ROUTE CAPACITY MODEL

(RCM)

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Forward

This report outlines the capabilities of the Route Capacity Model(RCM) and describes the design of the model from a user perspective.

Technical documentation is stored in Transportation Plannings' on line documentation package. This includes detailed instructions for using the model, system documentation and program documentation.

This model was developed by Operational Research under the auspices of Transportation Planning. The following members of the Transportation Research staff aided in the design and validation of the model:

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Executive Summary

The Route Capacity Model (RCM) is a software tool for analysing the capacity of a CTC rail line. Specifically, a simulation of train movements is used to determine train delays under different plant, traffic and maintenance conditions.

The route to be analysed may include intermediate terminals and may be composed of sections of single track with sidings and sections of double track. The double track sections may include single or double crossovers and the mainline may contain junctions. Switches at sidings may be power or spring switches. Signals are not explicitly modelled, but two methods for determining the separation between following trains allow the effect of signal spacing to be analysed. Maintenance activities such as scheduled track outages and slow orders may also be modelled. Trains to be simulated may be scheduled individually or created by several methods of "random" train generation.

The user input to the RCM is a "Specification File" (specfile): this consists of a set of free format data tables which are prepared, by the analyst, using a TSO screen. The tables define the plant, trains and maintenance for a simulation. Run options are also selected by entries in the specfile. Other input consists of an eastbound and a westbound TPS file containing speed and minimum run time data for each speed class of trains that travel on the simulated route: these files are prepared, by computer program, from TPC outputs.

Output from the RCM includes detailed reports on the components and location of train delay, average train speed, and the statistical confidence limits for the average train delay. In addition, a time-distance plot which shows graphically the movement of each train may be produced. A summary output for each simulation is also available.

Data preparation for the RCM is easy and fast. As well, only 30 to 50 cpu seconds of computer execution time are required for a typical one week simulation. Thus the model is suitable for analysing a large variety of alternative plant capacity improvement strategies.

To date, the RCM has been used to study alternative theoretical approaches to double tracking and as an aid to design the B.C. North Line.

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1. Background to Model Development

Before the initiation of the RCM development project, several computer simulation models were available to Transportation Planning for line capacity analysis. These included:

the Macro Route Model,

the Macro Line Model,

the PMM Line Dispatching Model,

the Line Interactive Model

the Burlington Northern (BN) Line Model and

the Queen's University Line Model.

For the purposes of studying theoretical approaches to the design of double track and the phasing of plant expansion to reach double track, the Macro Route Model contained too little detail, and the PMM Model and the Line Interactive Model were too slow and cumbersome to allow investigation of the large number of alternatives. The Macro Line Model is a general mathematical model which was found to be unsuitable for analysing double tracking alternatives. The BN Model and the Queen's University Model both showed promise but lacked many of the features that were required to adequately model CN's operating practices. The BN Model was found to be closer to our requirements.

Initially, our approach was to extend the BN Model. However, the data and program structure were found to be inadequate to handle extensions to the level of detail required for our purposes, particularly in the modelling of full and partial double track. This has led to a rewrite of the code, although the approach is similar. We have retained the BN concept of using a front-end program to edit data and preprocess the run time and delay calculations, and their method of approximating the effect of signals by means of train headways. The RCM makes use of the batch means method of testing for convergence of train delay that was included in the BN Model.

2. Terminology

Route:	a railway line between two major train classification centres.
Terminal:	any location where trains may originate, terminate or be delayed for reclassification. In the RCM, terminals may hold any number of trains.
Subdivision:	a railway line between two adjacent terminals.
CTC:	centralized traffic control.
Switch:	a control point on a railway line where trains may pass from one track to another.
Power switch:	a switch which may be controlled from a remote location.
Spring switch:	a switch which allows trains in only one direction to change track. Spring switches may not be remotely controlled.
Link:	a section of railway line between two switches.

Single Link: a link which may be occupied by trains in one direction only at a given time.

Passing Link: a link composed of two or more tracks which allow trains to meet or overtake.

Double Link: a link composed of two tracks which allow trains travelling in opposing directions to operate concurrently.

Crossover: a section of track between two adjacent double links which allows trains to cross from one track on the first link to the other track on the next link.

Turnout: a short section of track located at a switch which allows trains to turn onto a parallel track.

Turnout speed: the maximum speed at which trains may cross a turnout.

Lateral turnout: a turnout at which only trains taking the diverging route are required to travel at the turnout speed.

Equilateral turnout: a turnout at which all trains are required to travel at the turnout speed. At equilateral turnouts, both routes diverge though usually to a lesser degree than at lateral turnouts. Hence, the turnout speed at equilateral turnouts is generally higher than that at lateral turnouts.

Junction: a switch at which trains may enter or leave a subdivision.

Train class: a named list of train running and breaking characteristics.

Group of trains: a set of trains having the same train class, origin and destination that are generated at times derived from one of three possible types of user specified distributions.

Schedule of trains: a set of trains having the same train class, origin and destination that are generated at times directly controlled by the user.

Headway: minimum time permitted between two trains departing a switch in the same direction. Headways are determined by the characteristics of the leading train.

Outage: the removal from service of a track for some maintenance activity. Outages begin and end at user specified times.

TPC: train performance calculator. Program for determining minimum running times of a set of train classes over segments of a subdivision.

TPS: reformatted output from TPC.

Specfile: a data file containing the user specifications for an RCM run

3. Details of RCM Capabilities

3.1 Plant

The mainline modelled by the RCM is considered to consist of a series of links (control blocks) connected through switches. Several types of link may be modelled: one main track (single link), one main track with multiple sidings (passing link), two main tracks (double track) and intermediate terminal.

Switches to sidings may be power or spring switches. The length of a single link and of the main line of a passing link is the distance between the switches at the two ends of the link. The length of a siding is taken to be the length of the adjacent main line less 820 feet, unless it is overridden by the user.

Turnouts to a double link from a single link may be equilateral or lateral to either side of the single track. The lengths of each track of a double link are taken to be the distance between the two end switches, unless overridden by the user. The minimum run time on both tracks is the same, calculated from the TPS data. Right hand running is assumed on double track.

Junctions can be specified at any switch. In single track sections the junction is assumed to be connected to the mainline, but in double track sections a junction can be specified as being connected to one or both tracks for each direction of trains entering the subdivision at that junction.

The speed limit of all switches is included as input data. This is used to calculate a turnout delay, which is applied to all trains taking the turnout at the switch.

Terminals are assumed to be sufficiently large to hold all trains which the dispatcher is unable to dispatch. The model also makes use of terminals to hold trains when there is an impassable track out-of-service on the subdivision ahead. The user may specify the number of tracks in a terminal causing the simulation to restrict the number of trains held for outages. However, if the dispatcher deems it infeasible to dispatch trains (see Section 6.3) the stated capacity may be temporarily exceeded. Output reports include a frequency distribution of the number of trains at each terminal.

The basic plant data is referenced by switch milepost and entered in the specfile in the "Plant Configuration" table. Siding and double track exception tables allow the user to override the standard track lengths and to specify single crossovers. The configuration of junctions is specified by means of data in the "Junction" table.

3.2 Trains

Trains which are to be simulated by the RCM must belong to one of the train classes which are present on the TPS file. Currently, this file holds a maximum of ten classes in each direction. An example of a train class is an Eastbound Freight train of weight to power 1.0. Essentially, the data on the TPS file is reformatted TPC output data. Train classes are referenced by an eight character class name. Trains of the same class have the same priority and the same headway (see 3.3).

The RCM provides a flexible, yet simple, method for allowing the user to specify the trains to be simulated. Trains belong to one of two distinct categories: scheduled trains and group trains.

Scheduled trains are specified by their train class, departure time, the days of the week on which they run, and the mileages at which they enter and leave the route. In addition the user may randomise the train departure about the base time by specifying a percentage of trains that are early, a standard deviation for the early trains and a standard deviation for the late trains. Each scheduled train is given a unique name which appears on the time-distance diagram and on the delay statistics reports.

Group trains allow the user to create many similar trains with departure times chosen by one (or all) of three different methods: random, weekly distributed and evenly distributed. For the random method, the user specifies only the number of random trains per day. The simulation schedules these trains at inter-departure times chosen from the exponential distribution, equivalent to random departures. The number of trains departed on any particular day may differ from the number specified but the average will approach this number as the simulation progresses. To use the weekly distributed trains the user must prepare a table giving the percentage distribution of trains by day and by period within each day, the periods are user-defined. The daily number of trains to be created by this method and the table to use are specified. For each simulated week exactly seven times the daily number of trains are created. Their departure times are set according to the specified distribution. The evenly distributed trains allow the user to specify trains which are approximately evenly spaced during certain times every day. The user specifies the number of such trains, the time of the first one and the interval between successive train departures. Randomisation about such times may be achieved by giving a non-zero standard deviation.

Scheduled delay at any station may be specified for any group or schedule. The station is specified by milepost and the station time by a mean and a standard deviation.

3.3 Headways

In the Route Capacity Model, separation between following trains is maintained by the use of headway times. These times are train class and switch specific. A train is allowed to leave a switch only when the headway time of the preceeding train has elapsed since the departure of the preceeding train. This models the effect of the first train clearing the signals behind it. The advantage of this approach is that the specific locations and types of signals do not need to be input or modelled.

The RCM also has the capability to model absolute block in the case of a plant consisting of single track with sidings. For this case, the user inputs headway values of zero and a train is allowed to proceed only when the block ahead is clear.

The input of headway data has been designed so that user effort is minimized. First, headways for single track and double track are entered in the "speed class" table. These values are applied to all switches where that class of train enters a single link or a double link, respectively. If the headways are different at certain switches they are supplied, by switch and train class, in an override table.

3.4 Maintenance

Scheduled track outages and slow orders (TSOs) are modelled by the Route Capacity Model.

Any track may be taken out-of-service by an entry in the "Track Outages" table. Required parameters are the location of the track, the time that is to be taken out of service and the length of time that it is to remain out of service.

An outage may be repeated a certain number of times at specified intervals. If the outage is impassable, for example a single link or both tracks of a double link, then trains are held at the closest terminal and released in priority order just in time to reach the track when it returns to service. A user option exists to cause an outage to delay until trains that are already on the subdivision have crossed the affected track. Several outages may occur at the same time.

Slow orders are specified by the end mileposts, speed, start time and duration. A slow order may overlap a switch and may be on any track other than a passing track. At any location, slow orders may overlap in time: the most restrictive speed will be used at the appropriate time in the simulation.

Specification of the slow order speed causes trains to operate with an increased running time. When the plant simulated is single track with no intermediate signals (absolute block), the effect of slow orders on the separation of trains leaving the slow order is accurately modelled. Otherwise, this effect must be approximated by user supplied slow order headways. These are applied to trains at the first switch after the TSO only.

3.5 Plot and trace capabilities

For each simulation the user specifies the starting time and duration for which the time-distance diagram of trains is required.

The main use of the trace feature is for detailed examination of the working of the simulation. The user selects the beginning time and duration of the trace and the level of detail of desired. This can range from a two line event summary to a list of all train locations and signal settings with details of the reasons for each dispatcher decision. The various levels of detail that may be produced and the corresponding values for the trace index are described on the Master specification file.

3.6 Miscellaneous run options

The user specifies the maximum duration of the simulation, the start statistics time and the level of confidence in the average delay that is required. Section 6.8 contains a detailed explanation of the application of these parameters and typical values are contained on the Master specification file.

Random numbers are used by the simulation to create group trains and to determine the scheduled delay to both scheduled and group trains. The user specifies a random number stream from 1 to 10. Choice of the same random number stream and the same train data in two simulations causes generation of the same trains in each run.

The user may select to optimise meets, or dispatch on a first-come first-served basis and also specify whether overtakes are to be allowed.

Another option allows the user to specify that an outage is to be delayed if any train on the subdivision would be trapped by the outage.

Further options control the quantity of output produced by the RCM. The detailed front-end reports, (headways, run times, delays and switch clear constants), may be suppressed. Output of individual train movement times and delays may be requested, or not.

3.7 Optional train commands

In certain circumstances, it may be desirable to alter the decisions of the internal dispatcher. This can be accomplished, after a trial simulation, by supplying train specific commands through a "Command File". One available command is to hold a train at a switch until a given time or until a certain other train has passed. Another command allows the user to force a train to take a certain track. These commands are sufficient to allow the user to force a meet or overtake to take place in any desired manner.

Details of the method of using this feature are available in the User Procedures documentation.

4. Computer System Overview

The RCM is based on two SIMSCRIPT II.5 programs. The first of these, referred to as the front-end, uses none of the SIMSCRIPT II.5 simulation features; it simply preprocesses the RCM input data. This input consists the eastbound and westbound TPS files and the user-prepared specfile. The front-end module performs the following actions:

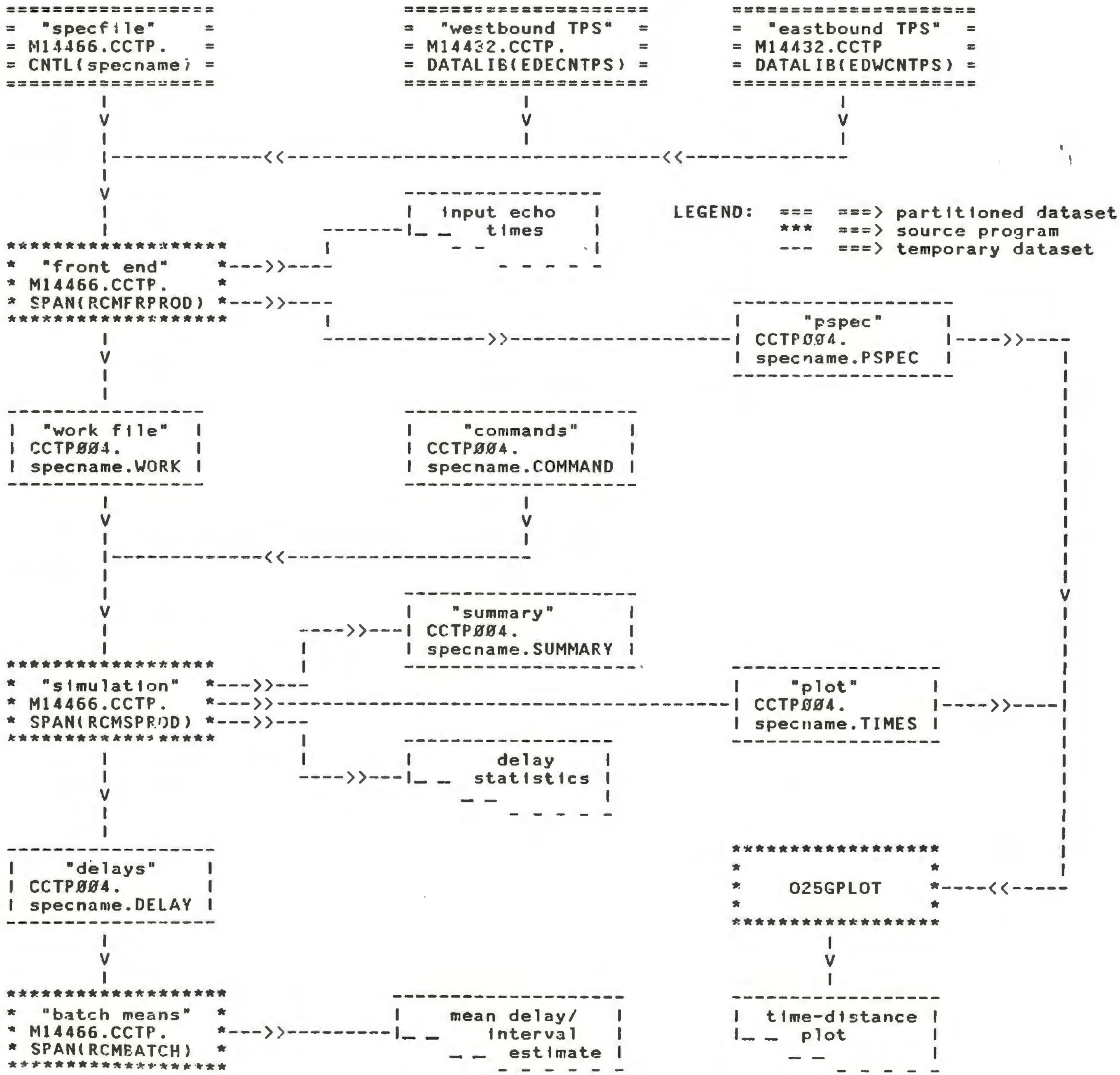
- reads the specfile and TPS files,
- prints an echo of the input data,
- calculates, for each train class listed in the specfile, the following:
    - minimum switch to switch running times,
    - switch clear times,
    - delay due to acceleration and deceleration at each switch.
- prints the calculated times,
- prepares a "Plot Specification" (pspec) file from the plant data and
- writes plant and train data and the calculated times on a work file to be used by the RCM simulation program.

The second RCM module is an event-based simulation. Input data to the simulation program consists of the work file prepared by the front-end and an optional command file prepared by the user. The simulation performs the following actions:

- reads the work file,
- converts the plant data to an internal
- representation,
- creates the specified trains,
- simulates the movement of each train across the route and
- prints a report of the train delay statistics accumulated during the simulation.

During the simulation, the delay to each train and the arrival and departure times at each switch for each train are recorded on two data files. These files are used by two optional post-processing programs. The first of these uses the batch means method to determine an independent interval estimate of train delay. The second program creates a time-distance plot which is used for visual evaluation of the simulation performance.

Complete system documentation is in Transportation Planning System's documentation library. The system is shown schematically in the following figure.


"specfile"
M14466.CCTP.
CNTL(specname)
"westbound TPS"
M14432.CCTP.
DATALIB(EDECNTPS)
"eastbound TPS"
M14432.CCTP
DATALIB(EDWCNTPS)
input echo
times
LEGEND:
=== ===> partitioned dataset
*** ===> source program
--- ===> temporary dataset
"front end"
M14466.CCTP.
SPAN(RCMFRPROD)
"pspec"
CCTPØØ4.
specname.PSPEC
"work file"
CCTPØØ4.
specname.WORK
"commands"
CCTPØØ4.
specname.COMMAND
"summary"
CCTPØØ4.
specname.SUMMARY
"simulation"
M14466.CCTP.
SPAN(RCMSPROD)
"plot"
CCTPØØ4.
specname.TIMES
delay
statistics
"delays"
CCTPØØ4.
specname.DELAY
O25GPLOT
"batch means"
M14466.CCTP.
SPAN(RCMBATCH)
mean delay/
interval
estimate
time-distance
plot

5. Front-end design

The front-end program first reads the data tables from the specfile. Table headings and notes are echoed exactly, table contents are reformatted and echoed. Many checks are made for reasonableness and consistency of the data values. When input of the specfile is complete summary reports of the plant and train data and a gross ton mile report are produced.

Next, the program reads the minimum run time and speed data from the two specified TPS files. This data is converted from quarter mile intervals to minimum run time across links and speeds at each switch. An internal TPC is now used to estimate, for each train class and switch, various delay times. These are for acceleration from stop to track speed, deceleration from track speed to stop, acceleration from switch turnout speed to track speed and deceleration from track speed to switch turnout speed. Turnout delay, for each train class at each switch, is calculated as the difference between the time taken for the length of the train to cross the switch at track speed and at switch turnout speed plus the appropriate acceleration or deceleration delay between track and turnout speed. Switch clear times (by class and switch) are simply the time taken for the train length to clear the switch at track speed. If input reports were requested the results of all the above calculations are reported.

Finally, the front-end prints the number of errors detected and writes all of the data necessary for the simulation module on a work file. Also prepared is a "plot specification" file with data used to draw the axis and write the heading on the time-distance diagram.

6. Simulation Design

6.1 Introduction

The computer program used to determine train delay in the RCM is a discrete-event simulation. In such programs, a simple variable is used to represent the point in time being simulated. Events, which represent changes in the state of the system, are scheduled to occur at some future point in time. The simulation then progresses by setting the artificial system clock equal to the time specified for the event with the lowest scheduled time. Each event also has associated with it, a specification of actions to be performed when the event is activated. As an example, it is possible to think of a simulation for moving trains which consists of a single event; the event called train arrival, is used to represent the arrival of the head end of a train at a switch. The train arrival event performs the following actions:

- sets the variable representing the train position equal to the number of the switch that the train is arriving at.
- calculates the time required to run to the next switch and
- schedules another train arrival event to occur at a time later than that indicated by the artificial system clock by an amount equal to the calculated run time.

Of course most simulations employ many more events; the RCM for example, uses 24 different events. The most important of these, are discussed in Section 6.2 - 6.7 below.

6.2 Train generation

Two events are used in the RCM to generate trains to be simulated. The first event causes one new randomly distributed group train (see Section 3.2) to be added to the simulation. Each such event then schedules another identical event to take place; the time interval between successive random train generations is chosen from an exponential distribution.

The other event related to train generation occurs at the beginning of each simulated day. This event may cause three types of trains to be added to the simulation. First, one train from each user-specified train schedule which includes the day currently being simulated is created. As well, the specified number of evenly distributed trains are created. Unlike the randomly distributed trains which are scheduled to arrive at the origin switch when they are created, the schedule trains and evenly distributed trains are scheduled to arrive at a time later in the day. The exact time is determined from the user specified base times and standard deviations. The latter permits a random deviation from the base time to be used.

The third type of train that may be created at the beginning of a simulated day is a weekly distributed group train. Such trains are added to the simulation on the first day of the simulation and every seven days thereafter. On such first days of the week, the user-specified number of weekly trains are created and their departure times are determined from the user-defined distribution table. The arrivals at the origin switch are then scheduled.

6.3 Dispatching logic

In the RCM, each train movement is controlled by a portion of the program called the dispatcher. Every train that arrives at a switch must use the dispatcher to determine what successive action should be taken. The dispatcher must decide whether to:

- advance the train on the mainline,
- advance the train on an alternate track or
- stop the train.

To make such a decision, the following tests are performed:

- determine if the switch in front of the train is occupied by another train,
- check if there are any orders to hold the train; such orders may be specified by the user or generated internally,
- if the train is leaving a terminal, check if there are any outages that could delay the train. (see Section 6.6)

- for each accessible track on the next link, check if it is possible to advance the train on the track. This involves the following tests:

    - check for opposing trains on the track,
    - check if the track has been removed from service by an outage,
    - if the track is a passing track
        - check if the track is long enough to hold the train and
        - check that any weight limitation on the track is not exceeded,

    - ensure that the proposed move does not lead to infeasibility, ie. a situation in which opposing trains block each others forward progress.

- for each track found to be acceptable by the previous test:
    - determine if any higher priority following train should overtake and
    - determine if there is any opposing train that will be delayed by the proposed move. If the opposing train has lower priority it is ignored; otherwise the train will be forced to take another track and/or ordered to wait for the opposing train.

- if a suitable track is found, check that no other train travelling in the same direction has been advanced on the same track recently. The allowed spacing between following trains is described in Section 3.3

6.4 Train Movement

After the dispatcher has determined that a train should be advanced, several actions must be performed. The first of these consists of updating the set of variables used to represent the current position and status of the train. Next, several events are scheduled to occur when the tail end of the train clears the switch. These events are used to restart any trains that may have been stopped because of interference from the train. Finally, the time required by the train to run to the next switch is calculated and the arrival at the next switch is scheduled.

6.5 Run Time Calculations

The majority of the calculations concerning train running times are performed by the front-end as described in Section 5. The specific situations in which these times are applied are described here. Three types of delay may be added to the minimum TPC run time to determine the run time to the next switch.

A turnout delay is applied to trains that:

- enter a subdivision at a junction,
- enter or leave a passing track,
- enter or leave a double link over a turnout or
- use a crossover between double links.

An acceleration delay is applied to trains if no turnout delay has been applied and if the train is stopped.

Finally, a deceleration delay may be applied to trains when the dispatcher decides to hold a train at a switch. In addition to the various delays, a user-specified scheduled stop time may be added to the train running time. This method of calculating run times is used to reduce the amount of detailed input to the model and to reduce the computational effort required. During temporary slow orders however, more detailed calculations are necessary. Since any combination of slow orders may be present on a track at a given time, the run time over the track for each train class is recalculated whenever a temporary slow order begins or ends. When all slow orders on a track have ended, the run time reverts to the TPC minimum running time.

6.6 Maintenance activity

Maintenance activities include temporary slow orders (described above) and track outages. Two types of track outages are distinguished. In the most severe case, all tracks on a link are removed from service. This type of outage may cause trains to be held in a terminal until the capacity of the terminal is exceeded or until the trains may run without being delayed by the outage. For the second type of outage, one or more tracks are left in service and trains are not held directly. Of course, the outage may reduce the plant capacity to such an extent that trains are held in the terminal because of infeasibility.

Three events are used to model track outages. The first event activates the outage. This causes the dispatcher to determine if trains leaving a terminal will be delayed by the outage. It preceeds the actual beginning of the outage by a time equal to the running time of the slowest train from the terminal to the outage. This does not however, ensure that all trains previously dispatched will not be delayed because of the outage; the possibility of unscheduled delay due to interference by opposing trains is not explicitly taken into account.

The second outage related event causes an outage to begin. Several circumstances however, may prevent an outage from actually starting at the scheduled time. In the case of an outage of a complete link, the user may have specified (in the option list) that outages are to be delayed if there are any trains on the route that must cross the link being removed from service. If any such trains are found, the outage is delayed until they have crossed it. In the case of a partial outage, it is possible that removal of the track is infeasible because of prior commitment of trains to the track. The outage will then be delayed until the situation is resolved. Finally, the presence of trains on any track being removed from service will cause the outage to be delayed; no further trains are allowed on the track even though the outage is not actually started until the track is cleared. The final event concerned with outages restores the outage tracks to service when the user-specified duration since the scheduled begin time has elapsed.

6.7 Train termination

In the RCM, trains are terminated when their tail end has crossed their destination switch. Several actions are performed by the termination event. First, the delay statistics accumulated by the train during its run are added to the overall statistics being accumulated for the simulation. Then, the arrival and departure time of the train at each switch is recorded for later use by the plotting program. Finally, the train is removed from the simulation.

6.8 Convergence tracing and statistics gathering

The initial state of the RCM simulation consists of a route with no trains. The inaccuracy caused by this unrealistic situation is overcome by discarding any statistics accumulated during some initial start-up period. The length of this period may be specified by the user, or it may be determined by the program. The latter method is related to the convergence tracing procedure and is described below. In either case, the start statistics event is used to clear the statistical counters.

The RCM incorporates a means of detecting that the average overall delay to trains has been determined to be within some user-specified degree of accuracy. This is accomplished using the batch means method[1] to calculate an interval estimate for the delay. The batch size to be used is determined at the beginning of the simulation from analysis of the expected number of trains per day.

This batch size is also used to determine the duration of the simulation start-up period; if the default statistics reset time is specified, a start statistics event will take place after the first batch of trains has terminated.

1 Fishman G.S., "Principles of Discrete Event Simulation", pp 237 - 247.

6.9 Plot window

The information used to produce the time-distance plot is recorded only during some user-specified period of simulated time. Two events are used to enable and disable the recording of plot data. The first, scheduled at the beginning of the simulation, occurs at the user-specified plot begin time. The second event is scheduled by the plot begin event and occurs after the user-specified duration has elapsed. In addition to disabling the recording of plot data, the end plot event also causes plot data for any trains which have departed but not terminated to be recorded.

6.10 Trace output

Output produced during the simulation, normally consists of only a few messages indicating that an event such as the beginning or ending of a slow order or track outage has occurred. A report showing the position and status of each train, the average delay and the number of trains waiting in each terminal is also produced after every twelve hours of simulated time. The event which produces the status report is included to allow users to monitor the progress of the simulation and to verify that the value of the delay reported at the end of the simulation is consistent with the intermediate values.

Additional monitoring of the simulation is available through the use of the trace feature. The level of detail and time interval for each trace may be specified by the user. At the beginning of the simulation, a trace begin event for each trace is scheduled to occur at the specified simulation time. Since multiple, overlapping traces are possible, output is produced at the level of detail indicated by the highest index of the activated traces. The end trace event occurs after the specified trace duration has elapsed; it deactivates the trace and resets the value of the trace index.

6.11 Simulation end

Two methods of ending the simulation are provided. The first, described in Section 6.7, will occur when, during the course of convergence tracing, the calculated interval estimate of the overall delay is found to be less than the user-specified precision. To provide for the possibility that the required precision is not achieved within a reasonable time, an end simulation event is also scheduled at the beginning of the simulation. It will cause the simulation to terminate after a user-specified maximum number of days have been simulated. In either case, the end simulation event prints the output reports described in Section 7.

7. Output Reports

7.1 Detailed Reports

The RCM output consists primarily of an analysis of the delays incurred by simulated trains. This analysis is presented in the form of a series of reports. An example of these reports is shown in Appendix II of this report.

The train statistics report shows, for each subdivision, the breakdown of train delay for each class of train, for group and schedule trains and for trains in each direction. Three components of train delay are reported. Scheduled delay includes time spent at user-specified station stops; offline delay includes unscheduled delay in terminals and at junctions; online delay includes accelerat	aion, deceleration, turnout, meet, overtake and scheduled delay. In addition, the unscheduled delay per train mile and overall average speed is reported for trains on each subdivision.

The link statistics report shows for each subdivision, the delay incurred by trains at various plant locations. Offline delay at each terminal, delay on the mainline of each link and delay incurred in sidings on passing links are given in hours per day. This report is used as an aid in identifying plant bottlenecks.

The terminal statistics report gives a detailed account of delay to trains in each terminal. Included are the average, maximum and standard deviation of train delay and the average maximum and standard deviation of the number of trains in the terminal. These statistics are reported for trains in each direction as well as combined for each terminal.

In addition, the distribution of the number of trains present in the terminal is shown, and a histogram of the delay in the terminal is displayed. The terminal report shows the utilization of each terminal and gives an indication of saturation.

The crew statistics report shows the distribution of running times for each subdivision. The running time includes delay in a terminal.

The daily statistics report shows the distribution of total delay per day.

The meet statistics report shows the distribution of meets between opposing trains at sidings per eight hour shift. This report serves as an indicator of dispatcher workload.

The final report displays the overall simulation results including total number of days simulated, traffic density, number of trains generated and number of trains terminated as well as the expected delay and interval estimate at 95 percent confidence.

7.2 Summary report

In addition to the detailed reports described above, the RCM generates a summary report designed to show the major results of a simulation. This feature is of interest to users making a large number of simulation runs.

The summary report includes the simulation status reports described in Section 6.10, the train statistics report, the link statistics report and the overall simulation results.

8. Limitations of Model

Whilst the Route Capacity Model is capable of modelling the types of track that exist, or are likely to be built, in Western Canada, it cannot handle multiple track with complex crossover configurations such as that existing on the Kingston subdivision. Neither is it capable of handling train routings through specific tracks.

The RCM is not signal specific. The design approach was to approximate the effect of signals on following moves by means of train headways. This approach allows simpler data preparation for theoretical studies in which the train headways do not change between the different scenarios and also has allowed the computer execution time to remain low. However, for plants with intermediate signals considerable effort is required to obtain the headway values for each train class at each switch and the accuracy with which the effect of the signal system is modelled is limited. When there are temporary slow orders the headways between trains leaving the block containing each TSO must also be determined. The model is able to capture the effect of train spreading after the TSO but does not model the effect approaching the TSO. We can expect such inaccuracies to have a similar effect on the estimation of capacity of all similar plants under similar conditions and that the model is suitable for comparing such alternatives.

Terminals are not modelled in detail by the RCM. Particular problems are that trains are not queued on line on the previous subdivision when an intermediate terminal is filled to capacity and that terminals usually release large fleets of trains when an outage terminates. Although these effects affect operations and may appear disturbing on the time-distance diagram, it is unlikely that they have a large effect on the average delay per train.

The dispatcher in the RCM has no global policy. Rather, each meet is resolved in the "best" manner considering only the first train in each direction that is involved in the meet. Generally, the resulting dispatching is very reasonable but in extreme conditions this may not be the case. It is left to the user to check the train time-distance diagrams for reasonableness.

On double track sections, the single minimum run time from the TPS file is used as the run time for the train on either track. The simulation assumes right hand running on double track. A small timing inaccuracy occurs when a train takes the left hand track to overtake or to bypass a track which is out of service.

9. Possible Enhancements

Currently, the user cannot assign priorities to individual trains. All trains in a train class have the same priority. The ability to override the class priority for certain trains and to change this priority by location would allow modelling of work and ballast trains. This extension would be easy.

Generally, the current methods of specifying engineering work require a large amount of manual effort on the part of the user. At the present state of development this appears to be unavoidable. However, several labour saving options could be developed. These could include the provision of an outage priority, (an outage would not interfere with trains that have a higher priority), modelling of special trains such as a rail grinder and the capability of specifying a major work program (which would automatically trigger a train track outage, a siding outage, a work train, a ballast train and trailing TSO). These extensions would require a significant amount of development work.

The RCM currently produces a single time-distance diagram for a route. If the model is to be used to simulate a long route, diagrams by subdivision and a compressed diagram for the route are desirable. This could be accomplished by minor changes to the simulation and plotting routines.

The RCM was designed with a view to modelling double track sidings. The data structure will support this feature but the program is not yet complete. If required, this extension could be made.

APPENDIX I

```
            SPECIFICATION FILE - ROUTE CAPACITY MODEL
            =========================================

TITLE: ______________________
EASTBOUND TPS:____________ (DO NOT LEAVE BLANK AFTER :)
WESTBOUND TPS:____________

            RULES FOR PREPARING DATA TABLES
            ===============================
  SSSSS READ THE NOTES CAREFULLY SSSSS

 1. DO NOT MOVE OR REMOVE ANY LINE BEGINNING WITH ---- OR **** OR END
 2. ANY NUMBER OF LINES (OR NONE) MAY BE INSERTED IN TABLES
 3. CLASS NAMES MUST BEGIN IN COLUMN 1 WITHIN THE TABLES
 4. ALL COLUMNS OF A LINE MUST HAVE ENTRIES
    GENERALLY, Ø WILL GIVE THE OBVIOUS DEFAULT
 5. THE END CARD OF EACH TABLE GIVES THE REQUIRED DATA TYPE
     A CHARACTER FIELD MAY CONTAIN NUMBERS
     A REAL FIELD MAY BE INTEGER, BUT NOT VICE VERSA
     A REAL OR INTEGER FIELD MAY NOT CONTAIN CHARACTERS
 6. COMMENTS WITH A "." IN COLUMN 1 WILL NOT BE PRINTED
 7. ALL SWITCH MILEAGES ARE REAL EG. 73.23
 8. DO NOT LEAVE BLANKS IN ANY NAME FIELD (TRAIN CLASS NAME)
 9. ANY TABLE NOT REQUIRED MAY BE OMITTED BY INSERTING IN COLUMN 1
     "NO XXXXX XXXXXX".
 1Ø. LINKS ARE REFERRED TO BY THE WESTERN MILEAGE

****
```

PLANT CONFIGURATION

SWITCH MILEPOST	NAME	SWITCH TYPE	TRACK TO EAST	TURNOUT SPEED	TURNOUT TRACK
END REAL	CH 8	CH 1	CH 1	REAL	CHAR

NOTES

1. SWITCH MILEPOST IS REAL EG: 33.20
2. PLANT IS ENTERED WEST TO EAST
3. SWITCH TYPE P=POWER S=SPRING
4. TRACK TO EAST MAY BE ONE OF THE FOLLOWING:
   S = SINGLE,P = SINGLE SIDING,D = DOUBLE,T = TERMINAL,
   PN = N PASSING TRACKS
   IF 'TRACK TO EAST' HAS "T" THE TURNOUT TRACK COLUMN MUST CONTAIN THE NAME OF THE SUBDIVISION WHICH ENDS AT THIS MILEPOST.
5. TURNOUT TRACK MUST BE SPECIFIED AS EITHER NORTH,SOUTH OR BOTH AT BOTH ENDS OF A DOUBLE TRACK SECTION
6. AT A TERMINAL(T) THE TURNOUT TRACK COLUMN MUST CONTAIN THE NAME OF THE SUBDIVISION TO THE WEST

DEFAULTS (MAY BE OVERIDDEN BY TABLES BELOW)

1. SIDING LENGTH = DISTANCE BETWEEN SWITCHES LESS 820 FEET
2. DOUBLE CROSSOVERS ARE ASSUMED
3. NORTH AND SOUTH TRACKS EACH HAVE LENGTH = DISTANCE BETWEEN SWITCHES LESS 820 FEET
4. TERMINALS HAVE INFINITE CAPACITY

****

TERMINAL DESCRIPTION

TERMINAL NAME	MILEAGE	TRACKS WEST	TRACKS EAST	TOTAL TRACKS
END CH 8	REAL	INTEGER	INTEGER	INTEGER

NOTES:

1. MILEAGE SPECIFIES THAT OF THE WEST SWITCH OF THE TERMINAL, EXCEPT FOR THE WEST END YARD WHICH IS SPECIFIED BY THE EAST SWITCH.

2. TRACKS EAST (WEST) IS THE MAX. NUMBER OF TRAINS THAT WILL WAIT TO GO EAST(WEST) WHEN THERE IS AN OUTAGE ON THE NEXT SUBDIVISION.

3. TOTAL TRACKS IS THE MAX. TOTAL NUMBER OF TRAINS TO BE HELD IN THE TERMINAL IN THE CASE OF OUTAGES.

4. THIS TABLE IS OPIONAL.

****

SIDING EXEPTICNS

WESTERN SW MILEAGE	LENGTH (FEET)	WEIGHT (TONS)
END REAL	INT.	INT.

NOTES
1. BOTH THE LENGTH AND THE WEIGHT COLUMNS MUST HAVE ENTRIES.
   AN ENTRY OF ZERO WILL NOT OVERIDE THE CORRESPONDING ENTRY.

****

DOUBLE TRACK EXCEPTIONS
======================

WESTERN SW MILEAGE	LENGTH NORTH	LENGTH SOUTH	CROSSOVER AT SWITCH
---------	-------	-------	----------
END REAL	INT.	INT.	CH 1

NOTES
1. ALL COLUMNS MUST HAVE ENTRIES
2. X = DOUBLE CROSSOVER
   ES = EASTBOUND TRAFFIC ON SOUTH TRACK MAY USE CROSSOVER
   EN = EASTBOUND TRAFFIC ON NORTH TRACK MAY USE CROSSOVER
   Z = NO CROSSOVERS
3. LENGTH IS IN FEET. IT AFFECTS THE LENGTH OF THE TRAINS THAT CAN FIT ON THE NORTH TRACK OR SOUTH TRACK. LENGTH OF Ø LEAVE THE DEFAULT LENGTH

****

JUNCTION DEFINITION
==================

SWITCH MILEAGE	TRACK FOR WESTBOUND TRAINS	TRACK FOR EASTBOUND TRAINS	CAN TRAINS ALSO TAKE OTHER TRACK
-------	--------	--------	----------
END REAL	CH4	CH4	CH3

NOTES:

1. ALL ORIGIN AND DESTINATION SWITCHES (OTHER THAN TERMINALS) FOR GROUP AND SCHEDULE TRAINS MUST BE SPECIFIED HERE.
2. TRACKS MAY BE NORT,MAIN,SOUT OR NONE - JUNCTIONS ON SIDINGS ARE NOT ALLOWED.
3. ENTRY IN LAST COLUMN MUST BE YES OR NO

****

TRAIN DATA - SPEED CLASSES
========================

SPEED CLASS	DIR. E OR W	HEADWAY ST	HEADWAY DT	PRITY Ø-99	TRAIN TYPE	W/P RATIO
------	------	------	-----	----	------	-----
END CH8	CH 1	REAL	REAL	REAL	CH 1	REAL

NOTES
1. ALL SPEED CLASSES USED BELOW MUST BE DEFINED IN THIS TABLE
2. THE ST HEADWAY IS APPLIED TO EVERY SWITCH WHERE THIS TRAIN CLASS ENTERS SINGLE TRACK. THE DT HEADWAY IS APPLIED TO EVERY SWITCH WHERE THE TRAIN CLASS ENTERS DOUBLE TRACK. DIFFERENT HEADWAY VALUES MAY SUPPLIED FOR SPECIFIC SWITCHES USING THE HEADWAY OVERRIDE TABLE BELOW.
   AT SWITCHES WHERE THE HEADWAY IS ZERO, THE MODEL ASSUMES THAT THERE ARE NO INTERMEDIATE SIGNALS IN THE BLOCK AHEAD AND DISPATCHES FOLLOWING TRAINS WHEN THE BLOCK IS CLEAR.
3. HIGHER PRIORITY NUMBER = HIGHER PRIORITY
3. EACH SPEED CLASS MUST BE ON TPS FILE FOR ITS DIRECTION
4. TRAIN TYPE = P-PSGR, E-EXP, F-FRT, U-UNIT.

****

WEEKLY TRAIN DISTRIBUTION

TABLE (COMMENTS)

1

DAY	PERCENT	PERCENTAGE DURING THESE HOURS			
		Ø-4	4-8	8-15	15-24
1	5	1Ø	2Ø	25	45
2	1Ø	15	25	2Ø	4Ø
3	1Ø	5Ø	25	25	Ø
4	15	Ø	5Ø	Ø	5Ø
5	2Ø	5Ø	5Ø	Ø	Ø
6	2Ø	Ø	Ø	Ø	1ØØ
7	2Ø	Ø	Ø	1ØØ	Ø

TABLE (COMMENTS)

2

DAY	PERCENT	PERCENTAGE DURING THESE HOURS			
		Ø-4	4-8	8-15	15-24
1	5	1Ø	2Ø	25	45
2	1Ø	15	25	2Ø	4Ø
3	1Ø	5Ø	25	25	Ø
4	15	Ø	5Ø	Ø	5Ø
5	2Ø	5Ø	5Ø	Ø	Ø
6	2Ø	Ø	Ø	Ø	1ØØ
7	2Ø	Ø	Ø	1ØØ	Ø
END INT	REAL	REAL	REAL	REAL	REAL

1. THE HEADING LINE CAN BE USED TO BREAK THE DAY INTO UP TO 1Ø PERIODS, THEY DO NOT NEED TO BE OF EQUAL LENGTH.
2. DAILY AND HOURLY PERCENTAGES MUST EACH TOTAL 1ØØ.
3. THERE IS A MAXIMUM OF 1Ø TABLES. THE TABLE NUMBER IS SELECTED BY THE "GROUPS OF TRAINS" TABLE.

GROUPS OF TRAINS

SPEED CLASS	GROUP NAME	NUMBER RANDOM TRAINS	NUMBER DISTRB TRAINS	TABLE FOR WEEKLY	NUMBER EVEN TRAINS	TIME OF 1ST	INT. BETW EVENS	ST. DEV.	FIRST SW.	LAST SW.
END CH8	CH4	REAL	INT	INT	INT	REAL	REAL	REAL	REAL.	REAL

NOTES
1. THE GROUP NAME SPECIFIED HERE IS USED ON ALL REPORTS. EACH LINE MUST HAVE A UNIQUE NAME. THIS NAME IS ALSO USED TO SPECIFY TRAIN STOPS.

SUGGESTED NAMING CONVENTION:-

```
FIRST LETTER    TRAIN CLASS (EXP,PSGR,FRT,UNIT)
SECOND LETTER   W/P CLASS (A-.02,B-.03,C-.04,D-.05,E-.06,F-.07,ETC)
THIRD LETTER    DIRECTION
FOURTH LETTER   LAST DIGIT W/P
```

2. RANDOM TRAINS ARE GENERATED USING EXPONENTIALLY DISTRIBUTED DEPARTURE TIMES. ON THE AVERAGE THE NUMBER RANDOM PER DAY WILL LEAVE DAILY.
3. NUMBER DISTRB TRAINS IS ONE SEVENTH OF THE NUMBER OF TRAINS WHICH ARE TO BE GENERATED EACH WEEK ACCORDING TO A WEEKLY DISTRIBUTION. THE TABLE FOR WEEKLY GIVES THE TABLE NUMBER OF THE DISTRIBUTION TO BE USED FOR THESE TRAINS.
4. EVENLY DISTRIBUTED TRAINS LEAVE AT THE FIRST TIME AND THEREAFTER AT THE STATED INTERVAL APART, SUBJECT TO THE SPECIFIED STANDARD DEVIATION(MINUTES).
   IF THE NUMBER OF EVEN TRAINS IS NON-ZERO, DATA IS REQUIRED IN THE NEXT THREE COLUMNS.
5. THE FIRST SW. AND LAST SW. ARE USED TO SPECIFY THE MILEAGE AT WHICH THE TRAINS ENTER AND LEAVE THE SUBDIVISION. ZERO VALUES WILL DEFAULT TO THE APPROPRIATE ENDS OF THE SUBDIVISION.

****

```
                    SCHEDULED TRAINS
                    ================

SPEED    DEP.  TRAIN  DAYS OF WEEK  FIRST  LAST   PERCENT S.D.  S.D.
CLASS    TIME  NAME   (LIST OR Ø)   SWITCH SWITCH EARLY   EARLY LATE
-----    ----  -----  ------------  ------ ------ ------- ----- ----



END CH8  REAL  CH4    INTEGER       REAL   REAL   REAL    REAL  REAL

 NOTES
 1. TRAIN NAME IS USED ON ALL REPORTS AND ON THE PLOT. IT MUST BE UNIQUE
     SUGGESTED NAMING CONVENTION:-
     FIRST TWO LETTERS  TRAIN CLASS (EX,PA,FR,UN)
     THIRD LETTER       TRAIN DIRECTION
     FOURTH LETTER      W/P CLASS (A-.Ø2,B-.Ø3.C-.Ø4,D-.Ø5.E-.Ø6,ETC)
 2. DEPARTURE IS IN DECIMAL HOURS
     S.D. (STANDARD DEVIATION) IS IN MINUTES
 3. DAYS OF WEEK OF ZERO GIVES THIS TRAIN EVERY DAY
     OTHERWISE THIS SHOULD BE A STRING OF DAY NUMBERS EG. 246
 4. ORIGIN AND DESTINATION OF ZERO DEAFAULT TO ENDS OF PLANT

****
```

TRAIN STOPS - GROUP TRAINS
========================

```
TRAIN      WEST      AVER.     ST.
GROUP      SWITCH    STOP      DEV.
-----      ------    -----     ----


END CH4     REAL    REAL MIN.  REAL MIN.
```

NOTES
1. THE WEST SWITCH DEFINES THE LINK ON WHICH THE TRAIN(S) WILL STOP
2. TRAIN GROUP MAY BE ALL, EAST, WEST OR A GROUP NAME DEFINED ABOVE
   TRAIN GROUP OF ALL,EAST OR WEST GIVES DELAY TO ALL,ALL EAST OR
   ALL WEST GROUP TRAINS. THIS IS OVERIDDEN BY LATER ENTRIES.
3. MANY STOPS MAY BE SPECIFIED FOR ANY GROUP(INCLUDING ALL,EAST,WEST).

****

TRAIN STOPS - SCHEDULED TRAINS
==============================

TRAIN NAME	WEST SWITCH	AVG STOP TIME	ST. DEV.	EARLIEST DEPART.
----	-------	--------	-----	---------
END CH4	REAL	REAL MIN.	REAL	REAL HOURS

NOTES
1. TRAIN WILL STOP FOR AT LEAST THE RANDOMIZED STOP TIME AND WILL NOT LEAVE BEFORE THE EARLIEST DEPART TIME
2. OTHER ENTRIES AS FOR GROUPS
3. EARLIEST DEPARTURE TIME NOT IMPLEMENTED

****

HEADWAYS BY SWITCH AND CLASS
==========================

SPEED CLASS	SWITCH MILEAGE	HEADWAY (MIN)
-----	------	-------
END CHG	REAL	REAL

NOTES
1. THESE HEADWAY OVERIDE THE SPEED CLASS HEADWAYS APPLIED AT ALL SWITCHES

****

SLOW ORDER HEADWAYS BY SWITCH AND CLASS

SPEED CLASS	SWITCH MILEAGE	HEADWAY (MIN)
END CHS	REAL	REAL

NOTES
1. DEFAULT SLOW ORDER HEADWAYS ARE REGULAR HEADWAYS - AFTER OVERIDES. ENTRIES IN THIS TABLE OVERIDE THESE DEFAULTS.
2. CLASS OF ALL,EAST OR WEST CAUSES ALL,ALL EAST OR ALL WEST TO HAVE THE SPECIFIED SLOW ORDER HEADWAY AT THIS SWITCH.

****

TRACK OUTAGES

DESCRIPTION	BEGIN HOUR	DURATION HOURS	REPEAT INT.	NUM. REPEATS	WEST MILEAGE	TRACK
END 8 CHAR	REAL	REAL	INTEGER	INTEGER	REAL	CH 4

NOTES

1. OUTAGES SPECIFIED WILL REPEAT AT REPEAT INT(DAYS) UP TO THE NUMBER REPEATS.
2. THE TRACK GIVEN SHOULD BE NORT, SOUT, MAIN, ALL OR SID
   IF THERE ARE MORE THAN TWO TRACKS IT CAN BE THE TRACK NUMBER.
3. THE WEST MILEAGE IS THAT OF THE SWITCH TO THE WEST OF THE AFFECTED LINK.
4. THE DURATION IS NOT RESTRICTED TO 24 HOURS. FOR LONG OUTAGES SPECIFY A LONG DURATION, DO NOT REPEAT A SHORTER OUTAGE.

****

SLOW ORDERS
===========

NAME	BEGIN HOUR	DURATION HOURS	WEST MILEAGE	EAST MILEAGE	SPEED MPH	TRACK
----	-----	--------	--------	--------	-----	-----
END	REAL	REAL	REAL	REAL	REAL	CH 4

NOTES

1. NAME IS 4 CHARACTERS AND IS MANDATORY
2. TRACK MUST BE SPECIFIED AS MAIN,ALL,NORT OR SOUT
   SLOW ORDERS NEVER APPLY TO SIDINGS
3. THERE IS NO PROVISION FOR AUTOMATICALLY REPEATING SLOW ORDERS.
4. THE MODEL DOES NOT ADD THE TRAIN LENGTH TO SLOW ORDERS, NOR DOES IT ALLOW FOR ACCELERATION OR DECELERATION DELAYS. THIS CAN BE COMPENSATED BY INCREASING THE LENGTH OF THE TSO.
5. SLOW ORDERS MAY COVER MORE THAN ONE LINK AND MAY OVERLAP

****

```
PLOT          BEGIN HOUR     DURATION
                REAL         REAL(HOURS)
----          ----------     --------


TRACE          BEGIN HOUR      DURATION       INDEX.1       INDEX.2
-----          ----------      --------       -------       --------


END              REAL              REAL           INT            INT

 NOTE
 INDEX 1.   1=SIMPLE EVENT SUMMARY,  2=1+LINEUPS,  3=2+QUEUE OF TRAINS
 INDEX 2    CONTROLS THE AMOUNT OF THE DISPATCHING DECISIONS AND REASONS
```

RUN PARAMETERS AND OPTIONS   INSERT APPROPRIATE PARAMETERS

```
STATISTICS START TIME = 24.ØØ HOURS
MAX. LENGTH OF SIMULATION = 1Ø DAYS
CONFIDENCE INTERVAL =  .1Ø                (RECOMMEND  .1Ø)
CHOICE OF RANDOM NUMBER STREAM = 1        (MAY BE 1 TO 9)
OPTIMISE MEETS - YES
TAKE INTO ACCOUNT TOTAL DELAY - NO        (DO NOT CHANGE TO YES)
OVERTAKES - NO
HOLD OUTAGES FOR TRAINS ALREADY ON LINE - YES
LIST WORK FILE - YES
PRINT FRONT END REPORTS - YES
TRAIN TIMES DURING PLOT - YES
```

APPENDIX II

ROUTE CAPACITY MODEL INPUT DATA

VERSION 1, RELEASE 1, 19 OCT 1981

SPECIFICATION FILE - ROUTE CAPACITY MODEL

TITLE:DEMONSTRATION

EASTBOUND TPS:DUMTRMFE

WESTBOUND TPS:DUMTRMFW

RULES FOR PREPARING DATA TABLES

SSSSS READ THE NOTES CAREFULLY SSSSS

1. DO NOT MOVE OR REMOVE ANY LINE BEGINNING WITH ---- OR **** OR END
2. ANY NUMBER OF LINES (OR NONE) MAY BE INSERTED IN TABLES
3. CLASS NAMES MUST BEGIN IN COLUMN 1 WITHIN THE TABLES
4. ALL COLUMNS OF A LINE MUST HAVE ENTRIES
   GENERALLY, Ø WILL GIVE THE OBVIOUS DEFAULT
5. THE END CARD OF EACH TABLE GIVES THE REQUIRED DATA TYPE
   A CHARACTER FIELD MAY CONTAIN NUMBERS
   A REAL FIELD MAY BE INTEGER, BUT NOT VICE VERSA
   A REAL OR INTEGER FIELD MAY NOT CONTAIN CHARACTERS
6. COMMENTS WITH A "." IN COLUMN 1 WILL NOT BE PRINTED
7. ALL SWITCH MILEAGES ARE REAL EG. 78.23
8. ANY TABLE NOT REQUIRED MAY BE OMITTED BY INSERTING IN COLUMN 1
   "NO XXXXXXXXXXXX".
9. ANY REFERENCE TO ANY LINK IS REFERRED TO AS BY ITS WESTWARD MILEAGE

PLANT CONFIGURATION

SWITCH MILEPOST	NAME	SWITCH TYPE	TRACK TO EAST	TURNOUT SPEED	TURNOUT TRACK
BEGINNING OF TRACK DATA					
/278.5Ø	S1WTRM	P	D	15.ØØ	NORT
/269.15	S2	P	S	45.ØØ	NORT
3/261.15	S3S1	P	P	15.ØØ	
4/259.85	S4	P	S	15.ØØ	
5/251.85	S5S2	P	P	15.ØØ	
6/25Ø.55	S6	P	S	15.ØØ	
7/242.55	S7S3	P	P	15.ØØ	
8/241.25	S8	P	S	15.ØØ	
9/233.25	S9S4	P	P	15.ØØ	
1Ø/231.95	S1Ø	P	S	15.ØØ	
11/223.95	S11DT2	P	D	45.ØØ	NORT
12/213.35	S12	P	S	45.ØØ	NORT
13/2Ø5.35	S13S5	P	P	15.ØØ	
14/2Ø4.Ø5	S14	P	S	15.ØØ	
15/196.Ø5	S15S6	P	P	15.ØØ	
16/194.75	S16	P	S	15.ØØ	
17/186.75	S17S7	P	P	15.ØØ	
18/185.45	S18	P	S	15.ØØ	
19/177.45	S19S8	P	P	15.ØØ	
2Ø/176.15	S2Ø	P	S	15.ØØ	
21/168.15	S21DT3	P	D	45.ØØ	NORT
22/153.55	S22XOV	P	D	45.ØØ	BOTH
23/14Ø.25	S23WITRM	P	T	15.ØØ	
END OF SUBDIVISION FIRST					
24/138.25	S24EITRM	P	S	15.ØØ	
25/13Ø.2Ø	S25S9	P	P	15.ØØ	
26/128.9Ø	S26	P	S	15.ØØ	
27/12Ø.9Ø	S27S1Ø	P	P	15.ØØ	
28/119.6Ø	S28	P	S	15.ØØ	
29/111.6Ø	S29S11	P	P	15.ØØ	
3Ø/11Ø.3Ø	S3Ø	P	S	15.ØØ	
31/1Ø2.3Ø	S31S12	P	P	15.ØØ	
32/1Ø1.ØØ	S32	P	S	15.ØØ	
33/ 93.ØØ	S33S13J	P	P	15.ØØ	
34/ 91.7Ø	S34	P	S	15.ØØ	
35/ 83.7Ø	S35S14	P	P	15.ØØ	
36/ 82.4Ø	S36	P	S	15.ØØ	
37/ 74.4Ø	S37S15	P	P	15.ØØ	
38/ 73.1Ø	S38	P	S	15.ØØ	
39/ 65.1Ø	S39S16	P	P	15.ØØ	
4Ø/ 63.8Ø	S4Ø	P	S	15.ØØ	
41/ 55.8Ø	S41S17	P	P	15.ØØ	
42/ 54.5Ø	S42	P	S	15.ØØ	

43/	46.50	S43S18	P	P	15.00
44/	45.20	S44	P	S	15.00
45/	37.20	S45S19	P	P	15.00
46/	35.90	S46	P	S	15.00
47/	27.30	S47S20	P	P	15.00
48/	26.60	S48	P	S	15.00
49/	18.60	S49S21	P	P	15.00
50/	17.30	S50	P	S	15.00
51/	9.30	S51S22	P	P	15.00
52/	8.00	S52	P	S	15.00
53/	0.	S53ETRM	P	T	15.00

END OF SUBDIVISION SECOND

END OF TRACK DATA

NOTES
1. TRACK TO EAST MAY BE ONE OF THE FOLLOWING:
   S = SINGLE,P = SINGLE SIDING,D = DOUBLE,T = TERMINAL,
   PN = N PASSING TRACKS
   IF 'TRACK TO EAST' HAS "T" THE TURNOUT TRACK COLUMN MUST CONTAIN
   THE NAME OF THE SUBDIVISION WHICH ENDS AT THIS MILEPOST.
2. STATION NAMES MAY NOT CONTAIN BLANKS
3. RIGHT HAND RUNNING IS ASSUMED FOR NOW
4. TURNOUT TRACK MUST BE SPECIFIED AS NORTH,SOUTH OR BOTH AT BOTH ENDS
   OF DOUBLE TRACK.
   IF TURNOUT TRACK IS NORTH ,TRAINS TAKING THE NORTH TRACK WILL DELAY
   IF TURNOUT TRACK IS SOUTH ,TRAINS TAKING THE SOUTH TRACK WILL DELAY
5. OVERTAKING TRAINS WILL TAKE RIGHT HAND OR BEST TRACK

DEFAULTS (MAY BE OVERIDDEN BY TABLES BELOW)
1. SIDING LENGTH = DISTANCE BETWEEN SWITCHES LESS 820 FEET
2. DOUBLE CROSSOVERS ARE ASSUMED
3. NORTH AND SOUTH TRACKS EACH HAVE
   LENGTH = DISTANCE BETWEEN SWITCHES LESS 820 FEET
4. TERMINALS HAVE INFINITE CAPACITY

TERMINAL DESCRIPTION
==================

TERMINAL NAME	MILEAGE	TRACKS WEST	TRACKS EAST	TOTAL TRACKS
BEGINNING OF TERMINAL TABLE				
WTRM	278.50	Ø	5	5
INTTRM	143.25	3	2	4
ETRM	Ø.	6	Ø	6

END OF TERMINAL TABLE

NOTES:

1. MILEAGE SPECIFIES THAT OF THE WEST SWITCH OF THE TERMINAL, EXCEPT FOR THE WEST END YARD WHICH IS SPECIFIED BY THE EAST SWITCH.
2. TRACKS EAST (WEST) IS THE MAX. NUMBER OF TRAINS THAT WILL WAIT TO GO EAST(WEST) WHEN THERE IS AN OUTAGE ON THE NEXT SUBDIVISION.
3. TOTAL TRACKS IS THE MAX. TOTAL NUMBER OF TRAINS TO BE HELD IN THE TERMINAL IN THE CASE OF OUTAGES.
4. THIS TABLE IS OPIONAL.

SIDING EXEPTIONS

WESTERN SW MILEAGE	LENGTH (FEET)	WEIGHT (TONS)
BEGINNING OF SIDING EXCEPTIONS		
13.6Ø	5544	Ø
9.3Ø	Ø	2ØØØ
END OF SIDING EXCEPTIONS		

NOTES

1. BOTH THE LENGTH AND THE WEIGHT COLUMNS MUST HAVE ENTRIES, AN ENTRY OF ZERO WILL NOT OVERIDE THE CORRESPONDING ENTRY.

DOUBLE TRACK EXCEPTIONS

WESTERN SW MILEAGE	LENGTH NORTH	LENGTH SOUTH	CROSSOVER AT SWITCH
BEGINNING OF DOUBLE EXCEPTIONS			
153.55	Ø	Ø	EN
END OF DOUBLE TRACK EXCEPTIONS			

NOTES

1. LENGTH AND CROSSOVER COLUMNS MUST HAVE ENTRIES
   A LENGTH OF ZERO WILL NOT CHANGE THE DEFAULT
2. X = DOUBLE CROSSOVER
   ES = EASTBOUND TRAFFIC ON SOUTH TRACK MAY USE CROSSOVER
   EN = EASTBOUND TRAFFIC ON NORTH TRACK MAY USE CROSSOVER
   Z = NO CROSSOVERS
3. LENGTH IS IN FEET, IT AFFECTS THE LENGTH OF THE TRAINS THAT CAN
   FIT ON THE DOUBLE TRACK SECTION.

JUNCTION DEFINITION

SWITCH MILEAGE	TRACK FOR WESTBOUND TRAINS	TRACK FOR EASTBOUND TRAINS	CAN TRAINS ALSO TAKE OTHER TRACK
BEGINNING OF JUNCTION TABLE			
93.00	MAIN	MAIN	YES
END OF JUNCTION TABLE			

NOTES:

1. ALL ORIGIN AND DESTINATION SWITCHES FOR GROUP AND SCHEDULE TRAINS MUST BE SPECIFIED HERE.
2. TRACKS MAY BE NORT,MAIN,SOUT OR NONE - JUNCTIONS ON SIDINGS ARE NOT ALLOWED.
3. ENTRY IN LAST COLUMN MUST BE YES OR NO

TRAIN DATA - SPEED CLASSES
========================

SPEED CLASS	DIR. E OR W	HEADWAY ST	HEADWAY DT	PRITY Ø-1ØØ	TRAIN TYPE	W/P
BEGINNING OF SPEED CLASSES						
THOPAEØ2	E	Ø.	12.ØØ	9Ø.ØØ	P	.2Ø
THOEXEØ5	E	Ø.	12.ØØ	6Ø.ØØ	E	.5Ø
THOFRE1Ø	E	Ø.	12.ØØ	4Ø.ØØ	F	1.ØØ
THOFUEØ3	E	Ø.	12.ØØ	4Ø.ØØ	U	.3Ø
THOPAWØ2	W	Ø.	12.ØØ	9Ø.ØØ	P	.2Ø
THOEXWØ5	W	Ø.	12.ØØ	6Ø.ØØ	E	.5Ø
THOFRW1Ø	W	Ø.	12.ØØ	4Ø.ØØ	F	1.ØØ
THOFUW12	W	Ø.	12.ØØ	4Ø.ØØ	U	1.2Ø

END OF CLASS DEFINITIONS

NOTES

1. ALL SPEED CLASSES USED BELOW MUST BE DEFINED IN THIS TABLE
2. THE ST HEADWAY IS APPLIED TO EVERY SWITCH WHERE THIS TRAIN CLASS ENTERS SINGLE TRACK. THE DT HEADWAY IS APPLIED TO EVERY SWITCH WHERE THE TRAIN CLASS ENTERS DOUBLE TRACK. DIFFERENT HEADWAY VALUES MAY SUPPLIED FOR SPECIFIC SWITCHES USING THE HEADWAY OVERRIDE TABLE BELOW.

   AT SWITCHES WHERE THE HEADWAY IS ZERO, THE MODEL ASSUMES THAT THERE ARE NO INTERMEDIATE SIGNALS IN THE BLOCK AHEAD AND DISPATCHES FOLLOWING TRAINS WHEN THE BLOCK IS CLEAR.
3. EACH SPEED CLASS MUST BE ON TPS FILE FOR ITS DIRECTION
4. TRAIN TYPE= P-PSGR, E-EXP, F-FRT, U-UNIT.

WEEKLY TRAIN DISTRIBUTION

TABLE (COMMENTS)

DAY	PERCENT	PERCENTAGE DURING THESE HOURS < 4.ØØ	< 8.ØØ	< 15.ØØ	< 24.ØØ
1	14.ØØ	Ø.	5Ø.ØØ	25.ØØ	25.ØØ
2	18.ØØ	25.ØØ	Ø.	5Ø.ØØ	25.ØØ
3	11.ØØ	25.ØØ	25.ØØ	Ø.	5Ø.ØØ
4	17.ØØ	5Ø.ØØ	25.ØØ	25.ØØ	Ø.
5	1Ø.ØØ	25.ØØ	25.ØØ	25.ØØ	25.ØØ
6	15.ØØ	35.ØØ	15.ØØ	45.ØØ	5.ØØ
7	14.ØØ	25.ØØ	25.ØØ	25.ØØ	25.ØØ

END

1. THE HEADING LINE CAN BE USED TO BREAK THE DAY INTO UP TO 1Ø PERIODS, THEY DO NOT NEED TO BE OF EQUAL LENGTH.
2. DAILY AND HOURLY PERCENTAGES MUST EACH TOTAL 1ØØ.
3. THERE IS A MAXIMUM OF 1Ø TABLES, THE TABLE NUMBER IS SELECTED BY THE "GROUPS OF TRAINS" TABLE.

GROUPS OF TRAINS

SPEED CLASS	GROUP NAME	NUMBER RANDOM TRAINS	NUMBER WEEKLY TRAINS	TABLE FOR WEEKLY	NUMBER EVEN TRAINS	TIME OF 1ST	INT. BETW EVENS	ST. DEV.	FIRST SW.	LAST SW.
BEGINNING OF GROUP DEFINITIONS										
THOEXEØ5	XDE5	Ø.	Ø	Ø	3	3.ØØ	2.ØØ	3Ø.ØØ	278.5Ø	Ø.
THOEXWØ5	XDW5	Ø.	Ø	Ø	3	1.ØØ	3.ØØ	3Ø.ØØ	Ø.	278.5Ø
THOFRE1Ø	FIEØ	Ø.	4	1	Ø	Ø.	Ø.	Ø.	278.5Ø	Ø.
THOFRW1Ø	FIWØ	Ø.	3	1	Ø	Ø.	Ø.	Ø.	Ø.	278.5Ø
THOFUEØ3	UBE3	2.ØØ	Ø	Ø	Ø	Ø.	Ø.	Ø.	278.5Ø	Ø.
THOFUW12	UKW2	2.ØØ	Ø	Ø	Ø	Ø.	Ø.	Ø.	Ø.	278.5Ø

END OF GROUP DEFINITIONS

NOTES -

1. THE GROUP NAME SPECIFIED HERE IS USED ON ALL REPORTS. EACH LINE MUST HAVE A UNIQUE NAME. THIS NAME IS ALSO USED TO SPECIFY TRAIN STOPS. SUGGESTED NAMING CONVENTION:-

```
FIRST LETTER    TRAIN CLASS (EXP,PSGR,FRT,UNIT)
SECOND LETTER   W/P CLASS (A-.02,B-.03,C-.04,D-.05,E-.06,F-.07,ETC)
THIRD LETTER    DIRECTION
FOURTH LETTER   LAST DIGIT W/P
```

2. RANDOM TRAINS ARE GENERATED USING EXPONENTIALLY DISTRIBUTED DEPARTURE TIMES. ON THE AVERAGE THE NUMBER RANDOM PER DAY WILL LEAVE DAILY.
3. NUMBER DISTRB TRAINS IS ONE SEVENTH OF THE NUMBER OF TRAINS WHICH ARE TO BE GENERATED EACH WEEK ACCORDING TO A WEEKLY DISTRIBUTION. THE TABLE FOR WEEKLY GIVES THE TABLE NUMBER OF THE DISTRIBUTION TO BE USED FOR THESE TRAINS.
4. EVENLY DISTRIBUTED TRAINS LEAVE AT THE FIRST TIME AND THEREAFTER AT THE STATED INTERVAL APART, SUBJECT TO THE SPECIFIED STANDARD DEVIATION(MINUTES).
   IF THE NUMBER OF EVEN TRAINS IS NON-ZERO, DATA IS REQUIRED IN THE NEXT THREE COLUMNS.
5. ORIGIN AND DESTINATION OF ZERO WILL DEFAULT TO THE APPROPRIATE ENDS OF THE PLANT

SCHEDULED TRAINS
================

SPEED CLASS	DEP. TIME	TRAIN NAME	DAYS OF WEEK (LIST OR Ø)	FIRST SWITCH	LAST SWITCH	PERCENT EARLY	S.D. EARLY	S.D. LATE
BEGINNING OF SCHEDULED TRAINS								
THOPAWØ2	9.3Ø	PAS1	234	Ø.	278.5Ø	Ø.	Ø.	3Ø.ØØ
THOPAWØ2	18.ØØ	PAS9	1234567	93.ØØ	278.5Ø	Ø.	Ø.	3Ø.ØØ
THOPAEØ2	8.3Ø	PAS2	1567	278.5Ø	Ø.	Ø.	Ø.	3Ø.ØØ
THOPAEØ2	19.ØØ	PAS8	1234567	278.5Ø	93.ØØ	Ø.	Ø.	3Ø.ØØ
THOPAEØ2	15.6Ø	PAS4	1	278.5Ø	93.ØØ	Ø.	Ø.	Ø.
THOFRE1Ø	16.ØØ	SLOW	1	278.5Ø	Ø.	Ø.	Ø.	Ø.

END OF SCHEDULED TRAINS

NOTES
1. TRAIN NAME IS USED ON ALL REPORTS AND ON THE PLOT, IT MUST BE UNIQUE
   SUGGESTED NAMING CONVENTION:-
   FIRST TWO LETTERS TRAIN CLASS (EX,PA,FR,UN)
   THIRD LETTER TRAIN DIRECTION
   FOURTH LETTER W/P CLASS (A-.Ø2,B-.Ø3,C-.Ø4,D-.Ø5.E-.Ø6,ETC)
2. DEPARTURE IS IN DECIMAL HOURS
   S.D. (STANDARD DEVIATION) IS IN MINUTES
3. DAYS OF WEEK OF ZERO GIVES THIS TRAIN EVERY DAY
   OTHERWISE THIS SHOULD BE A STRING OF DAY NUMBERS EG. 246
4. ORIGIN AND DESTINATION OF ZERO DEAFAULT TO ENDS OF PLANT

TRAIN STOPS - GROUP TRAINS
=========================

TRAIN GROUP	WEST SWITCH	AVER. STOP	ST. DEV.
-----	------	-----	----

BEGINNING OF DELAY(STOP) TIMES FOR GROUPS

XDE5	140.25	60.00	5.00
XDW5	140.25	60.00	5.00
FIE0	140.25	60.00	5.00
FIW0	140.25	10.00	1.00
UBE3	140.25	60.00	5.00
UKW2	140.25	180.00	21.00

WARNING - STOP TIME OF MORE THAN 1 HOUR

END OF DELAY(STOP) TIMES FOR GROUPS

NOTES
1. TRAIN GROUP MAY BE ALL, EAST, WEST OR A GROUP NAME DEFINED ABOVE
   TRAIN GROUP OF ALL,EAST OR WEST GIVES DELAY TO ALL,ALL EAST OR
   ALL WEST GROUP TRAINS, THIS IS OVERIDDEN BY LATER ENTRIES.
2. MANY STOPS MAY BE SPECIFIED FOR ANY GROUP(INCLUDING ALL,EAST,WEST).

TRAIN STOPS - SCHEDULED TRAINS

TRAIN NAME	WEST SWITCH	AVG STOP TIME	ST. DEV.	EARLIEST DEPART.
BEGINNING OF DELAY(STOP) TIMES FOR SCHEDULED TRAINS				
PAS1	140.25	30.00	2.00	0.
PAS3	140.25	30.00	2.00	0.
PAS2	140.25 .	45.00	16.00	0.
PAS8	140.25	30.00	2.00	0.
SLOW	140.25	65.00	20.00	0.
WARNING - STOP TIME OF MORE THAN 1 HOUR				
ALL	242.55	10.00	2.00	0.
SLOW	205.35	30.00	6.00	0.
END OF DELAY(STOP) TIMES FOR SCHEDULED TRAINS				

NOTES
1. TRAIN WILL STOP FOR AT LEAST THE RANDOMIZED STOP TIME AND WILL NOT LEAVE BEFORE THE EARLIEST DEPART TIME
2. OTHER ENTRIES AS FOR GROUPS
3. EARLIEST DEPARTURE TIME NOT IMPLEMENTED

HEADWAYS BY SWITCH AND CLASS

SPEED CLASS	SWITCH MILEAGE	HEADWAY (MIN)
BEGINNING OF HEADWAY OVERIDES BY SWITCH		
THOPAEØ2	278.5Ø	6.ØØ
THOEXEØ5	278.5Ø	6.ØØ
THOFREIØ	278.5Ø	8.ØØ
THOFUEØ3	278.5Ø	8.ØØ
THOPAWØ2	259.15	6.ØØ
THOEXWØ5	259.15	6.ØØ
THOFRW1Ø	259.15	8.ØØ
THOFUW12	259.15	8.ØØ

END OF HEADWAY OVERIDES BY SWITCH

NOTES
1. THESE HEADWAY OVERIDE THE SPEED CLASS HEADWAYS APPLIED AT ALL SWITCHES

SLOW ORDER HEADWAYS BY SWITCH AND CLASS

SPEED CLASS	SWITCH MILEAGE	HEADWAY (MIN)

BEGINNING OF SLOW ORDER HEADWAY OVERIDES BY SWITCH

END OF SLOW ORDER HEADWAY OVERIDES BY SWITCH

NOTES
1. DEFAULT SLOW ORDER HEADWAYS ARE REGULAR HEADWAYS - AFTER OVERIDES. ENTRIES IN THIS TABLE OVERIDE THESE DEFAULTS.
2. CLASS OF ALL,EAST OR WEST CAUSES ALL,ALL EAST OR ALL WEST TO HAVE THE SPECIFIED SLOW ORDER HEADWAY AT THIS SWITCH.

TRACK OUTAGES
=============

DESCRIPTION	BEGIN HOUR	DURATION HOURS	REPEAT INT.	NUM. REPEATS	WEST MILEAGE	TRACK
BEGINNING OF OUTAGES						
SID18OUT	24.00	12.00	1	1	46.50	SID
P811	78.00	4.00	1	1	153.55	NORT
TIES	34.00	6.00	1	1	250.55	MAIN
END OF OUTAGES	34	8	1.0	1	40	N

NOTES
1. OUTAGES SPECIFIED WILL REPEAT AT REPEAT INT(DAYS) UP TO THE NUMBER REPEATS.
2. THE TRACK GIVEN SHOULD BE NORT, SOUT, MAIN, ALL OR SID IF THERE ARE MORE THAN TWO TRACKS IT CAN BE THE TRACK NUMBER.
3. THE WEST MILEAGE IS THAT OF THE SWITCH TO THE WEST OF THE AFFECTED LINK.
4. THE DURATION IS NOT RESTRICTED TO 24 HOURS. FOR LONG OUTAGES SPECIFY A LONG DURATION. DO NOT REPEAT A SHORTER OUTAGE.

SLOW ORDERS
===========

NAME	BEGIN HOUR	DURATION HOURS	WEST MILEAGE	EAST MILEAGE	SPEED MPH	TRACK
----	-----	--------	--------	--------	-----	-----
BEGINNING OF SLOW ORDERS						
SO.1	44.00	12.00	51.00	48.00	20.00	MAIN
SO.2	20.00	24.00	123.50	122.90	15.00	MAIN
SO.3	24.00	12.00	46.50	46.50	10.00	MAIN

END OF SLOW ORDERS

NOTES
1. NAME IS 4 CHARACTERS AND IS MANDATORY
2. TRACK MUST BE SPECIFIED AS MAIN,ALL,NORT OR SOUT
   SLOW ORDERS NEVER APPLY TO SIDINGS
3. THERE IS NO PROVISION FOR AUTOMATICALLY REPEATING SLOW ORDERS.
4. THE MODEL DOES NOT ADD THE TRAIN LENGTH TO SLOW ORDERS, NOR DOES IT ALLOW FOR ACCELERATION OR DECELERATION DELAYS. THIS CAN BE COMPENSATED BY INCREASING THE LENGTH OF THE TSO.

```
PLOT        BEGIN HOUR      DURATION
              REAL            REAL
----        ----------      --------

             Ø.             168.ØØ


TRACE       BEGIN HOUR      DURATION      INDEX.1      INDEX.2
-----       ----------      --------      -------      --------
BEGINNING OF TRACE INTERVALS


END OF TRACE INTERVALS

 NOTE
 INDEX 1    1=SIMPLE EVENT SUMMARY,  2=1+LINEUPS,  3=2+QUEUE OF TRAINS
 INDEX 2    CONTROLS THE AMOUNT OF THE DISPATCHING DECISIONS AND REASONS

RUN PARAMETERS AND OPTIONS
--------------------------
READING PARAMETERS AND OPTIONS
STATISTICS START TIME =  999.ØØ
MAX. LENGTH OF SIMULATION =   1Ø.ØØ
CONFIDENCE INTERVAL =      .1Ø
CHOICE OF RANDOM NUMBER STREAM =     1.ØØ
OPTIMISE MEETS -YES
TAKE INTO ACCOUNT TOTAL DELAY -NO
OVERTAKES -YES
HOLD OUTAGES FOR TRAINS ALREADY ON LINE -YES
LIST WORK FILE -NO
PRINT FRONT END REPORTS -YES
TRAIN TIMES DURING PLOT -NO
```

27.3Ø	273Ø	S47S 2Ø	P	2876	2876	Ø	Ø	S	999999
26.6Ø	266Ø	S48	S	4142Ø	Ø	Ø	Ø	S	Ø
18.6Ø	186Ø	S49S 21	P	6Ø44	5544	Ø	Ø	S	999999
17.3Ø	173Ø	S5Ø	S	4142Ø	Ø	Ø	Ø	S	Ø
9.3Ø	93Ø	S51S 22	P	6Ø44	6Ø44	Ø	Ø	S	2ØØØ
8.ØØ	8ØØ	S52	S	4142Ø	Ø	Ø	Ø	S	Ø

LINK DATA COMPUTED AND/OR OVERIDDEN

SWITCH MPOST	TRUE DIST	NAME	TRACK TO E	LENGTH MAIN	SIDING LENGTH	NORTH LENGTH	SOUTH LENGTH	CROSS OVER	SIDING WEIGHT
278.50	27850	S1WT RM	D	48548	0	48548	48548	X	0
269.15	26915	S2	S	41420	0	0	0	S	0
261.15	26115	S3S1	P	6044	6044	0	0	S	999999
259.85	25985	S4	S	41420	0	0	0	S	0
251.85	25185	S5S2	P	6044	6044	0	0	S	999999
250.55	25055	S6	S	41420	0	0	0	S	0
242.55	24255	S7S3	P	6044	6044	0	0	S	999999
241.25	24125	S8	S	41420	0	0	0	S	0
233.25	23325	S9S4	P	6044	6044	0	0	S	999999
231.95	23195	S10	S	41420	0	0	0	S	0
223.95	22395	S11D T2	D	55148	0	55148	55148	S	0
213.35	21335	S12	S	41420	0	0	0	S	0
205.35	20535	S13S 5	P	6044	6044	0	0	S	999999
204.05	20405	S14	S	41420	0	0	0	S	0
196.05	19605	S15S 6	P	6044	6044	0	0	S	999999
194.75	19475	S16	S	41420	0	0	0	S	0
186.75	18675	S17S 7	P	6044	6044	0	0	S	999999
185.45	18545	S18	S	41420	0	0	0	S	0
177.45	17745	S19S 8	P	6044	6044	0	0	S	999999
176.15	17615	S20	S	41420	0	0	0	S	0
168.15	16815	S21D T3	D	76268	0	76268	76268	S	0
153.55	15355	S22X OV	D	69404	0	69404	69404	EN	0
140.25	14025	S23W ITRM	T	9740	0	0	0	X	0
138.25	13825	S24E ITRM	S	41684	0	0	0	S	0
130.20	13020	S25S 9	P	6044	6044	0	0	S	999999
128.90	12890	S26	S	41420	0	0	0	S	0
120.90	12090	S27S 10	P	6044	6044	0	0	S	999999
119.60	11960	S28	S	41420	0	0	0	S	0
111.60	11160	S29S 11	P	6044	6044	0	0	S	999999
110.30	11030	S30	S	41420	0	0	0	S	0
102.30	10230	S31S 12	P	6044	6044	0	0	S	999999
101.00	10100	S32	S	41420	0	0	0	S	0
93.00	9300	S33S 13	P	6044	6044	0	0	S	999999
91.70	9170	S34	S	41420	0	0	0	S	0
83.70	8370	S35S 14	P	6044	6044	0	0	S	999999
82.40	8240	S36	S	41420	0	0	0	S	0
74.40	7440	S37S 15	P	6044	6044	0	0	S	999999
73.10	7310	S38	S	41420	0	0	0	S	0
65.10	6510	S39S 16	P	6044	6044	0	0	S	999999
63.80	6380	S40	S	41420	0	0	0	S	0
55.80	5580	S41S 17	P	6044	6044	0	0	S	999999
54.50	5450	S42	S	41420	0	0	0	S	0
46.50	4650	S43S 18	P	6044	6044	0	0	S	999999
45.20	4520	S44	S	41420	0	0	0	S	0
37.20	3720	S45S 19	P	6044	6044	0	0	S	999999
35.90	3590	S46	S	44588	0	0	0	S	0

Calculate Siding Length.

[(N. Switch MP − S. Switch MP) × 5,280 FT/MI] − 820 ⇒

ex. (37.20 − 35.90) 5,280 − 820 ⇒ 6,044 FT

1.3

6,864

TRAIN DATA FROM THE TPS FILES

SPEED CLASS	DIR.	TPS COL	TYPE	W:P RATIO	LENGTH (FT)	GROSS TONS	TRAILING TONS	AV CAR WEIGHT	EQUIV. #UNITS
THOP AEØ2	1	1	P	.2Ø	1525	15Ø4	112Ø	7Ø.ØØ	2.5
THOE XEØ5	1	2	E	.5Ø	5949	449Ø	39Ø5	55.ØØ	3.Ø
THOF RE1Ø	1	6	F	1.ØØ	5898	597Ø	558Ø	6Ø.ØØ	2.Ø
THOF UEØ3	1	8	U	.3Ø	59Ø4	36ØØ	282Ø	3Ø.ØØ	4.Ø
THOP AWØ2	2	1	P	.2Ø	1525	15Ø4	112Ø	7Ø.ØØ	2.5
THOE XWØ5	2	2	E	.5Ø	5949	449Ø	39Ø5	55.ØØ	3.Ø
THOF RW1Ø	2	6	F	1.ØØ	5398	597Ø	558Ø	6Ø.ØØ	2.Ø
THOF UW12	2	1Ø	U	1.2Ø	5934	1443Ø	1365Ø	13Ø.ØØ	4.Ø

TRAFFIC VOLUME

SEGMENT		NO TRAINS DAILY		ANNUAL GROSS TONS(M)	
FROM	TO	EASTBOUND	WESTBOUND	EASTBOUND	WESTBOUND
273.5Ø	14Ø.25	11	9	15.47	2Ø.93
138.25	93.ØØ	11	9	15.47	2Ø.93
93.ØØ	Ø.	1Ø	8	15.Ø1	2Ø.53

```
*****************************************************************************
***     C A N A D I A N   N A T I O N A L   R A I L W A Y S     ***
***        R O U T E   C A P A C I T Y   M O D E L               ***
*****************************************************************************
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VERSION OF OCT. 14,1981

DEMONSTRATION

ERROR COUNT =   Ø
WARNING COUNT =   2

SIMULATION WILL RUN FOR   1Ø DAYS

OPTIONS IN EFFECT FOR THIS RUN: LOPT OVER HOLD OUTAGES

NO COMMANDS FOR THIS SIMULATION RUN

INPUT COMPLETED

USING BATCH SIZE OF   9 TRAINS

```
OUTAGE TIES      IS COMMENCING ON LINK   6 AT      34.00 HOURS

OUTAGE SID18OUT ON TRACK  2 OF LINK  43 ENDING AT      36.00 HOURS

SYSTEM STATUS AT   1.50 DAYS

LINK  6 S ALL TRACKS OUT OF SERVICE
LINK 32 S XD67 (E-GO  -ON 1)
LINK 39 P UK75 (W-GO  -ON 2)
LINK 41 P FI13 (E-FOR -ON 2) PAS1 (W-HEAD-ON 1)
LINK 45 P FI22 (E-FOR -ON 1)
LINK 46 S UK76 (W-GO  -ON 1)

THERE ARE   2 TRAINS WAITING TO GO WEST ON THE FIRST    SUBDIVISION

AVERAGE DELAY PER TRAIN SO FAR      1.14  HOURS

10.00 MPH SLOW ORDER ON SWITCH AT MILEAGE   46.50 ENDING AT    36.0000
PAS1 IS AHEAD OF UK74 WHICH ATTEMPTED TO RELEASE

TRAIN PAS1 RELEASED BY FIX.TERMINAL.Q AT  38.16

INTTRM   TERMINAL FULL:   PAS1 BYPASSING OUTAGE CHECK AT     38.16 HOURS

TRAIN PAS1 HAS ALREADY BEEN DISPATCHED TO LINK   22

OUTAGE TIES      ON TRACK 99 OF LINK   6 ENDING AT      40.00 HOURS

BEGINNING 20.00 MPH SLOW ORDER - SO.1 ON TRACK  1 BETWEEN MILEAGES   51.00 AND   48.00 AT TIME   44.0000 HOURS

ENDING 15.00 MPH SLOW ORDER - SO.2 ON TRACK  1 BETWEEN MILEAGES  123.50 AND  122.90 AT TIME   44.0000 HOURS

SYSTEM STATUS AT   2.00 DAYS

LINK 11 D UB79 (E-GO  -ON 1)

AVERAGE DELAY PER TRAIN SO FAR      1.89  HOURS

ENDING 20.00 MPH SLOW ORDER - SO.1 ON TRACK  1 BETWEEN MILEAGES   51.00 AND   48.00 AT TIME   56.0000 HOURS

SYSTEM STATUS AT   2.50 DAYS

LINK 11 D XD85 (W-GO  -ON 2)
LINK 28 S PAS1 (W-GO  -ON 1)
LINK 30 S FI34 (W-GO  -ON 1)
LINK 33 P UK89 (W-GO  -ON 1)
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LINK 44 S XD82 (E-GO  -ON 1)


AVERAGE DELAY PER TRAIN SO FAR     1.69  HOURS

SYSTEM STATUS AT   3.00 DAYS

LINK  4 S UB91 (E-GO  -ON 1)
LINK  6 S FI 3 (E-GO  -ON 1)
LINK 10 S FI30 (W-GO  -ON 1)
LINK 24 S FI12 (E-GO  -ON 1)


AVERAGE DELAY PER TRAIN SO FAR     1.56  HOURS

OUTAGE P811     ON LINK  22 DELAYED AT     78.00 HOURS

OUTAGE P811     ON LINK  22 DELAYED AT     78.00 HOURS

OUTAGE P811     ON LINK  22 DELAYED AT     78.01 HOURS

OUTAGE P811     ON LINK  22 DELAYED AT     78.02 HOURS

OUTAGE P811     ON LINK  22 DELAYED AT     78.06 HOURS

OUTAGE P811     ON LINK  22 DELAYED AT     78.06 HOURS

OUTAGE P811     ON LINK  22 DELAYED AT     78.12 HOURS

OUTAGE P811     ON LINK  22 DELAYED AT     78.13 HOURS

OUTAGE P811     ON LINK  22 DELAYED AT     78.13 HOURS

OUTAGE P811     ON LINK  22 DELAYED AT     78.14 HOURS

OUTAGE P811     ON LINK  22 DELAYED AT     78.16 HOURS

OUTAGE P811     ON LINK  22 DELAYED AT     78.17 HOURS

OUTAGE P811     ON LINK  22 DELAYED AT     78.17 HOURS
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OUTAGE P811     IS COMMENCING ON LINK  22 AT     78.18 HOURS

OUTAGE P811     ON TRACK  2 OF LINK  22 ENDING AT     82.ØØ HOURS

SYSTEM STATUS AT   3.5Ø DAYS

LINK 21 D FI17 (E-GO  -ON 1)
LINK 24 S PAS1 (W-GO  -ON 1)
LINK 29 P XD94 (E-GO  -ON 1)
LINK 34 S FI 9 (E-GO  -ON 1)
LINK 43 P FI18 (E-GO  -ON 1)
LINK 48 S FI 8 (E-GO  -ON 1)


AVERAGE DELAY PER TRAIN SO FAR     1.55  HOURS

SYSTEM STATUS AT   4.ØØ DAYS


AVERAGE DELAY PER TRAIN SO FAR     1.46  HOURS

SYSTEM STATUS AT   4.5Ø DAYS

LINK 18 S XD 9 (W-GO  -ON 1)
LINK 38 S PAS2 (E-GO  -ON 1)
LINK 44 S XD 6 (E-GO  -ON 1)
LINK 5Ø S FI 5 (E-GO  -ON 1)


AVERAGE DELAY PER TRAIN SO FAR     1.41  HOURS

SYSTEM STATUS AT   5.ØØ DAYS

LINK 18 S UB13 (E-GO  -ON 1)
LINK 44 S FI 4 (E-GO  -ON 1)


AVERAGE DELAY PER TRAIN SO FAR     1.32  HOURS

TIME =      5.27     TRAINS =       99          AVG. DELAY =    1.3Ø
SYSTEM STATUS AT   5.5Ø DAYS

LINK  4 S FI19 (E-GO  -ON 1)
LINK  6 S UK24 (W-GO  -ON 1)
LINK  8 S XD19 (W-GO  -ON 1)
LINK 1Ø S FI25 (E-GO  -ON 1)
LINK 21 D UB25 (E-GO  -ON 1)
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LINK 22 D FI 7 (E-GO  -ON 1)
LINK 32 S FAS2 (E-GO  -ON 1)
LINK 33 P FI47 (W-FOR -ON 2)
LINK 38 S XD16 (E-GO  -ON 1)
LINK 45 P FI32 (W-GO  -ON 1)
LINK 5Ø S UK26 (W-GO  -ON 1)


AVERAGE DELAY PER TRAIN SO FAR      1.3Ø  HOURS

SYSTEM STATUS AT   6.ØØ DAYS



AVERAGE DELAY PER TRAIN SO FAR      1.25  HOURS

SYSTEM STATUS AT   6.5Ø DAYS

LINK 11 D FI39 (W-GO  -ON 2)
LINK 22 D FI43 (W-GO  -ON 2)
LINK 38 S PAS2 (E-GO  -ON 1)
LINK 42 S XD3Ø (E-GO  -ON 1)
LINK 46 S UB38 (E-GO  -ON 1)


AVERAGE DELAY PER TRAIN SO FAR      1.23  HOURS

 168.ØØØØ PLOT ENDS
 PLOT COMPLETED AT  168.ØØØØ HOURS
     SUMMARY OF TRAINS GENERATED FOR WEEK   2
     ========================================
DAY XDE5 XDW5 FIEØ FIWØ UBE3 UKW2
 1     Ø    Ø    4    7    Ø    Ø
 2     Ø    Ø    6    2    Ø    Ø
 3     Ø    Ø    1    2    Ø    Ø
 4     Ø    Ø    5    3    Ø    Ø
 5     Ø    Ø    1    2    Ø    Ø
 6     Ø    Ø    9    2    Ø    Ø
 7     Ø    Ø    2    3    Ø    Ø

SYSTEM STATUS AT   7.ØØ DAYS

LINK 11 D UB39 (E-GO  -ON 1)


AVERAGE DELAY PER TRAIN SO FAR      1.2Ø  HOURS

SYSTEM STATUS AT   7.5Ø DAYS

LINK  1 D FI81 (W-GO  -ON 2)
LINK  4 S FI72 (W-GO  -ON 1)
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```
LINK 10 S FI55 (E-GO  -ON 1)
LINK 14 S FI85 (W-GO  -ON 1)
LINK 18 S U3 [illegible] (E-GO  -ON 1)
LINK 21 D FI66 (E-GO  -ON 1) XD94 (W-GO  -ON 2)
LINK 49 P XD91 (E-GO  -ON 1)

THERE ARE   2 TRAINS WAITING TO GO EAST ON THE SECOND   SUBDIVISION

AVERAGE DELAY PER TRAIN SO FAR      1.17  HOURS

TRAIN PAS2 RELEASED BY FIX.TERMINAL.Q AT 180.33
SYSTEM STATUS AT   8.00 DAYS

LINK 16 S FI86 (W-GO  -ON 1)
LINK 48 S SLOW (E-GO  -ON 1)


AVERAGE DELAY PER TRAIN SO FAR      1.19  HOURS

SYSTEM STATUS AT   8.50 DAYS

LINK 12 S XD10 (W-GO  -ON 1)
LINK 36 S XD 7 (E-GO  -ON 1)
LINK 51 P XD 6 (E-GO  -ON 1)
LINK 52 S UB14 (E-GO  -ON 1)


AVERAGE DELAY PER TRAIN SO FAR      1.18  HOURS

SYSTEM STATUS AT   9.00 DAYS

LINK  1 D FI71 (W-GO  -ON 2)
LINK 25 P FI64 (E-GO  -ON 1)


AVERAGE DELAY PER TRAIN SO FAR      1.15  HOURS

SYSTEM STATUS AT   9.50 DAYS

LINK  6 S XD22 (W-GO  -ON 1)
LINK 21 D PAS1 (W-GO  -ON 2)
LINK 24 S UB27 (E-GO  -ON 1)
LINK 46 S XD19 (E-GO  -ON 1)


AVERAGE DELAY PER TRAIN SO FAR      1.13  HOURS
```

SCHEDULED TRAINS WITH INTERNAL TRAIN IDENTIFICATION

SCHEDULE	1	2	3	4	5	6	7	8	9	10
PAS1	0	71	86	98	0	0	0	0	211	223
PAS9	56	72	87	99	110	120	134	195	212	224
PAS2	57	0	0	0	111	121	135	196	0	0
PAS8	58	73	88	100	112	122	136	197	213	225
PAS4	59	0	0	0	0	0	0	198	0	0
SLOW	60	0	0	0	0	0	0	199	0	0

SUMMARY STATISTICS FOR TRAINS ON THE FIRST SUBDIVISION

GROUP TRAINS

GROUP	SPEED CLASS	ORIG - DEST	AVERAGE RUNNING TIME	MAX RUNNING TIME	RUNNING TIME STD DEV	AVERAGE SCHEDULED DELAY	AVERAGE OFFLINE DELAY	AVERAGE ONLINE DELAY	AVERAGE TOTAL DELAY	MAX TOTAL DELAY	AVERAGE SPEED (MPH)	NUMBER OF TRAINS
XDE5	THOEXEØ5	1-53	2.45	3.36	.29	Ø.	.Ø1	.26	.27	1.18	56.33	27
XDW5	THOEXWØ5	53- 1	2.65	6.Ø5	.74	Ø.	.15	.25	.4Ø	3.8Ø	52.23	27
FIEØ	THOFRE1Ø	1-53	3.64	6.64	.72	Ø.	.11	.63	.74	3.75	37.98	36
FIWØ	THOFRW1Ø	53- 1	3.45	4.67	.52	Ø.	Ø.	.5Ø	.5Ø	1.73	4Ø.Ø6	29
UBE3	THOFUEØ3	1-53	3.Ø6	5.8Ø	.94	Ø.	.17	.56	.72	3.47	45.19	19
UKW2	THOFUW12	53- 1	3.8Ø	1Ø.24	1.77	Ø.	.45	.51	.96	7.39	36.37	15

* THE FOLLOWING AGGREGATE STATISTICS EXCLUDE TRAINS THAT ENTER OR LEAVE THE SUBDIVISION AT JUNCTIONS.

	AVERAGE RUNNING TIME	MAX RUNNING TIME	AVERAGE OFFLINE DELAY	AVERAGE ONLINE DELAY	AVERAGE TOTAL DELAY	MAX TOTAL DELAY	NUMBER OF TRAINS
EASTBOUND AGGREGATE	3.12	6.64	.Ø9	.49	.58	3.75	82
WESTBOUND AGGREGATE	3.22	1Ø.24	.15	.41	.56	7.39	71
GRAND AGGREGATE	3.16		.12	.45	.57		153

SCHEDULE TRAINS

SCHED	SPEED CLASS	ORIG - DEST	AVERAGE RUNNING TIME	MAX RUNNING TIME	RUNNING TIME STD DEV	AVERAGE SCHEDULED DELAY	AVERAGE OFFLINE DELAY	AVERAGE ONLINE DELAY	AVERAGE TOTAL DELAY	MAX TOTAL DELAY	AVERAGE SPEED (MPH)	NUMBER OF TRAINS
PAS1	THOPAWØ2	53- 1	2.Ø2	2.84	.41	.17	.11	.28	.4Ø	1.22	68.56	5
PAS9	THOPAWØ2	33- 1	1.93	2.1Ø	.Ø8	.18	Ø.	.31	.31	.48	71.62	1Ø
PAS2	THOPAEØ2	1-53	2.21	3.19	.57	.18	Ø.	.61	.61	1.59	62.54	4
PAS8	THOPAEØ2	1-33	1.92	2.29	.15	.18	.Ø1	.3Ø	.31	.69	72.16	1Ø
PAS4	THOPAEØ2	1-33	1.78	1.81	.Ø3	.14	Ø.	.18	.18	.2Ø	77.71	2
SLOW	THOFRE1Ø	1-53	4.Ø8	4.13	.Ø5	.82	Ø.	1.18	1.18	1.23	33.88	2

* THE FOLLOWING AGGREGATE STATISTICS EXCLUDE TRAINS THAT ENTER OR LEAVE THE SUBDIVISION AT JUNCTIONS.

	AVERAGE RUNNING TIME	MAX RUNNING TIME	AVERAGE OFFLINE DELAY	AVERAGE ONLINE DELAY	AVERAGE TOTAL DELAY	MAX TOTAL DELAY	NUMBER OF TRAINS
EASTBOUND AGGREGATE	2.21	4.13	.Ø1	.45	.46	1.59	18
WESTBOUND AGGREGATE	1.96	2.84	.Ø4	.3Ø	.34	1.22	15
GRAND AGGREGATE	2.Ø9		.Ø2	.38	.41		33

* THE FOLLOWING STATISTICS INCLUDE JUNCTION TRAINS:
* DELAY/TRAIN-MILE DOES NOT INCLUDE SCHEDULED DELAY.

DELAY PER TRAIN MILE FOR EASTBOUND TRAINS : .ØØ374 HOURS
DELAY PER TRAIN MILE FOR WESTBOUND TRAINS : .ØØ355 HOURS
=========
DELAY PER TRAIN MILE FOR ALL TRAINS : .ØØ365 HOURS

AVERAGE SPEED FOR EASTBOUND TRAINS : 46.84 MPH

AVERAGE SPEED FOR WESTBOUND TRAINS :	46.Ø9	MPH
	=========	
AVERAGE SPEED FOR ALL TRAINS :	46.49	MPH

SUMMARY STATISTICS FOR TRAINS ON THE SECOND SUBDIVISION

GROUP TRAINS

GROUP	SPEED CLASS	ORIG - DEST	AVERAGE RUNNING TIME	MAX RUNNING TIME	RUNNING TIME STD DEV	AVERAGE SCHEDULED DELAY	AVERAGE OFFLINE DELAY	AVERAGE ONLINE DELAY	AVERAGE TOTAL DELAY	MAX TOTAL DELAY	AVERAGE SPEED (MPH)	NUMBER OF TRAINS
XDE5	THOEXE05	1-53	2.71	3.88	.39	0.	.03	.44	.47	1.63	50.92	28
XDW5	THOEXW05	53- 1	2.49	3.55	.34	0.	.10	.20	.31	1.36	55.52	27
FIE0	THOFRE10	1-53	3.71	5.11	.55	0.	.06	.70	.76	2.16	37.30	39
FIW3	THOFRW10	53- 1	3.54	5.13	.58	0.	.18	.46	.64	2.24	39.04	29
UBE3	THOFUE03	1-53	3.08	4.58	.56	0.	.04	.64	.68	2.19	44.90	19
UKW2	THOFUW12	53- 1	3.71	4.99	.67	0.	.24	.68	.92	2.20	37.27	16

* THE FOLLOWING AGGREGATE STATISTICS EXCLUDE TRAINS THAT ENTER OR LEAVE THE SUBDIVISION AT JUNCTIONS.

	AVERAGE RUNNING TIME	MAX RUNNING TIME	AVERAGE OFFLINE DELAY	AVERAGE ONLINE DELAY	AVERAGE TOTAL DELAY	MAX TOTAL DELAY	NUMBER OF TRAINS
EASTBOUND AGGREGATE	3.25	5.11	.05	.60	.65	2.19	86
WESTBOUND AGGREGATE	3.18	5.13	.17	.41	.58	2.24	72
GRAND AGGREGATE	3.22		.10	.52	.62		158

SCHEDULE TRAINS

SCHED	SPEED CLASS	ORIG - DEST	AVERAGE RUNNING TIME	MAX RUNNING TIME	RUNNING TIME STD DEV	AVERAGE SCHEDULED DELAY	AVERAGE OFFLINE DELAY	AVERAGE ONLINE DELAY	AVERAGE TOTAL DELAY	MAX TOTAL DELAY	AVERAGE SPEED (MPH)	NUMBER OF TRAINS
PAS1	THOPAW02	53- 1	2.32	2.80	.38	0.	.06	.66	.72	1.19	59.67	5
PAS9	THOPAW02	33- 1	.65	.87	.13	0.	.01	.13	.14	.36	69.11	10
PAS2	THOPAE02	1-53	1.85	2.00	.12	0.	.03	.19	.23	.38	74.92	4
PAS8	THOPAE02	1-33	.68	1.04	.17	0.	.03	.07	.10	.47	66.92	10
PAS4	THOPAE02	1-33	.72	.75	.03	0.	0.	.14	.14	.18	63.00	2
SLOW	THOFRE10	1-53	3.01	3.06	.06	0.	0.	.06	.06	.12	46.00	2

* THE FOLLOWING AGGREGATE STATISTICS EXCLUDE TRAINS THAT ENTER OR LEAVE THE SUBDIVISION AT JUNCTIONS.

	AVERAGE RUNNING TIME	MAX RUNNING TIME	AVERAGE OFFLINE DELAY	AVERAGE ONLINE DELAY	AVERAGE TOTAL DELAY	MAX TOTAL DELAY	NUMBER OF TRAINS
EASTBOUND AGGREGATE	2.23	3.06	.02	.15	.17	.38	6
WESTBOUND AGGREGATE	2.32	2.80	.06	.66	.72	1.19	5
GRAND AGGREGATE	2.27		.04	.38	.42		11

* THE FOLLOWING STATISTICS INCLUDE JUNCTION TRAINS:
* DELAY/TRAIN-MILE DOES NOT INCLUDE SCHEDULED DELAY.

DELAY PER TRAIN MILE FOR EASTBOUND TRAINS : .00437 HOURS
DELAY PER TRAIN MILE FOR WESTBOUND TRAINS : .00421 HOURS

DELAY PER TRAIN MILE FOR ALL TRAINS : .00430 HOURS

AVERAGE SPEED FOR EASTBOUND TRAINS : 44.11 MPH

AVERAGE SPEED FOR WESTBOUND TRAINS :	44.86	MPH
	=========	
AVERAGE SPEED FOR ALL TRAINS :	44.45	MPH

PLANT PERFORMANCE - FIRST

LINK WESTERN MP	AVG DELAY ON MAIN (IN HOURS/DAY)	AVG DELAY IN SIDINGS (IN HOURS/DAY)
AVERAGE DAILY DELAY EASTBOUND AT WTRM TERMINAL: .81 HOURS/DAY		
278.50	.22	0.
269.15	.00	0.
261.15	0.	.21
259.85	.03	0.
251.85	0.	.14
250.55	.00	0.
242.55	0.	.18
241.25	.00	0.
233.25	0.	.23
231.95	.00	0.
223.95	.70	0.
213.35	.06	0.
205.35	0.	.16
204.05	.00	0.
196.05	0.	.23
194.75	.00	0.
186.75	0.	.21
185.45	.02	0.
177.45	0.	.30
176.15	.00	0.
168.15	.14	0.
153.55	.00	0.
AVERAGE DAILY DELAY WESTBOUND AT INTTRM TERMINAL: 1.19 HOURS/DAY		

PLANT PERFORMANCE - SECOND

LINK WESTERN MP	AVG DELAY ON MAIN (IN HOURS/DAY)	AVG DELAY IN SIDINGS (IN HOURS/DAY)
AVERAGE DAILY DELAY EASTBOUND AT INTTRM TERMINAL: .40 HOURS/DAY		
138.25	.00	0.
130.20	0.	.08
128.90	.00	0.
120.90	0.	.22
119.60	.00	0.
111.60	0.	.27
110.30	.00	0.
102.30	0.	.19
101.00	.00	0.
93.00	0.	.22
91.70	.00	0.
83.70	0.	.16
82.40	.00	0.
74.40	0.	.22
73.10	.03	0.
65.10	0.	.14
63.80	.00	0.
55.80	0.	.29
54.50	.03	0.
46.50	0.	.29
45.20	.03	0.
37.20	0.	.81
35.90	.00	0.
27.30	0.	.04
26.60	.00	0.
18.60	0.	0.
17.30	.01	0.
9.30	0.	0.
8.00	.00	0.
AVERAGE DAILY DELAY WESTBOUND AT ETRM TERMINAL: 1.32 HOURS/DAY		
ONLINE TOTALS	1.25	4.57

TERMINAL STATISTICS

NAME	CAPACITY			AVERAGE NO. OF TRAINS			MAXIMUM NO. OF TRAINS			STANDARD DEVIATION			AVERAGE WAIT TIME		MAXIMUM WAIT TIME		STANDARD DEVIATION	
	EAST	WEST	ALL	E	W	ALL	E	W	ALL	E	W	ALL	EAST	WEST	EAST	WEST	EAST	WEST
WTRM	5	Ø	5	.Ø	Ø.	.Ø	3	Ø	3	.3	Ø.	.3	.64	Ø.	3.Ø7	Ø.	1.1Ø	Ø.
INTTRM	2	3	4	.4	.4	.9	4	4	6	.6	.7	1.Ø	.Ø4	.13	.56	6.68	.Ø9	.81
ETRM	Ø	6	6	Ø.	.1	.1	Ø	3	3	Ø.	.3	.3	Ø.	.4Ø	Ø.	.85	Ø.	.26

OCCUPANCY DISTRIBUTION FOR WTRM TERMINAL

NO. OF TRAINS IN TERMINAL	% OF TIME EAST BOUNDS	CUMULATIVE % EAST BOUNDS	% OF TIME WEST BOUNDS	CUMULATIVE % WEST BOUNDS	% OF TIME ALL TRAINS	CUMULATIVE % ALL TRAINS
0	98.29	98.29	100.00	100.00	98.29	98.29
1	.41	98.70			.41	98.70
2	.95	99.65			.95	99.65
3	.35	100.00			.35	100.00

DISTRIBUTION OF DELAYS TO EASTBOUND TRAINS AT WTRM TERMINAL

```
TIME IN TERMINAL              NO. OF TRAINS
----------------              -------------

                       5
 Ø.    -  .17   *********
  .17 -  .33
  .33 -  .5Ø
  .5Ø -  .67
  .67 -  .83
  .83 - 1.ØØ
 1.ØØ - 1.17   *
 1.17 - 1.33
 1.33 - 1.5Ø
 1.5Ø - 1.67
 1.67 - 1.83
 1.83 - 2.ØØ
 2.ØØ - 2.17
 2.17 - 2.33
 2.33 - 2.5Ø
 2.5Ø - 2.67
 2.67 - 2.83
 2.83 - 3.ØØ   *
 3.ØØ - 3.17   *
```

EACH '*' REPRESENTS 1 TRAIN(S).

THE MEDIAN OF 12 TRAINS IS APPROXIMATELY .111 HOURS

OCCUPANCY DISTRIBUTION FOR INTTRM TERMINAL

NO. OF TRAINS IN TERMINAL	% OF TIME EAST BOUNDS	CUMULATIVE % EAST BOUNDS	% OF TIME WEST BOUNDS	CUMULATIVE % WEST BOUNDS	% OF TIME ALL TRAINS	CUMULATIVE % ALL TRAINS
Ø	63.Ø8	63.Ø8	65.52	65.52	44.35	44.35
1	31.13	94.21	26.55	92.Ø7	32.25	76.61
2	5.26	99.48	6.32	98.39	16.77	93.37
3	.38	99.86	1.61	1ØØ.ØØ	5.18	98.55
4	.14	1ØØ.ØØ			1.21	99.77
5					.18	99.95
6					.Ø5	1ØØ.ØØ

DISTRIBUTION OF DELAYS TO EASTBOUND TRAINS AT INTTRM   TERMINAL

```
TIME IN TERMINAL             NO. OF TRAINS

                        5    10    15    20    25    30    35    40    45    50    55    60    65    70    75    80    85    90
 0.    -  .17  *******************************************************************************************
  .17 -  .33  *******
  .33 -  .50  *
  .50 -  .67  *

EACH '*' REPRESENTS  1 TRAIN(S).

THE MEDIAN OF   100 TRAINS IS APPROXIMATELY      .092 HOURS
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         DISTRIBUTION OF DELAYS TO WESTBOUND TRAINS AT INTTRM   TERMINAL
         ----------------------------------------------------------------

TIME IN TERMINAL               NO. OF TRAINS
----------------               -------------

                      5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
  Ø.    -  .33   ************************************************************************************
   .33 -  .67   *
   .67 - 1.ØØ
  1.ØØ - 1.33
  1.33 - 1.67
  1.67 - 2.ØØ
  2.ØØ - 2.33
  2.33 - 2.67
  2.67 - 3.ØØ
  3.ØØ - 3.33
  3.33 - 3.67
  3.67 - 4.ØØ   *
  4.ØØ - 4.33
  4.33 - 4.67
  4.67 - 5.ØØ
  5.ØØ - 5.33
  5.33 - 5.67
  5.67 - 6.ØØ
  6.ØØ - 6.33
  6.33 - 6.67
  6.67 - 6.83   *

EACH '*' REPRESENTS  1 TRAIN(S).

THE MEDIAN OF    87 TRAINS IS APPROXIMATELY      .Ø86 HOURS
```

OCCUPANCY DISTRIBUTION FOR ETRM   TERMINAL

NO. OF TRAINS IN TERMINAL	% OF TIME EAST BOUNDS	CUMULATIVE % EAST BOUNDS	% OF TIME WEST BOUNDS	CUMULATIVE % WEST BOUNDS	% OF TIME ALL TRAINS	CUMULATIVE % ALL TRAINS
Ø	1ØØ.ØØ	1ØØ.ØØ	95.54	95.54	95.54	95.54
1			3.58	99.12	3.58	99.12
2			.74	99.86	.74	99.86
3			.14	1ØØ.ØØ	.14	1ØØ.ØØ

DISTRIBUTION OF DELAYS TO WESTBOUND TRAINS AT ETRM TERMINAL

```
TIME IN TERMINAL             NO. OF TRAINS
----------------             -------------

                    5
 Ø.    -   .17  *********
  .17 -   .33  ******
  .33 -   .5Ø  ****
  .5Ø -   .67  ********
  .67 -   .83  *****
  .83 - 1.ØØ  *

EACH '*' REPRESENTS  1 TRAIN(S).

THE MEDIAN OF    31 TRAINS IS APPROXIMATELY      .375 HOURS
```

CREW STATISTICS FOR THE FIRST SUBDIVISION

SEGMENT RUNNING TIMES IN HOURS	NO. OF TRAINS	% OF TRAINS	CUM % OF TRAINS
Ø TO 1	Ø	Ø.	Ø.
1 TO 2	26	13.98	13.98
2 TO 3	84	45.16	59.14
3 TO 4	58	31.18	9Ø.32
4 TO 5	14	7.53	97.85
5 TO 6	1	.54	98.39
6 TO 7	2	1.Ø8	99.46
7 TO 8	Ø	Ø.	99.46
8 TO 9	Ø	Ø.	99.46
9 TO 1Ø	Ø	Ø.	99.46
1Ø TO 11	1	.54	1ØØ.ØØ

NUMBER OF TRAINS ANALYZED: 186

CREW STATISTICS FOR THE SECOND SUBDIVISION

SEGMENT RUNNING TIMES IN HOURS	NO. OF TRAINS	% OF TRAINS	CUM % OF TRAINS
Ø TO 1	21	1Ø.99	1Ø.99
1 TO 2	6	3.14	14.14
2 TO 3	71	37.17	51.31
3 TO 4	7Ø	36.65	87.96
4 TO 5	21	1Ø.99	98.95
5 TO 6	2	1.Ø5	1ØØ.ØØ

NUMBER OF TRAINS ANALYZED: 191

DAILY STATISTICS

DISTRIBUTION OF AVERAGE DELAY BY DAYS

DELAY INTERVAL IN MINUTES	NUMBER OF DAYS
20.0 TO 30.0	1
30.0 TO 40.0	0
40.0 TO 50.0	0
50.0 TO 60.0	3
60.0 TO 70.0	2
70.0 TO 80.0	1
80.0 TO 90.0	0
90.0 TO 100.0	0
100.0 TO 110.0	0
110.0 TO 120.0	1

MEET STATISTICS FOR PASSING LINKS ON THE FIRST SUBDIVISION

AVERAGE NUMBER OF MEETS PER DISPATCHING SHIFT = 5.77

DISTRIBUTION OF AVERAGE MEETS PER SHIFT

MEETS PER SHIFTS	NUMBER OF SHIFTS	% OF SHIFTS	CUM % OF SHIFTS
1 TO 5	18	69.23	69.23
6 TO 1Ø	3	11.54	8Ø.77
11 TO 15	2	7.69	88.46
16 TO 2Ø	1	3.85	92.31
21 TO 25	Ø	Ø.	92.31
26 TO 3Ø	2	7.69	1ØØ.ØØ

MEET STATISTICS FOR PASSING LINKS ON THE SECOND SUBDIVISION

AVERAGE NUMBER OF MEETS PER DISPATCHING SHIFT = 7.00

DISTRIBUTION OF AVERAGE MEETS PER SHIFT

MEETS PER SHIFTS	NUMBER OF SHIFTS	% OF SHIFTS	CUM % OF SHIFTS
1 TO 5	11	42.31	42.31
6 TO 10	7	26.92	69.23
11 TO 15	3	11.54	80.77
16 TO 20	5	19.23	100.00

DISTRIBUTION OF DELAYS FOR THE FIRST SUBDIVISION

```
TOTAL DELAY (HOURS)            NO. OF EASTBOUND TRAINS

                        5    10   15   20   25   30   35   40
 0.    -  .25  EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE
  .25  -  .50  EEEEEEEEEEEEEEEEEEEEEEE
  .50  -  .75  EEEEEEEEEEEEEE
  .75  - 1.00  EEEEEE
 1.00  - 1.25  EEE
 1.25  - 1.50  EEEE
 1.50  - 1.75  EE
 1.75  - 2.00  EE
 2.00  - 2.25  EE
 2.25  - 2.50
 2.50  - 2.75
 2.75  - 3.00
 3.00  - 3.25
 3.25  - 3.50  E
 3.50  - 3.75  E
 3.75  - 4.00
 4.00  - 4.25
 4.25  - 4.50
 4.50  - 4.75
 4.75  - 5.00
 5.00  - 5.25
 5.25  - 5.50
 5.50  - 5.75
 5.75  - 6.00
 6.00  - 6.25
 6.25  - 6.50
 6.50  - 6.75
 6.75  - 7.00
 7.00  - 7.25
 7.25  - 7.50
```

EACH 'E' REPRESENTS 1 TRAIN(S).

THE MEDIAN OF 100 TRAINS IS APPROXIMATELY .337 HOURS

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                    DISTRIBUTION OF DELAYS FOR THE FIRST    SUBDIVISION
                    ---------------------------------------------------

TOTAL DELAY (HOURS)            NO. OF WESTBOUND TRAINS

                            5    1Ø    15    2Ø    25    3Ø    35    4Ø    45    5Ø    55    6Ø
 Ø.    -  .5Ø  WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW
  .5Ø  - 1.ØØ  WWWWWWWWWWWWWWWW
 1.ØØ  - 1.5Ø  WWWWW
 1.5Ø  - 2.ØØ  WWW
 2.ØØ  - 2.5Ø
 2.5Ø  - 3.ØØ
 3.ØØ  - 3.5Ø
 3.5Ø  - 4.ØØ  W
 4.ØØ  - 4.5Ø
 4.5Ø  - 5.ØØ
 5.ØØ  - 5.5Ø
 5.5Ø  - 6.ØØ
 6.ØØ  - 6.5Ø
 6.5Ø  - 7.ØØ
 7.ØØ  - 7.5Ø  W

EACH 'W' REPRESENTS  1 TRAIN(S).

THE MEDIAN OF    86 TRAINS IS APPROXIMATELY      .239 HOURS
```

DISTRIBUTION OF DELAYS FOR THE FIRST SUBDIVISION

```
TOTAL DELAY (HOURS)          TOTAL NO. OF TRAINS

                        5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80   85
 Ø.   -  .25   TTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT
  .25 -  .5Ø   TTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT
  .5Ø -  .75   TTTTTTTTTTTTTTTTTTTTT
  .75 - 1.ØØ   TTTTTTTTTTTTTTT
 1.ØØ - 1.25   TTTTTTT
 1.25 - 1.5Ø   TTTTT
 1.5Ø - 1.75   TTTTT
 1.75 - 2.ØØ   TT
 2.ØØ - 2.25   TT
 2.25 - 2.5Ø
 2.5Ø - 2.75
 2.75 - 3.ØØ
 3.ØØ - 3.25
 3.25 - 3.5Ø   T
 3.5Ø - 3.75   T
 3.75 - 4.ØØ   T
 4.ØØ - 4.25
 4.25 - 4.5Ø
 4.5Ø - 4.75
 4.75 - 5.ØØ
 5.ØØ - 5.25
 5.25 - 5.5Ø
 5.5Ø - 5.75
 5.75 - 6.ØØ
 6.ØØ - 6.25
 6.25 - 6.5Ø
 6.5Ø - 6.75
 6.75 - 7.ØØ
 7.ØØ - 7.25
 7.25 - 7.5Ø   T

EACH 'T' REPRESENTS  1 TRAIN(S).

THE MEDIAN OF   186 TRAINS IS APPROXIMATELY      .239 HOURS
```

```
                    DISTRIBUTION OF DELAYS FOR THE SECOND   SUBDIVISION
                    ---------------------------------------------------

TOTAL DELAY (HOURS)             NO. OF EASTBOUND TRAINS

                        5    1Ø   15   2Ø
 Ø.    -   .25  EEEEEEEEEEEEEEEEEEEEEEEE
  .25 -   .5Ø  EEEEEEEEEEEEEEEEEEEEEEE
  .5Ø -   .75  EEEEEEEEEEEE
  .75 -  1.ØØ  EEEEEEEEEEEEEEE
 1.ØØ -  1.25  EEEEEEEE
 1.25 -  1.5Ø  EEE
 1.5Ø -  1.75  EEE
 1.75 -  2.ØØ  EE
 2.ØØ -  2.25  EE

EACH 'E' REPRESENTS  1 TRAIN(S).

THE MEDIAN OF    92 TRAINS IS APPROXIMATELY      .489 HOURS
```

DISTRIBUTION OF DELAYS FOR THE SECOND   SUBDIVISION

```
TOTAL DELAY (HOURS)            NO. OF WESTBOUND TRAINS

                  5   1Ø   15   2Ø   25
 Ø.   -  .25  WWWWWWWWWWWWWWWWWWWWWWWWWWWW
  .25 -  .5Ø  WWWWWWWWWWWW
  .5Ø -  .75  WWWWWWWWWWWWW
  .75 - 1.ØØ  WWWWWWWW
 1.ØØ - 1.25  WWWWWW
 1.25 - 1.5Ø  WWWW
 1.5Ø - 1.75  W
 1.75 - 2.ØØ  WWW
 2.ØØ - 2.25  WW
```

EACH 'W' REPRESENTS 1 TRAIN(S).

THE MEDIAN OF   77 TRAINS IS APPROXIMATELY   .458 HOURS

DISTRIBUTION OF DELAYS FOR THE SECOND   SUBDIVISION

```
TOTAL DELAY (HOURS)          TOTAL NO. OF TRAINS

                            5    10    15    20    25    30    35    40    45    50
 0.    -   .25  TTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT
  .25 -   .50  TTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT
  .50 -   .75  TTTTTTTTTTTTTTTTTTTTTTTTT
  .75 - 1.00  TTTTTTTTTTTTTTTTTTTTTTT
 1.00 - 1.25  TTTTTTTTTTTTTT
 1.25 - 1.50  TTTTTTT
 1.50 - 1.75  TTTT
 1.75 - 2.00  TTTTT
 2.00 - 2.25  TTTT

EACH 'T' REPRESENTS  1 TRAIN(S).

THE MEDIAN OF   169 TRAINS IS APPROXIMATELY      .479 HOURS
```

EXPECTED DELAY AT 95% CONFIDENCE

```
*************************************************************
*                                                           *
*              1.10  PLUS OR MINUS  .57                     *
*                                                           *
*************************************************************
```

SIMULATION PARAMETERS

CONVERGENCE C.I. WIDTH	CONVERGENCE TIME(DAYS)	TRAFFIC DENSITY (TRAINS/DAY)	GENERATED TRAINS	TERMINATED TRAINS
10% OF MEAN	10.00	20.20	229	199

TRAINS REMAINING IN TRANSIT :

LINK 7 P FI82 (W-GO -ON 1)
LINK 18 S UB29 (E-GO -ON 1)
LINK 20 S UK28 (W-GO -ON 1)

LINK CLEAR SUCCEEDED   10 OUT OF   322 TIMES OR   3.1056%

0.95 INTERVAL ESTIMATION---BATCH METHOD

SAMPLE MEAN = 1.10E 00

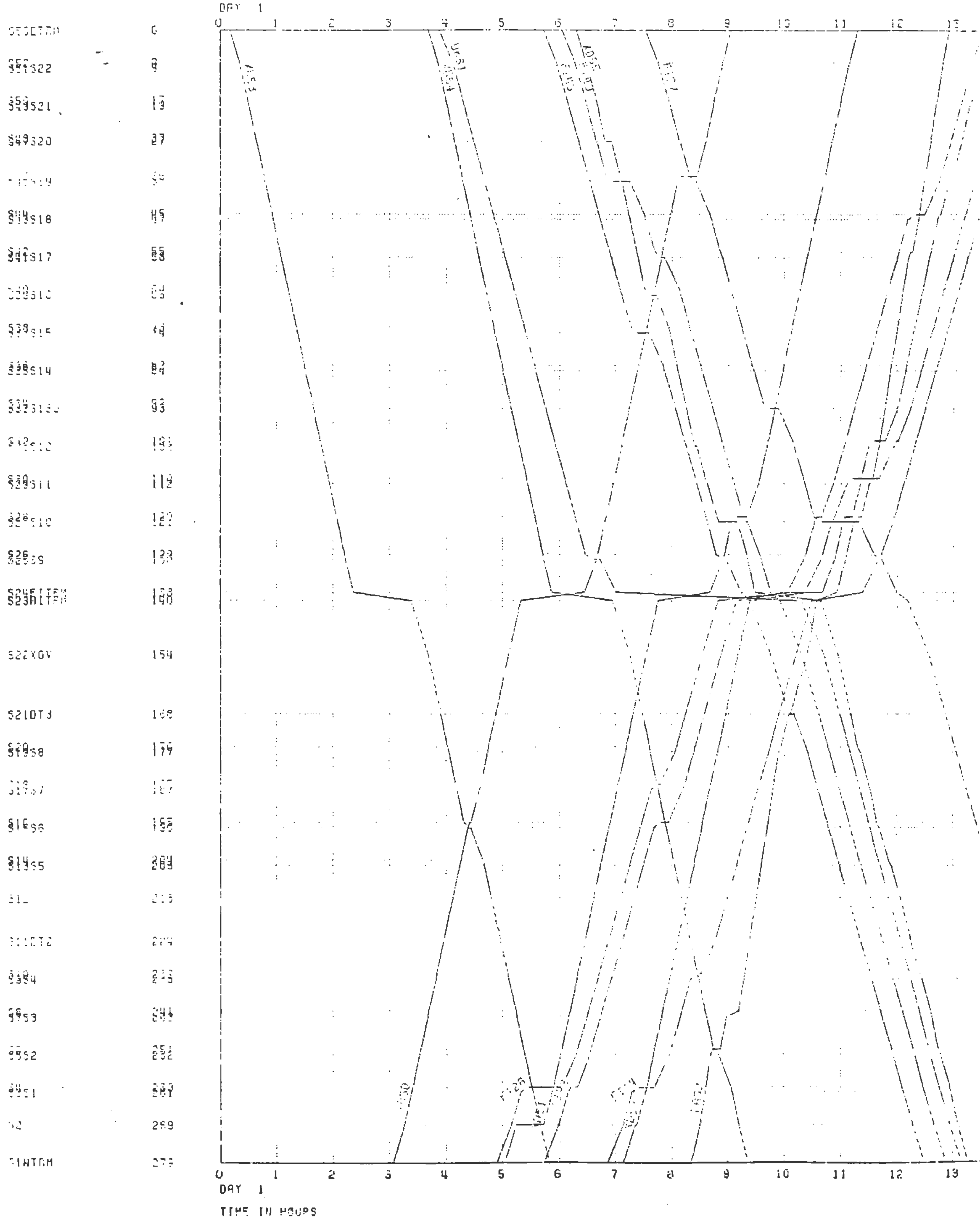
# OF BATCH	# OF OBS. /BATCH	S VARIANCE OF S MEAN	0.95 INTERVAL ESTIMATE LOWER	UPPER	C	CRITICAL VALUE
190	1	5.0732E-03	9.6112E-01	1.2407E 00	.446	.119
95	2	7.6407E-03	9.2913E-01	1.2727E 00	.305	.167
47	4	1.0107E-02	9.0279E-01	1.2990E 00	.595	.235
23	8	1.6777E-02	8.4414E-01	1.3577E 00	.362	.328
11	16	2.8435E-02	7.6205E-01	1.4398E 00	-.143	.451

11 BATCHES SUFFICE TO PASS TEST OF INDEPENDENCE AT 0.05 LEVEL

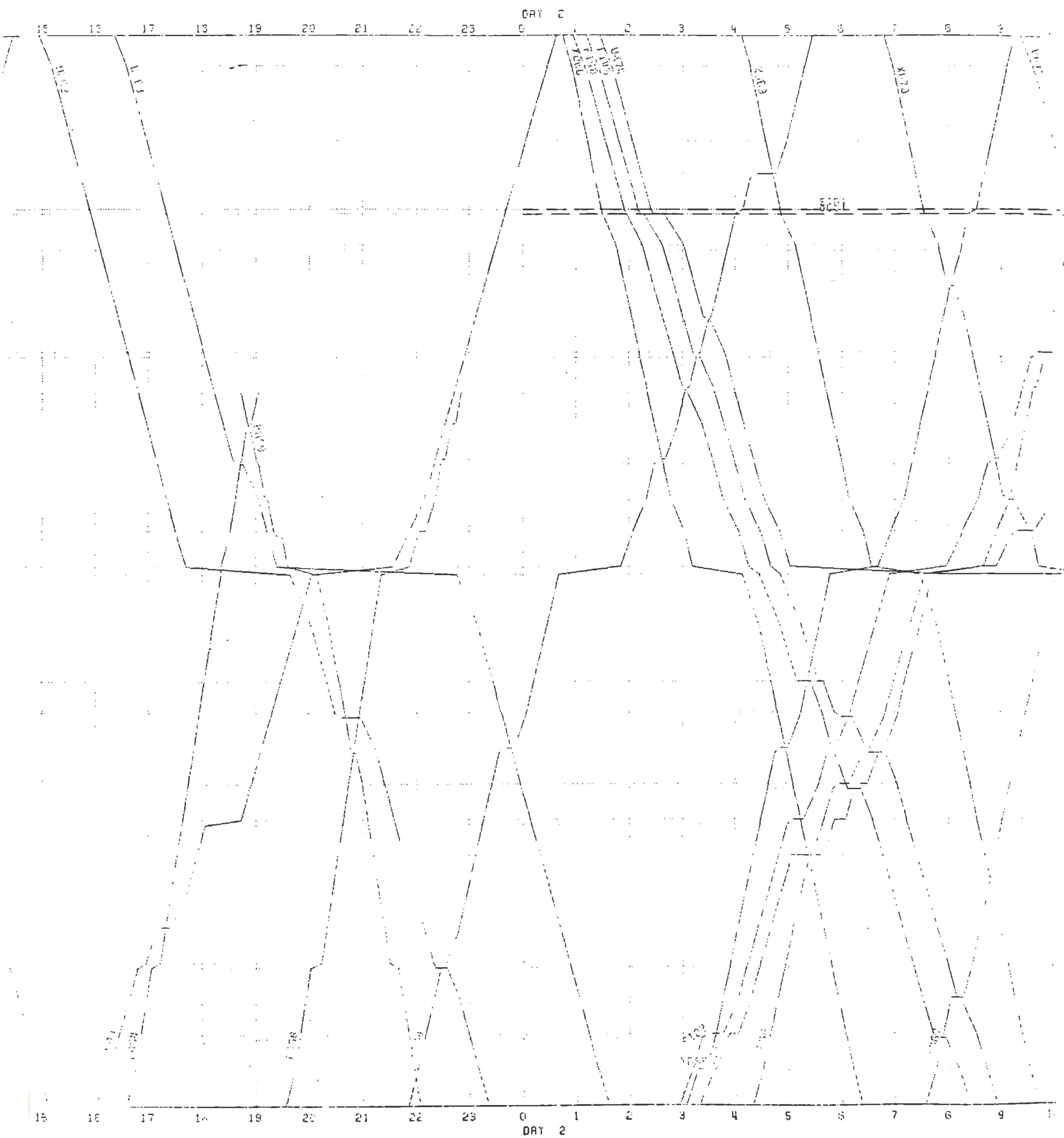
CANADIAN NATIONAL - TRANSPORTATION PLANNING

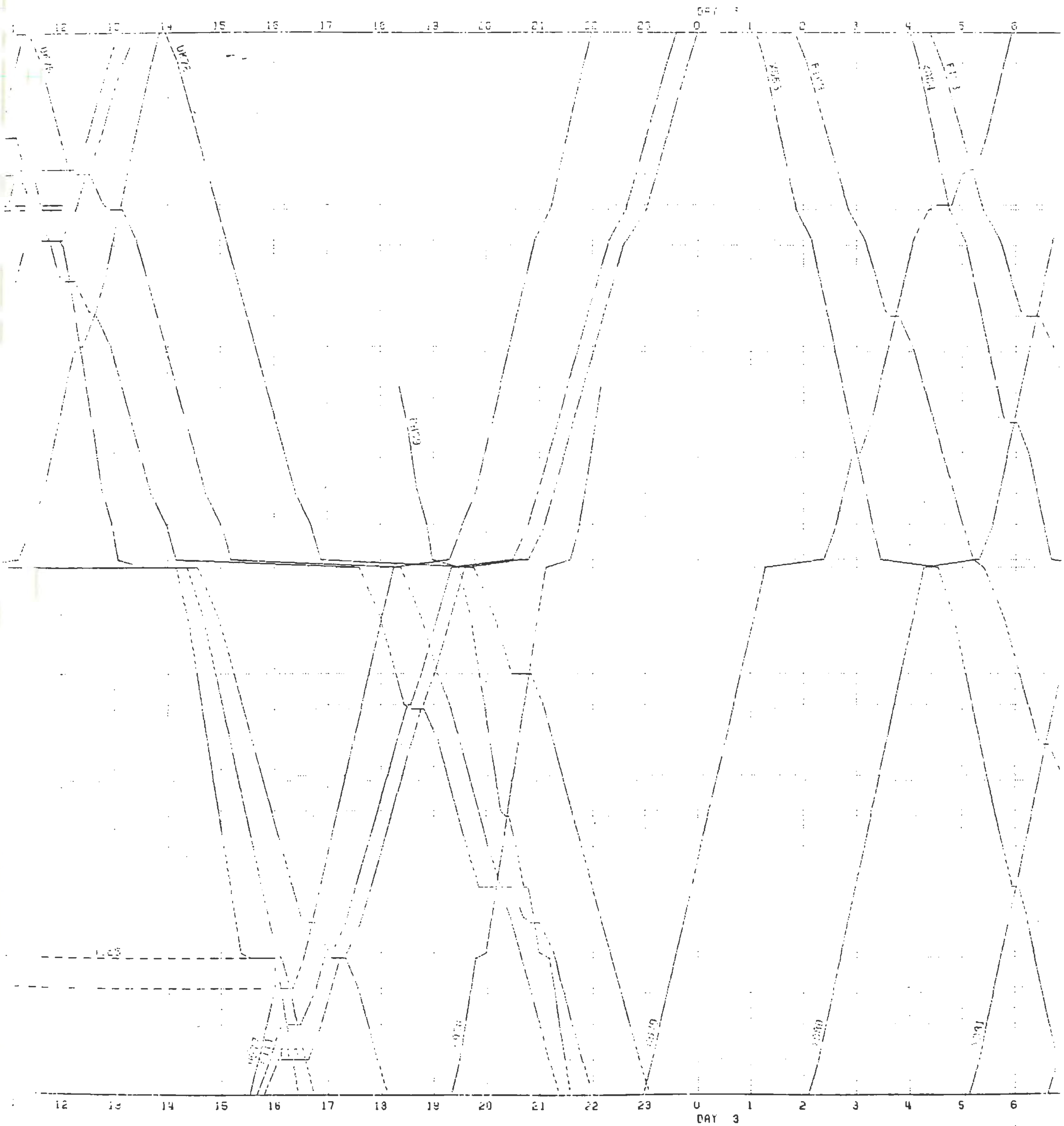
ROUTE CAPACITY MODEL   DEMONSTRATION

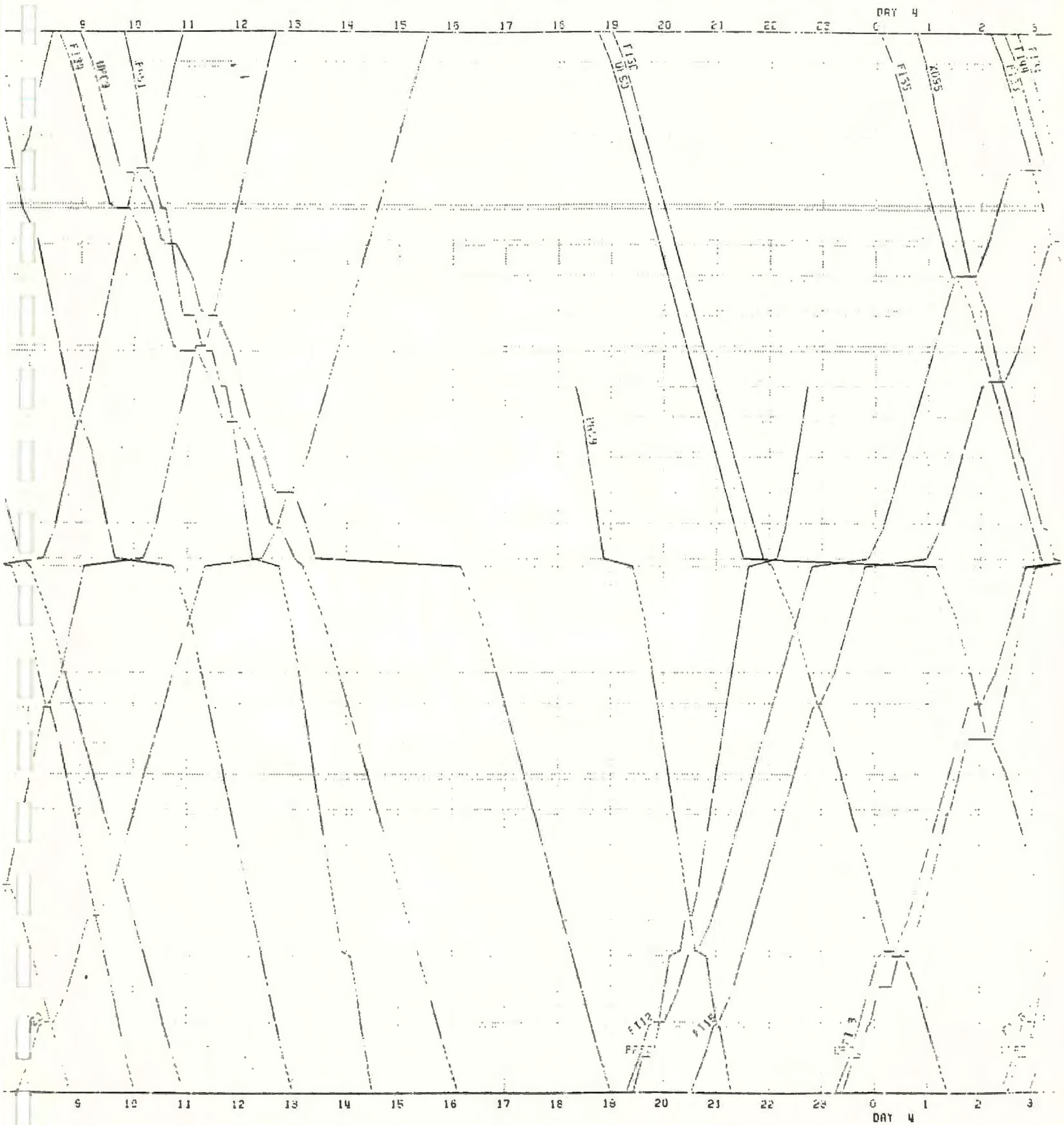
DATED   /   /   AT   :   :

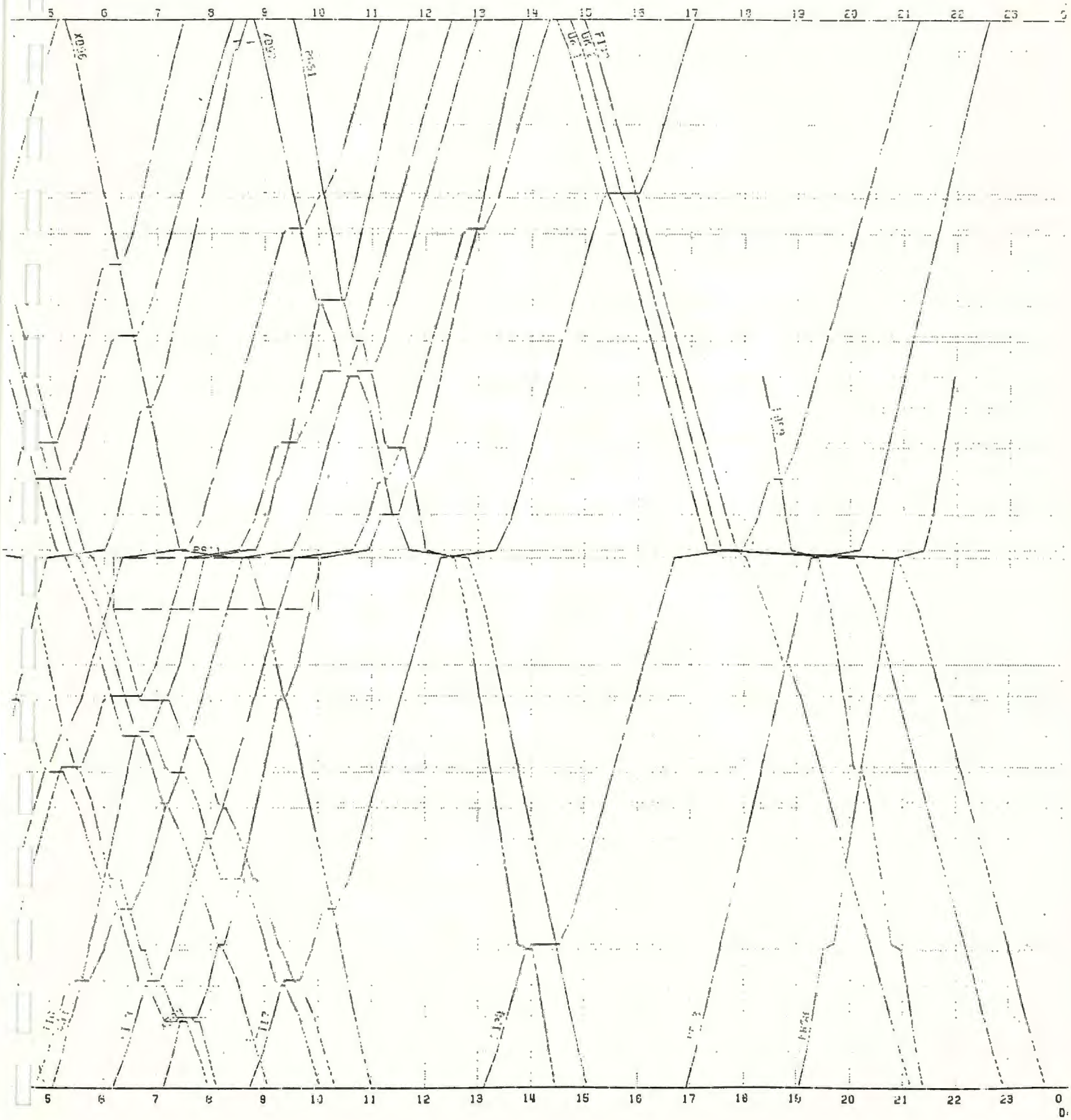


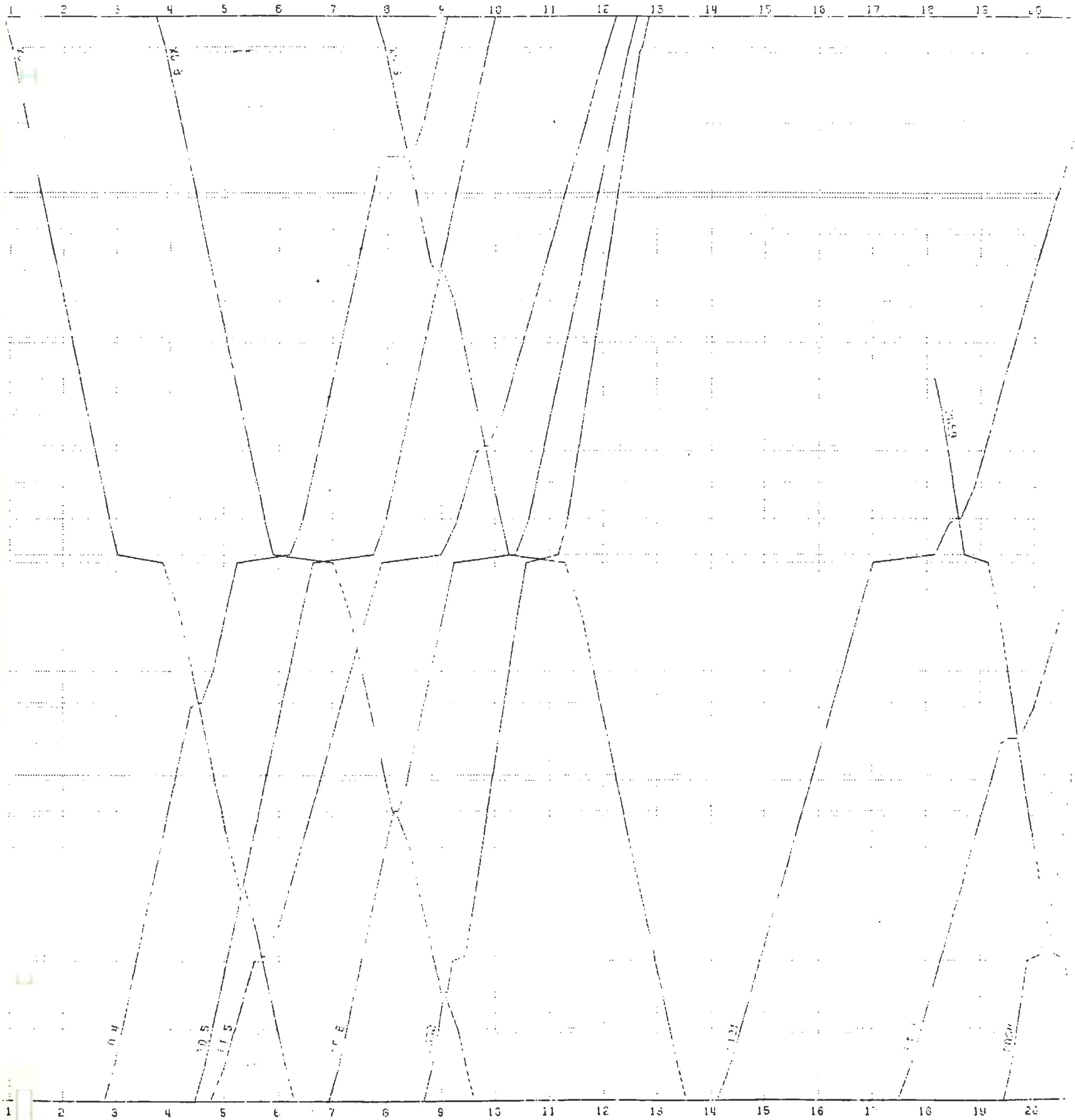
CN - TRANSPORTATION - PLANNING 25/10/81 C25GF

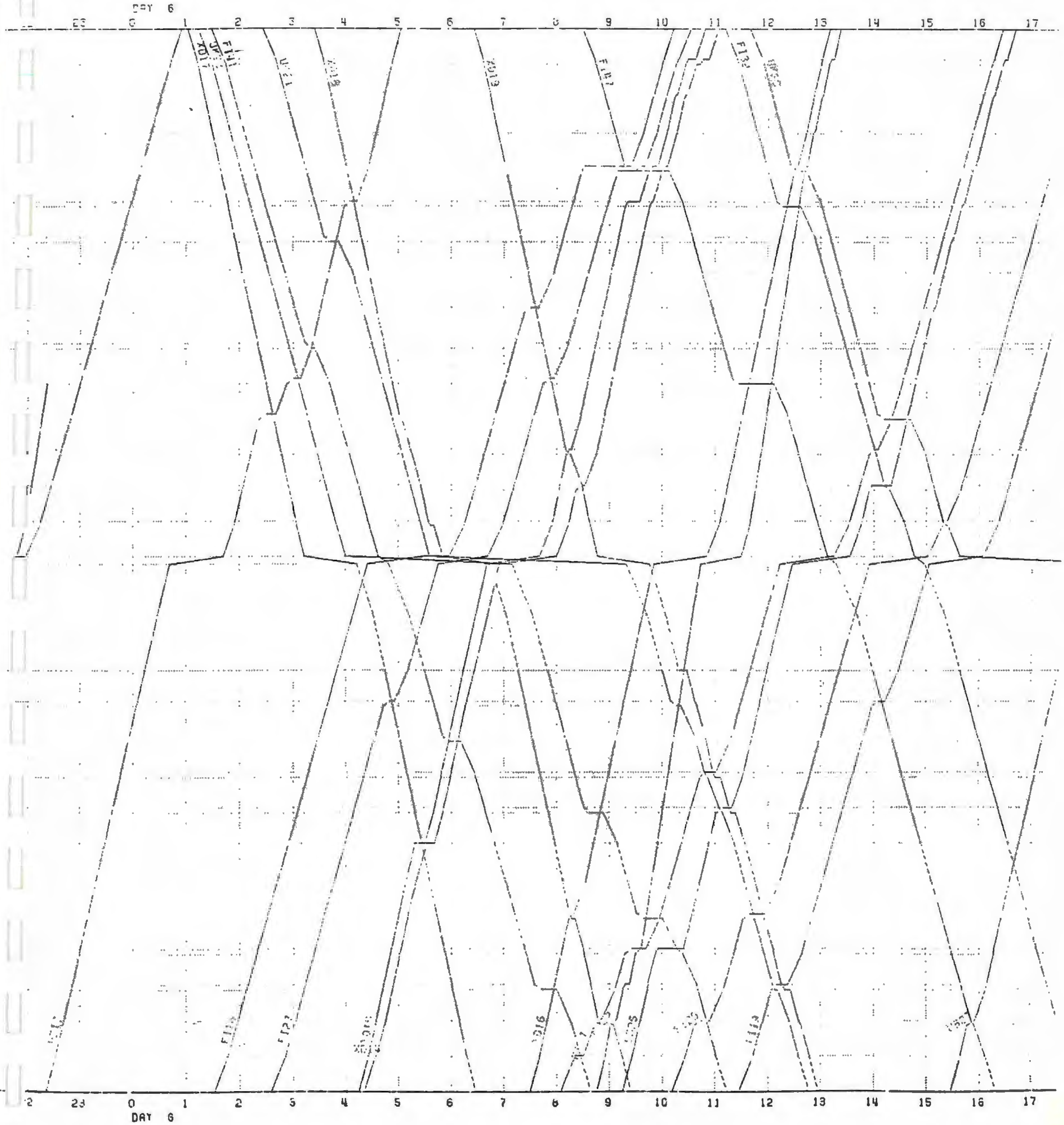

DAY 2
15 16 17 18 19 20 21 22 23 0 1 2 3 4 5 6 7 8 9
SCBL
15 16 17 18 19 20 21 22 23 0 1 2 3 4 5 6 7 8 9
DAY 2

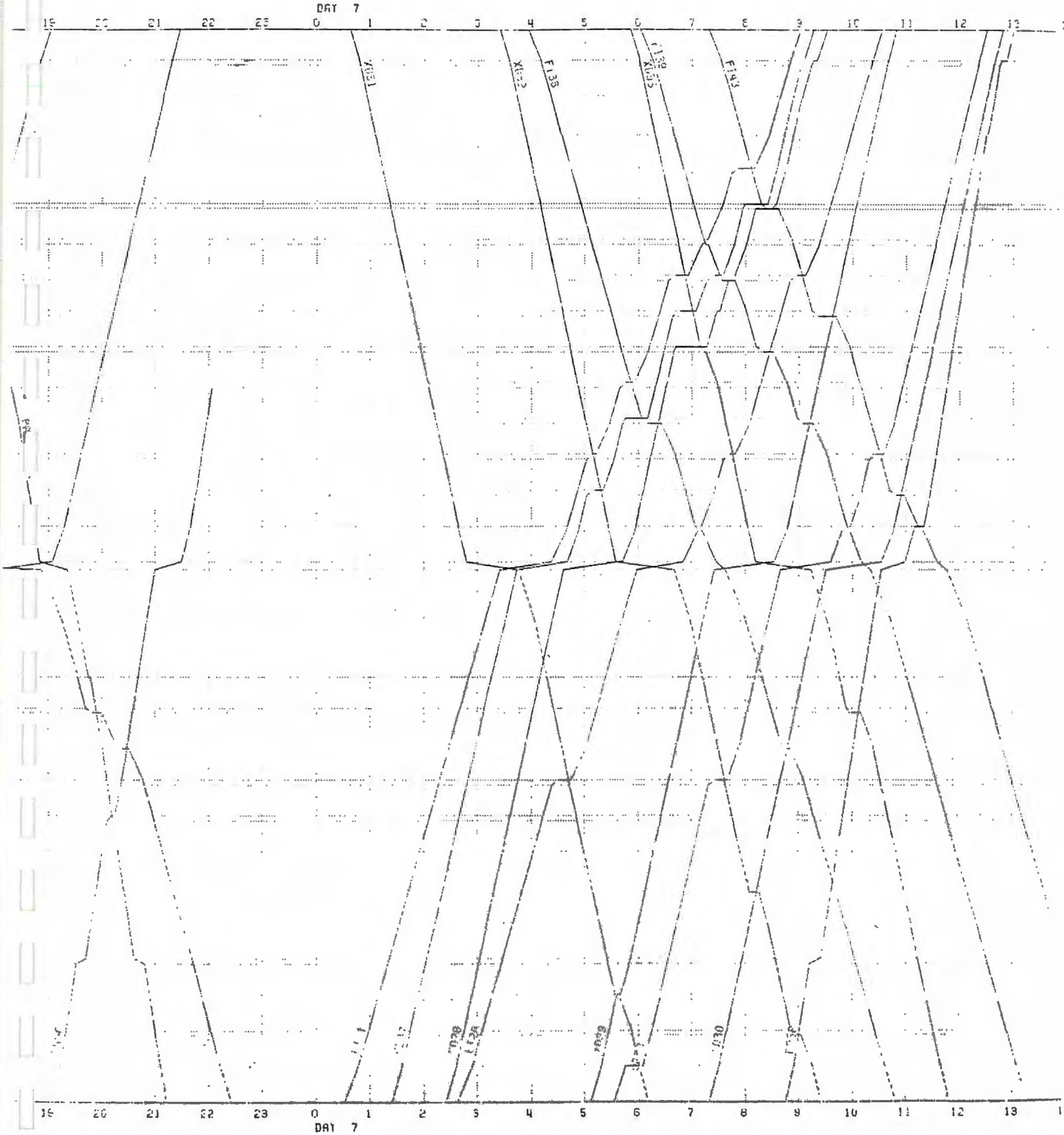

12 13 14 15 16 17 18 19 20 21 22 23 0 1 2 3 4 5 6
DAY 3

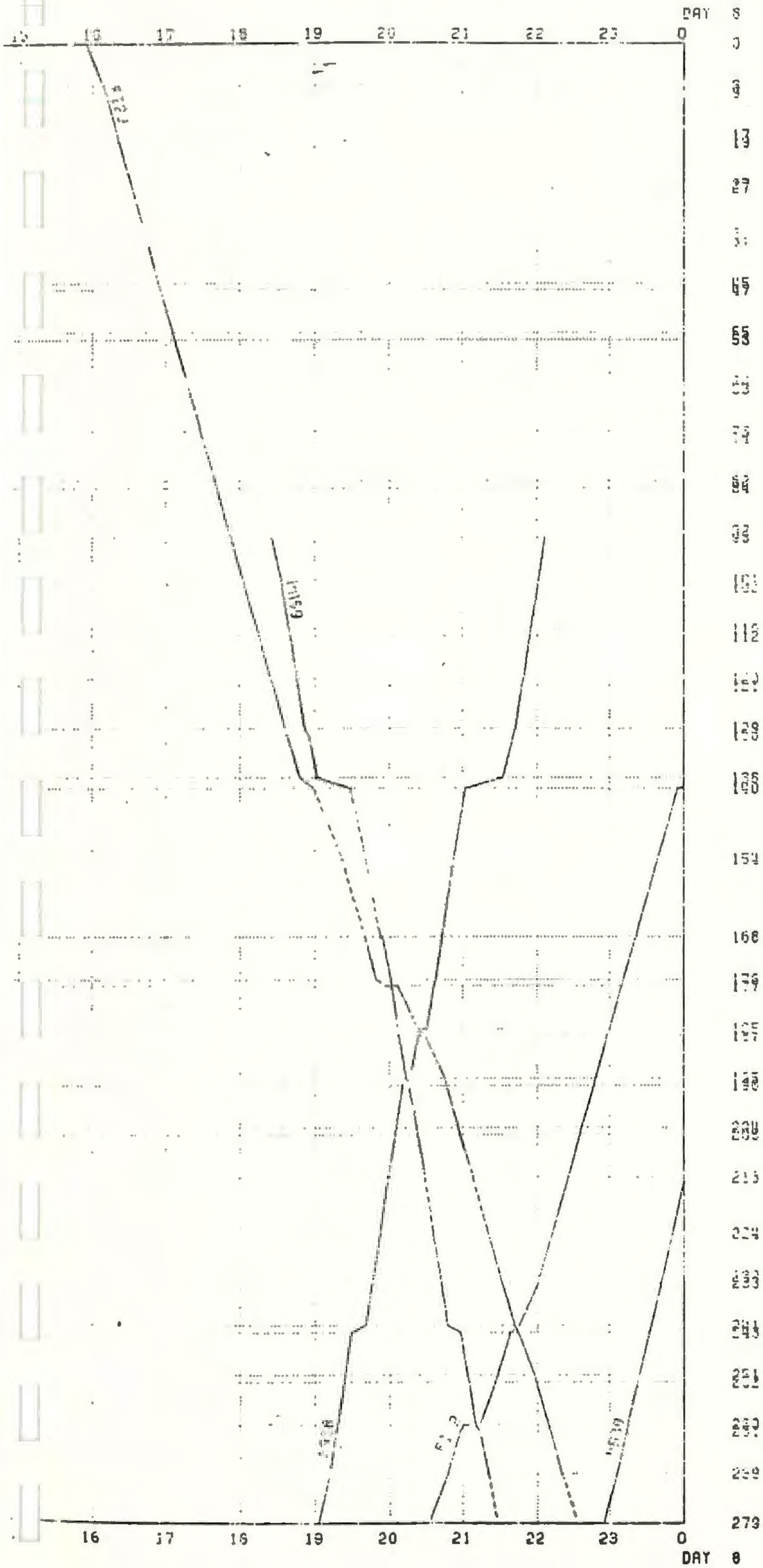

DAY 4
9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0 1 2 3
9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0 1 2 3
DAY 4


5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


DAY 6
23 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
DAY 6


DAY 7
19
20
21
22
23
0
1
2
3
4
5
6
7
8
9
10
11
12
13
X051
F138
F143
DAY 7



DAY 8
16
17
18
19
20
21
22
23
0
DAY
8
0
273

APPENDIX III

Route Capacity Model - User Procedures

Contents

Ø Purpose

This documentation assumes that the user understands the capabilities of the Route Capacity Model (RCM) and/or has read the report filed under OR project no. OR73-213Ø. Detailed within are methods for creating and handling RCM Specfiles and instructions for executing the model and maintaining datafile libraries. File naming conventions are also included.

1 User Procedures

1.1 Preparation of Input Files

1.1.1 TPS files

For information concerning creation of TPS files, see M14466.TPS.DATA(TPCGUIDE).

1.1.2 Specification file

To run the Route Capacity Model the user must prepare, manually,a Specfile containing data on plant, trains and maintenance and some run parameters. This file must be on M14465.CCTP.CNTL(RCM<specname>) where <specname> is the user chosen name for the specfile. The <specname> may be three characters or less and the first character must be alphabetic.

To prepare this file,

- Use SPF option 2, edit M14466.CCTP.CNTL(RCM<specname>)
- Copy M14466.CCTP.DOCUM(RCM0MAST)
- Ignore warning messages about linesize
- Continue the edit session by puting your data in the tables
- Follow the footnotes of each table (these may be deleted)
- Do not leave blank lines in the body of any table
- Save

1.1.3 Command file

In addition, the user may optionally provide a command file for the RCM. This file, prepared manually after a simulation, can be used to force the model to change some dispatching decisions. The name of this file is 'CCTP003(or 4).<specname>.COMMAND'.

The possible commands and their format is as follows:-

```
HOLD (internal train id) AT (internal switch number) UNTL (time)
HOLD (internal train id) AT (switch number) FOR (id of other train)
TRAK (internal train id) AT (switch number) NO (track number)
```

for example :-

```
HOLD   2  AT   7  UNTL   3.5
HOLD   2  AT  17  UNTL   5.5
HOLD   2  AT  25  FOR    21
TRAK   4  AT  24  NO     2
```

These commands are sufficient to cause a train to wait at any switch or to make a particular meet/ overtake in a chosen way.

Internal train ids are train numbers given in sequence when the train are generated. Unfortunately, it is not possible to print the train ids on the plot. For scheduled trains, a table is printed at the end of the simulation.this table lists the schedule name and the train id given to this train on each simulation day. For all computer generated trains, the name on the plot is composed of two characters from the group name followed by the last two digits of the train id. A rough idea of the leading digits of the train id can be obtained by knowing the sequence of generation and the number of trains per day.

1.2 Studies consisting of several files

Often many simulations using a few different values for selected inputs are required. Recommended practice is to prepare one specfile with the base data and run the Route Capacity Model foreground (see 1.3.2) to check the data. Other files can then be prepared by copying and editing the base case. This task is greatly simplified if you know how to program the PF-keys (SPF option Ø.3). The set of specfiles should, if possible, have the same first character in their name. A single execution of the clist RCMBRUN allows you to submit all of the specfiles in the set, summary output for the set is consolidated on a study file.

1.3 Job execution

The Route Capacity Model consists of two SIMSCRIPT II.5 programs:-

The front-end program checks the Specfile for data errors, performs timing calculations and passes a work file of reformatted and expanded data to the simulation program.

The simulation program reads the work file and performs the line simulation.

The system makes use of the program 025GPLOT to produce a string-line plot of the simulated trains.

The clists described below initiate execution of the relevant programs.

1.3.1 Background submission

The clist RCMBRUN is used to submit background runs (front-end,simulation and plot) of one or more specfiles.

Many options are available to the user, defaults have been established for most of them and are selected by hitting enter in response to the questions.

The clist commences by asking for the name of a studyfile thus

```
*  STUDYFILE NAME
MUST BE 4 CHAR OR LESS, FIRST 3 NOT EQUAL TO ANY SPECFILE
     (*=GENERAL)                           ===>
```

The name <study> is used to consolidate a summary version of the output, this is useful when many similar runs are required for a particular study eg. different siding spacings. If you are not interested in this summary, select the default - the name general. When a name other than general is entered, the summary output is automatically listed on REMOTE8 and saved on

M14466.CCTP.DOCUM(RCM1<study>) by the job CCTPZ<job> where <job> is the first three characters of <study>. Also a list of the specnames in the study is saved on CCTP006.<study>.SPECLIST - this list can be used later by the clists RCMCAN,RCMSTORE,RCMRETR,RCMEDIT and by RCMBRUN itself.

* STUDY TITLE (in 'quotes') ===>

The title entered here is written on the study file.

* PRODUCTION RUN (*/Y) ===>

Users should normally select the default (Y) here, this selects the production versions of both programs and deletes all the work files when the job is complete. Selection of N allows override of any of the above.

* YOUR NAME ===>

Enter your name as it is to appear on the output.

* DEPARTMENT (*=RESEARCH/LP/DEV) ===>

The response to this question determines the account and budget code according to transportation planning standards.

* PRIORITY (*=0=FREE,7=SLOW.9=EXPENSIVE) ===>

Enter the priority for your job.

* JOB CLASS (*=A/Q) ===>

Generally, the default CLASS A is appropriate. For short simulations known to take less than 15 seconds of CPU time class Q may be selected.

* PRINTER (*=DISK/LOCAL/REMOTE8/...) ===>

The default here sends the job output to the R-queue on disk. This is suitable for large studies when the summary output is all that is usually required. The individual simulation outputs can be browsed or printed local using SPF option 3.8. The user is responsible for deleting unwanted output from the R-queue by the Clist RCMCAN.

For individual studies, where all of the simulation output is required, select either local or remote8.

```
    *   PLOTTER (*=LOCAL/15/NONE)                 ===>
```

Select the plotter for the string-line plot.

```
    *   POST SIMULATION ANALYSIS  ? (*=N/Y)       ===>
```

A postprocessor batch means program may be run.

This concludes the information which is common to each of the simulations in a study. The Clist now echos all of the above on a new screen for verification. After you hit enter the screen clears again to permit you to enter the names of the specfiles that are to be run.

```
            SPECFILES TO BE SUBMITTED
            =========================
              (HIT ENTER TO END)
        IF YOU WANT TO USE AN OLD LIST OF SPECFILES,
         ENTER THE WORD STUDY FOR THE FIRST ONE

        *  SPECFILE  ===>
```

Generally, enter the <specname>s one at a time. Hit enter to terminate the list. The exception allowed here is that if you have an old <study> containing the list you may re-use the speclist, thus avoiding retyping - in this case type the word STUDY and you will be prompted for the name of the old study.

The following screen is now displayed and you may leave

```
* * * * * * * * * * * * * **
*  BUSY SUBMITTING JOBS   *
*        GO AWAY          *
** * * * * * * * * * * * *

PREPARING JCL
```

As each <specname> is prepared and submitted the screen clears and displays the following:-

```
* * * * * * * * * * * * * **
*  BUSY SUBMITTING JOBS   *
*        GO AWAY          *
** * * * * * * * * * * * *

SUBMITTING SPECFILE <specname>
```

The name of the job submitted is CCTPZ<specname>.

Finally, the job which lists and stores the consolidated summary output CCTPZ<job> is submitted and the screen displays

```
*** END OF RCMBRUN ***
```

1.3.2 Foreground

The clist RCMFRUN runs the front-end program and/or the simulation in foreground mode. The Clist commences by asking for the study file in the same way as RCMBRUN. Again Production run = y selects the production version of both programs. Next, the name of the Specfile to be run is requested thus:

```
*  SPECFILE NAME                    ===>
```

The Clist continues by asking whether you want to run the front-end

```
RUN FRONT END  (*=Y/N)              ===>
```

Normally, the user will select the default, yes.

The following messages are now displayed:

```
EASTBOUND TPS : <name of eastbound tps file>
WESTBOUND TPS : <name of westbound tps file>
PERFORMING ALLOCATIONS FOR FRONT END
FRONT END BEGINNING :
```

Next, the output of the front-end appears on the screen, followed by

```
FRONT END COMPLETED:
HIT ENTER TO CONTINUE
RUN SIMULATION (Y OR N)        ===>
```

A response of N will terminate the Clist, Y will run the simulation in foreground mode. The output may be taken directly to the screen or may be saved on a TSO dataset by the response to the next question:

```
OUTPUT ON THE SCREEN (Y OR N) ===>
```

The following messages indicate normal operation of the Clist:-

```
      USING BLANK COMMAND FILE
      MODEL BEGINNING:
      MODEL COMPLETED :
      OUTPUT FOR PLOTTING PROGRAM IS ON 'CCTPØØ3.<specname>.PLOT'
      TRAIN TIMES OUTPUT IS ON 'CCTPØØ3.<specname>.TIMES'
      SIMULATION OUTPUT IS ON 'CCTPØØ3.<specname>.OUTPUT'
***   END OF RCMFRUN   ***
```

If the screen was not selected for the simulation output, the output can now be browsed on CCTPØØ3.<specname>.OUTPUT.

Files CCTPØØ3.<specname>.PLOT/PSPEC/TIMES/DELAY/WORK are also saved and may be browsed. These files are not normally of interest to the user; the system documentation contains details of their contents.

A plot of the trains simulated can now be obtained by running the Clist RCMPLOT.

1.4 Job cancellation

When heavy use is made of the system, it is very important that you cancel old output on the R-queue.

The clist RCMCAN requests <study> and then busies itself deleting the output and files associated with each of the <specname>s on the file CCTPØØ6.<study>.SPECLIST.
This Clist can also be used to cancel jobs of a study that were erroneously submitted.

Since CCTPØØ6.<study>.SPECLIST is a TSO dataset, a problem arises when jobs submitted on Friday are to be cancelled on Monday. See 1.6.3

1.5 Editing a set of files

Suppose that you have a set of specfiles in which you want to make the same minor alteration eg. change the traffic volume

One possibility is to program the PF-keys and edit the files one at a time.

A more efficient method, for a large number of files, is as follows:-

- Copy the clist RCMEDIT to RCM<ii>ED, where ii are your two initials (RCMEDIT is a model clist which changes trains per day, 9Ø to 6Ø)
- Edit the clist RCM<ii>ED to your requirements
  be careful that the find and change commands that you write uniquely identify the fields that you want to change
- Test out your new clist with one data file
- Run your clist with all your files
  note : the list may be typed or may refer to an old <study>
- Cleanup: delete your clist (SPF 3.1)

1.6 Library maintenance

1.6.1 Storage of inactive specfiles on panvalet

When a study is complete, please do not leave a large number of files on M14466.cctp.CNTL. Proceed as follows:-

- Delete files that are very similar to others.

- Run the clist RCMSTORE

  This asks you for your initials-<ii>, and a list of specfiles

  note : the list may be typed or may refer to an old <study>.

  Files .CNTL(RCMspecname) are copied to PPAN(RCM<ii> <specname>)

- Check that the files are on PPAN

- Delete the files from .CNTL

1.6.2 Retrieval of files from Panvalet

The clist RCMRETR reverses RCMSTORE. It uses your initials and a list of specfiles.

Check that your files have been moved. Do not forget to make the file inactive on Panvalet.

1.6.3 Backup of studylists on the week-end

The clists RCMBRUN, RCMCAN, RCMEDIT, RCMSTORE and RCMRETR can all run refer to the <specname>s submitted by an old <study>. All except RCMCAN can also use a list which is typed in at run time. Unfortunately the dataset CCTP006.<study>.SPECLIST which holds the studylist does not survive the week-end cleanup of TSO datasets. If your lists are long you may save them on Friday on .CNTL or .PPAN and retrieve them on Monday. Do not forget to delete them from .CNTL or .PPAN after retrieval.

1.6.4 Consolidation of output on M14466.CCTP.DOCUM

Each submission with RCMSRUN with studyname other than GENERAL automatically saves the summary output on M14466.CCTP.DOCUM(RCM1studyname). If several of these belong together they may be consolidated by going into edit mode and copying one onto the end of another then deleting the unwanted member. Please delete summary output that you no longer require.

2 Naming conventions

2.1 Files

2.1.1 M14466.CCTP.CNTL

Specfiles - RCM<specname> <specname> is three characters or less, the first one being alphabetic

Other eg. studylists, JCL
-RCM<ii> <any> <ii> are your initials
<any> less than three characters

2.1.2 M14466.CCTP.DOCUM

Documentation - RCMØ<doc> <doc> is at most four characters

eg. RCMØmast - master specfile
RCMØtrns - train packages
RCMØplnt - prepared plants
RCMØsyst - system documentation
RCMØproc - user procedures
RCMØfrpr - front-end program documentation
RCMØprsm - simulation program documentation

Summary output - RCM1<study>

2.1.3 M14466.CCTP.CLST

Master clist - RCM

User clists - RCM<name>

Backup of user clists - RCM<name>B

System clists - RCMS<name>

Other - RCM<ii> <name> <ii> initials of author

2.1.4 M14466.CCTP.PFAN

Specfiles - RCM<ii> <specname>

2.2 Program naming conventions

All source programs are on M14465.CCTP.SPAN

All load modules are on M14466.CCTP.LOAD with the same member name

Front-end programs - RCMF<type>

Simulation programs - RCMS<type>

```
    where <type> = PROD for production
                 = BACK for back-up
                 = DEV  for development
```

Subroutines - RCM<ii>SUB <ii>= initials of author>

Other - RCMO<name>

2.3 Job names

All job names have the form CCTPZ<job>, where <job> is described below

Simulations	- <job>=<specname>
Summary print	- <job>=First 3 characters of <study>
Compile of front-end	- <job>=PRG
Compile of model	- <job>=PRO,BAC or DEV
File listing	- <job>=LIS