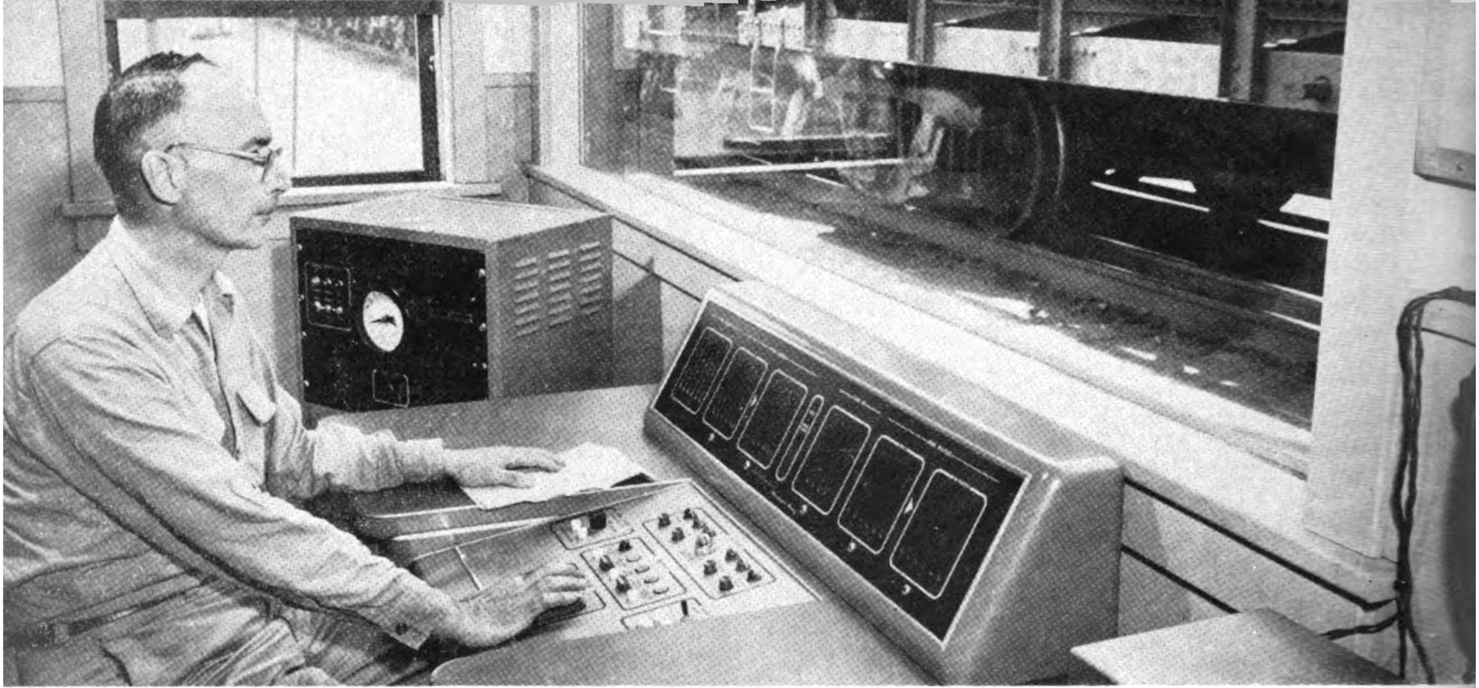

How Railroads Use Computers

Large and intermediate-scale computers have been in use on railroads for only a few years. During this period *most* of the work they have done is more or less routine paperwork. By and large the computer has paid for itself in reducing the cost of such work. Perhaps more important for the long pull, this period of programming the routine has familiarized railroaders with both the workings of the computer and its capabilities. Some roads have gone beyond the routine paperwork stage into more dramatic and probably more profitable work.

Certainly a computer can do much more than paperwork alone. Improving management controls is, in fact, probably the most important computer function. To do so, a computer can provide information otherwise unattainable or too expensive to obtain by former methods. A part of this information function, for example, is computer simulation of railroad operations. Simulation enables management to *test* possible solutions to a problem before putting them into operation.

What follows are some examples of how railroads are using computers. This by no means covers the field.

A western railroad installed a computer to provide complete weight information at one of its iron ore docks. Speeding up the weighing process and other paper work has made it possible for the railroad to advise the shipper (mining company) quickly how much of a required grade of ore is on hand at the docks. Consequently, the shipper can quickly make up any deficiencies in an order. This reduces ship waiting times.

Here's how the system operates: As cars of iron ore pass over a scale, the operator enters information into the computer by pushbuttons. He inserts car initial and mine waybill number. The scale feeds the gross weight into the computer, which then calculates the weight of ore per car and each run of cars in a mine waybill. Formerly, such calculations were determined manually by the scale operator. Now the computer and scale working together can weigh and process five to six cars per minute.

Data emerges from the computer via a punched tape. This is processed and information sent to the mining companies and the railroad's ore docks. Such speed is important. As soon as the mines receive a record of weights shipped, they can determine whether additional ore will be necessary to complete the loading of a ship. Guesswork is eliminated from the job of providing different grades of ore in correct amounts to meet steel mill requirements. As a result, mining companies have improved their customer relations. For the railroad, quick production of weight information eases the old problem o "preference" ore— ore which the rai road is called upon to rush to the dock to finish loading a vessel. In case mor than enough ore has already been dis patched to the docks, the railroad wi avoid over-dumping, with the conse quent tying up of dock space.

'Brain' Remembers 55,000 Item

A midwestern railroad is automatin its P&S procedures around a memor storage type of digital business con puter. Current information on inve tory control and accounting is availabl on a daily, rather than on the conve tional monthly, basis. The automate system reduces inventories, but stoc items are not exhausted before bein replenished by computerized reorderin processes. Aside from savings due t reduced inventories, the railroad est mates there are additional 15% t 25% savings representing such hidde costs of P&S operations as obsolescenc insurance, deterioration, handling, sto age and theft. Also, the efficiency c P&S operations is improved.

This road's purchasing officer report that the new system furnishes a pe petual record of the amount of mone the company owes for materials an supplies purchased, delivered or du for delivery. It automatically prepar vouchers and drafts on dates due, th nproving the cash flow.

When "asked," the computer can in-antly provide the unit price of each f about 55,000 items listed in the stores italog. Many other financial details ·e available upon interrogation: the 'stem quantity of each item on hand; ırrent usage of each item at each ication; lead time for ordering each em: dollar values in terms of classes material in hand, issued or returned, id transferred from one location to other. The computer can search its itire file to uncover surplus material nditions at store points. When such ırplus conditions are disclosed, it will itomatically initiate transfer of such aterial when necessary.

Annual inventory will be simply a atter of mark-sensing item cards and eding them into the file computer. his will be to double check the per-tual figures carried by the machine.

Two eastern railroads, in a joint roject, used computer techniques in a iarket study of shipments from a iedium-size city. An objective was to nd the traffic flow by type of transpor-ition—rail or truck. The railroads ob-iined information from over 25 com-anies manufacturing diverse products. he industries reported the number of iipments made during the sample ionth, the weight of each shipment, nd the distance each traveled.

Computer techniques were used, be-ause of the large amount of data to be andled. One of the roads wanted the iformation to try to recapture traffic iat moved by truck. The railroad eeded information quickly. The road as since been engaged in a broad rate nd service study, based on the com-uter data, designed to recapture as iuch of the traffic as it can.

Study results, incidentally, indicated ıat trucks moved about 83% of ship-ients made during the sample month. ınd more important, a method was stablished by which all railroads can iake traffic flow studies.

imulated Train Operation

In still another area of computer pplication, a workable program has een developed for simulating single ack operation in centralized traffic ontrol territory. Using an electronic igital computer, this program (in-ructions to the computer) can handle o to 10 trains at a time over a 100-50-mile section of railroad. As each ain's run is completed, another train iay be added. Ten trains can be com-uted over the road in about 1 hr 40 iin.

The computed information is of con-iderable assistance in planning the ack and signal layouts for CTC. New data for a complete change in track and signal layout may be prepared from blueprints in half a day. Train data, such as motive power, departing times and station stops, may be changed in a few minutes.

The advantage of computer simula-tion is that changes in the signal sys-tem, track layout, motive power sched-uling, and similar problems can be tried out without incurring the expense or inconvenience of modifying the real physical plant. The best arrangement can be found, and expensive wrong decisions eliminated, before actual changes are introduced. As much as two to three years of experience can be condensed into a few hours' com-puter time.

Computer Tells Train Performance

An eastern railroad is using a digital computer to calculate: (1) train per-formance, (2) fuel or electrical energy consumption, and (3) locomotive ton-nage ratings. The computer cuts the time required in figuring tonnage ratings by 80%. It also determines train sched-ules possible where given tonnages are to be hauled by a train with a given motive power. Chief advantage of such calculations is to permit the economi-cal assignment of motive power to freight or passenger trains.

For example, the assignment of addi-tional motive power to a train might decrease running time between given points. The computer helps determine whether or not this assignment will be economical in terms of the time that might be saved. Factors included in the calculations are: grades, curves and distances; speed restrictions; weight and tractive resistance of the train; tractive force of the motive power; rate of deceleration during braking; and the number, location and duration of station stops.

Train performance is calculated at rates varying between 700 and 2,000 miles of track per hour, depending up-on the number of station stops, speed restrictions and grades. Tonnage rating calculations on the digital computer re-quire from one to five minutes per locomotive group, depending upon the length of track involved and degree of accuracy required. A tolerance of zero to minus 3% of the exact rating has been found acceptable. Using an analog train performance calculator for the same job requires one-man-day. To do the same work with slide rule and desk calculator, the time required would be prohibitive.

A western railroad, in a program now temporarily shelved, used a com-puter for providing information on better distribution of empty box cars. It plans to handle this work on a new, larger computer to be delivered in 1960.

One of the first factors needed in the road's car distribution study was to find the level of loading and unloading activity on each division. Also required was information about empty cars on hand on each division; receipts and de-liveries to and from connections of loads and empties; time delays involved for each division in each of the various types of moves (spotting of empty cars, for example); and the combination of moves which would best meet the needs of each division while minimizing cross haul and empty mileage.

The railroad developed a 7 a.m. yard check report—showing number of box cars on hand loaded and in possession of the railroad; cars on shippers' and receivers' tracks; and empty cars in possession of the railroad. This in-formation and the road's car move-ment records, were required to estab-lish the inventory level on each division.

A mathematical model of the rail-road was constructed, showing con-ditions on each division. This model showed clearly that down-grading of cars represents no direct cost; upgrad-ing of cars does generate cost; and, of course, moving cars from one division to another does generate crew, fuel and other direct costs.

Computer Processes Data

From this model, the railroad was able to establish both a system for estimating the actions which would have to be taken to bring about a given car supply on any division, and the approximate cost of such actions.

A computer was used to process the data to produce the best distribution plan. Fed into the computer were: (1) data from wheel and interchange re-ports, showing station-to-station moves of each empty box car, and receipt or delivery in interchange of each such car; and (2) loading and unloading re-ports, which show each car spotted empty on a shipper's tracks to load, or released empty by a shipper after un-loading. With this data reduced, in-ventory updating, activity forecasts for the divisions and time standards for each type of movement involved, are introduced into the equation.

The computer, operating at high speeds, found the best program pos-sible. (The approximate cost of every car movement involved was known.) Essentially, according to the railroad, the computer took all possible com-binations of actions, weighed the conse-quences of each such combination, and eventually came up with the answer which struck the best balance between costs and service for the whole railroad.