



Mechanized yards (Car-Fax field stations) cover the North Western system. All send reports to Chicago via a transceiver network.

# C&NW Has System-Wide Car Reporting

**A fast, basic communications system is established with Car-Fax. It is a transceiver network linking 68 reporting points with Chicago, the railroad's headquarters. In the belief that "the railroad communications engineer must be familiar with every function of railroad operation," Railway Signaling and Communications is publishing this article. From time to time other articles will be presented in which the communications role is not the primary one, although a very important one.**

The Chicago & North Western's new Car-Fax system is the largest commercial transceiver network in the world. It keeps tab on car and train movements as they occur, 24 hours a day. At 68 reporting points along the C&NW's 9,300-mile system, waybill and car report information is placed on punched cards. The information goes to Car-Fax headquarters in Chicago. In addition to providing fast, ac-

curate car tracing data, Car-Fax produces—from one source, the waybill—the required control and statistical reports for traffic, operation and accounting. Car-Fax went into service last January 1. One year was spent planning the system, and a second year was required to put it into service.

Car-Fax is the newest device in Chicago & North Western manage-

ment's continuing campaign to increase railroad operating efficiency. It costs \$1.1 million a year to operate, but the railroad thinks it's worth every penny.

Here's what the Car-Fax system provides:

- Fast, accurate car tracing service through Car-Fax headquarters at Chicago, and its traffic offices from coast to coast.
- Fast, accurate reconsignments or diversions of freight en route.
- Immediate information on shipments delayed because of bad order cars.
- Improved car utilization, resulting in availability of more cars of the type and quantity needed, when they are needed.
- Reduced switching time through advance train consists, allowing advance planning for switching in C&NW yards.

In summary, the principal objective of Car-Fax is to permit preparation of required control and statistical reports for traffic, operations and

accounting from one original source. The reports will:

(1) Facilitate traffic department work by providing information necessary for directing and evaluating sales efforts and for better customer service.

(2) Enable the operating department to utilize and move cars more efficiently.

(3) Facilitate accounting for revenues and for car per diem.

The first and most obvious benefit of Car-Fax to the traffic department is car tracing information. "Flash" listings of train consists are posted hourly in the Car-Fax information center at Chicago. The listings cover arrivals, departures and interchange of some 50,000 cars moving over North Western lines daily.

In addition to the "flash" listings, a central tracing record is compiled daily (cut off time: 11 p.m.). This record, available the first thing each morning, shows all car movements of the previous day and the last location of each car on the railroad. Copies of a simplified version of this report are air-mailed to 60 traffic offices throughout the country.

Because Car-Fax reports train and car movements as they occur, a whole new area of better car distribution and utilization is open to the operating department. North Western men liken the Car-Fax system to a quality control system used in manufacturing industries. Reports about empty cars on line, terminal car detention, empty car location reports, bad order reports of cars set out and then released after repair, and interchange reports are a few of the many the system makes available to the operating department. Some reports present the information by divisions, so that management always has an up-to-date picture of operations on the entire railroad.

"Car-Fax," said one North Western man, "places the general manager in every yard office." Why? Because many of these daily reports are on management's desk first thing each morning, making the previous day's activities known. Thus the operating department can "be on top of the situation" at all times.

Car-Fax integrates revenue accounting requirements with fast, accurate car reporting. This is so be-

cause the waybill information is put on the punched card at the origin point, or where the car is received in interchange. Waybill information is sent via transceiver to Car-Fax headquarters at Chicago, where it is reproduced on punched cards. Cards containing waybill revenue information are sent to the accounting department for machine processing.

### How Car-Fax Operates

Punched cards are prepared at the 68 Car-Fax field stations, which are known as mechanized yards. Each mechanized yard prepares punched cards for: (1) Cars loaded locally; (2) cars received locally from connecting lines; (3) cars arriving in trains for which cards have not been prepared at some other mechanized yard; (4) cars departing empty, either in trains or delivered to connecting lines after unloading locally; and (5) car movements reported from non-mechanized yards. In this latter category, interchange reports are mailed from the smaller interchange stations to the nearest mechanized yard for card punching and transmission of the information

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## These reports originate from one manual card punching of waybill information.

### DAILY REPORTS INCLUDE

**Loading summary:** Cars loaded locally and received from connections. Each day's report is cumulative from the first of the month.

**Commodity loading summary:** Number of cars loaded locally and received from connections by 24 commodities.

**Commodity loading analysis:** This report for each commodity group details the local loading by operating division and the cars received from connections by gateways.

**Unearned revenues:** Shows the revenue value of cars originated and received from connections by commodities.

**New loads reports:** Two new loads reports are prepared daily for each state. One report lists all cars originated in the state and the other report lists all cars destined to the state.

**State loading summary:** Shows the total number of cars for each state, province, country, etc., by origin and by destination. This report is the basis for indicating traffic trends.

**Summary of cars on line:** Number of day's loadings represented by the loads on line, based on current local loadings and receipts from connecting lines. The day's loadings shown for empties is the number of days' loadings represented by the empties on line, based on current local loadings and receipts from connecting lines.

**Equipment loading summary:** Shows local loadings by kind of cars, segregated between system and foreign.

**Empty car location summary:** The empty cars of each kind are summarized into approximately 45 location groups, consisting of 37 key distribution points and on all other stations group for each division.

**Empty car forwardings:** Shows the movement of empty cars out of selected terminals on a daily basis. Lists individual cars forwarded to each destination with totals by kind of car.

**Cars received from and delivered to connecting lines:** Cars received from connecting lines shows the cars received at each junction from each connecting line. The report of cars delivered to connecting lines shows the cars delivered to each connecting line at each junction.

**Per diem distribution to divisions:** Accumulates the equivalent per diem value of cars on line by divisions.

**Central tracing and per diem record:** A daily listing of cars on line, showing the last completed movement, arrival or interchange for each car and all such movements reported during the current day.

**Car movement report:** The report is prepared daily and includes departures and interchange reported between 11 a.m. on the previous day and 11 a.m. on the current day. This report is air mailed to agency offices.

**Bad order report:** Bad order setouts report lists cars which have been set out because of mechanical difficulties or shifted loads. Each car set out is included in this report each day until repaired and released for movement. The bad order releases report lists the cars which have been released.

**Flash listings:** All departure, arrival and interchange reports received on the transceivers are listed hourly. These "flash listings" are filed by terminal at the central tracing rotary table and provide the tracing clerks with current information on car movements throughout the day.

to Car-Fax headquarters at Chicago.

Two cards are punched for each car. A third card will be punched with special handling instructions, if applicable. Punched cards are prepared for empties as well as loads. The No. 1 card contains all information necessary for advance train consists and interchange reports. The No. 2 card contains revenue accounting information and the route. A duplicate of the No. 1 card is automatically made on the card punch and placed with the waybill. The other copy of the No. 1 card and the No. 2 card are set aside for accumulating all new loads to be reported to the Car-Fax headquarters. Cards on new loads normally are accumulated and transmitted between 10 p.m. and 3 a.m. to Car-Fax headquarters in Chicago.

For train departures from initial terminals, a No. 1 punched card for each car and a No. 3 card, special instructions where applicable, are needed to report the train's departure. Before departure of the train, punched cards are arranged in train order from the head end. If cars are to be set out en route, divider cards are placed in front and behind

cards for any cars to be set out at an intermediate mechanized yard. Car-Fax headquarters can therefore identify cars to be set out, and will relay this information to the proper yard. The deck of cards for the train, with a header card giving train information, is run through an accounting machine, which prepares the conductor's wheel report. The conductor takes with him two copies of the wheel report and the freight waybills.

After the train departs, the deck of cards (with the header card and a caboose card indicating the time of departure, conductor's name, etc.), is put in the IBM transceiver. Next, the operator, using the phone circuit associated with the transceiver, calls Car-Fax headquarters, telling them that the yard is ready to send a train consist report on the train's departure. The operator at Car-Fax headquarters will "dial" the yard onto the circuit so transmission can be started.

The transceivers operate at the rate of 10 cards per minute. Thus, it takes only 10 or 15 minutes to handle a train consist. When transmission is completed, cards at Car-Fax



Car-Fax headquarters at Chicago is where all reports from the 68 field stations or mechanized yards come in via transceiver network. Up to four field stations can be handled simultaneously on one transceiver circuit. The transceivers operate at the rate of 10 cards per minute. It takes only 10 to 15 minutes to handle a train consist.

## WEEKLY REPORT

**Earned Revenue:** For accounting purposes revenues are reported as earned when the cars are delivered to consignees or to connecting lines and this report is prepared on that basis. This report of earned revenues is prepared for four 7 day periods in each month, and for the period between the 28th and the last day of the month.

## MONTHLY REPORTS

**Regional traffic summary:** A regional summary report is prepared for each region. The all regions summary report combines the totals from the regional summaries into an over-all summary. These reports show traffic forwarded from the regional territories and separate reports are prepared on a received basis.

**Agency commodity report:** These monthly reports indicate traffic trends in each territory by commodity. Separate reports are prepared for cars forwarded and cars received.

**Agency firm summary:** These reports forwarded and received for each agency,

provide a means for ready analysis of traffic from and to each agency territory by firms.

**Shipper and consignee analysis:** Summarize the traffic by shipper and by consignee. A report for cars forwarded by a selected firm is prepared as well as a separate report for cars received. Separate reports are prepared for the firms requested by the various agencies and the cars for the smaller firms are combined.

**Controlled firm summary:** These reports combine the traffic from or to each plant into a single report for multiple plant customers. These reports include all plants regardless of location, while the agency firm summaries include only those plants located in each agency's territory.

**Gateway report:** The gateway report, by commodities, is prepared for each gateway shown separately on the summary report. Separate reports are prepared for cars received and for cars delivered and detailed listings of the individual cars will be available for special studies.

**Cars on line empty:** A summary report is prepared based on the empty cars on line at the end of each month. The report lists the empty cars, based on the number of

elapsed days since the last reported loaded movement of each car. The report is supported by a more detailed report classifying the number of cars in each age bracket by kind of car. Detailed listings of individual cars, showing their present location, is also available.

**Car detention summary:** Car detention time has been classified by type of movement. (a) Load-same load: These are loaded cars moving through the terminal. (b) Load-new load. These are cars arriving loaded, which are unloaded and reloaded before departure. (c) Load-empty: These are cars arriving loaded and departing empty. (d) Empty-load: These are cars arriving empty and departing loaded. (e) Empty-empty: These are empty cars moving through the terminal. The car detention detail report accumulates the number of cars, the total hours, on a daily basis, and these totals are used to accumulate the data for calculating the average hours for the month in the car detention summary report.

**Hire of Freight Equipment:** This report provides a summary of per diem by kind of car and related equipment costs. Car utilization can be measured on a general basis by the net income or expense for each kind of car.

headquarters are used for preparing the various reports. A flash listing is prepared by putting the cards through an accounting machine. This listing is given to Car-Fax tracing headquarters.

Car-Fax headquarters also takes the cards which pertain to cars to be set out at an intermediate point. The cards, with the appropriate header card to indicate the train number and train information, are placed in an IBM transceiver for transmission to the intermediate yard. A clerk uses the phone circuit associated with the transceiver circuit to call the intermediate yard, telling them that he has a list of cars to be set out. The yard clerk sees that his transceiver is loaded with blank punch cards, and tells the Car-Fax headquarters clerk to send. After dialing the transceiver, the operator at Chicago presses a start button and the punched card information is sent to the intermediate yard.

If cars are to be picked up at an intermediate yard by this train, the yard will prepare punched cards for the cars to be picked up, and, with an appropriate header card, will transmit the information to Chicago.

The Chicago headquarters relays the information concerning cars picked up at an intermediate yard and also cars set out at an intermediate yard, to the final or terminal yard for the train. The train consist as sent from the initial yard on the train's departure, is relayed by Car-Fax headquarters to the terminal yard (destination of train). From these consist cards, an advance train consist and switch list is prepared, enabling the yardmaster to preplan his switching operations.

After the train arrives and cards are made out for cars not previously having cards, the cards are arranged into groups representing all cars which move between the same two stations. A divider card is inserted in front of each card group to indicate the station from, the station to, and miles. The cards are then used to transmit arrival information to Chicago. These groups of cards are preceded by a header card of train information and followed by a caboose card and an end-of-report card.

If a car is bad ordered at a mechanized yard, a punched card would be available for the car when it arrived or when it was loaded at that

point. This card is used with the appropriate header card to indicate that it is a bad order, and so reported to Chicago Car-Fax headquarters. The header card in front of the car card gives the location of the car (where it was set out), and the reason it was bad ordered. When the dispatcher notifies the yard office that the bad order has been repaired, then this information, using the punched card previously prepared on the car (usually a No. 1 card, and a No. 3 card if necessary) is transmitted to Car-Fax headquarters, indicating that the car is now released and ready for movement.

### ***From Idea to Fact in Two Years***

North Western management began planning for Car-Fax in 1957. That entire year was spent with the accounting firm of Arthur Andersen & Co. working out the plans and details of the Car-Fax system. Also working with the railroad were International Business Machines Corporation, which furnished the transceiver and data processing equipment, and American Telephone & Telegraph Co., whose circuits are used. The railroad is leasing the IBM equipment and AT&T circuits.

One of the big problems in planning such an installation was where to locate the mechanized field stations. One object of the system, of course, is to "catch" as many cars as possible each day. As presently set up, all time freights originate and terminate at one of the field stations. Individual cars may pass several field stations a day. Hence, it is common to have the central tracing record show a freight car passing through two, three or more yards.

Field stations were selected on the basis of train movement and were located where train movements were concentrated. This, of course, included interchange points. Although the North Western has 222 interchange points, 80% of interchange movements occur at the mechanized yards (Car-Fax stations).

The study and planning for Car-Fax was completed by the end of 1957. The system was installed during 1958. First transceiver installations were in South Dakota and Wyoming, the west end of the railroad. Simultaneously, Car-Fax headquarters was set up at the Ravenswood accounting office in Chicago. To be

of any use even to the first field station, Car-Fax headquarters had to be able to receive punched card information and process it. Traffic is lightest at the west end of the system where stations were cut in first.

As personnel both at the field stations and at Car-Fax headquarters became accustomed to handling greater volume of punched cards, installation was able to proceed more rapidly. One of the next Car-Fax stations to be put in service was at Proviso yard, the North Western's large retarder classification yard just west of Chicago. All field stations have one transceiver, except Proviso and Butler, Wis., which have two each. Twenty transceivers are in Car-Fax headquarters in Chicago.

Most Car-Fax field stations are in previously existing structures, such as freighthouses, yard offices or passenger stations. In nearly all cases, the buildings were rehabilitated, at least to the extent of installing air conditioning. In some cases, sound deadening material in the ceilings, and fluorescent or new lighting was installed. At Crystal Lake, Ill., one-half of the passenger station waiting room was utilized for the Car-Fax field station. At Fortieth Street, Chicago, a new building was constructed which also houses the local agent's offices as well as welfare facilities. Most offices have air conditioning, which is desirable for operation of the transceivers and other IBM data processing equipment.

As with any new system, extensive training was needed to enable C&NW personnel to operate Car-Fax. As expected, the system required additional personnel, not only at Car-Fax headquarters in Chicago, but at some of the field stations. In late 1957, North Western set up a group of 25 instructors who took a five-week course in Chicago on Car-Fax operations, and also in accounting methods and procedures. The course included instruction by IBM on use of its equipment. The 25 instructors supervised the installation and setting up of the Car-Fax field stations, and trained the clerks and telegraphers to use the transceivers and IBM equipment at the 68 stations. The training program is continuing. Other North Western personnel working in the Car-Fax system are taking additional training in integrated data processing techniques.