CYBER 170 SYSTEM for Railroad Equipment Control

RAIL-CARRIER

CONTROL DATA CYBER 170

for

Railroad Equipment Control

Control Data Corporation

8100 34th Avenue South

Minneapolis, Minnesota 55440

CONTROL DATA
CORPORATION

PROPRIETARY NOTICE

The ideas and designs set forth in this document are the property of Control Data Corporation and are not to be disseminated, distributed, or otherwise conveyed to third persons without the express written permission of Control Data Corporation.

For further information, contact your local representative or:

Mr. E. Wrathall
Control Data Corporation
P.O. Box 0
Minneapolis, Minnesota 55440

CONTENTS

Section 1

INTRODUCTION

Many factors in today's industrial nations are leading to a resurgence in railroad freight traffic; this means increased demands on railroads are appearing for timely and dependable service, as well as the capability to efficiently meet these changing demands. Together with these factors is the demand for increased productivity from the work force, rolling stock and facilities which must be achieved to meet the requirements for rail movement by cost-conscious customers.

These pressures are, to varying extents, being felt by the other modes of freight transportation, and ultimately all modes are under heavy pressures to control costs, while providing dependable and efficient service.

As transportation is a service provided over a possibly widespread geographic area, cost control, as well as service and operations control, must be effected at all major locations which can affect these vital factors.

Realizing the current trends of industry, and following its experiences in rail, road, and other transportation information and control systems, Control Data has designed a system specifically tailored to the problems of the modern international railroad. This system, as with Control Data's Motor Freight CARRIER system (which is in use in a number of major trucking companies), is based on the most modern system design techniques and computer and communications technology. Today's data base management systems and programming techniques provide a significant advance over systems designed and implemented in the past.

The principal locations which must provide the work needed to move freight by rail are the stations (yards) which collect cars from industry, deliver them to industry, and make up and break down trains. Work to be accomplished at these locations is critical and continuous, and the station master needs a full range of timely information available to him and his staff to assist in planning their operations and executing them. Hence, the principal yards or stations on a railroad are the focal points for a modern railroad information and control system. These locations will require the ability to report (or input) data describing basic events, and it must also be able to make inquiries into the system to get basic information on trains, cars, etc., as well as receive regular reports summarizing work inbound to the locations, etc.

The Rail-CARRIER system comprises, therefore, several basic parts:

- Computer terminal devices located at major yards and other key operational offices (car distribution offices, district headquarters, train dispatch offices, etc.).

- A communications network to link all the remote terminals to the central computer system.

- A central computer system which retains records of all basic car, customer, yard, and train operations reported from the railroad as a whole, and which stores them in a real-time data base. Geared to the use of the railroad's operating department, the central system monitors major railroad movement events as they occur, as well as reporting vital operational information to all individuals and departments requiring timely information on any or all aspects of the railroad's operation and its equipment fleets. The system will also permit a message switching function between the remote locations.

The system is designed to assist railroad management in monitoring and controlling its operations, in planning and/or controlling deviations from scheduled or assigned operational events, in generating and/or discriminating movement orders, and very importantly in providing all levels of management with performance reports and traffic analyses to ensure close measurement and control of the railroad as well as a continually evolving system for planning future operations.

A short description of the basic reporting, monitoring, and control functions of the Rail-CARRIER system, as they pertain to the railroad, is given in the following paragraphs.

- Train Operations

  The physical movement of all trains will be reported to and recorded by the system. In addition, all trains being built will be monitored to ensure that train limits are not being violated and to give advance notice of limits being approached due to unusually heavy traffic (or other reasons) which may require train planning/dispatching offices to schedule an extra train. In addition, schedule changes, cancelled trains, etc., are all reported under this functional discipline. The controls inherent in the train area will permit close train traffic management, and the maintenance of an accurate data base describing current locations and status of all rolling stock. This rolling stock disposition knowledge is vital in planning, monitoring, and controlling the equipment fleets which is needed to be able to improve utilization and customer service. A full set of train-oriented operation reports and summaries is output by the system.

  Car (Wagon/Fleet Operations)

  All station-to-station car movements are reported via the consist discipline enforced in train operations; in addition, the consist discipline will cause all cars set off, or picked up by scheduled

1-2

local or through trains to be reported to the system. Cars come on-line and go off-line either through industrial switching or via interchange with other railroads. These movements are basically reported to the system so that changes in a car's status as it goes through its work cycle will then be recorded, reported, and measured according to the status it is in, etc. In addition, the system will require reports on cars leaving service for maintenance due to defects in running equipment, etc. Cars being stored in pools due to falling demand will also be reported, as will car(s) being reserved for a particular status. The object of the car operations discipline is to require a timely and accurate reporting of all status and location changes, so the system can monitor and assist in the planning and control of any and all equipment fleets. Similar control is exercised on locomotives, guard vans (cabooses) and any special equipment fleet deemed to be in need of this type of control.

A comprehensive series of reports describing such areas as: car utilization by customer, by type; car movement statistics; and off-line, on-line equipment status are available.

In addition, the system will schedule loaded and empty car movements by route, block and scheduled train to whatever depth is required by a railroad.

- Station (yard) Operations

  Train and car event reporting will provide a full profile of all basic yard processing. The data captured by train and by car will permit a comprehensive set of reports for use by station management, and their management, describing such areas as: inbound workload (cars inbound on trains), missed connections (cars missing scheduled trains), car detention by yard, inbound freight by customer, scheduled outbound cars by station. These report types will prove a vital element in the assistance that the CARRIER system will provide station management — constant use of this information, and attention to trouble spots being reported by the system will permit yard personnel to enhance their operations consistently.

- Maintenance Operations

  The maintenance function is designed to permit the maintenance department to schedule and control the (preventative) maintenance required on all rolling stock, and to do this interactively with operations so as to maintain orderly rolling stock service. In addition, equipment which becomes inoperable while being used will be reported into this function. All equipment to be maintained will be monitored and maintenance performance and standards-type reports will be generated. This comprehensive maintenance function should permit greatly improved maintenance functions and equipment maintenance cost control.

- Customer Contracts

  Large volume and high-value customers may be permitted to enter into specific service contracts which may delineate such factors as: the actual

flow of cars to and from a customer, the trains to be used, etc. The
system will maintain updated records on all customer contracts. These
contracts may call for such factors as specific train movements.
Any deviations will be reported by the system; in addition, specific
blocking and scheduling contracts will cause the relevant consists to be
updated accordingly.

- Traffic Analysis

  The system, in gathering and keeping records of all basic freight
  movements, whether on a train, to a customer loaded, etc., will
  have the ability to perform practically any analysis of its traffic
  flow which it may require. Specifically at this time, the system
  will provide such reports as:

  - Weekly reports on specific train operations
  - Reports on expected train traffic
  - Tonnage carried for major customers
  - Comparative traffic loading
  - Monthly and yearly summaries of inbound and outbound
    freight by station.

The Rail-CARRIER type of on-line system, its reporting demands and potential
management controls, as well as the possibilities it opens to the railroad planner,
must be approached carefully. The system will come to be involved in almost
all major departments in a railroad and this represents a major change in the way
a railroad has historically conducted its business. To be assured that the system
will be used to its full potential and that its introduction will not cause disruption
to normal freight operation activities, system implementation must be carefully
studied. Control Data is keenly aware of the need for careful implementation plan-
ning tailored for each specific railroad; a section of this report discusses a possible
and feasible implementation plan which can be used as a general guidelines. The
actual location, function, and time schedule to be observed in a railroad must be
planned by the railroad in question.

This system has been planned with the requirements and operating practices of the
international railroad in mind. The planning has been done in the light of experience
gained by other railroads over the past decade or more. With careful consideration
of functions to be implemented, changed procedures required to more adequately
suit a particular railroad's practices, and the definition of a well reasoned imple-
mentation plan, the benefits accruing to a railroad installing a Rail-CARRIER
system can be very substantial.

Section 2

SYSTEM DESCRIPTION

INFORMATION FLOW

CAR AND TRAIN MOVEMENT INFORMATION FLOW

The on-line system described in this document is concerned with keeping a full set of contemporaneous data describing the principal movement, repair, and status change events occurring on a railroad. This basic design philosophy requires that a set of principal events be determined and reported — where the set of principal events represents those major events which, if not accomplished in a timely and accurate fashion, will cause operational and service delays, etc. More minor events which may be necessary to accomplish major events are not reported in the system until a later phase, or may not be recommended for reporting (at least to a central computer facility). Examples of major events are train consist build, train dispatch, train arrival, and rolling stock maintenance; minor events currently include generating industrial switch orders for yard switchers, flat yard switch lists, locomotive fueling orders, etc.

This section describes how the computer system reporting requirements and the accomplishment of related major operational events fit together, and how the computer system will basically assist operations management in the planning and execution of their responsibilities. This basic description should be augmented by a close study of the reports being generated, summarizing car, train, traffic, and yard work accomplishments for use on station, district (regional), and head office levels. This information is provided in Section 3. A similar description of a basic car distribution cycle from an operations and computer viewpoint is provided.

The basic information and event flow described in this section is represented in Figure 2-1. The following describes events represented in the diagram, commencing at the top of the diagram.

The upper left-hand event represents a car(s) being received in interchange; these car(s) are reported to the system to update the files describing home cars returning on-line or foreign cars being received on-line. These cars are inspected via the BAD event (this is basically for bad order inspection, but it should be expanded to include
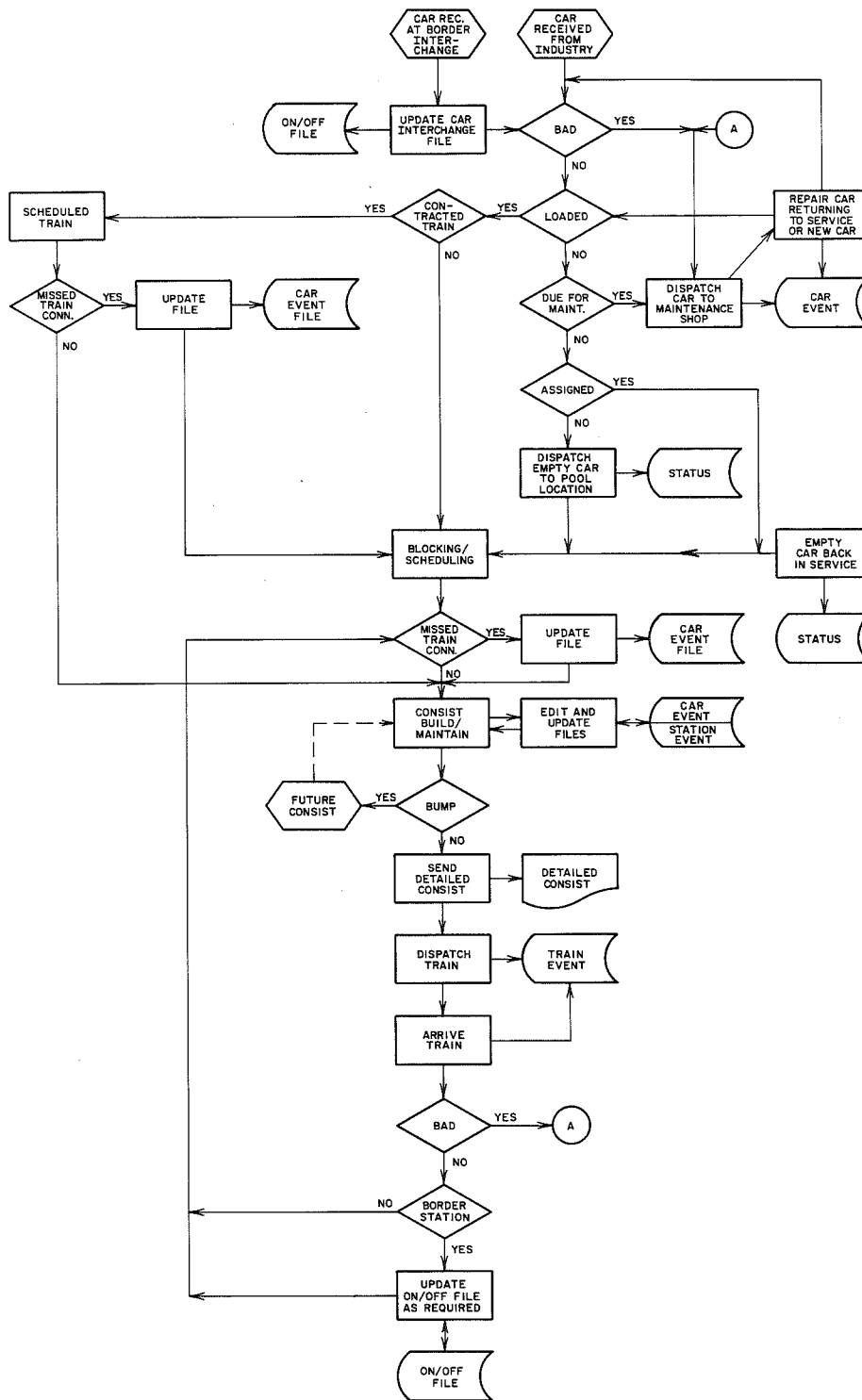
Figure 2-1. Car and Train Movement Information Flow

other servicing events such as customs clearance; cleaning; ice or heat servicing; livestock service such as water, rest, and feed; airing; etc. Cars requiring maintenance (and/or service) are reported bad ordered (and the data base updated accordingly), and are either directed to the appropriate facilities (maintenance shop, etc.), or move orders are generated for dispatching bad ordered cars to a repair facility. Cars being received in interchange that do not require repair or servicing following inspection join the event stream of other cars coming on-line from industry.

Cars are received (empty or loaded) from industry as shown in the right uppermost event box. These are similarly inspected for bad order condition, and a service determination is made. Cars requiring maintenance follow the BAD order event path described above. The cars not requiring such attention are ready for assignment and/or movement. Cars are either empty or loaded.

Empty cars are available for scheduled maintenance, and are dispatched to a designated maintenance shop in accordance with car maintenance move orders as described in Section 3; the data base is updated to reflect maintenance events. The nonmaintenance ordered empty car is then scrutinized to ascertain if it is assigned (by type assignment or number) to move to fill an empty car demand at some other location, or it may be held, or ordered held, for later assignment from its current yard. Nonassigned empty cars may be ordered to move (as a type or by number) to a pool storage location. If a car is ordered to move, the routing, blocking, and scheduling of the empty car must be accomplished. (This is the same process as for loaded cars and is explained below.) Essentially, the first move of the car's route is determined by the yard master, or his staff. The system assigns any later blocked movements and scheduled trains for the car to reach its final destination. Once blocked and assigned to an initial train, the car is built into the train, and is reported via a consist build/consist maintain message.

If the car coming on-line is loaded and not bad ordered, it follows a different logical path. The first question to be answered is whether the car was contracted to travel on a specific train from this station (this type of movement contract for certain customers/movements is prevalent in certain railroads). If the car was contracted to travel on a specific train, it must be determined if the car can be put on the train or if it has missed its connection. If the connection has been missed or cannot be made, the connection is reported missed and the car event file updated. Contracted car movements flow directly to the contracted train consist build/maintain event;

missed connections for contracted cars require car rescheduling and flow to the blocking/scheduling event; uncontracted cars have their first move assigned following the routing/blocking scheduling orders of the railroad. The system, which has a record of the railroad's routing/blocking/scheduling rules, determines the desired future moves of the car and updates the future consists being built accordingly. The blocking/scheduling function is tailored to conform with each individual railroad's philosophy and operating rules and procedures. If all routing/blocking/scheduling is to be done manually, this requirement can be easily encompassed by the system.

It is recommended that the initial train movement of a car be determined manually according to a railroad's routing/blocking/scheduling rules and that later moves, etc., be determined by the system according to these same rules. This obviates the need for an extra data entry describing the car (when it is first received on-line in a yard) which would be necessary if the system had to do all train assignment. This is a practical arrangement in the initial phases of operation for a system of this type. As mentioned in the yard subsection of Section 4, earlier car data input may be desired, thus allowing complete scheduling by the system. Railroads requiring way-bill data entry before movement can commence, may also have a blocking pattern and train schedules completely determined by the system.

A determination will be made to see if assigned empty cars have missed or will miss their scheduled trains; similarly, if loaded cars not under contract, but which have a train move scheduled, will make the train build cycle in time. If missed connections are evident, these facts are reported and the Car Event file is updated. Also, missed connection reports are generated for use by appropriate management to review for frequency of occurrence, etc.

The next function shown is the consist build/maintain event where all information describing cars moving on trains is entered into the system, and the train consist is completed. To assist the yard master in planning trains, the system prints out, on request, either inbound train consists or expected future consists, or both. The system examines a reported consist (or consist update) for car feasibility and move feasibility, and ensures that height, width, length, and load restrictions for a particular train are not being abrogated. This last editing may result in cars being bumped, rescheduled, and inputted to a future consist.

This consist is sent to required down-line stations. The train is dispatched, and the dispatching is reported to the system, as well as to the next reporting arrival station on its schedule. The actual arrival time of a train at an inbound station is reported in a timely fashion. These reported events update the Train Event file; summaries are made of late and early train schedule deviations for traffic/dispatch management. The arrive train event may be followed by the removal of cars from the train which were observed to have defective equipment; this type of car is treated in the same manner as bad ordered cars reported earlier.

If the train has arrived at a border/interchange yard, cars being set off at such a station for interchange must be reported as going off-line via a car interchange departure message. This information is used to update the On-line/Off-line file, and appropriate and timely reports summarizing these events are generated by the system for use by responsible management.

The train's consist is maintained (if it is ongoing) to reflect errors in the original consist which were detected enroute or at the arrival yard, and to reflect cars set off or picked up (spotted or pulled) in industrial movements between yards (a typical local train activity). In addition, consist changes representing cuts or blocks of cars being switched onto or off a train will require consist maintenance message activity, hence, the flow loops back through the major train consist and movement activities. Prior to this, if train delays occurred, some cars to be switched may have missed their connections; this determination, together with rescheduling, is necessary.

SYSTEM CAPTURE OF CHANGED DATA

The system is concerned with assisting railroad operations management in the planning, monitoring, and controling of various responsibility areas. The monitoring function is concerned with tracking known equipment being processed by planned events. This monitoring requires the system to have, and maintain, a data base describing a variety of events, etc. The system data requirements are:

- The Train Schedule must be maintained in an accurate fashion. All cancelled trains, and special trains, must be reported to the system, as are all train schedule deviations. When the description of a train's schedule changes to reflect such factors as changed powering levels (which affects a train's tonnage capacity, etc.), changed station stops, changed speeds, etc., this information must also be input to the system.

● The car fleet must be completely described (as with the locomotive, caboose [guard van] fleets) in the data base. This description includes unit number (initial and number for foreign cars temporarily on-line), length, empty weight, braking coefficient, car type, loaded capacity, beginning service date, and projected maintenance data. Other information describing maintenance status (miles traveled, weight carried, etc.) may be captured at a later date but it is not required initially. Also, as transportation contracts change, cars are reassigned onto or off a particular contract. This data is also entered. If cars are withdrawn from service for storage in an empty car pool, these assignments are entered into the system, and the appropriate car file updated. As new cars are added to the fleet, old cars retired, or existing cars rebuilt or modified, the data base must be updated accordingly. The locomotive fleet must be completely described: number, beginning service date, power rating, etc.; the data must also be kept current.

CAR DISTRIBUTION INFORMATION FLOW

An initial car distribution function which can be automated is described in the following subsection. More sophisticated techniques to assist car dispatch management in scheduling and control of empty car fleets will not be described here. Basically, the subsection will be concerned with the regular reporting cycle for empty car supply and demand data, and the issuing of empty car movement orders back to responsible district and yard management. Again, this subsection describes both the operational events and the related flow of data to and from the on-line system. The following paragraphs describe the sequence of events shown in Figure 2-2.

The distribution function is concerned with assigning cars to meet customers' orders, returning foreign cars, assigning foreign cars to customers' orders, cross-hauling cars between districts to balance overages and shortages, moving surplus cars to pool storage locations, and returning cars from storage locations. In addition, upgrading cars to overcome shortages of cars of a specified type and classification can be scheduled and accomplished by this cycle.

The car distribution function is essentially a cyclical chain of events which is repeated each day in a set fashion, and probably following a rather similar time schedule. The possibility of nonscheduled events, and events where planned car movements did not occur, are included in the following paragraphs. This basic car distribution cycle and its computer involvement can possibly be replicated on many railroads. Changes in this logic can, in most cases, be encompassed without major difficulty.
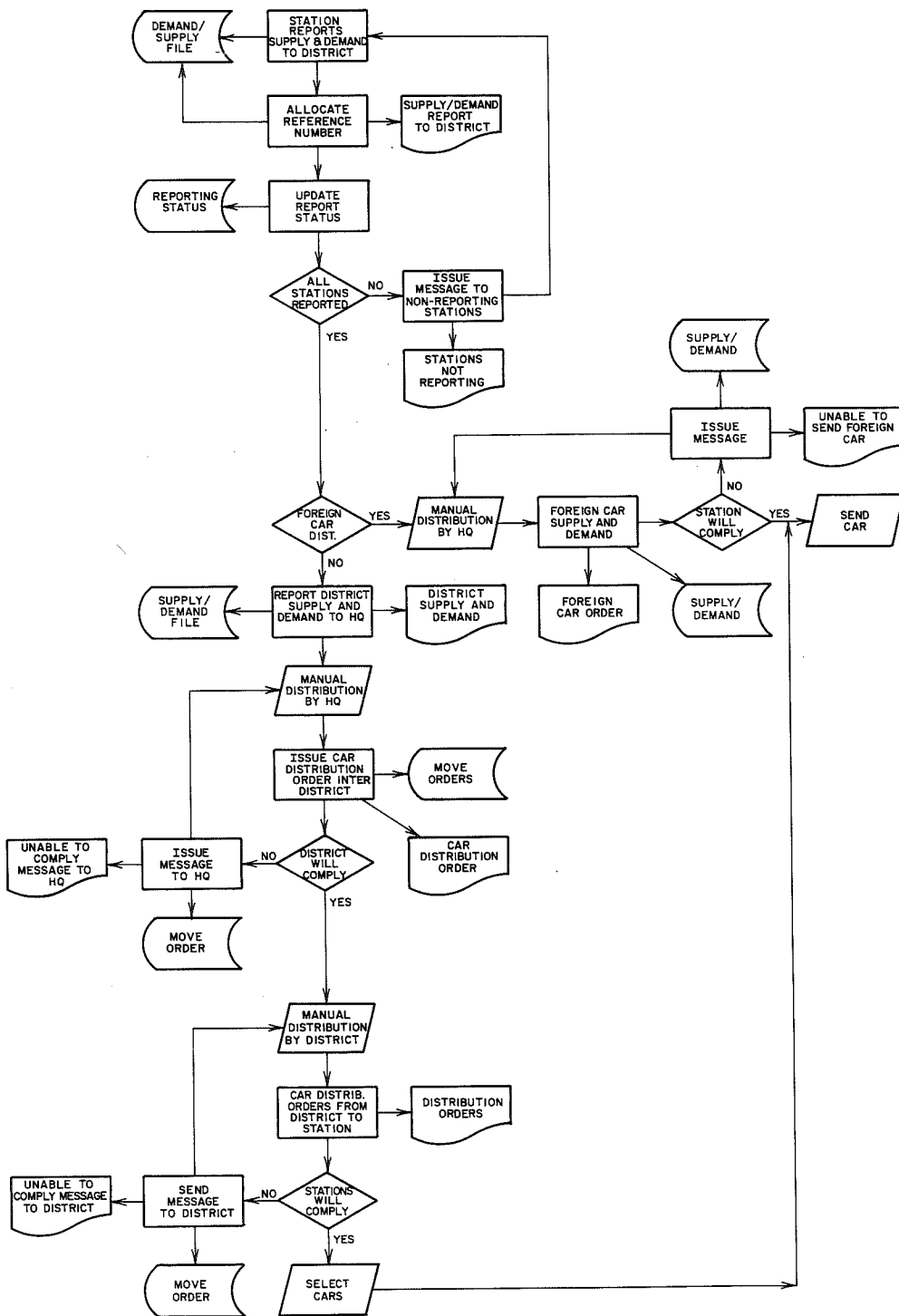
Figure 2-2. Car Distribution

2-7

The initial event in the cycle is the reporting to the system of all empty car demand and supply data by each station. Stations not automated can either report their data via telephone to an automated station, or can be canvassed by an automated station and included in its daily data. When the demand data is received for a station, the system assigns a reference number to the demand. All car movements needed to fill this demand carry this reference number, as will all reporting to the demand station describing inbound car movements to fill the demand. The supply demand data/station is used to update the Demand/Supply file in the on-line system. All home car demand/supply data is reported to the responsible district. The system monitors the stations reporting, and nonreporting stations are sent reminder messages.

All foreign car supply/demand data is sent directly to the head office car dispatchers who manually determine foreign car move orders. These move orders are input to the system to generate and disseminate foreign car move orders directly to stations, and to update the foreign car records in the data base. Stations not able to comply with foreign car move orders report this fact, and new (adjustment) foreign car move orders are generated and sent directly to stations. The data base is also updated.

All home car empty supply/demand data is summarized by type and by district. This information is sent to head office car distribution personnel and dispatchers. These dispatchers determine the interdistrict balance movements needed by car type. These required movements are sent to each district, and the data base is updated. Districts unable to comply with these orders will report this inability, which is recorded in the data base. If necessary, new (adjustment) move orders will be sent and recorded.

Upon receipt of their home car move orders, the districts manually determine how they will comply with their interdistrict move orders and their intradistrict demands. This will be in the form of station move orders which are generated and disseminated following district input to the on-line system. Stations unable to comply will report this situation, the data base will again be updated, new move orders will possibly be cut, etc.

GENERAL DESCRIPTION

The general Rail-CARRIER system consists of four basic parts:

- A number of terminals distributed around the railroad
- A data communications network
- A central computer system
- A data base system

Refer to Figure 2-3.

TERMINALS

A number of terminals of different types can be used for the operation of the Rail-CARRIER system. Low-speed terminals are used at the railroad stations and some of the offices of the railroad. These terminals have a keyboard and a low-speed printer, the speed of which may vary between 10 and 30 characters per second.

At Headquarters and district offices, faster terminals may be located. These terminals should have a card reader and a line printer. Printing speed is about 300-600 lines per minute. These terminals are used for producing larger reports and multiple copies of a report.

Other types of terminals may also be used, if necessary.

COMMUNICATION NETWORK

Messages between terminals, or between terminals and the central computer system, are routed through a general data communication network. The routing of messages through the network is controlled by one or more 2550 data communication controllers.

Control Data's 2550 data communication controllers are a family of 16-bit mini-computers especially designed to be used in data communication networks. The computers are modular and may handle from 2 to 256 communication lines of different speed and types. A communication line may connect either to a terminal or another 2550; there is no practical limitation on the number of terminals that may be connected to the network.
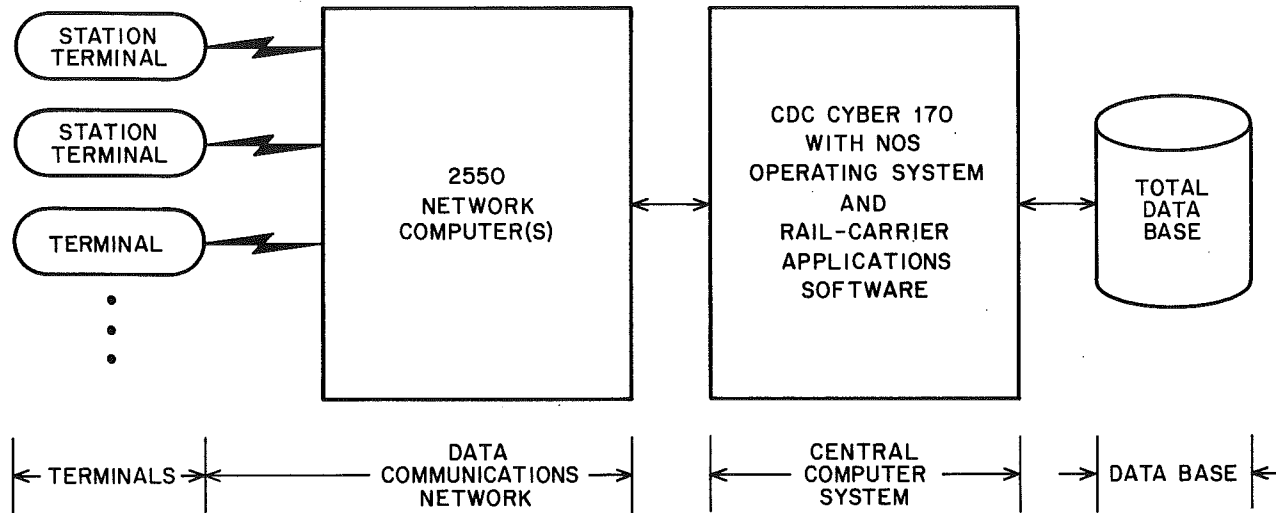
Figure 2-3. Rail-CARRIER Computer System

At least one of the 2550s has a direct connection to the central computer system.

Data is routed through the network by means of a packet switching technique. This technique, together with the very dependable and flexible data communication controllers, ensures a very reliable network. The network may be configured so that if one or more of the 2550s becomes inoperable, the network will still be operational, but with reduced capacity.

CENTRAL COMPUTER SYSTEM

The central computer system is built around a CDC CYBER 170-series computer and the Network Operating System (NOS).

The CDC CYBER 170 series, which is based on the most advanced computer design and technology available today, offers a comparitive capacity range of 1 to 10. The smallest model in this series, the Model 172, which may be incrementally upgraded to the larger models, is used for running the Rail-CARRIER system for a small- or medium-sized railroad.

The NOS operating system is a general-purpose operating system especially designed for communicating with a large data communications network. NOS simultaneously runs transaction processing, batch jobs, and any type of time-sharing on the entire CDC CYBER 170-series computers.

Transaction processing is handled by TRANEX, an NOS subsystem. NOS routes all data coming from a transaction terminal to TRANEX, which analyzes the transaction, and initiates the jobs necessary to process the transaction. TRANEX processes more than one transaction simultaneously. Data from TRANEX is transmitted to the data communications network through NOS. The actual routing of the data is controlled by the network.

DATA BASE SYSTEM

The data base system used for implementing the Rail-CARRIER system on the CDC CYBER 170-series is TOTAL. This system runs on most of the large computer systems and is the most widely used data base system available today.

The system was chosen for implementation of the Rail-CARRIER because of its ability to handle complex structured data and because of its efficiency and low system overhead.

TRANSACTION PHILOSOPHY

The transactions to the Rail-CARRIER system are normally input through a transaction terminal. However, the system also accepts transactions input on punched cards. The cards may be read through a card reader located at a central site or through the card readers of some of the terminals.

Each transaction is assigned a priority number; the manner in which the transaction is handled depends on this priority. A transaction with very high priority is handled as soon as possible after it has reached the central computer; typical response time for these transactions is 2 to 10 seconds.

The transactions with the lowest priority are handled only when the high priority load on the system permits. With these transactions, the elapsed time between transaction input and output will range from minutes to hours.

The output resulting from the processing of a transaction is routed in different ways, depending on the origin and priority of the transaction.

The priorities of the transactions are divided into four groups.

GROUP 1

Transactions in this group require fast response time and produce relatively little output. The output is always sent back to the sending terminals and to other appropriate terminals.

GROUP 2

The transactions in this group demand responses within minutes. These transactions may produce more output than the transactions in group one. This system limits the number of lines to be sent to a low-speed terminal. The full output may be sent to any high- or medium-speed printer.

GROUP 3

Transactions in this group require response times ranging from minutes to hours. Output resulting from these transactions will never be routed to a low-speed terminal; however, it may be routed to a terminal with a medium-speed printer.

GROUP 4

Transactions that demand response times ranging from several hours to one day are located in this group. These transactions may produce voluminous reports and, to process the transaction, removable disk packs may be needed. The output is always routed to a high-speed line printer either at the central site or at a high-speed terminal connected to the communications network.

The transactions in the same group may have different internal priorities. This priority affects only the response times for the transactions. The computer operators at the central site may change the internal priority of transactions within the same group.

DATA BASE

The data base needed for the Rail-CARRIER System has a rather complex network structure. Due to this complexity and the requirement for concurrent use of the data, the TOTAL data manager has been chosen. TOTAL has a low central memory requirement and utilizes mass storage effectively, which is necessary in a transaction-oriented environment.

A data base using TOTAL is made up of two types of files:

- Single entry files

  Each record has a unique key and may be retrieved by this key.

- Variable entry files

  The records are linked to one or more record in a single entry file.
  Records linked to the same single entry record are also linked together.
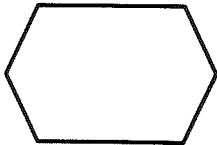 Multiple record formats may be stored in the same file.

By means of these two types of files, complex data bases may be created and maintained.

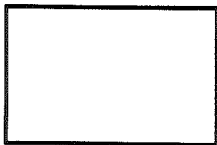Notations used when describing TOTAL data bases are:

RECORD TYPE
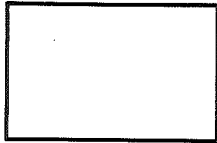
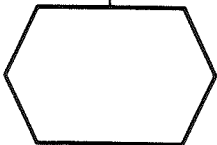Single entry file, access through
record key.

Variable entry file, access through
a record in a single entry file.

A DATA BASE

Occurrence of one or more single
entry records.

'One to many' relation between a
single entry record and variable
entry records.

Occurrence of one or more variable
entry records. Each must be owned
by at least one single entry record.

Files used in the Rail-CARRIER data base are as follows:

- Route

  The trains on the railroad network travel predefined routes; each of these routes is described in this file. Data stored is route identifier, capacity limitations of the route, etc.

- Rost (Route/Station)

  This file is used for linking all the stations along a route and then giving all the routes passing a station.

- TRRO (Train/Route)

  This file is used for linking trains and corresponding routes.

- Train No.

  A record for each scheduled train on the railroad network is kept in this file. Data stored is train identification, type of train, etc. The file is updated when new or extra trains are scheduled, or trains are cancelled for a period of time.

- Sched/Descr.

  A record for each of the scheduled stops of the train on the railroad network is stored in this file. Data stored in each record is station, arrival and dispatch time, planned capacity and locomotives for each leg of the route, days when a train does not stop at the station, etc. Data about extra trains is also stored in this file.

- Station

  Each station used by the railroad has an entry in this file. Data stored is the identification of the station, type of station, district and area code, pointers to sidings, tracks, etc.

- Station Event

  This file contains an entry for all cars which should be picked up at a station by one of a group of specified trains. A record is stored in this file when a loaded car is received from a customer siding, when a car is set off one train to be picked up by a connecting train, etc. Data stored is car identification, destination, identification of the train which is to pick up the car, etc. When the car leaves the station, the corresponding record is deleted.

- Car No.

  All rolling stock (including locomotives, cabooses, etc.) used by the railroad has a record in this file. Data stored is identification, mileage, owner, time last maintained, etc.

2-15

- Car

  A detailed description of all of the rolling stock used by the railroad.
  Data stored in this file is owner, type, weight, length, maximum
  speed, maximum load, braking weight, load carried, detailed description
  of the equipment of the car, etc. For the locomotives, the file also
  contains data about load hauled, tractive power, type, etc. The records
  in this data base are linked to records in other files. For example,
  when a car is located at a station, but not within a train, it is linked to
  the Station file. When a car is dispatched from a station on a train, it
  is delinked from the Station file, and linked to the corresponding record
  in the Train file. This file is updated each time an event occurs to a
  car.

- Car Events

  Each time a record in the car file is updated, a record reflecting the
  changes is stored in this file. When a car is dispatched from a station,
  planned train connection switching is also stored in this file, and the
  records are limited to the corresponding Train and Station records.
  As the actual events take place, the records are updated to show what
  actually took place. Most of the reports on car utilization are produced
  from this file.

  The file contains historical data about all car events on the user's
  railroad, and the size of the file may become very large. To prevent
  this file from filling up all available mass storage, the records reflecting
  events that took place more than two weeks ago must be copied to tape
  and deleted from the data base.

- Car Type

  This file contains an entry for each type of rolling stock utilized by the
  railroad. All of the cars, etc., of the same type are grouped through
  records in this file. Data stored is equipment type, and a brief descrip-
  tion of the type.

- Group Link and Group

  These two files are used for grouping cars of the same type together. By
  entering the data base through these files it will, for example, be easy to
  find information stored in the Car file near all locomotives.

- Train

  Each time a train is built, a record is stored in this file. The record is
  deleted as the train reaches the destination station. Data stored is train
  identification and type of train. Each record is linked to the Car records
  of the equipment standing in the train in the same sequence as they are
  present in the train. The link is updated as the consist is changed at
  intermediate stations to reflect the actual consist of the train.

- Train Events

  For each planned train event, a record is stored in this file, and the
  records are linked to the station where the event is planned to happen.
  Examples of train events are arrival or dispatch of a train from a
  station. Data about unplanned train events is also stored in this file.

  As the event actually happens, the records are updated to reflect how the
  event took place. Data stored is: planned and actual arrival and dis-
  patch time at a station, train capacity, weight, length, locomotives used,
  braking weight, etc.

  Records concerning events that took place more than two weeks ago are
  copied to tape and deleted from the data base.

  The Train Event file is used for producing reports on train utilization,
  deviation from schedules, total weight of freight moved in a given time
  interval, etc.

- On/Off Line

  When a home car goes off-line or a foreign car comes on-line, a record
  is stored in this file. This file is used for keeping track of foreign cars
  and also for producing statistics about the time home cars are off-line,
  foreign cars on-line, etc. The file is updated to reflect home cars re-
  turning or foreign cars going off-line.

- Status

  A car might be assigned one or more status, such as: bad ordered
  (defective), loaded, empty, being repaired, etc. All the cars with the
  same status are linked through records in this file.

- Siding

  The sidings within the responsibility area of each station have a record
  in this file. The record is linked to the responsible station. Data kept
  in the file is the track identification and track description, etc.

- Siding Link

  These two files establish correspondence between sidings, stations, and
  customers using the sidings. The file is updated as the number of
  customers varies.

- Customer

  Records for each customer using the railroad are kept in this file. Data
  stored is: customer name, address, telephone number, etc. The re-
  cords also contain pointers to cars owned or leased by the customer.

- Contract No.

  When a contract for transporting one or more cars is agreed upon by the customer and the railroad company, a record is stored in this file. Data stored in the file is: contract number, type of contract, and a pointer(s) to the car(s) involved in the contract.

- Contract

  More detailed description of the contracts is stored in this file. The records contain pointers to customer and contract number.

- Contracted Train

  When customers contract for their loaded cars to be picked up by a specific train, a record is stored in this file. Each time a loaded car is released to the railroad by the customer, this file is consulted to find the contracted train that is to move the car.

- Demand/Supply

  This file is used for the car distribution system. A record for each station and district is always present in this file. When a station has reported its daily car supply/demand data, it is stored in this file. After all stations have reported, the total demand/supply is summed by region, and stored in the corresponding region records.

  Data stored is station or district identification, demand and supply for each type of home car, and demand and supply of foreign cars.

  Data about supply and demand is erased by midnight.

- Region

  One record for each railroad region (district) is stored in this file. Data stored is: identification of region, pointers to the stations in each region, and pointers to demand and supply of a region.

- Reporting Status

  Records in this file link all stations that have reported car supply/demand. After midnight, the link is changed to indicate that no stations have reported this day. As the stations start reporting, the links are changed accordingly.

- Ref. No.

  Each report of car supply or demand is assigned a reference number and this file establishes correspondence between this number and the supply/demand data stored in the Demand/Supply file.

● Foreign Car

The reported data of demand and supply of foreign cars at the stations are chained through this file. This file also contains pointers to move orders given by the head office to move foreign cars. The data is erased by midnight.

● Move Orders

When the head office has finished the manual distribution of groups of home cars, move orders are issued to the regional offices. Data describing the move orders is stored in this file. Data describing orders to move foreign cars (given directly to the stations) is also stored in this file. Data in this file is erased by midnight.

Figure 2-4 illustrates the data base file relationships; Table 2-1 provides a summary of these files.

SYSTEM RESPONSES

Each input message is acknowledged to inform the terminal operator that the computer has received the transaction.

One of the following three responses is received.

1. An error message.

2. An inquiry reply.

3. A date and time stamp.

All messages are edited for format and content validity (see below). If an error is detected, the system responds with an error message. Each error message has a reference number assigned by the computer.

If an operator is using an interactive transaction, responses are in the form of computer replies. However, if an input-only message is acceptable to the system, only a date and time stamp are returned.

EDITS

Edits are performed on all entries where possible. Message codes and subcodes are validated on all messages. Train and unit numbers are checked to ensure that these numbers are known to the system, and movements and status changes are checked
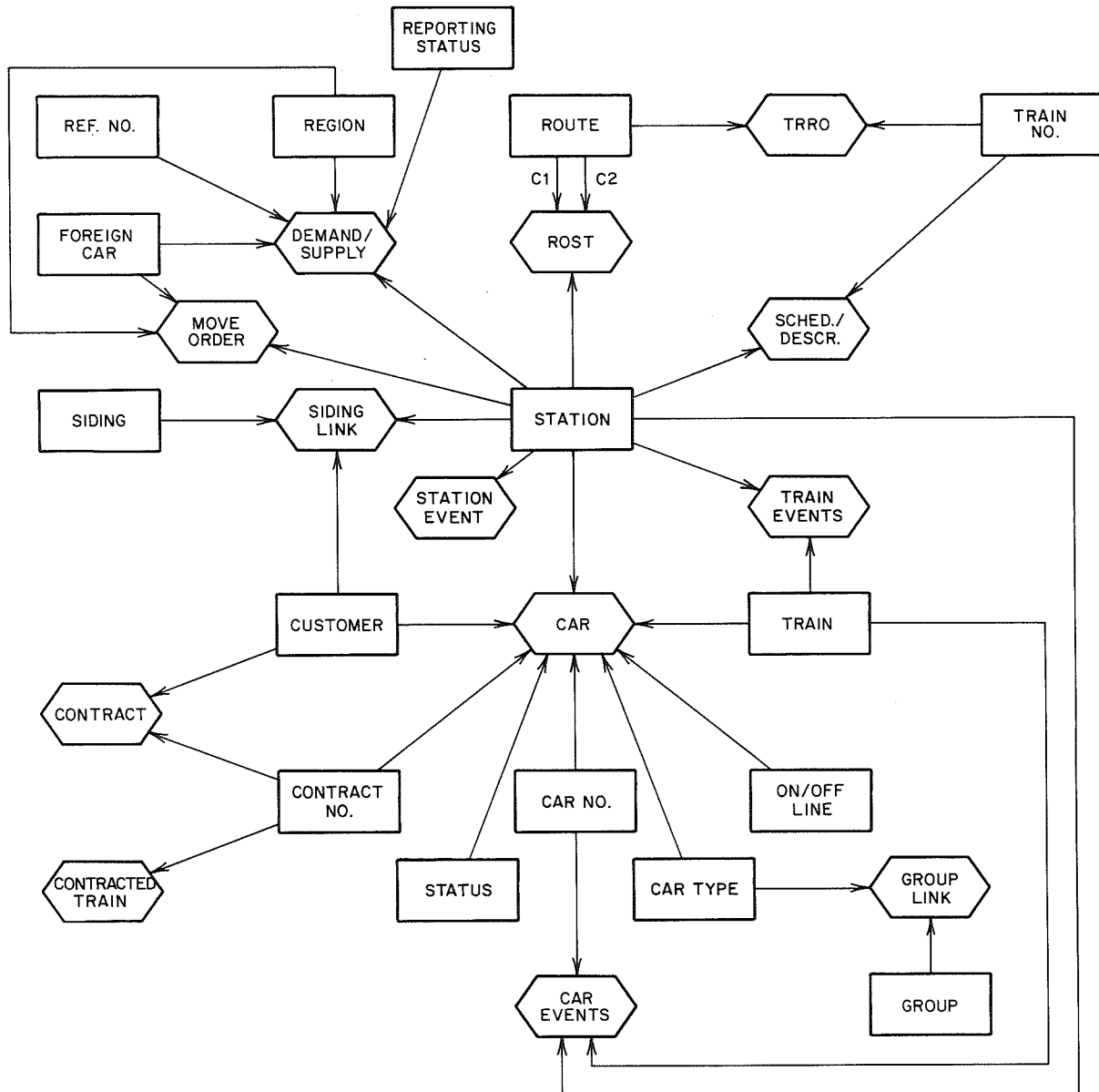
Figure 2-4. Data Base File Relationships

TABLE 2-1.   DATA ELEMENT RELATIONSHIPS

File	Contents	Type	Code	Function
Car	Car No.	1:1		Links car (unit) number to car (unit) data
Car	Car Type	1:N		Links car (unit) of same type
Group Link	Car Type	1:1		Establish connection between car (unit) type and car (unit) group
Group Link	Group	1:N		Links cars (units) within same group
Car Events	Car No.	1:N		Planned and actual events for a car (unit)
Car	Status	1:N		Gives status associated with a car (unit)
Car	On/Off Line	1:N		Chains cars going off-line or coming on-line
Car	Station	1:N		Chains all cars located at a station
Car Events	Station	1:N		Links actual and planned car events to station
Car	Train	1:N		Consist information
Car Events	Train	1:N		Links events planned for each car in train
Train Events	Train	1:N		Events planned and actually occurred for a train
Train Events	Station	1:N		Train events related to station
Siding Link	Station	1:N		Links siding to customer and stations
Siding	Siding Link	1:1		Establish correspondence: siding – station
Car	Customer	1:N		Cars owned or leased by customer
Contract	Customer	1:N		Contract associated with a customer
Car	Contract No.	1:N		Cars involved in a contract
Contract	Contract No.	1:1		Contract details
Contracted Train	Contract No.	1:N		Trains involved in a contract
Demand – Supply	Station	1:N		Demand and supply of cars at a station
Demand – Supply	Region	1:N		Chains the car demands and supply of districts
Demand Supply	Ref. No.	1:1		Associate a reference number with demand and supply
Demand Supply	Foreign Car	1:N		Chains all foreign cars
Move Order	Foreign Car	1:1		Order to move a foreign car
Move Order	Station	1:N		Links move orders to a station
Station Events	Station	1:N		Links station events to stations
Move Order	Region	1:N		Links move orders to district
Demand/Supply	Reporting Status	1:N		Links all stations' reported demand/supply
ROST	Station	1:N		Links station to routes
ROST	Route	1:N	C1	Links routes to stations
ROST	Route	1:N	C2	Gives possible routes to reach another route
TRRO	Train No.	1:N		Links trains to routes
TRRO	Route	1:N		Links routes to trains
Schedule/Descr.	Station	1:N		Links station to scheduled trains
Schedule/Descr.	Train No.	1:N		Gives the schedules for each leg of a train

against last movement and status. In the cases where absolute values are not known, such as dates, times, and weights, the figures are checked for reasonability. If customer or contract numbers or codes are used, each entry is checked to ensure that the number or code has been entered properly. Additional edits performed are briefly outlined in the various message descriptions.

It is necessary to identify the reporting station only when the message is sent from a terminal not located at that station. The system assumes that the terminal sending the message is at the station at which the event occurred. Should a station's computer terminal be inoperable, another station may report for it by identifying the station the report is for.

Section 3

TRANSACTIONS

This section contains the major discussion of the equipment control system from the user's point of view. The section, which is divided by major operations-oriented functional entities (train, car, yard, etc.), describes all real-time messages and all responses. This real-time orientation is at the heart of any transportation equipment control system. The data base must be updated in a timely fashion, and answers to time-critical information needs must also be received in a timely manner.

The system, in capturing a continuous description of all major real-time operational events, is able to compile an impressively detailed and complete history of the railraod's activity stream. This enables railroad planning departments and management to determine and review historical trends, and to plan future operations and business activities accordingly. The major non real-time report types offered by the system are described in this section. Again, these reports are discussed in the generic operational area to which they pertain. No rigorous discussion has been attempted to strictly delineate which railroad department should use which message/function/report as this will vary between railroads, as organizational structures and responsibilities vary between one railroad and another. However, the types of information available, and necessary, are discussed and general comments made regarding the utility and basic function to be served by different reports, etc.

The major areas by which the system is analyzed in this section are:

1. Train Transactions

2. Car Transactions

3. Station/Yard Transactions

4. Maintenance Transactions

5. Contract Transactions

6. Data Base Update Transactions

7. Traffic and Special Messages

8.   Locomotive Transactions

9.   Administrative Message Switching

The subject of Car Distribution is treated in detail in Section 4.

Each Transaction subsection is preceded by an alphabetically ordered list of the transactions described in the section.

The actual order in which the transactions are presented within each section is intended to reflect the basic transaction implementation sequence.

TRAIN TRANSACTIONS

An alphabetical listing of train transactions and descriptions of these transactions are as follows:

Transaction	Function	Page
TAR	Arrive train	3-7
TCB	Consist build	3-3
TCL	Train cancel	3-9
TCM	Consist maintenance	3-4
TCR	Request consist	3-8
TCS	Request cancelled train summary	3-11
TDC	Train description change	3-9
TDL	Train delay	3-10
TDR	Request late train dispatch summary	3-10
TDS	Dispatch train	3-7
TSD	Request schedule deviation summary	3-12
TSS	Request switching summary by train	3-11
TUG	Request summary of train capacity utilization by leg	3-11
TUL	Request weekly summary of train capacity utilization by lane	3-11

TCB — Consist Build

Prior to the departure of a train, a final consist must be prepared showing the equipment by actual standing order, on the outbound train. Entered are train number, departure date, and train description information. The following are then repeated for each car:

- Car number

- Status

- Commodity

- Final destination (siding, if applicable)

- Intermediate transfer station

- Loaded weight

- Consignee identification

- Contract number (if applicable)

- Remarks, etc.

Empty cars will have car identification, intermediate transfer station and destination. Additional edits are performed to check gross weight, braking weight, and length, against the power capabilities, and route restrictions which may exist for a train.

If it should become evident (based on cars entered into the consist) that the limits of the scheduled train's capacity (total tons, length) are being approached, a message so indicating is generated and transmitted to the yard terminal responsible for the train. Also, at the initialization of the consist build planning cycle in the yard office, the to-date consist expected can be requested from the central site. This to-date consist expected represents all cars whose blocking and scheduling has caused them to be scheduled for a particular train.

If desired, a car movement priority scheme could be implemented. This would determine car priority by a combination of known factors (commodity being moved, car type, etc.) or by simply inputting a car priority code with its originating TCM or TCB message.

The system will transmit to the destination station master a detailed consist containing all locomotive's identifications, etc., train number, origin and destination stations, followed by car information in the standing order of the cars in the train. The car information given is car number, status, sending and receiving stations, final destination, number of axles, gross weight, consignee, contract identification, and remarks. After all cars are listed, a train summary is given detailing length, weight, and axles.

TCB is utilized each time a train is being made up. It creates a detailed consist for the TCM (Consist Maintenance) message to alter, and to reflect changes in the train as the train travels on its schedule. This transaction updates the Car Event, Train, and Station files, among others.

TCM — Consist Maintenance

This message is necessary when the actual cars and/or their standing order on the train are changed, due to: switching at a customer/industry siding between reporting stations stops (either pick ups or set off cars); cars (blocks) being set off or picked up at the reporting station; errors in the original consist (this includes missed connections that did not leave with the train from the prior yard); cars being bad ordered or bumped, etc. It is not necessary to reenter the entire consist, but merely to make the appropriate changes as required. TCM is used when a car is being added to or deleted from an existing consist; or when the consist contains errors.

To identify the activity which has occurred, the following subcodes are required:

- PIC — Unit is added (picked up) to the consist.

- SET — Unit is deleted (set off) from the consist.

- EXC — Correct exceptions noted between printed consist and actual standing train.

- BMP – Unit has been bumped from a train because of weight or length restrictions being violated, etc.

- BAD – Unit has been removed from a train because it is 'bad ordered'.

The information needed for the TCM message is as follows:

Using PIC Subcode

TCM

Train Number

PIC

Number of preceding car on consist.

Car number, status, commodity, origin station, destination station, final location, consignee, contract identification (if applicable), weight, and remarks.

This line is repeated for each car in their standing order on the train. It is assumed that each car will follow the previous car entered. If not, line 3 must be entered to indicate a new relative position on the train. Empty car information is entered as in TCB.

Using SET Subcode

TCM

Train Number

SET

Unit number of car or first car of cut set off, followed by unit number of last car of cut set off.

This line is repeated for each car or cut set off.

Using EXC Subcode

TCM

Train Number

EXC

Exception noted:

        ADD — Car on train but not on consist

        DEL — Car on consist but not on train

        REL — Relocate car on consist

        COR — Correct data on car

If ADD is used, the following data must be entered. Number of preceding car on consist, car number, status, commodity, origin station, destination station, final location, consignee, contract identification (if applicable), weight and remarks. (For connecting loaded cars, only car number needs to be input.)

DEL requires only the car number referenced on the consist. This transaction is noted in the car event file.

REL requires the number of the actual preceding car in the consist and the number of the car to be relocated.

If the COR is used, the car number and all information relating to that car (see ADD) must be entered. If a car number is in error, then the preceding car number must be entered followed by the correct car number (and any subsequent data being corrected).

Using BMP Subcode

TCM

Train Number

BMP

Car Number, remarks.

As with the Consist Build (TCB) message, additional edits are done to ensure that train limits and capacities are not exceeded.

The Train, Car Event, and Status files are updated.

An updated consist is generated for the next inbound yard. This updated consist now serves the same function as the original consist. A car being bumped will appear on a missed connection report and the system will note that the original schedule for the car is no longer scheduled; it will then require rescheduling by the system, or manual rescheduling if it cannot be automatically rescheduled.

TDS — Dispatch Train

As a train (with its consist reported or updated,) departs from a station, that station reports this event via the TDS message. The message must contain the number of the train being dispatched and the actual departure time and date. If a station is reporting a dispatch for another station (computer terminal is not communicating or a station is not equipped with a computer terminal), the identity of the actual station the train is being dispatched from, must be given. If a station identification is not present, it is assumed that the dispatch is from the sending station.

In addition to the normal edits, a check is made to ensure that the last event of this train was an arrival at this station, or that this is the origin station of this train.

A dispatch message is then transmitted to the stations that this train will pass through, or stop at, notifying them that the train has left, together with any delay or other schedule adjustment information.

The train event file is updated to provide proper data for inquiry and management reporting.

An example of the TDS message is:

    TDS

    HAM (If a station is reporting for HAM)

    300157, 1645 – 30

    Train   Actual time
    Number   and date

TAR — Arrive Train

The TAR message should be transmitted as soon after a train arrives at a station as is practical. It must be sent before this train can be dispatched again.

This message is transmitted only to the central computer and serves to update the appropriate files.

The message must contain the train number being arrived and the actual train arrival time and date. If a station is reporting an arrival for another station (computer terminal is out of order or a station is not equipped with a computer terminal), the identity of the actual station the train is being reported arrived at must be given. If a station identification is not present, it is assumed that the arrival is at the sending station. This information is used in train delay report generation, etc.

If the preceding station has not dispatched this train, an area is reserved in the Train Event file for the dispatch information and a message is sent to the responsible station informing it of this required train data.

An example of the TAR message is:

TAR

SKI (If a station is reporting for SKI)

30157, 1740 – 30

TCR – Request Consist

When a station desires a printout of a given train's consist, it uses the TCR message. The entry need only contain the train number, and train running date. This allows a yard master to plan train makeup with full knowledge of expected connections.

The consist printed contains locomotive information for each locomotive (identification, type, capacity), train origin and destination stations, station last dispatched from, current location or stations, train length, train weight, and total number of axles. Each car is listed in standing order showing number, status, origin and destination stations, final destination, weight, and number of axles, customer contract information (if applicable), and remarks. A notification ordering a locomotive(s) off a train (as per the train's description) if the unit is to be removed, is added where appropriate.

An example of the TCR request is:

TCR

30157

TCL — Train Cancel

Should a previously scheduled train be canceled entirely or in part for one or more days, an appropriate message should be entered into the system.

Entered are the train number, beginning date, ending date (if required), first station affected by cancel, last station affected by cancel, and remarks. The station entries are not required if the entire train is canceled.

This message will update the corresponding files and cause a Cancelled Train message to be sent to the district centers and designated stations showing the stations and dates affected by this train cancellation. The message should not be confused with regular data base maintenance of the train schedule.

TXT — Extra Train

If an extra train or train section is scheduled, this message is transmitted by the appropriate regional center. This will update the various files to allow consists, dispatches, and arrivals to be generated, as well as initiating the system monitoring of this data.

Data required is train number and type, effective dates, station stops, scheduled times, and locomotive information. This updates the Train Schedule Description file (Sched/Descr).

A report containing this information is sent to affected stations, district and headquarters dispatching offices, etc.

TDC — Train Description Change

Should a change be required in train data, as entered in the Train Schedule Description file, a TDC message is necessary.

This is especially useful to railroads that closely schedule locomotives. Changes to locomotive assignments, length of train, capacity, and speed can be entered in this manner. In addition to the normal edits, locomotive assignments are validated to ensure that they are not contradictory.

Files are updated and appropriate regional offices and stations are notified.

TDL — Train Delay

When a train is delayed, it is important to keep the key operating departments informed.

The TDL message is used to capture the key information relative to the delay, such as: train number, station, expected time of delay, and the reason for the delay.

A train delay message showing expected length of delay is transmitted to the appropriate regional centers and stations.

The system uses this data to match against dispatches and schedules to summarize the reasons for delays, actual versus forecasted delays, and delays by district and train.

TDR — Request Late Train Dispatch Summary

When a dispatching office requires a summary of late dispatches, it can be obtained by the TDR request.

Entered is the train number and date, for a simple request; if a specific leg of a train is to be queried, the from and to stations desired are identified. If an area is to be examined, the TDR message code is followed by AR and the district code(s) of the areas to be reviewed.

An example of the TDR request is:

    TDR

    30157, 4 — 30, OKC, PAR

    TDR

    AR14, 4 — 30

The report will indicate train number, station pair(s), date(s), delays, with reasons where available.

TXS — Request Extra Train Summary

The extra train or extra train section summary report is called by the TXS request. Dates or specific stations may be selected.

The report gives the cumulative extra train tonnage, total cars and weight (loaded and empty), total cars and weight picked up and set off, and the capacity utilized. This information is given for the cumulative period desired (either YTD to a defined date, or between two defined dates), and for a specified station set.

TCS — Request Cancelled Train Summary

The Cancelled Train Summary is called by this request.

The report gives a monthly or a year-to-date summary of cancelled trains by station. The date, or dates, cancelled, and the reason cancelled (if known) is shown. This report is intended principally for head office traffic and dispatch management.

TUL — Request for Weekly Summary of Train Capacity Utilization by Lane

The capacity utilization summary by traffic lane is generated by the TUL request, by stating the train number and the originating and receiving station desired. (Entering ALL in originating station causes all stations to be printed for all traffic lanes.)

The report shows a weekly breakdown by originating and receiving station of axle capacity, braking capacity, total axles, total weight, axle count, and amount of capacity utilized. This is summarized for each day of the week.

TUG — Request for Summary of Train Capacity Utilization by Leg

This report is generated by the TUG request by entering the originating and receiving station and the dates desired. (Entering ALL in originating station causes all stations to be listed.)

The report gives a summary (by originating and receiving station within dates) of capacity and amount utilized for each train leg of all trains.

TSS — Request Switching Summary by Train

When a location desires the switching summary of a particular train, it can be requested by this message.

The desired date and train number is entered with the station identification (if other than the requesting terminal).

The report produced shows train number, date, station, and a summary of the total number of axles and weight of cars set off at that station; also a summary of the number of axles and weight that continued on the indicated train.

TSD — Request Schedule Deviation Summary

The Scheduled Deviation Summary is called by the TSD command. Train numbers and/or dates may be requested.

The report summarizes by train number each delay, station delayed at, time delayed by arrivals and departures, and reasons for delays (if available).

CAR TRANSACTIONS

An alphabetical listing of car transactions and descriptions of these transactions are as follows:

Transaction	Function	Page
CBB	Bad order car.	3-13
CBS	Dispatch bad order car to maintenance shop.	3-16
CCR	Bad ordered car returning or new car entering service.	3-14
CCU	Request customer car utilization summary.	3-18
CFS	Request foreign car summary.	3-19
CIA	Car interchange arrival.	3-13
CID	Car interchange departure.	3-13
CMP	Dispatch empty car for pool storage.	3-17
CMS	Return car in pool storage to service.	3-17
COF	Request home cars off-line report.	3-18
COL	Request on-line car summary by type.	3-19
CRC	Reserve a car.	3-16
CRR	Release reserved car.	3-16
CST	Request car statistics report.	3-18
CUL	Request car utilization report.	3-18

CIA — Car Interchange Arrival

Interchanging rolling stock between railroads is a frequent occurrence for many railroads. To assist operations management in their efforts to monitor and control cars affected by these movements, the CIA message is used. This message reports all home cars returning and foreign cars coming on the home line.

The data entered consists of the station receiving the car (if different from the reporting terminal), arrival time, and date. The following data regarding each car received is then entered: car number and type, status, commodity, destination, consignee, and gross weight. If the car is not a home car, the following additional data is required: empty weight, number of axles, braking coefficient, length, weight capacity, volume capacity, and any remarks which may be desired.

Additional edits are performed to ensure that the car is not already reported on-line, that it is a correct car number (if home car), and has reasonable weight, length, and volume.

CIA updates the Car file, Car Event file, and On/Off-line file. It is used each time a car or cut of cars comes on the home line, which have previously been reported off line; or for foreign cars entering the system.

CID — Car Interchange Departure

When reporting home or foreign cars going off-line, the CID message is provided.

The data entered consists of the station code (if different from the reporting terminal), date, and time. Then the car number is repeated for each car in the cut. If car status, origin station, destination, consignee, or weight are required, these elements may be entered (in most cases the system will already have this data captured). Additional remarks may also be entered.

CID updates the Car file, Car Event file, Status file, and the On/Off-line file.

CBB — Bad Order Car

This message is not used for cars already reported in a consist; bad ordered cars coming off a train are reported via a consist maintenance message.

3-13

If a car is discovered to be mechanically defective and unable to complete its currently scheduled movement(s) without maintenance, it must then be taken out of service and repaired. This message is used to report a car being ordered out of service due to mechanical defects.

The data entered is: station code (if other than reporting station), car number, date and time, and a code describing the defect. The data base is updated concerning this car (Car Event file, Blocking Schedule file, future consists, and Maintenance file). It is reported on a missed connection report with a bad order code. The car is ordered by maintenance or operations personnel to a maintenance facility to be repaired, and appropriate move orders are generated. The car enters the maintenance reporting and monitoring functions in the on-line system.

A car judged mechanically deficient, but still able to complete its current loaded move before repair, is reported with an entry code specifying this situation in the body of the message. This causes the Status file to be notified of this condition, and edit its next move to assure it is a maintenance movement, etc.

CCR — Bad Order Car Returning or New Car Entering Service

If a car is taken off-line for maintenance and is returning to service, or a new car is entering the rolling stock inventory, the CCR message causes the proper files to be updated. In addition, if cars change classification, are renumbered, or are permanently retired, this message is necessary.

Four subcodes may be utilized by this message:

    RET — Bad order car returning to service

    NEW — New car entering service

    DEM — Car being retired or demolished

    CHG — Change car number or type code, etc.

To use the RET subcode, the following entries are made (if applicable):

- Car number
- Date of next scheduled maintenance, and
- Date of next scheduled brake maintenance.

To use the NEW subcode, the following entries are made:

- Shop (location) identification
- Car number
- Type code
- Date of scheduled maintenance
- Date of scheduled brake maintenance
- Empty weight
- Weight capacity (axles)
- Volume capacity
- Length, etc.

To use the DEM subcode, the following entries are made:

- Shop (location) identification
- Car number
- Effective date, and
- Remarks

To use the CHG subcode, the following entries are made (when applicable):

- Shop (location) identification
- Original car number
- New car number
- New type
- New weight capacity
- New volume capacity, and
- Remarks

The necessary files are updated making this unit available for inquiry responses, information reporting, and movement monitoring.

CBS – Dispatch Bad Order Car to Maintenance Shop

When a car is located in a yard with a bad order (BAD) status, it must be dispatched to a maintenance shop for repair. The CBS message reports the car movement order needed for transporting the car to a designated shop via a train (or some other means).

Information required on the entry is origin station (if different from the terminal sending the message), shop location, and each car number desired, together with designated train.

Car number and location is checked together with valid station locations.

This message is a car movement order similar to those described under the Maintenance and Car Distribution sections. It can be generated by yard operations, or maintenance personnel depending on the railroad's practice. The system updates the anticipated consist of the designated train and monitors the placement and movement of the car. Appropriate maintenance reporting is triggered by the message. Operations / Maintenance departments are responsible for ensuring that the car is fit for movement to a shop. The car is reported as bad ordered, moving to shop, in the appropriate consist.

CRC – Reserve A Car

If a car is to be reserved for a particular purpose, then this message is used. This causes a change in the Status code of the car, and any future movements of the car are checked to make certain that they are compatible with the new status code. (Examples of special purposes are: reserved for maintenance of way supplies, and reserved for rail package traffic.)

CRR – Release Reserved Cars

Cars reserved for a specific purpose are released from that status by the CRR message.

Car number is the only entry required in this message. Cars are assigned an empty (EMP) status after they are released and treated accordingly (see the Car Distribution section).

CMP — Dispatch Empty Car for Pool Storage

The CMP message is a car movement order which assigns empty cars, located at various stations, to be pulled to a pool storage location, and stored for a period of time.

The data entered is: the station where the car(s) is located (if different from the sending terminal), car number, pool location, and remarks.

The station master is then informed that the car(s) should be put on a train to the pool location; the destination yard master is similarly informed. The data base is updated to reflect the changed status of such cars.

An example of the CMP message is:

    CMP

    631715, MSP

    541756, MSP

    217631, FBO

CMS — Return Car in Pool Storage to Service

Cars in pool storage must be released from that status before they can be reported in a normal service status.

The CMS message consists of the station code of the pool (if other than sending station), car number(s), destination station (if required), and remarks.

The car is then ready to be entered on a consist for movement to a particular station or assigned to a customer. It would be handled via the car distribution function when that phase has been implemented.

An example of the CMS message is:

    CMS

    631715, MAN

    541756

    217631, CGO

3-17

CCU — Request Customer Car Utilization Summary

This message is used to trigger a summary of car utilization by the customer. It can be requested for one or more (up to all) customers.

The report identifies, by customer, each car and type used, the origin and origination date, and the destination and completion date of each movement. This shipper-oriented report is important to the marketing and traffic functions.

CUL — Request Car Utilization Report

To request a Car Utilization Report, the operator uses the CUL message. A given month or car type may be selected, or an entire year-to-date report on one or all types may be obtained.

The report contains, for each type of car, the aggregate number of cars available during the period, number of cars used, average turnaround time, total weight hauled, average load weight, total mileage, and average length of haul per load.

CST — Request Car Statistical Report

The Car Statisical Report may be requested for a given car type (by entering the required car type code), for any or all car types. The month desired is requested. The report refers to home cars only.

This report shows the average number of home cars available, average turnaround time, average weight per load, average number of movements empty and loaded, average time off-line, average time in maintenance or bad ordered, average time leased to a customer, average number of cars unused over five, ten, twenty, and thirty days.

COF — Request Home Cars Off-Line Report

The Off-line Car Report is called by the COF request. This message/report is intended for use by the Head Office or traffic management. Individual stations may request this type of information on a specific car(s), or car type through the INQ (inquiry) directive.

The report gives the time off-line, station where set off-line, originating station, returning station, and destination station when returned. These items are listed by car number for each off-line occurrence.

CFS — Request Foreign Car Summary

A report showing the foreign cars on-line on a requested date or within specified dates is generated upon input of this message.

The report gives for all on-line foreign cars by owning railroad: the car number, type, date and location received, date and location returned (or put off-line).

COL — Request On-Line Car Summary by Type

To request a summary by car types within a given region, the COL request is used. The Head Office may request reports for any or all regions via this message.

This report gives the total number of cars located in a region by type, and the overall total of all cars in that region.

STATION/YARD TRANSACTIONS

An alphabetical listing of station/yard transactions and descriptions of these transactions are as follows:

Transaction	Function	Page
SCD	Request car detention report by station	3-21
SCI	Request car type inventory by station or train	3-21
SDR	Request car detention report	3-22
SFC	Request inbound freight summary for customer	3-21
SFO	Request report of foreign cars on-line by owner	3-21
SFR	Request foreign car report by station	3-22
SIW	Request inbound workload report	3-20
SMC	Request missed connection report	3-20
SOC	Request outbound car report	3-22
SSR	Request station report	3-20

SIW — Request Inbound Workload Report

The Inbound Workload Report is requested by a station using the SIW message and entering the date or dates desired.

This report shows by arrival time and train number, the following consist type information:

- Car identification
- Car type
- Status
- Final destination
- Customer identification
- Commodity
- Net weight

This information is given for all cars to be switched off at that station. This is generated from all trains scheduled in-bound for a specific date.

SMC — Request Missed Connection Report

A report listing missed train connections is available by station and date, or within dates. This is requested by the SMC message.

The Missed Connection Report shows by date and station the origin and destination of the car, the train that the car arrived on (if any), the missed train, car number and type, and status (loaded, empty, etc.). Other factors such as weight, commodity, and contract identification (if applicable) may be added at the railroad's discretion.

SSR — Request Station Report

The station report may be requested by station name; or a district office or the head office may request a report for all stations or a group of stations.

The report shows by station and month, the total time each car type has spent in the station. Foreign cars, by owner, as well as home cars are listed.

SFO — Request Report of Foreign Cars On-Line by Owner

This report can be requested showing foreign cars on-line, by owning railroad,and length of time on-line.

The report gives the movement history of all foreign cars on the home railroad's system. It shows by length of time and owner, each car number, major events concerning the car (stations assigned to and time assigned), total time on home line, and location and date the car departed from the system. This report permits the head office to review closely at any time, the path followed and work done by all foreign cars while they are on-line.

SCD — Request Car Detention Report by Station

This report is used to obtain a list of cars of a given type at a given station, the length of time the cars have been at that station, and any comments which may be available.

In addition to the SCD message code, the equipment type code and station name (if other than sending terminal) should be included in the request. If ALL is substituted for equipment type, a summary of detention for all car types at the station is given. This is an important planning and yard measurement tool for both district and head office management as well as the yard master.

SCI — Request Car Type Inventory by Station or Train

A complete inventory of cars of a designated type at a station, or on a train, may be obtained by this message. Desired station name or train number must be included.

The report gives by type the number and status of each car on a train or at a station. (If a train number is requested, the last reported location of that train is given.) Overall totals are given for each car type.

SFC — Request Inbound Freight Summary for Customers

This report may be requested for all customers, or for a given customer, by including the customer identification with the SFC message code.

Information on the report is by customer name and date. Included are:

- arriving train number and date,
- car number and type,
- status,
- originating station or location,
- net weight,
- contract identification (if applicable), and
- any appropriate comments.

All known inbound traffic will be listed, whether it is on an actual or a future consist.

SOC— Request Outbound Car Report

This message requests a listing of all cars, waiting for outbound movement on trains, which are currently in a given station.

The report shows the arrival train (if applicable), contract identification, car number and type, status, origin station, destination station, outbound train (if known), number of axles, gross weight, and comments.

This report, together with inbound consists, and information available from the system showing cars allocated to expected train consists via the blocking/scheduling logic in the system, permits comprehensive planning by the yard master of switching instructions for train makeup, etc.

SFR — Request Station Foreign Car Report

An accumulated foreign car by station report is available through the SFR request.

The report totals each type of car by number of days located at that station. It is given by car, by owner, with a grand total by owner.

SDR — Request System Car Detention Report

This report identifies cars by type and status which have been detained at each station 10 days, 11 to 15 days, 16 to 20 days, 21 to 30 days, and more than 30 days.

This report is triggered at the central site or headquarters by the SDR directive. This is a system wide report summarizing information which can be requested of a station/district level by the SCD request. It is used as an effective measurement of system efficiency, district and station work, etc.

MAINTENANCE TRANSACTIONS

An alphabetical listing of maintenance transactions and descriptions of these transactions are as follows:

Transaction	Function	Page
MAR	Maintenance arrival notice	3-23
MCO	Car maintenance order	3-24
MCS	Summary of car maintenance orders	3-25
MFR	Forecasted car maintenance report	3-25
MNC	Noncompliance with MCO message	3-25
MNS	Maintenance order noncompliance summary	3-26
MSR	Maintenance station recap	3-26
MTR	Maintenance turnaround recap	3-26

MAR — Maintenance Arrival Notice

The MAR message serves the function of reporting all cars (units) that arrive at a maintenance shop to the computer system.

Data required is time and date when the car(s) arrived, and car number(s). The Car Event file and Status files are updated. Cars are automatically assigned a status of OOS (Out of Service) when in maintenance.

An example of the MAR message is:

MAR

0300-0507

322418

691872

522731

1630-0507

678313

678318

MCO — Car Maintenance Order

The maintenance shop or regional office may order cars (units) to be directed to a maintenance facility because of scheduled maintenance, or some other reason.

The MCO message is concerned with directing stations to dispatch cars (units) to a specific maintenance shop as early as possible.

Data in the message includes car number, and maintenance shop location to where the car is to be directed.

An example of the MCO message is:

MCO

XYZ (maintenance shop)

322418

691872

522731

The computer will determine the current location or destination of the car, and direct a maintenance order regarding that car to the station where the car is, or will be, when it is unloaded.

A message in the following form will be sent to the appropriate station:

THE FOLLOWING UNITS AT YOUR STATION ARE SCHEDULED FOR MAINTENANCE. PLEASE DISPATCH TO XYZ AS SOON AS POSSIBLE.
322418

691872

or in the case of inbound traffic:

THE FOLLOWING UNITS ARE INBOUND TO YOUR STATION. PLEASE
DISPATCH TO XYZ AS SOON AS POSSIBLE.

CAR	TRAIN NUMBER
322418	30152
522731	01630

MNC — Noncompliance with MCO Message

If a station is unable to dispatch a car to a maintenance shop as directed in the MCO
message, it must use the MNC message to inform the maintenance area of this event,
as well as when the car may be available for maintenance (if known).

Data required for the MNC message is the maintenance location or sending location
of the applicable MCO message, car number, expected availability date, the station
where the car will be located when available (if known), and the reason for the delay.

An example of the MNC message is:

MNC

XYZ

322418, 05-15, KCM, LOADED TO KCM

MFR — Forecasted Car Maintenance Report

This report lists all cars (units) scheduled for maintenance in a given week. This
report will assist the maintenance department in scheduling their workload and the
car distribution department in ordering cars to maintenance shop locations, etc.

The report shows car (unit) number and type, date due for maintenance, and type of
maintenance scheduled (major overhaul, preventive, brake, etc.), and last known status.

MCS — Summary of Car Maintenance Orders

This report is a summary of all Car Maintenance Orders (MCO) which were sent
during the preceding week. Listed is the car (unit) number, station (location) that
sent the message, the station the message was directed to, and the shop location.

MNS — Maintenance Order Noncompliance Summary

This report is a weekly summary of all noncompliance with MCO messages (MNC) which were transmitted.

Data on the report shows the station that sent the message, car (unit) number, expected availability date (if available), the station where the car (unit) will be located when available (if known), plus the reason given for the noncompliance with the MCO message.

MSR — Maintenance Status Recap

This report lists units which have a BAD status at stations and an OOS status at shop locations. It is a cumulative report showing the length of time in that station and the status. It shows the maintenance status summary for the previous month.

MTR — Maintenance Turnaround Recap

This report lists the length of time a unit was in a maintenance shop (time unit was reported by MAR, though the time unit was reported back in service by CCR). Average time per equipment type, and type of maintenance performed, plus overall average turnaround time is calculated.

This report is generated monthly, and on a year-to-date basis. Through this report, cars (units) requiring more than standard amounts of maintenance can be identified.

CONTRACT TRANSACTIONS

An alphabetical listing of contract transactions and descriptions of these transactions are as follows:

Transaction	Function	Page
KCM	Contract maintenance.	3-27
KDR	Contract deviation report.	3-28
Per Diem		3-28

KCM — Contract Maintenance

To add to, delete from, or modify transportation contracts which the railway may have with various customers, the KCM message is provided.

The customer code and complete name must be included, with the alteration code for contract modifications. Following is the format for this message, describing the data which may be entered.

KCM — Contract Maintenance message code

CID, CNAME, M-CODE

O-STA, D-STA, D-SID, CON-ID, CON-NAM, B-DATE, E-DATE, F-CODE, COMM, TR-NO

CID = Customer identification number

CNAME = Customer name

M-CODE = Modification code

ADD = Add record to file

DEL = Delete record from file. (No additional input is necessary when deleting record)

MOD = Modify the fields which contain data

O-STA = Original station

D-STA = Destination station

D-SID = Destination siding

CON-ID = Consignee number

CON-NAM = Consignee name

B-DATE = Beginning date of contract

E-DATE = Ending date of contract

F-CODE = Frequency code — two digit code

COMM = Commodity code

TR-NO = Train number (if applicable)

When performing a delete or modify operation, the customer identification number and name must match exactly with information which is currently on the file, or an error message is generated and the files are not updated. All fields entered are checked for validity.

After the modify or add entry is made, the system returns the updated record for final verification by the operator. In the case of a delete, the entire record to be deleted is displayed to the operator before deletion.

An example of the KCM message is:

KCM — (Contract Maintenance message code)

A65-16372, MEDINA SUPPLY INC., ADD

MED, HAM, R63, 01052, HAMEL ELECTRIC CO., 03-05-75, 03-08-75, WM, 1012, A30177

KDR — Contract Deviation Report

This report lists the deviations from contracted car movements.

Information given is the date, sending customer, sending station, receiving customer, receiving station, car number, contracted or scheduled train, actual movement train, time delayed, and any remarks which may be available.

This report is generated by request on a monthly or year-to-date basis.

Per Diem

Per diem is a daily charge for freight cars which have been hired by customers or interchanged with another railroad.

Per diem is calculated by the system according to the rules and rates dictated by the particular railroad. This function may vary greatly between railroads, so it will be specifically tailored for a particular railroad.

Data entry for per diem processing is achieved via the CIA, CID, CRC, and CRR messages and other manual data inputs describing loaded car movement. The calculations are done in an off-line batch environment.

Suggested reports generated are:

- Daily Per Diem Transactions

  This report lists the daily car interchange and customer assignment transactions. It shows the railroad or customer interchanged with, point (station) of event, car number and type, and remarks. It is used for reference purposes. This will require off-line entry of customer car receipts.

- Per Diem Preliminary Report

  This listing shows, by customer and railroad, the preliminary billing information, which should be checked for accuracy.

- Per Diem Statements

  This is a printout of per diem statements to be sent to customers and interchange railroads.

- Monthly Recap of Accounts

  This is a monthly recap, by railroad, of accrued and actual accounts receivable and accrued and actual accounts payable with totals.

- Monthly Interchange Report

  For each railroad interchanged with, this report shows the breakdown, by car, of charges and other relevent information.

DATA BASE UPDATE TRANSACTIONS

An alphabetical listing of data base update transactions and descriptions of these transactions are as follows:

Transaction	Function	Page
UCG	Update car type and car group	3-30
UCT	Cancels train	3-30
UIR	Add new routes	3-30
UIT	New train schedules	3-30
URO	Update route data	3-30
USI	Update siding data	3-30
UST	Update station data	3-30
UTR	Change train schedules	3-30

URO — Updates the routes stored in the data base

UIR — Inserts new routes in the data base

UTR — Updates train schedules

UIT — Inserts new train schedules in the data base

UCT — Cancels train (permanently)

UST — Updates station data stored in the data base. May also be used for inserting new station in the data base and to remove non-existing stations from the data base.

USI — Updates, removes or inserts new data for sidings in the data base.

UCG — Used for maintenance of the data base files containing information for car types and groups.

SPECIAL DATA BASE UPDATE AND INQUIRY TRANSACTIONS

The following files within the data base are updated infrequently but are vital to the operation of the railroad:

- Station

- ROST

- Route

- TRRO

- Train No.

- Sched/Descr

- Siding

- Car Type

- Group Link

- Group

Transactions with transaction code UXX are used for updating of and inquiry into information kept in these files. The use of these transactions is restricted to a limited number of terminals. These terminals may either have update permission, inquiry permission, or both.

To perform the updating function, the transaction must be sent from a terminal with update permission, and the operator must also know a password which is given to each of the transactions.

The following shows the general procedure for using these transactions:

Step	Performed By	Terminal I-O	Comments
1 [†]	Operator	UXX	Transaction code.
2	System	Password?	Request password.
3 [††]	Operator	UPPW	Gives valid password
4	System	Update permission assigned	The system acknowledges correct password
5	Operator	TR, 602	Operator inputs code which is necessary for locating correct data.
6 [§]	System	Train No: 602 Sch. Oslo, 1245, Gol, 1550, : End schedules	The system shows the data which is to be updated All data listed
7	Operator	SCH. GOL, 1555 : END INPUT	Input given by operator; the input is keyword-oriented. Signals end input data.
8 [¶]	System	Updated Data: Train No: 602 Sch. Oslo, 1245 Gol, 1555 End Schedules	System shows how the inputted data will change the original data. All data listed.
9	Operator	UPDATE	Operator executes the update.
10	System	Updating finished at 1346	System shows when updating took place.

[†] If the terminal is not allowed to use this transaction, an error message is printed.

[††] If the operator types NO instead of a valid password, he will automatically be given inquiry permission. Steps 7 and 8 will not be performed.

[§] The system always shows the data which may be updated.

[¶] When the operator has given END INPUT, the system will show how the inputted data will change the original data, but the actual updating will not take place until the operator has sent the message UPDATE to the system. The operator also has the option of doing other changes to the displayed data before the actual update takes place.

TRAFFIC AND SPECIAL TRANSACTIONS

An alphabetical listing of traffic and special transactions and descriptions of these transactions are as follows:

Transactions	Function	Page
INQ	Inquiry messages	3-34
XCF	Comparative freight summary	3-33
XIO	Inbound, outbound freight summary	3-33
XMT	Request major customer traffic summary by route	3-33
XPM	Practice mode	3-33
XRS	Request train route summary	3-32
XTP	Request traffic lane movement prediction	3-32

XRS — Request Train Route Summary

This report lists, for a specific week's running of a train (number), the total number of axles, number of loaded cars of each type, number of empty cars of each type, net weight of each type, total weight of the train, net (freight) weight of the train, and total train length.

Also, a weekly summary can be requested which shows the following totals for the week: Number of trains, number of loaded cars by type, number of empty cars by type, number of cars, net weight by type, and net weight of all trains.

This data can be generated for one train for a week, all trains for a week, for traffic between two given stations on a weekly basis, or all stations, etc.

These reports are useful in train schedule planning, weekly workload planning for a yard, etc.

XTP — Request Traffic Lane Movement Prediction

This message requests a listing showing for future trains: number of axles, and total weight expected to travel between two given stations. (This is derived from future consist information.)

Data used is all future-expected events in the Train File. This report is generated to show traffic between a selected pair of stations, which must be input with the XTP request.

XMT — Request Major Customer Traffic Summary by Route

This report is a monthly breakdown of tonnage carried for the railroad's major customers. It is requested by customer and by month.

Listed by origin station are: destination stations, number of cars used that month, number of tons carried that month, and average tonnage per car.

Overall totals are calculated for cars, tonnage, and average tonnage for the month.

X CF — Comparative Freight Summary

This report gives a yearly comparison of tonnage carried by route. The report shows year-to-date tonnage carried between points for the current year, and for the previous year. The difference, plus or minus, is given. These figures are given for regular trains and extra or special trains. This report is generated upon an authorized request.

XIO — Monthly and Yearly Inbound Outbound Freight Summary

This monthly and yearly report shows the number of loaded cars, empty cars, and tonnage which originated and terminated at a station. The report shows this data for each station in the railroad system. This report is also provided upon authorized request.

XPM — Practice Mode Message

The message type code XPM START can be entered to signify to the computer that all of the following messages (until PM STOP) from a terminal are for practice only, and will not update the files or be transmitted to the destination. The terminal will remain in practice mode until PM STOP is entered. All messages entered from the device while in practice mode are subject to the normal edits, and if an error is detected, the program will respond with the normal error message followed by PRACTICE MODE ENTRY NO FILE UPDATES OR TRANSMISSIONS CREATED.

This is extremely useful in training operations personnel at the beginning of system implementation and for training new operators, as well as for practice exercises of already trained personnel.

INQ — Inquiry Messages

In order to inquire about the various statuses of a given train(s) or car(s) or other unit(s), the INQ directive is available. This transaction will have a priority in Group 2, as described in Section 2. Following is a list of the available subcodes and a description of their functions:

Subcode	Information Requested
STA	Last reported status and location of this car, unit, or train.
HST	History of up to 14 calendar days of events that have been reported on this unit. Train events are available for four calendar days via this subcode.
POI	Location where a foreign unit was received, railroad received from (if applicable), date received, and type.
ONL	Daily list of foreign units received on-line at the yard designated.
SAT	Lists the anticipated arrival time of all inbound trains at that station, or anticipated arrival time of a given train.
LOC	Lists all locomotives associated with a specific station; that is, scheduled to arrive, bad ordered, and on hand.

The following format is used on all inquiry messages:

INQ

Subcode, train number, or car (unit) number, if necessary.

LOCOMOTIVE TRANSACTION

The locomotive transaction and description of this transaction are as follows:

Transaction	Function	Page
LFS	Locomotive fleet status	3-34

LFS — Locomotive Fleet Status

One vital type of report which will be output describes locomotive fleet status. This report type is triggered by an LFS message which will generate a report on the past

week, or month, or YTD operating, etc., history of the locomotives reported in a particular district, or of a particular fleet, or a system-wide summary of locomotive movement history. This report capability should prove a vital tool in assisting scheduling and dispatching personnel in scheduling and controlling the locomotive fleet.

The road locomotive fleet, essential to the movement of trains, does not require a message type specific only to locomotives for the monitoring, scheduling, and control purposes which are the concern of this system.

Locomotives can be prescheduled on trains by dispatchers updating the train descriptions in the Train File. Actual running locomotives on trains are reported via consist build and consist maintain messages.

"Dead heading" locomotives (locomotives running free between stations, and not associated with a train) can be reported via dispatch and arrival messages with a special subcode (LOC) followed by the locomotive(s) number(s); in the case of the dispatch message, the estimated time of arrival at the next designated station stop. This discipline allows files to be updated describing the locomotive fleet, and causes appropriate train dispatch offices, etc., to be notified of the train's actual movements. Naturally, a railroad's actual traffic control disciplines must be adhered to in determining when a dead heading locomotive can safely traverse the track — the system is not responsible for traffic control.

Bad ordered locomotives are reported via the bad order message described in the car section (above). Again, the locomotive number is the vital link in the reporting discipline.

Regular scheduling of locomotive maintenance is accomplished via the appropriate messages and reports described in the maintenance function (above).

ADMINISTRATIVE MESSAGE SWITCHING

The general purpose of this feature is the automatic switching of messages. This function operates in a selective or general broadcast mode; that is, messages can be directed to any specific terminal, or sent to all terminals.

The system holds all messages for a terminal when a problem arises with the line or the computer terminal device. When the problem is corrected, the message is printed; or it may be routed to an alternate device. This message switching capability has advantages over a telephone conversation in that both parties have written documentation of requests, and there is less chance of error.

Administrative messages are all messages concerning administrative instructions, procedures, and reports; such as sales reports, empty mile reports, and all messages that do not require processing. This also includes customer service messages which do not request a reply. With administrative messages, no records or files are updated; they are merely transmitted to designated yard(s), etc.

An example of an Administrative message is:

    ADM — Message code

    ABC — Station message is directed to
           text of message.

Section 4

EXTENSION POSSIBILITIES

This section describes future extension possibilities to the Rail-CARRIER system.

CAR DISTRIBUTION

The Rail-CARRIER car distribution capabilities could be augmented to further assist car dispatch management by the addition of the following transactions:

Transaction	Function	Page
DAD	Additional car demand	4-5
DCH	Change car distribution order from Headquarters to regional offices	4-3
DCM	Change car distribution orders from regional office	4-5
DFM	Foreign car move order	4-3
DFS	Foreign car supply and demand	4-2
DMR	Request summary of stations not reported car supply and demand	4-5
DRF	Request summary of foreign car supply and demand	4-6
DRM	Car distribution orders from regional offices to stations	4-4
DRS	Request summary of car supply and demand	4-6
DSC	Send cars	4-3
DSD	Car supply and demand	4-1
DSF	Change in move orders for foreign cars	4-4
DUF	Unable to comply with foreign car orders	4-3
DUS	Unable to comply with car orders	4-5

The following pages describe these transactions.

DSD — Car Supply and Demand

Once a day, all stations must report the available car supply at their respective stations, as well as car demands for the next 24 hours. This reporting must take place before a given time of the day. Stations must send this message even if they do not have a car supply or demand to report. The code for these messages

is DSD. The car demand and supply is reported in groups of car types; the number of cars in each group is reported. Data to be reported includes:

- Supply

  Number of cars in each group, and comments

- Demand

  Number of cars in each group, priority assigned to the demand, and comments

Upon entry of this data, the system responds by assigning each reported demand and supply a unique reference number. If a station reports no car supply or demand, only the message code is sent.

DFS — Foreign Car Supply and Demand

The number of foreign cars at a station and the demand for foreign cars for the next 24 hours are reported in the message DFS. This message is used only when necessary. Data on each available car is reported, such as:

- Supply

  Car identification, type of car, owner, and comments

- Demand

  Type of car needed, number of each type needed, capacity, owner, and comments

The system assigns a reference number to each demand and supply which is reported.

DHR — Car Distribution Order, Headquarters to Regional Offices

The total home car demand and supply for each region (district) is reported by the system to Headquarters. A manual distribution will be done by Headquarters, and orders to move home cars from one region to another will be sent to the regional offices. Data sent by this message is:

- region reference number,
- region receiving the cars,
- groups (generic type) of cars,
- number of cars, and
- comments.

The system responds by assigning a unique reference number to each move order.

The messages are sent to the regional offices responsible for dispatching the cars and the regional offices receiving the cars.

DCH — Change Car Distribution Order from Headquarters
        to Regional Offices

The move orders from Headquarters to regional offices may be changed by Headquarters by the message DCH. Data sent by this message is:

- Headquarters reference number,
- number of cars, and
- comments.

DSC — Send Cars

When this message is sent from Headquarters, it informs the regional offices of no changes in the car distribution orders from Headquarters. The regional offices may then start distribution of the cars. The same message sent from a regional office informs the subordinate stations that the move orders are final and must be carried out as soon as possible.

DFM — Foreign Car Move Order

The foreign cars are distributed directly from Headquarters, and the message DFM is used to give the actual move orders directly to the stations. Data input in the message is:

- demand reference number,
- supply reference number(s), and
- comments.

The demand reference number corresponds to a reference number given by the system to a request for a foreign car. The supply reference number corresponds to a reference number given to the report of an available car at a station. The system uses the reference numbers for routing this message to the appropriate stations. The system assigns a reference number to the order.

DUF — Unable to Comply with Foreign Car Order

If a station is unable to comply with a foreign car move order, this is reported back to Headquarters. The message DUF is used for this purpose, and contains the following data:

- Reference number

- Reason for not sending the car

The reference number is assigned by the system to the move order.

DSF — Change in Move Orders for Foreign Cars

When a station reports that it is unable to comply with foreign car move orders, Headquarters may have to redistribute the foreign cars. This is done with the message DSF. Data input is:

- Reference number

  Reference number assigned to the foreign car move order which is to be changed.

- Demand reference number

  Foreign car demand reference number

- Supply reference number (s)

  Foreign car supply reference number (s)

- Comments

This message is used any time that Headquarters wants to change a foreign car move order.

DRM — Car Distribution Orders from Regional Offices to Stations

When the cars have been distributed from Headquarters between the regional offices, the regional offices will distribute the cars between the stations within their regions. The message DRS is used to inform the stations of the distribution orders as generated by their regional office. Data which may be given is:

- Demand reference number

  Reference number assigned to reported demand

- Supply reference number(s)

  Reference number assigned to reported supply

- Comments

The reference numbers are used for routing the messages to appropriate stations and finding the destination of the cars. Each move order is assigned a reference number by the system; this number is used for later references to this move order.

DUS — Unable to Comply with Car Orders

When a station is unable to comply with the car move orders, the regional offices are informed of this with the message DUS. Data input is:

- reference number,
- number of cars which may be sent, and
- comments.

Reference number refers to the move order.

DCM — Change Car Distribution Orders from the Regional Office

If the regional offices have to change a car move order, the message DCM is used. Data input is:

- reference number,
- demand reference number,
- supply reference number,
- number of cars, and
- comments.

The reference number points to the previous car move order cancelled by the system, and the system informs all the involved stations of the changes.

DAD — Additional Car Demand

If additional car demands occur after the regular car distribution has taken place, a station may inform the regional offices of this with the message DAD. The regional office may then use the message DRM to order stations to move cars to satisfy the demand. Data input is:

- type or group of cars,
- number of cars, and
- comments.

DMR — Request Summary of Stations Not Reporting Car Supply and Demand

The regional offices may request a summary of the stations that have not reported car supply or demand with this message.

DRS — Request Summary of Car Supply and Demand

This message is used by the regional office for requesting the report DLS which shows the car supply and demand within a region. The message may also be used by Headquarters for requesting the DRS report (car demand and supply of a region).

DRF — Request Summary of Foreign Car Supply and Demand

This input message is used by Headquarters for requesting the report DFS which gives the demand and supply of foreign cars.

OUTPUT REPORTS

New output reports provided by the Car Distribution resulting from the new input transactions are:

Transaction	Function
DHS	Headquarters summary of car supply and demand
DRS	Summary of region car supply and demand
DMR	Summary of station not reported car supply and demand
DRR	Request car supply and demand report from a station
DLS	Summary of car supply by station and type
DAR	Acknowledge car supply/demand report
DRM	Car move orders to station from regional offices
DMI	Inform stations that requested cars are being sent
DMC	Changes in empty cars being sent
DCM	Changes in the previous move orders
DER	Summary of cars which are required by a region
DES	Summary of empty cars which are to be sent from a district
DAD	Report of additional car supply and demand
DDS	Summary of the car distribution within a district
DUS	Report of station unable to comply with car move orders
DFS	Summary of foreign car supply and demand
DFM	Foreign car move order to stations
DFI	Informs stations that foreign cars are being sent to satisfy reported demand
DUF	Station unable to comply with foreign car move order
DFA	Acknowledge foreign car supply/demand message
DUC	Report on stations unable to comply with foreign car move orders

4-6

Note that in some cases the input and output transaction codes are identical. The following paragraphs describe each of these reports in the order of their logical sequence.

DAR — Acknowledge Car Supply and Demand Report
When the car supplies and demands are reported by the station with the message DSD, this is acknowledged with the report DAR. This report lists the car supply and demand at the station and gives the reference number assigned by the system to each group of cars reported.

DRR — Request Car Supply and Demand Report from a Station
If a station fails to report car supply and demand within a predefined time of the day, the system automatically requests this by the DRR report.

DMR — Summary of Stations Not Reporting Car Supply and Demand
At a predefined time of the day, the system produces this report to inform the regional offices of stations that have not yet reported car supply and demand. The report may also be requested at any time by the regional offices with the message DMR. Only the stations subordinate to the regional office receiving the report are listed. The report contains the identification of the stations not reported.

DLS — Summary of Car Supply and Demand by Station and Type
This report is produced for each region automatically at a predefined time of the day, or when all the stations within a region have reported car supply and demand. The report may also be requested by the regional offices with the message DRS.

The report shows the car demand and supply for each group of cars at all stations. It also shows the reference numbers assigned by the system to each of the reported car demands and supplies. The report gives a summary of total car demand and supply within the region.

DRS — Summary of Region Car Supply and Demand
Headquarters automatically receives this daily report which shows the number of cars in each group available in, or demanded by, a region. The report also shows the reference number assigned to each region's car demand and supply. The report may also be requested by Headquarters, and will then show the current car demand and supply of the region.

4-7

DER — Summary of Cars Received by a Region

This summary is received by a regional office when Headquarters has ordered other regions to send cars to this region to satisfy reported car demand. The summary contains:

- reference number to the reported demand,
- groups of cars,
- number in each group,
- sending region, and
- comments.

DES — Summary of Empty Cars Sent from a Region

When Headquarters has distributed the reported available cars between the regions, this summary is sent to the regional offices which are to transfer cars to another region. The summary contains:

- reference number of move order,
- reference number of reported car supply,
- groups of cars,
- number in each group,
- receiving regions, and
- comments.

DMC — Change in Empty Cars Being Sent

This output may be initiated by Headquarters to the regional offices or by the regional offices to the stations. It informs the receiver that cars requested will not be sent as reported in the DER summary; the report will be sent to the regional offices or the stations which are involved in the changes. The report shows the changes and contains:

- reference number of reported demand,
- group,
- number in group,
- sender, and
- comments.

4-8

DCM — Changes in the Previous Move Orders

This report is sent to regional offices or stations when the car move orders are changed by Headquarters or regional offices. The reports override previous move orders and contain:

- previous move order reference number,
- group,
- number of cars in each group,
- receiver, and
- comments.

DRM — Car Move Orders to Stations from Regional Offices

The stations are ordered to send cars by the report DRM. The report contains:

- move order reference number,
- car supply reference number,
- group,
- number of cars in each group,
- receiving station, and
- comments.

DMI — Inform Stations that Requested Cars are Being Sent

The stations are informed that cars are being sent to them to satisfy a reported car demand by the report DMI. The report contains:

- demand reference number,
- name of sending stations,
- number of cars sent from each station, and
- comments.

DUS — Report That a Station is Unable to Comply with Car Move Orders

If a station is unable to comply with a car move order, the message DUS is sent from the station. This produces the report DUS at the regional office. The report contains:

- move order reference number,
- sending station,
- receiving station,
- number of cars ordered,

- number of cars to be sent,
- group of cars, and
- comments.

DDS — Summary of the Car Distribution within a Region

When the regional offices have finished the car distribution within a district, the report DDS is produced. The report shows:

- each move order,
- which station is sending the cars,
- which station is receiving the cars, etc.

It also gives a summary of the total number of cars that have been sent and received, and data describing cars received from other regions.

DAR — Report on Additional Car Demand

When a station reports additional car demand by the message DAD, this report is produced at the corresponding regional office. The report contains:

- reference number,
- station,
- group of cars,
- number of cars in group,
- priority, and
- comments.

DFS — Summary of Foreign Car Supply and Demand

This report may be requested by the input message DRF by Headquarters, but it will also be produced automatically at predefined times. The report gives a summary to Headquarters of the foreign car supply and demand of the stations. Data to be reported is:

- Region, station
- Supply
  Reference number, type, owner, capacity, quantity, and comments.
- Demand
  Reference number, type, owner, capacity, quantity, priority, and comments.

4-10

DFA — Acknowledge Foreign Car Supply/Demand Message

When a station reports foreign car supply and demand by the message DFS, the system acknowledges this with the output DFA. This output echoes the data input by DFS and gives the reference number assigned to reported foreign car supply and demand.

DFM — Foreign Car Move Orders to Stations

Headquarters orders a station to send foreign cars by this message. Data output to the stations is:

- supply reference number,
- car number,
- receiving station, and
- comments.

DFI — Inform Station that Foreign Cars are Being Sent to Satisfy
    Reported Demand

When a station has been ordered by Headquarters to send cars to another station, the receiving station is informed of this with the report DFI. Data output is:

- demand reference number,
- car number,
- sending station, and
- comments.

DUF — Station Unable to Comply with Foreign Car Move Order

If a station is unable to comply with a foreign car move order, the station sends the message DUF to Headquarters. This causes report DUF to be given to the station expecting the car. The report contains:

- demand reference number, and
- comments.

DUC — Report on Stations Unable to Comply with Foreign
    Car Move Orders

When a station reports that it is unable to comply with a foreign car move order, the report DUC is produced at Headquarters. The report gives the name of the stations reported, and repeats information about the needed cars.

YARD REPORTS

This possible refinement of the on-line systems is intended to widen the spectrum of railroad operations activities being reported. In the previous sections of this document, the system was concerned with loaded cars being first reported when they were entered onto their first train's consist, and then being reported on each subsequent consist (together with train arrival and dispatch information) until they reach their destination train or yard. Empty cars are reported via the car distribution function as they are monitored and controlled from the origination yard to a destination yard (or to storage), as are maintenance-due cars.

Detailed information on delivery and pickup switching operations with industry is lacking from this earlier information, as is the detailed information describing car loading/unloading activities in a yard, and reloading activities (unloading followed by loading with a different consignment). This information may be desired or necessary for way-billing requirements, closer demurrage and per diem accounting, and closer planning and monitoring of various yard work (especially industrial switching).

To assist in these areas, the data described below would be reported to a yard reporting function expanded over that described earlier. This would be reported via a YDR message, and the particular event(s) being reported would be identified via various subcodes. This reporting should also be designed so as to encompass a particular railroad's way-billing requirements (that is, all way-billing data required should be captured at this phase). These yard reports should be input regularly throughout the day to report the flow of cars to and from industry, in a timely fashion.

The subcodes and the data to be reported by these subcodes as described below. The initial subcode LOB for cars pulled from industry and waiting to move would input (any) required way-bill data and would also cause the system to completely assign a movement route, blocking pattern, and a set of assigned train schedules for each LOB car (providing the railroad desired this feature and its operations allowed it). This would obviate the initial train movement assignment by the yard master as practiced in the earlier implementation; however, total automation of this function should be carefully approached by the operating department.

Subcodes for yard reporting are:

1. LOB — Loaded Outbound (pulled from industry and waiting for train)

    Car name and number
    Destination
    Customer name
    Contract number
    Commodity code
    Weight
    Time and date loaded
    Revenue, consignee

2. WOB — Working Outbound (Spotted in yard for loading)

    Car name and number
    Destination
    Commodity code
    Weight
    Time and date started
    Projected LOB date
    Consignee

3. SCL — Spotted at Customer Siding for Loading
        (This subcode is used for reporting actual customer
        delivery or spotting information)

    Car name and number
    Industry name and address (or code)
    Time and date spotted
    Pay code
    Projected LOB date
    Commodity code (if known)

4. SCR — Spotted at Customer Siding for Reloading
        (Car is unloaded by customer and then
        reloaded immediately)

    Car name and number
    Industry name and address (or code)
    Time and date spotted
    Pay code
    Projected LOB date
    Commodity code (if known)

5. SCU — Spotted at Customer Siding for Unloading

    Car name and number
    Industry name and address (or code)
    Time and date spotted
    Pay code
    Commodity code
    Projected EMP date

6. RCP — Released by Customer for Pulling

> Car name and number
> Loaded or empty
> Time and date released
> Projected pull date/time
> Destination (if loaded)
> Weight (if loaded)
> Commodity code (if loaded)

Again the set of subcodes implemented should correspond with the practices of a particular railroad, which may mean that more or less subcodes would be required. Information reported for a particular subcode would also possibly vary for a particular railroad. For example, the RCP subcode is possibly considered implementable principally for railroads with complex industrial switching problems, resulting in switching planning problems; and the data reported would be considerably less than that shown if the subcode is used only for gathering switching planning and monitoring information.

Summary reports describing industrial switching (pulling and spotting) activity and detailed and highly accurate demurrage accounting are some of the types of reports which could be generated by this system.

A detailed reporting, monitoring, and planning subsystem for use with all industrial switching activity could be visualized as an extension to the yard reporting area. This would include scheduling and generating work orders for all non main-line car activity such as: spotting cars to industry from a yard, pulling from industry to a yard, spotting and pulling activities concerning cars in storage or hold track areas (both loaded and empty cars), switching cars between industrial locations or within industrial locations, interchange switching, and some yard-to-yard switching. This is a more advanced yard control concept and must be carefully examined for operational feasibility in a railroad before it should be implemented.

CUSTOMER SERVICE INQUIRY

A customer service inquiry is a customer service message which asks for a reply. The message type code for a customer service inquiry is ACS.[†] This message type code is used when asking for delivery information or any type of tracing question to a yard or other location that requires a reply.

[†] This message type should not be confused with the inquiry capability (INQ inquiry message) all terminal-equipped locations have to determine the last reported status of all rolling stock.

The use of abbreviations is recommended as they can speed handling and, if properly used, can save a considerable amount of time in keying in a request and in transmission time on the lines.

If the message is a customer service message that does not need a reply, the message should be coded as an ADM, administrative message.

In addition to transmitting the customer service inquiry message to the terminals being addressed, the only processing that will be done with customer service inquiries is that they will be assigned a message number by the computer and stored in a customer service file until they are answered.

The following evening, the Customer Service Inquiry file is matched to the Customer Service Reply file, and the unanswered ACS messages are retransmitted to the necessary stations. This is done daily. After a message is three days old, it is dropped from the files and Customer Service Control is notified.

The program does not accept a message addressed to a nonreporting terminal. Such messages should be addressed to the nearest station with a computer terminal and forwarded.

Surveys are run on a daily, weekly, and monthly basis to determine if any terminals are not answering the messages addressed to them.

On all messages, the terminal or terminals to which the message should be distributed must be specified by the operator in the form of the alphabetic terminal code of the terminal or terminals being addressed.

The following information is needed to send a customer service inquiry message:

- ACS (message type code of a customer service inquiry message)
- Alphabetic terminal code of the destination station for each station to receive this message
- Name of the person to receive the message
- The message

The immediate response is the date and time stamp.

CUSTOMER SERVICE REPLY

A customer service reply is actually the reply to a corresponding customer service inquiry. The message type code for a customer service reply is ACR. As stated in the customer service inquiry explanation, the computer assigns a number to all ACS messages. This number is transmitted to the destination station together with that message. When a reply is made to this customer service message, it should be coded ACR and have the number of the corresponding ACS message on it. In this manner, the customer service inquiries are matched to determine which ones have not been answered.

The following information is needed in a customer service reply message:

- ACR (message type code of a customer service reply message)
- Alphabetic terminal code of the destination station for each station to receive the message
- The number of the customer service inquiry message that this message is answering
- The reply message

The date and time stamp is returned upon message entry.

DEMURRAGE REPORTS

Demurrage is a charge for detention of freight cars held by shippers or consignees beyond a prescribed free time, and is assessed for the prupose of expediting the release of freight cars.

As a car is moved to a customer's siding, a Yard Report entry is made entering a car status of SCL (Spotted at Customer's Siding for Loading), SCU (Unloading), or SCR (Reloading). Charges are normally calculated on the car after 48 hours, not counting weekends and holidays. depending on rates charged per type of car. These rates are calculated until an RCP (Released by Customer for Pulling) message is received.

Special consideration is given for any of the following reasons:

- Commodity is being exported through the port where the car is held, requiring the car to be held for customs.
- Extraordinary occurrences, such as weather, wreck, cancelled train, etc.
- Freight is being held for inspection.

Other free-time allowances vary according to reason for placement and commodity.

Charges are calculated and statements printed. Also, reports are generated showing each customer by station and a recap of accounts receivable.

Because demmurage is governed by local tariffs and regulations, this system must be localized for a particular railroad. Many exceptions do exist to these regulations; therefore, the ability to handle exceptions manually is provided.

The following demurrage reports are created by the system:

- Daily Demurrage Transactions

  This report lists demurrage transactions for the day by station. It gives car name and number, equipment type code, industry name (or code), date set off, and remarks.

- Preliminary Demurrage Billing Lists

  This report lists, by industry, the billing information to be checked for accuracy.

- Demurrage Record Update Listing

  This report shows a record of deletions and changes made to the preliminary billing statement list.

- Demurrage Statement

  This is a printout of demurrage charges.

- Monthly Recap of Demurrage Accounts by Industry

  This is a monthly recap, by industry, of accrued and actual accounts receivable for demurrage.

- Monthly Demurrage Report

  For each industry accruing demurrage charges, this report shows the breakdown, by car, of the charges and other relevant information.

Section 5

IMPLEMENTATION

Because of the complexity of the Rail-CARRIER system and the impact the implementation of this system could have on the operational procedures of a railroad, the Rail-CARRIER system will not be installed in one step. The installation may be divided into five phases. This will enable personnel using the system to become accustomed to the reporting procedures and the messages and reports produced by the system.

The implementation plan calls for implementation of a new phase each six months. It is assumed that the hardware and general software have been installed and accepted before implementation of the Rail-CARRIER system begins.

PHASE 1

This phase is primarily for testing and training. The main purpose of this phase is to familiarize personnel who are going to use the system, with the operational procedures of the terminals and the reporting procedures necessary to ensure successful operation of the system. Only basic transactions for reporting car and train movements will be implemented, and only reports which are vital for the movements of cars and trains will be produced.

The Phase 1 system will be run in parallel with the manual system; train and car movement will not depend on the operation of the Rail-CARRIER system. This phase will also be used for inputting data for all cars on the user's railroad. During the last part of Phase 1, the Rail-CARRIER system will gradually become the primary system for monitoring the control of the traffic on the railroad network, with the manual system used as a backup system. Transactions implemented during this phase are: CCR, INQ, TAR, TCB, TCL, TCM, TCR, TDC, TDL, TDS, TXT, UCG, all UXX transactions, and XPM.

PHASE 2

In this phase, the system tested during Phase 1 will be put into full production. Reports necessary for localizing cars and for producing statistics on trains and routes will be added. Implementation of maintenance scheduling functions will also be

5-1

started during this phase. New transactions which become available during this phase are: CBB, CIA, CID, CMP, CMS, CRC, CRR, SCD, SCI, SFO, SFR, SIW, SOW, and TXS.

PHASE 3

Maintenance scheduling based on the elapsed time since the last overhaul and on reported defects will be available through the Rail-CARRIER system. New transactions for reporting the status and localization of the railroad's rolling stock will be made available, and the system will produce reports which show the utilization of the railroad's rolling stock.

The system will also produce reports which show cars and locomotives due for maintenance in a given time period. Customer contract maintenance is also available during this phase. New transactions added are: CBS, CCU, CFS, COF, COL, KCM, KDR, all MXX transactions, SFC, TCS, TDR, TSS and XIO.

Testing of the car distribution system will start in the latter part of this phase.

PHASE 4

The car distribution system will become operational in this phase. All necessary transactions and reports for this phase will be made available (all DXX transactions are added during this phase).

PHASE 5

This phase will add traffic studies and yard reporting. Transactions and reports tailored for the railroad's particular need will also be added during this phase. The remainder of the Rail-CARRIER transactions will also be added during this phase.

Section 6

MESSAGE INDEX

This section contains an alphabetical listing of transactions and also a listing of transactions by priority.

TRANSACTIONS GROUPED BY PRIORITY

Group 1

Transaction		Function	Page
CBS	—	Dispatch bad order car to maintenance shop	3-16
CMP	—	Dispatch empty car for pool storage	3-17
DCH	—	Change car distribution order from Headquarters to regional offices	4-3
DCM	—	Change car distribution orders from regional office	4-5
DFM	—	Foreign car move order	4-3
DFS	—	Foreign car supply and demand	4-2
DRM	—	Car distribution orders from regional offices to stations	4-4
DSC	—	Send cars	4-3
DSD	—	Car supply and demand	4-1
DSF	—	Change in move orders for foreign cars	4-4
DUF	—	Unable to comply with foreign car orders	4-3
DUS	—	Unable to comply with car orders	4-5
TAR	—	Arrive train	3-7
TCB	—	Consist build	3-3
TCL	—	Train cancel	3-9
TCM	—	Consist maintenance	3-4
TDL	—	Train delay	3-10
TDS	—	Dispatch train	3-7
XPM	—	Practice mode	3-33

Group 2

CBB	—	Bad order car	3-13
CIA	—	Car interchange arrival	3-13
CID	—	Car interchange departure	3-13
CCR	—	Bad ordered car returning or new car entering service	3-14
CMS	—	Return car in pool storage to service	3-17
CRC	—	Reserve a car	3-16
CRR	—	Release reserved car	3-16