial example of a procedure flow chart to demonstrate how it is used. Each event is numbered and each of these numbers corresponds to the numbers in the narrative below.

1 - A three part document is initiated. Part one travels in one path and parts two and three travel together in another path.

2 - More information is entered on parts two and three.

3 - Parts two and three are separated.

4 - Part three is used to initiate a new document.

5 - This new document is placed into a file.

6 - Parts one and three have more information entered on them but part two by-passes this operation.

7 - Part three is transported to another area.
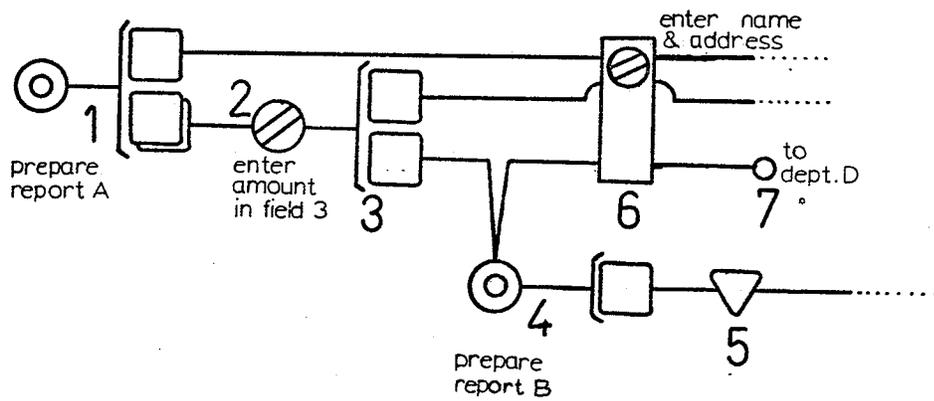
fig. A.1 USAGE OF THE PROCEDURE
FLOW CHART

APPENDIX B

Sample Documents Used in the Grain Trade

Document Number	Document
1	Storage Receipt
2	Producer's Certificate
3	Storage Report
4	Stored Purchase Report
5	Report of Grain Purchased
6	Advance Application
7	Shipping Report
8	Railway Waybill
9	Daily Grain Letter
10	Wheat Board 101 Report
11	Shipping Order
12	Summary Purchase Report
13	Advance Summary
14	Daily Grain Statement
15	Weekly Report to Board of Grain Commissioners
16	Statement of Cars Shipped
17	Terminal Outturn
18	Warehouse Receipts
19	Detail Delivery
20	Delivery Summary

Document Number	Document
21	Account Statement
22	Final Payment Cheque
23	Report of Car Requirements
24	Report of Stocks in Country Elevators
25	Report of Grain Received at Terminal
26	Recap of Warehouse Receipts
27	Daily Stock Record
28	Daily Tracing Report

Form B2—180,000-3-68—3239

SCALE RECORD IN LBS.	
GROSS WEIGHT	
WAGON WEIGHT	
GRAIN UNLOADED	
SCREENINGS ETC. CLEANEDOUT	
GROSS WGHT. AFTER CLEANING	
SHRINKAGE ALLOWANCE	
GROSS WGHT. TO ACCOUNT FOR	

	BUSHELS	10ths
GROSS WGHT. TO ACCOUNT FOR		
DOCKAGE		
NET WGHT. TO ACCOUNT FOR		

......................................STATION....................................19 —

UNITED GRAIN GROWERS Ltd.   C   30201

RECEIVED THIS DAY
FOR STORAGE FROM...°

GROSS GRAIN WEIGHT		KIND OF GRAIN	The Agreed Grade Of Which Is	SUBJECT TO DOCKAGE OF	
Bushels	Tenths			Matter Other Than Cereal Grains	Other Cereal Grains
				%	%

NET WEIGHT
(IN WORDS)..BUSHELS........................TENTHS

The charges payable in respect of the grain above described are to be calculated from
and are as follows:
    (a) For receiving, handling and shipping the said grain, including storage and insurance against loss by fire on the last
        mentioned date and for fourteen days thereafter   cents a bushel.
    (b) For cleaning the said grain   cents a bushel.
    (c) For storage and insurance against loss by fire for each day or part thereof following the expiration of the fourteen
        days above referred to   of one cent a bushel.
Upon the surrender of this receipt and the payment or tender of all lawful charges in respect of the grain above described, the
above quantity of grain of the grade specified will be delivered to the holder of this receipt at his own option either:
    (a) By its discharge into a railway car or other conveyance made available for loading at this elevator, or
    (b) By the substitution for this and like receipts, together covering a quantity not less than a carload lot, of a ware-
        house receipt for grain of the same quantity and grade, and subject only to the dockage above specified, issued in
        the prescribed form by a terminal elevator to which shipment of the said grain is authorized by The Canada Grain
        Act upon notice or otherwise.

Graded Storage Receipt   By...

                        Manager.

13041

PRODUCER'S ACCOUNT NO.	CASH TICKET NO.	DAY	MO.	YR.	
00 2158585	6 118211	11029		03100	

DURRANT THOMAS A
21585856

CO. NO. STN. NO.
767525009

UNITED GRAIN GROWERS LIMITED

MOOSE JAW

SCALE RECORD IN LBS	PAY TO			GRADED BY AGREEMENT IS	GRAIN	PRICE	GROSS AMOUNT
SS HT		GROSS BUSHELS TO ACCOUNT FOR					
ON NT		DOCKAGE					
CLEANED		NET BUSHELS	310	X/td Nk Oats		50 7/8	157 71
S AFTER		OTHER DEDUCTIONS				F.A.A. 1% LEVY	1 59
KAGE WANCE SS GHT ACCOUNT						BAL.	156 12
						OTHER DEDUCTIONS	
AMOUNT PAYABLE (IN WORDS)	One hundred fifty six				12/100 DOLLARS	NET AMOUNT TO PAY	156 12

OFFICE COPY   BY................................... ELEVATOR MANAGER **NOT NEGOTIABLE**

Form B6— —O.S. A23

91

Report No._____

DAILY SPECIAL BIN REPORT
UNITED GRAIN GROWERS LIMITED

C. W. Bd. No.

DATE_____ STATION_____

TICKET NOS.	WHEAT				OATS				BARLEY				FLAX				RYE			
	NET BUS.		Shrink.		NET BUS.		Shrink.		NET BUS.		Shrink.		NET BUS.		Shrink.		NET BUS.		Shrink.	
TOTAL																				

ALL BUSINESS MUST BE REPORTED TO HEAD OFFICE DAILY

4

Form B7a–

STORED PURCHASED REPORT

UNITED GRAIN GROWERS LIMITED

STATION.. DATE........................

List only One Grade of Grain and only one class of Storage Tickets on each Report.

Original Storage Tickets Must Accompany this Report.

Storage Must be Calculated on Gross Weight.

C.T. No..

C. W. Bd. No.

DATE OF TICKET	TICKET NUMBER	BUSHELS	DAYS STORAGE	AMOUNT OF STORAGE	DATE OF TICKET	TICKET NUMBER	BUSHELS	DAYS STORAGE	AMOUNT OF STORAGE

CUSTOMER'S NAME

BROADCAST No..

PRICE PER BUS..

LESS DEDUCTION
FOR DOCKAGE (IF ANY)..

NET PRICE..

KIND OF TICKETS..
GRADED OR S. BIN

GRADE..

DOCKAGE..%

STORAGE CHARGES $..

KIND OF GRAIN..

TOTAL BUSHELS..

LESS DOCKAGE
(IF SPECIAL BIN)..

NET BUSHELS..

93

CANADIAN WHEAT BOARD
DAILY REPORT OF GRAIN PURCHASED

76

CASH TICKET No.	LIST BUSHELS	TENTHS	TOTAL BUSHELS	TENTHS	GRADE	C.W.B. ADVANCE REFUND AMOUNTS	"X" IF STORED PUR- CHASED	DOCKAGE	SHRINK.	

For Office Use Only   DATE

STATION NAME   ELEV. No.   STATION No.

Limited

MANAGER

Form AR-A

Application for Advance Payment   Crop Year

DATE _Nov 29/64_   Specified Acreage _295._

To THE CANADIAN WHEAT BOARD: APPLICATION No. _33_   ADDRESS _Silverton_ P.O. Box No. _____ PROVINCE _MAN_

I/WE, the undersigned, whose signatures appear in Section 5 below, hereby apply for an Advance Payment pursuant to the Prairie Grain Advance Payments Act in respect of the grain hereinafter described to be delivered under the said permit and certify:

Delivery Point and Company No.

Applicants giving false information are liable to a fine or imprisonment or both.

1. I/We have not received a prior advance in respect of the grain hereinafter described.

2. The above described Permit Book does not bear an endorsement as provided by Sections 8 and/or 12 of the Prairie Grain Advance Payments Act.

3. Quantity of threshed grain of applicant(s) in storage (otherwise than in an elevator) eligible for delivery with respect to the above described Permit Book...............

WHEAT	OATS	BARLEY	TOTAL
1 5 0 0	2 0 0 0	2 0 0 0	5 5 0 0

4. COMPUTATION OF ADVANCE

(a) Specified acreage multiplied by six (6).... _6 x 295_

(b) Less total bushels of Wheat, Oats and Barley delivered under unit quota and general acreage quotas from and including August 1st........ to date of this application. (Malting Barley and certain deliveries under special permits may be excluded)...........................

(c) Net Bushels remaining (4(a) less 4(b))...................................

| 1 7 7 0 |
| 7 8 0 |
| 9 9 0 |

(d) Grain in respect of which Advance payment is sought. (Not to exceed the lesser of total bushels in 4(c) or quantities of grain described in 3)........................

WHEAT	OATS	BARLEY	TOTAL
9 9 0			9 9 0

(e) Advance payment per bushel........................

$1.00	40c	70c

(f) Amount of advance payment—total to be expressed in even dollars, but not to exceed $6,000.00 ....

| 4 4 5 | | | 4 4 5 |

5. UNDERTAKING

I/WE, in consideration of the receipt of the advance payment herein described, hereby covenant and agree with The Canadian Wheat Board that

(a) I/WE, as soon as any Quota or other permission given by the Board enables me/us to do so, will, in addition to deliveries described in subsection 1(a) of Section 11 of the Prairie Grain Advance Payments Act, deliver wheat, oats or barley or any combination thereof to The Canadian Wheat Board until one-half of the initial payment therefor is equal to the advance payment(s) made to me/us.

(b) MY/OUR permit book shall be endorsed and pursuant to such endorsement and the Prairie Grain Advance Payments Act, The Canadian Wheat Board shall deduct or cause to be deducted from initial payments for deliveries of my/our wheat, oats or barley, one-half of such payments until the total of such deductions (together with any amounts I/We may pay to the Board in lieu of delivery of grain and in respect of the advance payment) equal the advance payment made to me/us; and

(c) upon any default, as described in section 13 of the Prairie Grain Advance Payments Act, I/We will repay to The Canadian Wheat Board

(i) the amount in default, being the amount of the Advance Payment which has not been repaid, with interest at six per cent per annum after default, or

(ii) where, in this section the share of the advance payment to be paid to each one of us is specified, then, an amount that is in the same proportion to the amount in default as the share of the advance payment received is to the total advance payment, with interest at six per cent per annum after default.

If payment is made jointly, each recipient is jointly and severally responsible for repayment of whole of advance after default.

CERTIFICATE OF APPROVAL

I hereby certify that (a) I have checked the foregoing application and undertaking with care and am satisfied, to the best of my knowledge and belief that the statements made therein are true;
(b) the persons whose names appear as signatories in section 5 are all the persons named as producers in the above described Permit Book;
(c) the Permit Book was produced to me and I endorsed therein the endorsement required by the Prairie Grain Advance Payments Act; and
(d) I have approved of this application on behalf of the Board and have made the advance payment herein stated.

DATED at _Silverton_ the _29_ day of _Nov_ A.D. 19_65_

_____
Signature of Manager or Operator of Elevator.

SHARE OF ADVANCE
Actual Producer

Mervin Marzoff
Others Named in Permit. $ | 4 4 5 |

.... (Sign here) ...... $

.... (Sign here) ...... $

.... (Sign here) ...... $

.... (Sign here) ...... $

.... (Sign here) ...... $

Signatures must appear above in the same order as listed on the permit book declaration.

94

CAR INVOICE

TO BE ATTACHED TO BILL OF LADING

USE FOR

STREET and GRADED GRAIN
ONLY

PLUMAS #1 66120

Station _____ Shipment No. _35_

Car _CN_ No. _511626_ Destination _Pt Arthur_
Initial

Date Shipped _Feb 11/69_ Terminal _W44_

Kind of Grain _wheat_ Gross Bushels _2022_

If more than one grain or kind of grain, show weight of each grade or grain separately.

AS DEDUCTED FROM DAILY LETTER		
Grade	Net Bushels	% Dockage
3	1971	2½
Opn Order	100	
Total Net	1971	

FOR OFFICE USE ONLY

Selling Instructions _____

Contract No. _____

Traffic Dept. Record

EXPECTED	
Grade	% Dock.
No 3	2½

Moisture Test _18.0_

If car bulkheaded, attach statement of lumber.

Record of Shipment (BUS.)	
Gross	2022
Dock %	51
Net	1971

CAR RECORDS

Average Test Weight _58._

Were Railway Car Liners Used? _____

Were Railway Car Doors Used for Erecting Bulkhead? _____

If so, how many? { Small ____ Large ____

Seal Nos _300363 - 367_

What Repairs Did You Make? _____

Depth Grain Loaded to { B.E. _120/00_ Cent _124/00_ N.B.E. _45/00_

IF RAILWAY SUPPLIED LARGER CAR THAN ORDERED, GIVE CAPACITY OF CAR ORDERED

Hopper Scale Show Drafts Below

1	6340
2	6380
3	6320
4	6420
5	6450
6	6410
7	6430
8	6350
9	6400
10	6410
11	6350
12	6400
13	6370
14	6360
15	6390
16	6360
17	6370
18	6400
19	6340
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	

Pro. No. ____

RECORD OF INSPECTIONS AND OUTTURNS

	B.E.	N.B.E.	Centre
Inspected at			
Date Inspection Rec'd			
Date Inspected			
Grade			
Dockage			
Date Outturn Rec'd			
Date Unloaded			
Elevator			
Net Weight			
Dockage			
Screenings			

	B.E.	N.B.E.	Centre	Screenin
Sold to				
Sales Invoice				
Price				
Date				

7

95

CAR ORDERED	LENGTH	CAPACITY
CAR PPLIED		

105 - Canadian Pacific -105

TRAINS / TRUCKS / SHIPS / PLANES / HOTELS / TELECOMMUNICATIONS

WORLD'S MOST COMPLETE TRANSPORTATION SYSTEM

PRO NUMBER

96

CAR INITIALS AND NUMBER					ISSUED AT					DATE	WAYBILL NUMBER

CONTENT	TARE	SPL. ITEMS	DESTN. STN. NAME	DESTN. NO.	RR	ORIGIN NO.	RR	ORIGIN STN. NAME	SHIPPER	CONSIGNEE	CONTENTS

WAYBILL NO.	HR	TRAFFIC	COMMODITY	BILLING	DEST. RR. NO.	DEST. ZONE			

RECEIVED, SUBJECT TO THE TARIFF IN EFFECT ON DATE OF ISSUE OF THIS ORIGINAL BILL OF LADING. THE BULK GRAIN DESCRIBED BELOW, CONSIGNED AND DESTINED AS INDICATED BELOW, WHICH THE COMPANY AGREES TO CARRY TO ITS USUAL PLACE OF DELIVERY AT SAID DESTINATION, IF ON ITS ROAD, OTHERWISE TO DELIVER TO ANOTHER CARRIER ON THE ROUTE TO SAID DESTINATION, IT IS MUTUALLY AGREED, AS TO EACH CARRIER OF ALL OR ANY OF SAID BULK GRAIN OVER ALL ANY PORTION OF SAID ROUTE TO DESTINATION, AND AS TO EACH PARTY AT ANY TIME INTERESTED IN ALL OR ANY OF SAID BULK GRAIN, THAT EVERY SERVICE TO BE PERFORMED HEREUNDER SHALL BE SUBJECT TO ALL THE CONDITIONS. WHETHER PRINTED OR WRITTEN, HEREIN CONTAINED (INCLUDING CONDITIONS ON BACK HERE) AND WHICH ARE AGREED TO BY THE SHIPPER AND ACCEPTED FOR HIMSELF AND HIS ASSIGNS.

STATION   **PROV. / STATE**   **COUNTY** | **STATION FROM**

ROUTE

AGENT'S ROUTING "A"
OR
SHIPPER'S ROUTING "S"

CONSIGNEE AND ADDRESS   **SHIPPER**

ORDER OF _____

CARE OF _____

DESTINATION _____

NOTIFY _____

AT

BULK GRAIN WAYBILL

WEIGHT AGREEMENT STAMP OR WEIGHED AS BELOW

AT _____
GROSS _____
TARE _____
ALL'CE _____
NET _____

IF CHARGES ARE TO BE PREPAID. WRITE OR STAMP HERE "TO BE PREPAID"

BUSHELS	KIND OF GRAIN	WEIGHT	TRC	RATE	FREIGHT	ADVANCES (MISC. CHARGES)	
						CODE	AMOUNT
						PREPAID AMOUNT	

SHIPPING ORDER NO.

ESTIMATED GRADE

CLEANED TEST WEIGHT PER BUSHEL

MOISTURE TEST (IF TF. OR DP.)

SEALS

THE SURRENDER OF THIS ORIGINAL BILL OF LADING. PROPERLY ENDORSED. SHALL BE REQUIRED BEFORE DELIVERY OF THE BULK GRAIN WHEN CONSIGNED "TO ORDER" OR UPON APPLICATION BY THE OWNER OR CONSIGNEE FOR TERMINAL ELEVATOR DELIVERY OR WAREHOUSE RECEIPT. INSPECTION OF THE BULK GRAIN COVERED BY THE BILL OF LADING WILL NOT BE PERMITTED UNLESS PROVIDED BY LAW. OR UNLESS PERMISSION FOR INSPECTION AT THE FINAL POINT OF DESTINATION IS ENDORSED BY THE SHIPPER ON THE ORIGINAL BILL OF LADING OR GIVEN IN WRITING BY THE HOLDER THEREOF. THE SHIPPER REPRESENTS THE BULK GRAIN TO BE DRY AND SUITABLE FOR WAREHOUSING.

FIRST YARD	SECOND YARD	THIRD YARD	FOURTH YARD	

DESTINATION AGENT WILL STAMP HEREIN STATION NAME & DATE REPORTED

A

105 - Canadian Pacific -105

AFR 9H (IDP)
8-66

WHEAT

	1°	2°	3°	4°	°5	°6	Feed					1 C.W. Garnet	2 C.W. Garnet	3 C.W. Garnet			1 C.W. A.D.	2 C.W. A.D.	3 C.W. A.D.			WHEAT TOTAL	Dockage
1 Purchases Today including H.O. Setts of S. Bin Tickets																							
2 Graded Storage Received Today																							
TOTAL																							
3 Deduct Today's Stored Purchases of Graded Storage																							
4 TODAY'S NET RECEIPTS																							
5 Stocks on Hand Last Report																							
TOTAL																							
6 Less Local Sales and Street Shipments Today																							
7 GRADED STOCKS ON HAND																							
8 WILL SHIP AS																							

OATS

	2 C.W.	X 3 C.W.	3 C.W.	X 1 Feed	1 Feed	2 Feed		TOTAL	Dockage
1 Purchases Today including H.O. Setts of S. Bin Tickets									
2 Graded Storage Received Today									
TOTAL									
3 Deduct Today's Stored Purchases of Graded Storage									
4 TODAY'S NET RECEIPTS									
5 Stocks on Hand Last Report									
TOTAL									
6 Less Local Sales and Street Shipments Today									
7 GRADED STOCKS ON HAND									
8 WILL SHIP AS									

BARLEY

2 C.W. 2 Row	2 C.W. 6 Row	3 C.W. 6 Row	1 Feed	2 Feed	3 Feed				TOTAL	Dock

HOW MUCH OF THE ABOVE IS MALT..................BUS.

FLAX / RYE / RAPESEED / MISCELLANEOUS / SPECIAL BIN GRAIN

	1 C.W.	2 C.W.	FLAX TOTAL	Dockage	2 C.W.	3 C.W.	RYE TOTAL	Dockage	No. 1	RAPESEED TOTAL	Dockage			Dockage		On Hand Last Report	WHEAT	OATS	BARLEY	FLAX	RYE	RAPE SEED
1 Purchases Today Including H.O. Setts of S. Bin Tickets																						
2 Graded Storage Received Today															Received Today							
TOTAL															TOTAL							
3 Deduct Today's Stored Purchases of Graded Storage															Less Stored Purchases and H.O. Setts.							
4 TODAY'S NET RECEIPTS																						
5 Stocks on Hand Last Report																						
TOTAL															Less Shipments Today							
6 Less Local Sales and Street Shipments Today																						
7 GRADED STOCKS ON HAND															Less Re-Deliveries Today							
8 WILL SHIP AS															Special Bin Grain in Store							

TOTAL RECEIPTS TO DATE

	BUSHELS GRAIN	OTHERS		AVAILABLE SPACE	CARS ON ORDER
Issued Today					
Cash Tickets		U.G.G. LTD.			
Graded Storage Tickets					
Special Bin Tickets					
TOTAL					
Less Stored Purchased					
Net Receipts Today					
Brought Forward					
NET TOTAL TO DATE					

ESTIMATED RECEIPTS, SHIPMENTS AND SPACE

	RECEIPTS IN BUS. Today		To Date		CARS LOADED Today		To Date	
	GRAIN	MISC.	GRAIN	MISC.	GRAIN	MISC.	GRAIN	MISC.

U.G.G. SHIPMENTS TODAY

Car No.	Order No.	Bushels	Grade

OUTSTANDING SHIPPING ORDERS

Order No.	No. Cars	Destination	Grain

GRAIN IN ANNEX
Included in Stocks on Hand

GRADE	GRAIN	BUSHELS	Type of Annex

	Today	To Date		Today	To Date		Today	To Date
Wheat Dkge. Taken			Flax Dkge. Taken			Rape Dkge. Taken		
Wheat Shge. Taken			Flax Shge. Taken			Rape Shge. Taken		
Grain Cleaned			Grain Cleaned			Grain Cleaned		
Samples Mailed			Samples Mailed			Samples Mailed		
Wheat Dkge. IN	%		Flax Dkge. IN	%		Rape Dkge. IN	%	
Wheat Dkge. OUT	%		Flax Dkge. OUT	%		Rape Dkge. OUT	%	

REMARKS ON STOCKS BY DISTRICT MANAGER — U.G.G. LTD. ONLY

REPORT ON WEATHER AND ROADS

TOTAL SPACE	
DEAD SPACE	
WORKING SPACE	
BUSHELS TO COME	
ON EXISTING QUOTAS	
PRESENT QUOTA	

MANAGER

BE SURE TO SHOW ON LINE 8 THE CORRECT GRADE AT WHICH YOUR STOCKS WILL SHIP

9

97

FORM 101

ELEVATOR WEEKLY REPORT

TO: COUNTRY OPERATIONS DEPT.
- The Canadian Wheat Board

STATION...... BEAUSEJOUR ......

COMPANY.... UNITED GRAIN GROWERS LIMITED

60556

HOUSE No. 76

RAILWAY. C.P.R.

REPORT ALL BUSHELS BOTH RECEIPTS AND STOCKS IN EVEN HUNDREDS.

As at Friday...... FEB (14) 196 9

NOTE: Any revised figures mark "corrected."	Spring Wheat	Durum Wheat	Oats	Over Quota Milling & Seed Oats	Over Quota Malting & Pearling Barley	Other Grades Barley	Flaxseed	Rye	Rapeseed
(1) TOTAL RECEIPTS (Net Bushels Only) (Carried from line 3 of last report)	72100		9300	o		1700	4800		
(2) RECEIPTS SINCE LAST REPORT (Net Bus. Only) INCLUDING S. to G. SPEC. BIN and GRADED STORAGE	400		3300			200	100		o
(3) TOTAL RECEIPTS (Net Bushels Only) (Carry to line 1 of next report)	72500		12600			1900	4900		

DO NOT INCLUDE IN ABOVE FIGURES GRAIN UNLOADED FROM RAILWAY CARS OR TRUCKED IN FROM OTHER ELEVATORS

TOTAL STOCKS AS BINNED INCLUDING GRAIN IN ANNEXES

WHEAT Group No. 1	NET BUSHELS ONLY			No. of Car Lots
	Straight	Tough	Damp	
1 Nor.				
2 Nor.	24400			24
3 Nor.	16500	500		9
4 Nor.	9700	8100	1500	3
Subject to Grade or Spec. Bin				
NET BUS. TOTALS	63600	2600	1500	
Total of Group No. 1	67700			

OATS Group No. 4	NET BUSHELS ONLY		No. of Car Lots
	Straight	Tough Damp	
3 C.W. & Higher Grades	800		
X1 Feed			
1 Feed	3800	1100	2
2 Feed			
3 Feed & Lower Grades			
Subject to Grade or Special Bin			
NET BUS. TOTALS	4600	1100	
Total of Group No. 4	5700		

Group No. 2				
No. 5	300			
No. 6				
Feed				
Lower Grade Incl. Rejected				
1 A.R.W.				
2 A.W.				
All other A.W.				
Total All Grades Garnet				
All Grades Soft W-Spring				
NET BUS. TOTALS	300			
Total of Group No. 2	300			

BARLEY Group No. 5			
1, 2 & 3 C.W. 2 Row			
1, 2 & 3 C.W. 6 Row			
1 Feed	1900		
2 Feed			
3 Feed & Lower Grades			
Over Quota Malting & Pearling Barley			
Subject to Grade or Special Bin			
NET BUS. TOTALS	1900		
Total of Group No. 5	1900		

Durum Wheat Group No. 3				
1 & 2 C.W. Durum				
3 C.W. Durum				
Ex. 4 C.W. Durum				
4 C.W. Durum				
Subject to Grade or Spec. Bin				
All other Durums				
NET BUS. TOTALS				
Total of Group No. 3				

FLAXSEED Group No. 6			
1 C.W.	8000	500	1
Total of Group No. 6	8500		

RYE Group No. 7			
3 C.W.	1000		
Total of Group No. 7	1000		

RAPESEED Group No. 8		
Total of Group No. 8		

REGISTERED WORKING CAPACITY...... 93000 ......
(Elevators & Annexes)

SUMMARY of STOCKS

TOTAL GROUP No. 1	67700
" " " 2	300
" " " 3	
" " " 4	5700
" " " 5	1900
" " " 6	8500
" " " 7	1000
" " " 8	
DKGE. SCRGS., CORN BUCKWHEAT, PEAS, MUSTARD, ETC. } 9	2500
TOTAL (10)	81600

IT IS VERY IMPORTANT to show
Space now available for further receipts

...... 11400 ...... Bushels

IF NO SPACE PLEASE MARK "NIL"

Please indicate Estimate Balance to come from your Customers on Quota in effect this date.

...... 100077 ...... Bushels

IF NO BALANCE PLEASE MARK "NIL"

Also show additional quantity to come from your Customers when the Delivery Quota is increased by 1 Bushel.

...... 33000 ...... Bushels

FOR BALANCE DELIVERABLE ESTIMATES PLEASE REFER TO INSTRUCTIONS ON COVER "L"

TOTAL SHIPMENTS FOR THE SEASON	WHEAT	DURUM	OATS	Over Quota OATS	Over Quota BARLEY	OTHER BARLEY	FLAX-SEED	RYE	RAPE-SEED	TOTAL
(A) Total cars carried from last 101 report	36		8			1	2			47
(B) Cars shipped since last report			1			1	2			4
(C) TOTAL cars shipped since August 1	36		9			2	4			51
RECORD OF ORDERS — Shipping orders on hand	9					1				10
Orders placed with Rly. for cars	9					1				10

IMPORTANT—This report to be made up as at the close of business each FRIDAY and MAILED in time TO REACH your HEAD OFFICE NOT LATER THAN MONDAY.

Elevator Manager's Signature... O. L. Kubacki.

CABLE ADDRESS: WHEATBOARD
TELEX 03-5583

The Canadian Wheat Board

423 MAIN STREET
WINNIPEG 2, CANADA

United Grain Growers Ltd.,
Winnipeg, Manitoba.

September 24th, 1968.

Attention: Mr. J. Welsh.

Dear Sirs:

Re: Shipments to the Lakehead
Ex' Saskatchewan Stations

From stations situated in the province of Saskatchewan, please arrange for shipment to the Lakehead, all Carlots of Wheat grading No. 5 Wheat, No. 6 & Feed Wheat, Rejected Mixed Heated, Sample Grades etc., presently in store, using the following order numbers for this purpose:

All Carlots	No. 5 Wheat	Shipping Order No. 4014
All Carlots	No. 6 & Feed Wheat	Shipping Order No. 4015
All Carlots	Rej. Mxd. Htd.,	
	Sple. grades of wheat etc.	Shipping Order No. 4016

Please submit your list of stations, showing the number of cars of each grade allocated to each under the respective order numbers, and as shipments are made, report same to this office on form 21A, quoting the above order numbers.

These order numbers should also be shown on your delivery reports when submitted for settlement.

NOTE: As further carlots of the above grades accumulate, please submit your list, on a weekly basis, for our consideration.

Yours very truly,

THE CANADIAN WHEAT BOARD,
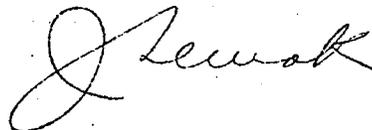
Shipments, Country Operations.

JL:dt

Form 3C-50M

The Canadian Wheat Board
WINNIPEG — MANITOBA

DAILY SUMMARY OF
STREET DELIVERIES

GRAIN

Manitoba and Saskatchewan

Your Report No.................................

Date ....19.......

Co. ....

Co. Permit No. ....

GRADE CODE	GRADE	NET BUSHELS					
		MANITOBA	TENTHS	SASK.	TENTHS	TOTAL	TENTHS

FOR BOARD USE ONLY

TOTAL NET BUSHELS

This form is a summary of the grades itemized on form No. 5.

Certified Correct:

_____
For the above Company

12

100

FORM AR-D

THE CANADIAN WHEAT BOARD
DAILY SUMMARY OF ADVANCES AND/OR REFUNDS

COMPANY...CO. PERMIT No........................DATE..

CROP YEAR

ADVANCES TO PRODUCERS

ADVANCES PAID:

REPORT No.		AMOUNT DUE COMPANY	AMOUNT DUE BOARD
	MANITOBA		¢
	SASKATCHEWAN		
	ALBERTA		

ADJUSTMENTS:

REPORT No.		AMOUNT DUE COMPANY	AMOUNT DUE BOARD
	MANITOBA		¢
	SASKATCHEWAN		
	ALBERTA		
	TOTAL		

DUE COMPANY   LESS DUE BOARD

AMOUNT PAYABLE TO COMPANY ¢

REFUNDS FROM PRODUCERS

GRAIN	CLASS OF PURCHASE	PROVINCE	REPORT No.	AMOUNT DUE BOARD	AMOUNT DUE COMPANY
					¢

ADJUSTMENT REPORTS:

GRAIN	CLASS OF PURCHASE	PROVINCE	REPORT No.	AMOUNT DUE BOARD	AMOUNT DUE COMPANY
					¢

ADJUSTMENTS BY ERROR SLIP:

GRAIN	ERROR SLIP No.			AMOUNT DUE BOARD	AMOUNT DUE COMPANY
					¢
			TOTAL		

DUE BOARD   LESS DUE COMPANY

AMOUNT RECEIVABLE FROM COMPANY ¢

SIGNED ON BEHALF OF COMPANY

NET AMOUNT PAYABLE TO COMPANY   ¢

NET AMOUNT RECEIVABLE FROM COMPANY   ¢

GRAIN DEPARTMENT STATEMENT

UNITED GRAIN GROWERS LIMITED

Vancouver Memo Contracts

Deferred.....................
Open.....................

Office at.....................Date.....................19.....

Over-Quota Barley.....................
Cars on Order Port Arthur.....................
Cars on Order Vancouver.....................

	FLAX	RYE	RAPESEED

MARKET POSITION

	WHEAT	OATS	BARLEY	FLAX	RYE	RAPESEED
Street Purchases						
Special Purchases						
Transfers						
O/S Tickets						
Old in Transit						
O/S P. & W.						
TOTAL LONG						
Street Sales						
Street Contracts						
Special Sales						
O/S Tickets						
Clear. House Bal.						
TOTAL SHORT						
Long						
Short						

IN ELEVATOR

	WHEAT	DURUM	OATS	BARLEY	FLAX	RYE	RAPESEED
Balance Forward							
Cash Tickets Today							
TOTAL							
Shipments Today							
BALANCE							
Farmers (East and West)							
In Elevators							

SPECIAL BIN

	WHEAT	DURUM	OATS	BARLEY	FLAX	RYE	RAPESEED
Balance Forward							
Stored Today							
TOTAL							
Surrenders Today							
BALANCE							
Spec. Bin Cars In Transit							

STREET STOCKS

	WHEAT	DURUM	OATS	BARLEY	FLAX	RYE	RAPESEED
Balance Forward							
Shipment Today							
TOTAL							
Sales Today							
BALANCE							
Farmers							
Line							

IN TRANSIT

	WHEAT	DURUM	OATS	BARLEY	FLAX	RYE	RAPESEED
East							
Vanc.							
Cons. Vanc.							

FARMERS' STOCKS

GRADED

	WHEAT	DURUM	OATS	BARLEY	FLAX	RYE	RAPESEED
Balance Forward							
Stored Today							
TOTAL							
Surrenders Today							
BALANCE							

DAILY BUSINESS

PURCHASES

	Stored Purchases	Street Purchases		P. & W.	Off-Street Contracts	Prev. Long Position	Hedges Off
Wheat							
Durum							
Oats							
Barley							
Flax							
Rye							
Rapeseed							

SALES

	Street Sales	Special Sales	On-Street Contracts		Spot	Prev. Short Position	Hedges On

WHEAT BOARD POSITION

	WHEAT		DURUM		OATS		BARLEY	
Season								
Purchases								
Deliveries								
BALANCE								
In Elevators								
In Transit								
Due Wheat Board								
Purchases Today								
Deliveries Today								
Shipments Today								

RECEIPTS TODAY / TOTAL THIS SEASON

	RECEIPTS TODAY	TOTAL THIS SEASON
Wheat		
Durum		
Oats		
Barley		
Flax		
Rye		
Rapeseed		
TOTAL		
TOTAL Last Year		

NON BOARD GRAIN

	Receipts	Total This Year
Wheat		
Oats		
Barley		
TOTAL		

TOTAL HANDLING

	This Year	Last Year
Board		
Flax		
Rye		
Rapeseed		
Non Board		
TOTAL		
MUSTARD		

INSURANCE:

	WHEAT	DURUM	OATS	BARLEY	FLAX	RYE	RAPESEED	BUCKWHEAT
Street Grain								
Farmers' Grain (Special Bin / Graded)								
Old O/S Tickets								
Board Grain								
TOTAL								

Receipts
Sales
Balance
In Transit

CASH SUMMARY	Cash Paymaster	$
	O/S Cash Tickets	$
	O/S Advance on Stored Grain	$

Original.....................
Checked.....................

14
102

DEPARTMENT OF AGRICULTURE

BOARD OF GRAIN COMMISSIONERS FOR CANADA

103

COUNTRY ELEVATOR WEEKLY REPORT

Company...

Address...

Week Ending...

Index No...
FORM B-845 REVISED 4-55

(Read Instructions on Back)

Q.P.21636

GRAIN AND PROVINCE	PLATFORM LOADINGS (A)	TOTAL ON HAND LAST REPORT (B)	PAST WEEK'S PRIM'Y RECEIPTS (C)	RE-SHIPMENT AND TRANSFER REC'TS (D)	PAST WEEK'S PRIM'Y SHIP'TS (E)	RE-SHIPMENT AND TRANSFER SHIPMENTS (F)	TOTAL ON HAND IN ELEVATOR (G)
		NET BUS.	NET BUS.	NET BUS.	NET BUS.	NET BUS.	NET BUS.
WHEAT (Other than Durum)							
MANITOBA							
SASKATCHEWAN							
ALBERTA							
TOTAL							
DURUM WHEAT							
MANITOBA							
SASKATCHEWAN							
ALBERTA							
TOTAL							
OATS							
MANITOBA							
SASKATCHEWAN							
ALBERTA							
TOTAL							
BARLEY							
MANITOBA							
SASKATCHEWAN							
ALBERTA							
TOTAL							
RYE							
MANITOBA							
SASKATCHEWAN							
ALBERTA							
TOTAL							
FLAXSEED							
MANITOBA							
SASKATCHEWAN							
ALBERTA							
TOTAL							
RAPESEED							
MANITOBA							
SASKATCHEWAN							
ALBERTA							
TOTAL							

DISTRIBUTION OF PRIMARY SHIPMENTS ONLY (COLUMN (E) ABOVE)

	LOCAL SALES EX-ELEVATOR — INCLUDING SEED FEED OR LOCAL GRISTING, ETC.	CARLOTS TO TERMINALS AT FORT WILLIAM OR PORT ARTHUR	CARLOTS ALL-RAIL DIRECT FROM WEST TO EAST OF LAKEHEAD	CARLOTS TO MILLS MALTSTERS, DISTILLERS OR OTHER MANUFACTURERS	CARLOTS TO TERMINALS AT PACIFIC COAST	SHIPMENTS TO U.S.A. —	CARLOTS TO GOVERNMENT & OTHER INTERIOR TERMINALS WEST OF THE LAKEHEAD (SHOW CHURCHILL SHIPMENTS SEPARATELY)
Wheat (not Durum)							
DURUM WHEAT							
OATS							
BARLEY							
RYE							
FLAXSEED							
RAPESEED							

AMOUNT OF FIRE INSURANCE IN FORCE ON GRAIN IN STORE AS ABOVE $.................................

OR IS THE INSURANCE EFFECTED BY MEANS OF AN "OPEN" GRAIN INSURANCE POLICY?.................................

I declare that this is a true and correct statement of the quantity of both purchased and stored grain received, shipped and in store in the above named elevator at the close of business WEDNESDAY OF EACH WEEK.

I have personal knowledge of the matters herein deposed to and I make this solemn declaration conscientiously believing the same to be true, and knowing that it is of the same force and effect as if made under oath, and by virtue of "The Canada Evidence Act".

Dated...19........

....
SIGNATURE OF PERSON MAKING THE REPORT

This form duly completed and certified must reach the Chief Statistician, Board of Grain Commissioners, Winnipeg, Man.

BY THE FOLLOWING SATURDAY WITHOUT FAIL

THE CANADIAN WHEAT BOARD

STATEMENT OF CARS SHIPPED

FROM LINE ELEVATORS   GRAIN

MANITOBA and SASKATCHEWAN —

COMPANY ....DATE ....19.........

STREET or CONSIGNED ....COMPANY PERMIT No. ....

Date Loaded	EX STATION	House	Wheat Board Station No.	Car No.	Bushels Shipped	Shipping Grade	Destination	Shipping Order No.

Signed ....

For above Company

• TERMINAL ELEVATOR OUTTURN •

DATE ISSUED	GRAIN	GRADE DESCRIPTION	NET BUSHELS
21/03/68	WHEAT	1 NORTHERN	2,028.8

DATE UNLOADED	CONSIGNEE	STATION	TERMINAL	VIA
21/03/68	MANITOBA PL	NIVERVILLE	MAN POOL 1-PORT ARTHUR	CP248906

SCALE WEIGHT	GROSS BUSHELS	SHRKGE.	DOCK. %	DOCK. BUS.	SCRGS. RET.	MOIST. %	M-S %	CHARGES CLEANING	CHARGES IN/WGH.	CHARGES OTHER
124,880	2,081.3	.5	2.5	52.0					4.50	

THE ABOVE SHOWS DETAILS OF GRAIN UNLOADED
INTO THE TERMINAL NAMED ABOVE, AND INDICATES ANY
CHARGES PAYABLE IN CONNECTION THEREWITH.

TOTAL AMOUNT PAYABLE   4.50

TERMINAL ELEVATOR WAREHOUSE RECEIPT   No. 25180

DATE OF ISSUE	GRAIN	GRADE DESCRIPTION	NET BUSHELS
5/12/67	WHEAT	TOUGH 3 NORTHERN	***1,848.2

UNLOAD OR STRGE PD. TO DATE	CONSIGNEE	TERMINAL	CAR NUMBER
5/12/67	PIONEER GRN	RICHARDSON-PORT ARTHUR	CN511107 15.3

Received in store in our terminal named above, subject
to the order of the above named consignee, Canadian
grain of grade and quantity as shown hereon. Like grade
and quantity will be delivered to the holder hereof upon
surrender of this receipt properly endorsed and on payment
of all lawful charges due to the above named terminal.

This receipt not valid unless
Signed, Countersigned and Registered

Signed

Counter-
signed

	FOR CANCELLATION ONLY		
1	SHIPMENT	DATE CANCELLED	DRYING LOSS %
2	ARTIFICIAL DRYING		
3	NATURAL DRYING		
4	CONSOLIDATION		
5	SPLIT	NEW GRADE	CHARGES
6	STOCK ADJUSTMENT		
7	GRADE CHANGE		
8	GRADE PROMOTION	AMOUNT OF SPLIT	CUSTOMER CODE
9	C.A.P.		

Registered as to Weight and Grade

DAILY REPORT
OF
STREET DELIVERIES

Prices Checked	
Check'd with Doc's	
Station No's.	
Compt. Checked	
Cards Punched	

THE CANADIAN WHEAT BOARD
WINNIPEG   GRAIN   MANITOBA
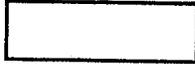
Manitoba and Saskatchewan

Your Report No......................
Sheet No......................
Date......................19.....
Company......................
Company Permit No......................

SHIPPING ORDER No.	GROSS WEIGHT In Pounds	LOADING DATE			W.H.R. No. or CAR No.	UNLOAD DATE			TERMINAL	EX. STATION			NET BUSHELS	TENTHS	Grade Code	GRADE	Fixed Price	GROSS VALUE	DEDUCTIONS						ADDITIONS		
		Day	Mo.	Yr.		Day	Mo.	Yr.		NAME	No.	√							Storage	Days	Freight	C. Charges	Days	Int. Term. Div. Prem.	Freight Differential	Rate
										TOTALS																

Net Amount Payable | |

THE CANADIAN WHEAT BOARD
DELIVERY SUMMARY

COMPANY __UNITED GRAIN GROWERS LIMITED__   DATE_____

MARK CLASS OF DELIVERY PLAINLY	BARLEY		OATS		WHEAT	
	BUSHELS	NET AMOUNT PAYABLE	BUSHELS	NET AMOUNT PAYABLE	BUSHELS	NET AMOUNT PAYABLE

GRAIN WO - BO	ERROR SLIP No.	DUE COMPANY X - 20	DUE BOARD No. X - 20			
				TOTAL MONEY. ALL GRAINS		
				ERRORS ADD		
				ERRORS DEDUCT		
				NET AMOUNT PAYABLE		
TOTAL				APPROVED _____		

THE CANADIAN WHEAT BOARD

**STATEMENT OF ACCOUNT
ADVANCE PAYMENT**

'20	1	1	MAY 26/69	62976	GLADSTONE		MAN	82075326	JUN 04/69
	C	SH.	LAST TRANSACTION	STN. NO.	STATION NAME			PERMIT NO.	

PRODUCER'S NAME AND NUMBER		ADVANCE REFUND	CO. NO.	YEAR/APP. NO. OR P.C. NO.	DATE DAY MO. YR.		VALUE	+
SINGLE HOWARD J	0082075326	ADV	35	68/661	101268	1	203 00	
SINGLE HOWARD J	0082075326	RFD	35	329278	140469	9126	11900	-
SINGLE HOWARD J	0082075326	RFD	35	329453	260569	9155	8400	-
AR-E						RETRD		

DO NOT WRITE OR STAMP IN THIS SCANNING AREA
NEGOTIABLE WITHOUT CHARGE AT ANY CHARTERED BANK IN CANADA. NOT NEGOTIABLE OUTSIDE CANADA

The Canadian Wheat Board

423 MAIN ST. • WINNIPEG • MANITOBA

FINAL PAYMENT
OATS

X- 008613   PAY TO THE ORDER OF

AMOUNT

$ ¢

TO THE
BANK OF MONTREAL
PORTAGE AVE. AT MAIN ST.
WINNIPEG 1. MAN.

NON NEGOTIABLE

GRADE DESCRIPTION	DELIVERIES BUSHELS 1/10	RATE ¢ DEC.	AMOUNT $ ¢
STATION NAME		STATION NO.	TOTAL AMOUNT
PRODUCER'S NO.		CHEQUE NO.	DAY MO. YR.

THE CANADIAN WHEAT BOARD
NOT NEGOTIABLE-DETACH & RETAIN

1967-68 FINAL OATS

Form 15A

THE CANADIAN WHEAT BOARD
STATEMENT OF ELEVATOR STOCKS, SPACE AND CAR REQUIREMENTS
(THOUSANDS OF BUSHELS)

DATE MAY 04 1969 RLWY C P R

PAGE	STATION	NO. OF STATIONS ON WHEAT QUOTA	NO. OF ELEVS.	TOTAL WORKING CAPACITY	TOTAL STOCKS ALL GRAINS	SPACE NOW AVAILABLE	BALANCE DELIVERABLE ON QUOTA	A	B	C	D	E	F	ORDERS OUTSTANDING	% DEL'D	CARS SUPPLIED CURRENT WEEK
	BRANDON DIV															
	LA RIVIERE															
	LA SALLE															
	DEMAIN															
	OSBORNE															
	MCTAVISH															
	SEWELL															
	ROSENFELD															
	THORNDEAN															
	HORNDEAN															
	ALTONA															
	GRETNA															
	PLUM COUL															
	WINKLER															
	MORDEN															
	THORNHILL															
	DARLINGFOR															
	MANITOU															
	LA RIVIER															
	BRANDON DIV															
	NAPINKA															
	WOOD BAY															
	PILOT MON															
	CRYSTAL C															
	CLEARWATE															
	PATHER															
	CARTWRIGH															
	HOLMFIELD															
	KILLARNEY															
	NINGA															
	BOISSEVAI															
	DELORAINE															
	LEIGHTON															
	MEDORA															
	BRANDON DIV															
	BOISSEVAIN															
	CROLL															
	REGENT															
	CHATHAWAY															
	DAND															

THE CANADIAN WHEAT BOARD

STOCKS IN COUNTRY ELEVATORS AS PER AGENT'S REPORTS FORM 101 — 000 OMITTED

STATION/COMP'Y NAME	STN. CODE/NO. OF ELEV'S	QUOTA HOUSE NO.
LAKE VY		
UNITED GR GR	231325	30T
UNITED GR GR	231325	1
LAMPMAN		
SASK POOL	203	
UNITED GR GR	160521	
UNITED GR GR	160521	2
SASK POOL	713317	
SASK POOL	713317	4
PIONEER GR		
PIONEER GR		
FEDERAL GR		403
LANCER		
NATIONAL GR		40T
LANDIS		
UNITED GR GR	311305	
UNITED GR GR	311305	3
SASK POOL		
SASK POOL		5
NATIONAL GR		
FEDERAL GR		
INTER OCEAN		
PATERSON GR		
FEDERAL GR		
LANG		20T
SASK POOL	605317	
SASK POOL	605317	5
SASK POOL		
NATIONAL GR		20T
LANGBANK		
SASK POOL	146325	
SASK POOL	146325	2
LANGENBUR		
SASK POOL		20T
UNITED GR GR		1
UNITED GR GR		2
UNITED GR GR		3
SASK POOL	523337	
SASK POOL	523337	4
NATIONAL GR		40T
LANGHAM		M
NATIONAL GR		
SASK POOL	242305	
SASK POOL	242305	2
LANIGAN		403
FEDERAL GR		
SASK POOL	634309	
SASK POOL	634309	2

CONSIGNEE	STATION	CAR NO.	GRN	GRADE	DK.%	POUNDS	GR.BUS.	SHKGE	DOK.BUS	NET BUS.	CLG.CHG.	T&W	OTHER	TOT.CHG.	SCRGS.	MOIST
SASK WHT PL	BALGONIE	CP259214	01	2 NORTHERN	2.0	132,270	2,204.5	.5	44.1	2,159.9				4.50	4.50	
SASK WHT PL	BALGONIE	CP243558	01	2 NORTHERN	2.0	128,010	2,133.5	.5	42.7	2,090.3				4.50	4.50	
SASK WHT PL	INDIANHEAD	CP266966	01	2 NORTHERN	2.0	133,500	2,225.0	.5	44.5	2,180.0				4.50	4.50	
SASK WHT PL	SINTALUTA	CP255584	01	2 NORTHERN	2.0	132,800	2,213.3	.5	44.3	2,168.5				4.50	4.50	
SASK WHT PL	SINTALUTA	CP244018	01	2 NORTHERN	1.0	122,900	2,048.3	.5	20.5	2,027.3				4.50	4.50	
							WAREHOUSE RECEIPT NO.		FOR	62,482.8	11.04	139.50				3,970
		TOTAL 2 NORTHERN				3,823,360	63,722.7	15.5	1,224.4	62,482.8*						
SASK WHT PL	MEATH PARK	CP262213	01	3 NORTHERN	2.0	131,560	2,192.7	.5	43.8	2,148.4				4.50	4.50	
SASK WHT PL	TANTALLON	CP090585	01	3 NORTHERN	2.0	132,860	2,214.3	.5	44.3	2,169.5				4.50	4.50	
SASK WHT PL	GRENFELL	CP244579	01	3 NORTHERN	1.5	123,120	2,052.0	.5	30.8	2,020.7				4.50	4.50	
SASK WHT PL	GRENFELL	CP244473	01	3 NORTHERN	1.5	122,640	2,044.0	.5	30.7	2,012.8				4.50	4.50	
							WAREHOUSE RECEIPT NO.		FOR	8,351.4		18.00				
SASK WHT PL	ROCANVILLE	CP243228	01	3 NORTHERN	1.5	121,650	2,027.5	.5	30.4	1,996.6				4.50	4.50	
							WAREHOUSE RECEIPT NO.		FOR	1,996.6		4.50				
		TOTAL 3 NORTHERN				631,830	10,530.5	2.5	180.0	10,348.0*						
SASK WHT PL	TYVAN	CP254407	01	R1N STONES	3.5	123,240	2,054.0	.5	71.9	1,981.6	10.27	4.50			14.77	3,700
							WAREHOUSE RECEIPT NO.		FOR	1,981.6	10.27	4.50				3,700
		TOTAL R1N STONES				123,240	2,054.0	.5	71.9	1,981.6*						
		TOTAL WHEAT				6,703,450	111,724.1	27.5	2,142.3	109,554.3**						15,940*
SASK WHT PL	THRASHER	CP240207	02	1CW DURUM	3.5	121,570	2,026.2	.5	70.9	1,954.8	10.13	4.50			14.63	3,650
SASK WHT PL	MORSE	CP253397	02	1CW DURUM	1.5	124,660	2,077.7	.5	31.2	2,046.0				4.50	4.50	
							WAREHOUSE RECEIPT NO.		FOR	4,000.8	10.13	9.00				3,650
		TOTAL 1CW DURUM				246,230	4,103.9	1.0	102.1	4,000.8*						
SASK WHT PL	OUNGRE	CP265834	02	2CW DURUM	3.0	130,640	2,177.3	.5	65.3	2,111.5	10.88	4.50			15.38	3,270
SASK WHT PL	FERLAND	CP227043	02	2CW DURUM	3.0	91,790	1,529.8	.5	45.9	1,483.4	7.65	4.50			12.15	2,290
							WAREHOUSE RECEIPT NO.		FOR	3,594.9	18.53	9.00				5,560
		TOTAL 2CW DURUM				222,430	3,707.1	1.0	111.2	3,594.9*						
SASK WHT PL	MOOSE JAW	CP260986	02	3CW DURUM	1.5	133,930	2,232.2	.5	33.5	2,198.2				4.50	4.50	
SASK WHT PL	MORSE	CP227256	02	3CW DURUM	1.0	91,250	1,520.8	.5	15.2	1,505.1				4.50	4.50	
							WAREHOUSE RECEIPT NO.		FOR	3,703.3		9.00				
		TOTAL 3CW DURUM				225,180	3,753.0	1.0	48.7	3,703.3*						
SASK WHT PL	HERBERT	CP261041	02	E4CW DURUM	1.0	96,760	1,612.7	.5	16.1	1,596.1				4.50	4.50	
							WAREHOUSE RECEIPT NO.		FOR	1,596.1		4.50				
		TOTAL E4CW DURUM				96,760	1,612.7	.5	16.1	1,596.1*						

25

111

N. & GRAIN LIMITED

REGISTRATION

WAREHOUSE RECEIPT NO.	DATE IN STORE	STORAGE PAID TO	CAR NO.	GRADE							CANC. NO.

26

112

DAILY STOCK RECORD   GRAIN ....   TERMINAL..................

GRADE	BALANCE	RECEIPTS	TOTAL	SHIPMENTS	ADD	DEDUCT	BALANCE	PRICE	VALUE	

CANADIAN PACIFIC RAILWAY COMPANY
DAILY TRACING LIST

I.D.P. 125E
11-64

SUPP

DATE				
MO.	DAY	YEAR		
11	09	66	0600	

4

SHIPPER	CONSIGNEE	CONTENTS	SPECIAL ITEMS	ORIGIN NAME	ORIGIN OR ON JCT. NO.	ON R.R. SYM.	DESTINATION NAME	DEST. OR OFF JCT. NO.	OFF R.R. SYM.	LOCATION	REP. SYM.	TRAIN OR RUN NUMBER	HOUR	DAY	REP. STN. SYM.	CONSIST NUMBER	UNIT INITIALS & NUMBER	
					D			5003		6325	A	89	1845	8	SZ	9877	CP	245072
					6428		FORTWILL	5003		6325	D	R312	2230	8	SZ	9878	CP	245072
					D			6325		6325	A	89	1845	8	SZ	9877	CP	245079
					6436		FORTWILL	5003		6325	D	R312	2230	8	SZ	9878	CP	245079
					D			5003		6325	A	89	1845	8	SZ	987.7	CP	245141
					6427		FORTWILL	5003		6325	D	R312	2230	8	SZ	9878	CP	245141
					D			5660		5660	A	80	1835	8	SU	5170	CP	245146
					D			5003		6016	A	74	1545	8	QN	279	CP	245203
					D			5003		6025	A	R223	2220	8	YJ	2191	CP	245219
					6380		FORTWILL	5003		5075	D	R322	15	9	KA	2677	CP	245229
SASWHEPO	SASWHEPO	WCNS		OGEMA	D			5003		5650	A	80	1835	8	SU	5170	CP	245263
					6145		FORTWILL	5003					1845	8	SU	8390	CP	245263
MANPOOEL	MANPOOEL	WONS		INGLIS	6232		FORTWILL	5003		5850	D	86	1845	8	ON	9550	CP	245284
					5868		FORTWILL	5003					10	9	SA	2754	CP	245312
					6154		FORTWILL	5003		5075	D	R322	15	9	KA	2677	CP	245416
					D			5003		6325	A	89	1845	8	SZ	9877	CP	245448
					6425		FORTWILL	5003		6325	D	R312	2230	8	SZ	9878	CP	245448
					6498		FORTWILL	5003		5075	D	R322	15	9	KA	2677	CP	245454
					D			5003		6016	A	74	1545	8	QN	.279	CP	245460
					D			5600		5600	A	R615	210	9	NA	3007	CP	245462
			EMPTY		7412		MOZART	6588		6016	D	971	2230	8	QN	277	CP	245481
					7412		WINNIPEG	5200		5600	D	954	10	9	NA	7948	CP	245512
					D			5003		5650	A	80	1835	8	SU	5170	CP	245539
MANPOOEL	MANPOOEL	WCNS		STONEWAL	5277		FORTWILL	5003					315	9	PE	4712	CP	246033
					D			5003		6325	A	89	1845	8	SZ	9877	CP	246046
					6426		FORTWILL	5003		6325	D	R312	2230	8	SZ	9878	CP	246046
					D			6325		6325	A	89	1845	8	SZ	9877	CP	246103
					6436		FORTWILL	5003		6325	D	R312	2230	8	SZ	9878	CP	246103
			EMPTY		D			5675		5675	A	80	1835	8	SU	5170	CP	246122
					6366		FORTWILL	5003		5075	D	R322	15	9	KA	2677	CP	246144
MANPOOEL	MANPOOEL	WCAS		SOURIS	5650		FORTWILL	5003					1845	8	SU	8390	CP	246147

CP FINAL DEST. OR OFF JCT. NO. = STOP-OFF,
   HOLD, LAKE & RAIL, CP-FGN-CP, ETC.
F = FINAL LEG - STOP-OFF, ETC.
R = REVISED BASIC TFC - DIVERSIONS,
   RECONSIGNMENT OR RELEASED.
C = CORRECTED UNIT NO.
D = CORRECTED DATA.

SPECIAL ITEMS CODING
N = NEW UNIT BASIC TFC - TRANSHIPMENTS
S = SKELETON BASIC TFC - OLD UNIT
   REFERENCE ACCOUNT TRANSHIPMENT.
T = NEW CAR, AS TRANSHIPPED.
M123 = LOT NOS. FOR MULTICAR SHIPMENTS.

ARRIVAL OR DEPARTURE SYMBOLS
D   DEPARTURE
S   SET OUT DESTINATION FOR DELIVERY
I   SET OUT FOR DELIVERY TO FOREIGN LINE
B   SET OUT ACCOUNT BAD ORDER OR BO
    TO REPAIR TRACK
K   O.K.—FROM REPAIR TRACK
O   SET OUT ACCOUNT OPERATING REASONS
A   ARRIVAL
T   BASIC TRAFFIC RECORD ONLY

114

APPENDIX C

A System for the Definition of Data Bases

C. 1 Introduction

A data base computing system requires a data description language through which a data base can be described to it.   The available literature on data base systems does not contain an adequate amount of material on the data description aspect of the data base problem. Recommendations have been made for the extension of COBOL to handle data bases [3] but no mention was made towards a means of describing the data base structure.   For the purposes of this thesis a hypothetical data description language, based upon concepts found in COBOL, PL/1, and IDS [1], was formulated and used in chapter three to show how a data base could be described to a computing system.

C. 2 Highlights of the Language

The description of the data base is enclosed within the statements START DATA BASE DESCRIPTION and END DATA BASE DESCRIPTION in order to facilitate its automatic translation into a form which could be used by the data base handler.

Since it is possible for more than one data base to exist in a system the data base is assigned a name through the use of the statement DATA BASE NAME IS.

A data base can be considered as being made up of logically independent segments, each of which can be assigned a name through the

use of the statement SEGMENTNAME IS.

Each segment of a data base can be considered as being composed of records each of which can be assigned a name through the use of the statement RECORD IS.

The structure of records within a segment of the data base can be specified through the use of one or more STRUCTURE IS statements. These are followed by one of the structural types UNORDERED, INDEXED, SEQUENTIAL, or LIST. The unordered structure requires no further parameters but the other three must be clarified.

An indexed structure requires the specification of the fields on which indexing can occur. A sequential structure requires the specification of the fields on which it is sequenced. The list structure requires clarification as to whether forward or forward and back linkage is to be used.

The specification of the occurrence of individual records within a segment can be specified as being a single occurrence, a random occurrence, or a repeating group.

If a segment has been assigned the structure list, then each record must specify the field, or fields, on which they are linked and the conditions under which linkage is to be established.

Each record is composed of fields which are assigned names and attributes in a manner similar to that found in COBOL or PL/1. An overflow area can be specified by the use of the statement

OVERFLOW AREA followed by its structure.

APPENDIX D

Information Retrieved from the Data Base

D. 1 Introduction

This appendix displays the results of a series of selected requests made of the data base to demonstrate the type of requests that can be satisfied by the data base handler.

In each report the first line is a reproduction of the request as received by the data base handler. One or more groups of information follow each request. Within each of these groups the first line identifies the record accessed and the remainder is the fields requested from that record.

The grain data from records in the country or terminal segments appears as three separate numbers. The first represents the current stock position, the second the year to date receipts and the third the year to date shipments.

Examples are given of the record accessing capabilities and the field accessing capabilities.

D. 2 Record Accessing

The following index points out the report or reports which exhibit the accessing of a specific record or series of records.

Record Type	Report
Country Segment	
specific company at a specific station	1, 6

Record Type	Report
each company at a speific station	2
each station	3
each company (overall)	4
each station occurrence of a specific company	5
country total	7
specific company (overall)	8
specific station	9
each country elevator	10
Transit Segment	
specific boxcar	11, 12
each occurrence of a specific company	13
each occurrence of a specific destination	14
each occurrence of a specific order number	15
Terminal Segment	
each elevator at a specific location	16
specific elevator for a specific company	17
each company at a specific location	18
specific company at a specific location	19

D. 3 Field Accessing

The following index points out the report or reports which exhibit the accessing of a specific field or group of fields within a record.

Field Type	Report
Country/Terminal Segment	
specific grade of a specific grain	1, 5, 18
each grade of a specific grain	2
specific grain total	3, 8, 10
elevator capacity	4
each grain total	6, 9
entire record	7, 17
space in use	16
each grade for each grain	19
Transit Segment	
entire record	11
destination	12
last reported location	13
grain	14
station of origin	15

1

APPLICATION#CNTRY,STN#ATWATER,COMP#FEDERAL,GRAIN#RAPESEED,GRADE#1CR

STATION #   ATWATER, COMPANY #   FEDERAL
RAPESEED 1CR   39123   61959   64377

APPLICATION#CNTRY,STN#ELIE,COMP#EACH,GRAIN#OATS,GRADE#EACH

STATION #	ELIE, COMPANY # FEDERAL		
OATS 1FEED	59422	56126	53236
OATS EX1FEED	122862	65547	40343
OATS EX3CW	73643	106755	62233

STATION #	ELIE, COMPANY # PIONEER		
OATS 1FEED	46076	47684	71900
OATS EX1FEED	44967	85462	91884
OATS EX3CW	68972	72792	34560

STATION #	ELIE, COMPANY # SASKPOOL		
OATS 1FEED	101925	74512	83454
OATS EX1FEED	64434	104383	86551
OATS EX3CW	54344	53893	75390

STATION #	ELIE, COMPANY # UNITED		
OATS 1FEED	47617	44407	88466
OATS EX1FEED	70232	65249	56986
OATS EX3CW	57671	108868	40056

3

APPLICATION#CNTRY,STN#EACH,GRAIN#FLAX

STATION #   ATWATER, COMPANY #   ALL .
FLAX TOTAL   685663   731044   808486

STATION #   BENARD, COMPANY #   ALL
FLAX TOTAL   676263   439251   495516

STATION #   COLBY, COMPANY #   ALL
FLAX TOTAL   654127   511164   528551

STATION #   DROPMORE, COMPANY #   ALL
FLAX TOTAL   627797   482696   615313

STATION #   ELIE, COMPANY #   ALL
FLAX TOTAL   614287   576376   624648

STATION #   GOLDEN, COMPANY #   ALL
FLAX TOTAL   267383   234978   263481

STATION #   HOMEWOOD, COMPANY #   ALL
FLAX TOTAL   567530   580306   474797

STATION #   LANCER, COMPANY #   ALL
FLAX TOTAL   375547   281986   435579

STATION #   MELVILLE, COMPANY #   ALL
FLAX TOTAL   300206   285116   226571

STATION #   OAKVILLE, COMPANY #   ALL
FLAX TOTAL   259250   246448   271240

STATION #   PENNANT, COMPANY #   ALL
FLAX TOTAL   553059   492066   517968

STATION #   SUCCESS, COMPANY #   ALL
FLAX TOTAL   269096   216703   269418

STATION #   WROXTON, COMPANY #   ALL
FLAX TOTAL   130314   93336   111436

4

APPLICATION#CNTRY,COMP#EACH,CAPACITY

    STATION # ALL   , COMPANY # FEDERAL
ELEVATORCAPACITY 12403701

    STATION # ALL   , COMPANY # NATIONAL
ELEVATORCAPACITY 11227438

    STATION # ALL   , COMPANY # PIONEER
ELEVATORCAPACITY 14048268

    STATION # ALL   , COMPANY # SASKPOOL
ELEVATORCAPACITY 16094638

    STATION # ALL   , COMPANY # UNITED
ELEVATORCAPACITY 11052977

5

APPLICATION#CNTRY,STN#EACH,COMP#UNITED,GRAIN#WHEAT,GRADE#TOUGH

STATION #   ATWATER, COMPANY #   UNITED
WHEAT TOUGH   71791   60254   51366

STATION #   BENARD, COMPANY #   UNITED
WHEAT TOUGH   76447   73215   64918

STATION #   COLBY, COMPANY #   UNITED   -
WHEAT TOUGH   103739   37893   33958

STATION #   ELIE, COMPANY #   UNITED
WHEAT TOUGH   81854   28026   · 74123

STATION # HOMEWOOD, COMPANY #   UNITED
WHEAT TOUGH   55630   67312   70984

STATION #   LANCER, COMPANY #   UNITED
WHEAT TOUGH   82821   38145   55444

STATION #   PENNANT, COMPANY #   UNITED
WHEAT TOUGH   75300   78434   78900

6

APPLICATION#CNTRY,STN#HOMEWCOD,COMP#PIONEER,GRAIN#EACH

STATION # HOMEWOOD, COMPANY # PIONEER

WHEAT TOTAL	312658	344579	388112
DURUM TOTAL	399510	383904	403435
OATS TOTAL	194640	202619	194274
BARLEY TOTAL	246271	260638	339709
FLAX TOTAL	79849	118380	142107
RYE TOTAL	105248	106142	137619
RAPESEED TOTAL	45862	90341	72179

APPLICATION#CNTRY

STATION # ALL	, COMPANY # ALL		
WHEAT TOTAL	14545423	15072037	14058783
WHEAT 1N	2644657	2744918	2649045
WHEAT 2N	2859430	2632021	2849579
WHEAT 3N	2982483	2896996	2611041
WHEAT 4N	2877512	3155023	2806202
WHEAT TOUGH	2663478	3102347	2642167
DURUM TOTAL	14302101	14290008	14639274
DURUM 1CW	2834442	2678584	2905209
DURUM 2CW	2726930	2636598	2973121
DURUM 3CW	2874746	2659809	2675042
DURUM 4CW	2711352	2967074	2938821
DURUM EX4CW	2599669	2825021	2705847
OATS TOTAL	8852832	8878476	8768348
OATS 1FEED	2829468	2947859	2793400
OATS EX1FEED	2842176	2844767	2944494
OATS EX3CW	2823240	2854709	2685211
BARLEY TOTAL	11870411	11464155	11878032
BARLEY 1FEED	2921952	2648797	2769565
BARLEY 2FEED	2878818	2780122	2971831
BARLEY 3CW6ROW	2760393	2741097	2906380
BARLEY TOUGH	2961601	2888314	2755051
FLAX TOTAL	6110836	5264806	5754440
FLAX 1CW	2755620	2514867	2641960
FLAX TOUGH	3151189	2550213	2695884
RYE TOTAL	5474711	5859250	5657584
RYE 2CW	2777475	2787522	2820050
RYE 3CW	2536402	2838484	2689551
RAPESEED TOTAL	2794113	2798865	2689139
RAPESEED 1CR	2682516	2715695	2596115
ELEVATORCAPACITY	66575177		
TOTAL SPACE USED	63950427		

8

APPLICATION#CNTRY,COMP#NATIONAL,GRAIN#DURUM

STATION #   ALL   , COMPANY # NATICNAL
DURUM TOTAL   2375893   2448040   2539332

9

APPLICATION#CNTRY,STN#SUCCESS,GRAIN#EACH

STATION #	SUCCESS,	COMPANY #	ALL
WHEAT TOTAL	648750	673021	717822
DURUM TOTAL	684863	656783	717410
OATS TOTAL	443688	439244	354148
BARLEY TOTAL	628509	404357	611174
FLAX TOTAL	269096	216703	269418
RYE TOTAL	302718	291793	218004
RAPESEED TOTAL	96215	149489	152425

10

APPLICATION#CNTRY,STN#EACH,CCMP#EACH,GRAIN#RYE

STATION #   ATWATER, COMPANY #   FEDERAL
RYE TOTAL   149092   132685   124076

STATION #   ATWATER, COMPANY # NATICNAL
RYE TOTAL   132628   141013   167344

STATION #   ATWATER, COMPANY #   PICNEER
RYE TOTAL   158074   170329   120113

STATION #   ATWATER, COMPANY # SASKPCOL
RYE TOTAL   91373   127214   96861

STATION #   ATWATER, COMPANY #   UNITED
RYE TOTAL   182809   84328   127095

STATION #   BENARD, COMPANY #   FEDERAL
RYE TOTAL   90614   161428   152401

STATION #   BENARD, COMPANY # NATICNAL
RYE TOTAL   81506   135211   133846

STATION #   BENARD, COMPANY # SASKPCOL
RYE TOTAL   185074   142981   172415

STATION #   BENARD, COMPANY #   UNITED
RYE TOTAL   155081   162657   187614

STATION #   COLBY, COMPANY # NATICNAL
RYE TOTAL   171100   145299   139622

STATION #   COLBY, COMPANY #   PICNEER
RYE TOTAL   127445   160485   135327

STATION #   COLBY, COMPANY # SASKPCOL
RYE TOTAL   144985   211517   73420

STATION #   COLBY, COMPANY #   UNITED
RYE TOTAL   97809   55998   113562

STATION # DROPMORE, COMPANY #   FEDERAL
RYE TOTAL   140415   147003   166828

STATION # DROPMORE, COMPANY # NATICNAL
RYE TOTAL   120768   181075   140572

STATION # DROPMORE, COMPANY #   PICNEER
RYE TOTAL   153684   142204   125330

STATION # DROPMORE, COMPANY # SASKPCOL
RYE TOTAL   92491   97477   87262

STATION #   ELIE, COMPANY # FEDERAL
RYE TOTAL   97683   111957   145279

STATION #   ELIE, COMPANY # PIONEER
RYE TOTAL   140394   160318   163578

STATION #   ELIE, COMPANY # SASKPOOL
RYE TOTAL   161634   169863   175797

STATION #   ELIE, COMPANY #   UNITED
RYE TOTAL   148827   162616   145438

STATION #   GOLDEN, COMPANY #   PIONEER
RYE TOTAL   142026   198298   154188

STATION #   GOLDEN, COMPANY # SASKPCOL
RYE TOTAL   142564   176327   99707

STATION # HOMEWOOD, COMPANY # NATIONAL
RYE TOTAL   189154   126546   143491

STATION # HOMEWOOD, COMPANY #   PIONEER
RYE TOTAL   105248   106142   137619

STATION # HOMEWOOD, COMPANY # SASKPCOL
RYE TOTAL   81373   126786   125667

STATION # HOMEWOOD, COMPANY #   UNITED
RYE TOTAL   158672   130081   107366

STATION #   LANCER, COMPANY # FEDERAL
RYE TOTAL   103821   135778   80138

STATION #   LANCER, COMPANY #   PIONEER
RYE TOTAL   114011   136379   100524

STATION #   LANCER, COMPANY #   UNITED
RYE TOTAL   139647   176436   137882

STATION # MELVILLE, COMPANY #   FEDERAL
RYE TOTAL   62415   164319   117901

STATION # MELVILLE, COMPANY # SASKPCOL
RYE TOTAL   148482   161008   88023

STATION # OAKVILLE, COMPANY # NATIONAL
RYE TOTAL   115073   170452   133283

STATION # OAKVILLE, COMPANY # SASKPOOL
RYE TOTAL   124771   109186   144532

STATION # PENNANT, COMPANY # FEDERAL
RYE TOTAL   103230   114822   189191

STATION # PENNANT, COMPANY # PIONEER
RYE TOTAL   114044   111956   156198

STATION # PENNANT, COMPANY # SASKPOOL
RYE TOTAL   138712   104688   127018

STATION # PENNANT, COMPANY # UNITED
RYE TOTAL   156674   144545   141310

STATION # SUCCESS, COMPANY # NATIONAL
RYE TOTAL   122849   147600   135354

STATION # SUCCESS, COMPANY # PIONEER
RYE TOTAL   179869   144193   82650

STATION # WROXTON, COMPANY # FEDERAL
RYE TOTAL   104295   85010   180856

11

APPLICATION#TRANS,CAR#249970

CAR NUMBER	249970
GRAIN	FLAX
GRADE	2N
QUANTITY	4280
DATE LOADED	152
ORIGIN	ELIE
LAST LOCATION	ATWATER
DESTINATION	LAKEHEAD
SHIPPING COMPANY	PIONEER
ORDER NUMBER	2588

12

APPLICATION#TRANS,CAR#223759,DEST

```
CAR NUMBER          223759
DESTINATION         LAKEHEAD
```

13

APPLICATION#TRANS,COMP#UNITED,LOC

CAR NUMBER	223239
LAST LOCATION	OAKVILLE

CAR NUMBER	252231
LAST LOCATION	ATWATER

CAR NUMBER	264471
LAST LOCATION	ELIE

CAR NUMBER	249099
LAST LOCATION	ELIE

CAR NUMBER	268875
LAST LOCATION	WROXTON

CAR NUMBER	245798
LAST LOCATION	SUCCESS

CAR NUMBER	227133
LAST LOCATION	ELIE

APPLICATION#TRANS,DEST#PACIFIC,GRAIN

| CAR NUMBER | 262708 |
| GRAIN | FLAX |

| CAR NUMBER | 252231 |
| GRAIN | WHEAT |

| CAR NUMBER | 258838 |
| GRAIN | RYE |

| CAR NUMBER | 264471 |
| GRAIN | OATS |

| CAR NUMBER | 251158 |
| GRAIN | DURUM |

| CAR NUMBER | 264056 |
| GRAIN | OATS |

| CAR NUMBER | 140319 |
| GRAIN | DURUM |

| CAR NUMBER | 249099 |
| GRAIN | FLAX |

| CAR NUMBER | 258338 |
| GRAIN | FLAX |

| CAR NUMBER | 259808 |
| GRAIN | OATS |

| CAR NUMBER | 268875 |
| GRAIN | DURUM |

| CAR NUMBER | 269334 |
| GRAIN | OATS |

| CAR NUMBER | 262604 |
| GRAIN | FLAX |

| CAR NUMBER | 264470 |
| GRAIN | RYE |

| CAR NUMBER | 254375 |
| GRAIN | RYE |

APPLICATION#TRANS,ORDER#2640,STN

CAR NUMBER	221259
ORIGIN	GOLDEN

CAR NUMBER	264471
ORIGIN	LANCER

CAR NUMBER	258338
ORIGIN	GOLDEN

CAR NUMBER	262604
ORIGIN	HOMEWCOD

CAR NUMBER	264470
ORIGIN	WROXTON

16

APPLICATION#TERM,LOC#LAKEHEAD,CCMP#EACH,ELEV#EACH,SPACE

LOCATION # LAKEHEAD, COMPANY # NATICNAL, ELEVATOR #   HOUSE1
TOTAL SPACE USED   5441780

LOCATION # LAKEHEAD, COMPANY # NATICNAL, ELEVATOR #   HOUSE2
TOTAL SPACE USED   5593330

LOCATION # LAKEHEAD, COMPANY # NATICNAL, ELEVATOR #   HOUSE3
TOTAL SPACE USED   5616239

LOCATION # LAKEHEAD, COMPANY # SASKPCOL, ELEVATOR #   HOUSE1
TOTAL SPACE USED   5595760

LOCATION # LAKEHEAD, COMPANY # SASKPOOL, ELEVATOR #   HOUSE2
TOTAL SPACE USED   5798691

LOCATION # LAKEHEAD, COMPANY #   UNITED, ELEVATOR #   HOUSE1
TOTAL SPACE USED   5795157

LOCATION # LAKEHEAD, COMPANY #   UNITED, ELEVATOR #   HOUSE2
TOTAL SPACE USED   5884544

APPLICATION#TERM,LOC#LAKEHEAD,COMP#UNITED,ELEV#HOUSE2

LOCATION # LAKEHEAD, COMPANY #	UNITED, ELEVATOR #	HOUSE2
WHEAT TOTAL	1526818	1230570	1084476
WHEAT 1N	232509	285133	196766
WHEAT 2N	310426	236307	289473
WHEAT 3N	374429	216566	190483
WHEAT 4N	245179	226127	244214
WHEAT TOUGH	291570	254254	121830
DURUM TOTAL	1255793	1216303	1194902
DURUM 1CW	193810	182976	165574
DURUM 2CW	228384	212668	204985
DURUM 3CW	224891	259511	244976
DURUM 4CW	294753	324833	275805
DURUM EX4CW	231801	236315	204901
OATS TOTAL	797169	779514	803906
OATS 1FEED	234738	261081	210580
OATS EX1FEED	251472	190654	267631
OATS EX3CW	295329	297798	294776
BARLEY TOTAL	1190669	1153605	1174852
BARLEY 1FEED	233140	315222	224006
BARLEY 2FEED	295198	286172	341791
BARLEY 3CW6ROW	307098	286891	302168
BARLEY TOUGH	343445	220951	261701
FLAX TOTAL	522025	418326	466330
FLAX 1CW	303441	185466	286316
FLAX TOUGH	208349	209182	180014
RYE TOTAL	389067	511428	511542
RYE 2CW	120822	212430	185453
RYE 3CW	236121	288970	306415
RAPESEED TOTAL	203003	262292	262221
RAPESEED 1CR	195196	259696	252136
ELEVATORCAPACITY	6119925		
TOTAL SPACE USED	5884544		

18

APPLICATION#TERM,LOC#PACIFIC,COMP#EACH,GRAIN#WHEAT,GRADE#3N

LOCATION # PACIFIC, COMPANY # FEDERAL, ELEVATOR # ALL
WHEAT 3N   1079832   1213177   991014

LOCATION # PACIFIC, COMPANY # PIONEER, ELEVATOR # ALL
WHEAT 3N   347181   226517   303887

APPLICATION#TERM,LOC#PACIFIC,COMP#PIONEER,GRAIN#EACH,GRADE#EACH

LOCATION # PACIFIC, COMPANY # PIONEER, ELEVATOR # ALL

	PACIFIC	PIONEER	ALL
WHEAT 1N	227924	347534	237673
WHEAT 2N	224242	249152	276756
WHEAT 3N	347181	226517	303887
WHEAT 4N	235396	284949	261945
WHEAT TOUGH	255851	267644	288133
DURUM 1CW	273154	265639	264564
DURUM 2CW	240767	349645	290722
DURUM 3CW	214096	273760	277795
DURUM 4CW	185445	201053	214893
DURUM EX4CW	290857	251028	307126
OATS 1FEED	188826	218958	235569
OATS EX1FEED	260879	217092	189098
OATS EX3CW	234037	287751	268099
BARLEY 1FEED	375155	188279	260057
BARLEY 2FEED	157130	297882	287014
BARLEY 3CW6ROW	296986	246343	274905
BARLEY TOUGH	265838	214603	244772
FLAX 1CW	270726	207223	275847
FLAX TOUGH	308325	296722	290514
RYE 2CW	240533	339784	161145
RYE 3CW	291932	315350	188809
RAPESEED 1CR	169122	284572	203862