INDUSTRIAL DATA PROCESSING APPLICATIONS REPORT

Applications	Design Automation
Type of Industry	Transportation Control Systems
Name of User	General Railway Signal Rochester, New York

Equipment Used	IBM System 360 Model 30

Synopsis

General Railway Signal is using an IBM 360/30 data processing system to produce highly technical schematic drawings of electrical transportation control systems.

The system has greatly speeded up the processing of orders from receipt to shipment by eliminating many of the time consuming manual steps. What began as an engineering approach to problem solving in an industry that is typified by custom designs, is fast reaching into virtually every aspect of the company's business.

At the present time General Railway Signal is working on a total systems approach that will be completed by 1970.

Building Railroad transportation systems is an exacting and demanding business. Each system is designed to meet specific geographic considerations and hardware requirements. No two are exactly the same.

Systems logic engineering is performed by highly specialized applications engineers who draw upon many years of experience in this field to develop specific solutions for the various problems encountered in each application.

The circuiting solutions to these problems must then be translated into terms of hardware arrangements and the thousands of electrical connections required to complete the circuits.

Normally the translating of systems logic into plans for use by the manufacturing division took as much as four times the effort and man-hours that was required to develop the systems logic. It is basically a non-creative clerical job, but much of the drudgery has been replaced with a computer-aided design program.

General Railway Signal Company, a unit of the General Signal Corp., manufactures transportation control systems for railroading, rapid transit and highway traffic. The Rochester, N.Y. company employs some 1,200 persons and according to the most recent figures had sales in the neighborhood of $25 million annually. GRS markets throughout the world and is a leader in the manufacture of railway signaling and control systems. By far the major part of the firm's business comes from the sale of systems — now largely electronic — and signaling equipment items to railroads, and a smaller part from sales to rail rapid transit lines. A relatively small, but substantial, part of the GRS business is the sale of ultrasonic vehicle detectors and modular solid state controllers for street and highway traffic control systems.

BACKGROUND TO EDP

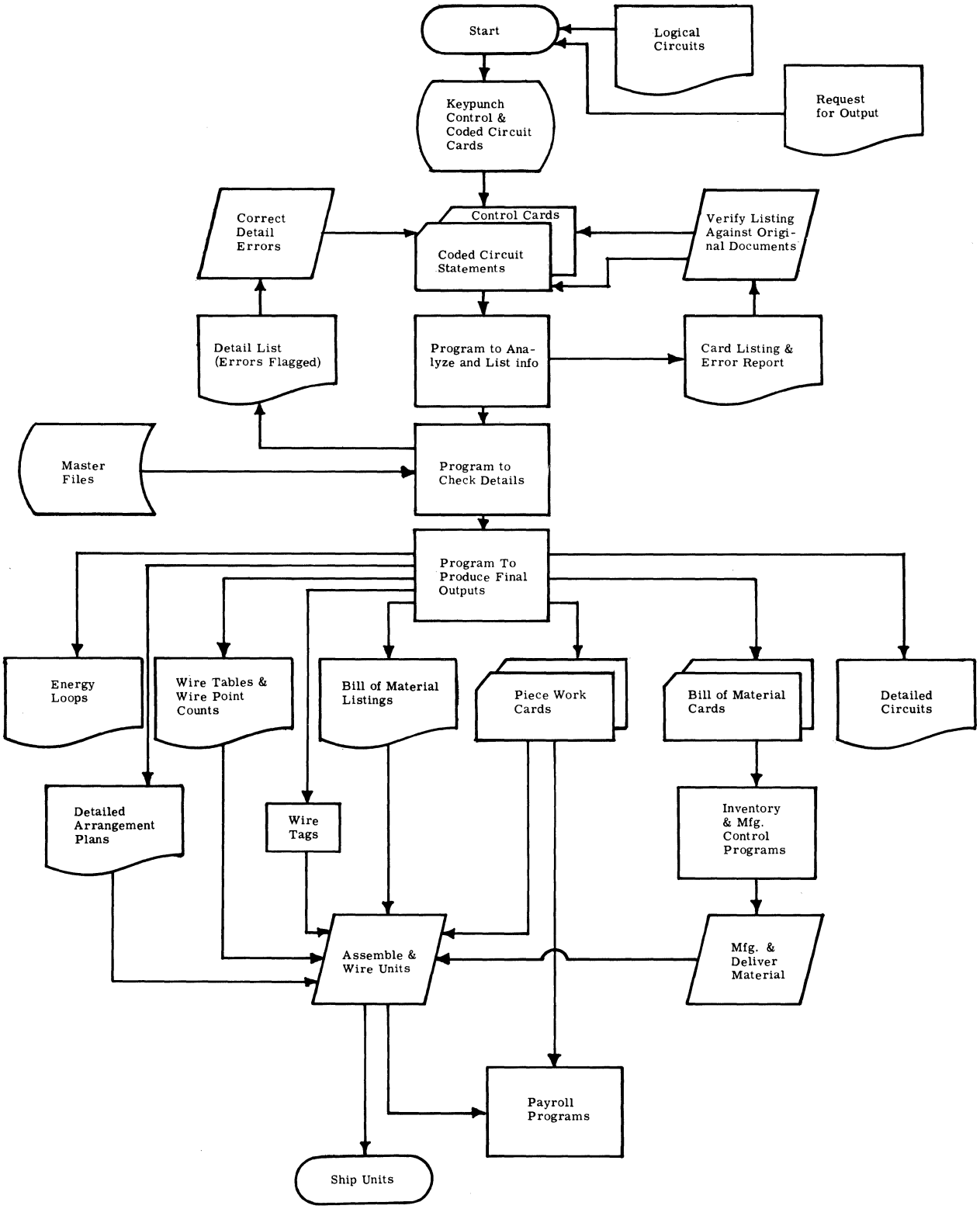
As far back as 1959, management at General Railway Signal recognized the potential of the digital computer. Using a primitive IBM 650 with 20/K drum storage, the company's engineers had wrestled with, and solved, a number of engineering design and traffic control problems.

It wasn't until 1961, though, that the company launched the forerunner of its present design automation program. At that time, an IBM 1401 system was placed on order. The company expressed its confidence in the new computer by assigning it to a design automation project for the New York City Subway System — at that time the largest single rapid transit contract GRS had ever received.

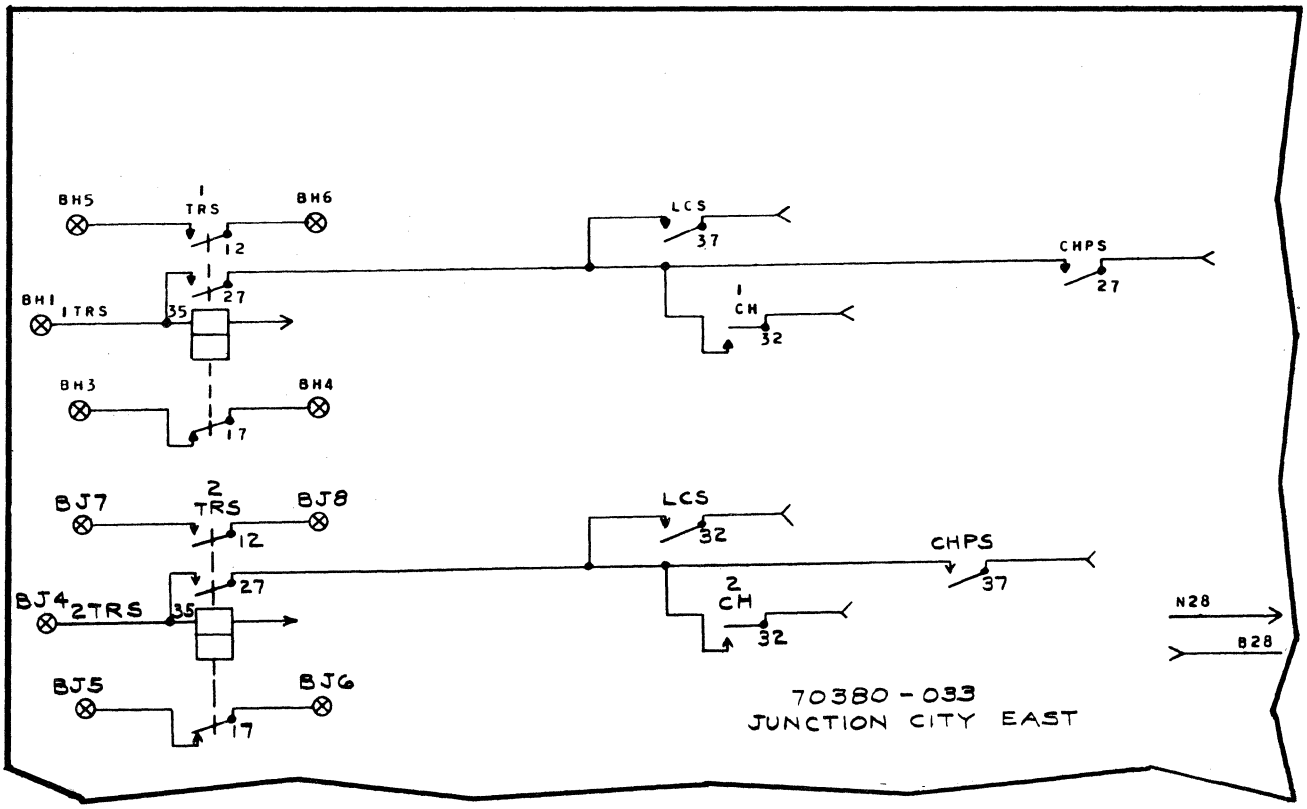
The company is currently using a 65K IBM System 360/30 computer with four disc drives and four tape drives. An IBM 1403 printer capable of 1,100 lines per minute is linked to the computer.

DESIGN AUTOMATION AT GRS

A study of the manual processes which were used at GRS prior to 1961 revealed that they were basically involved with collecting data, collating and sorting it, and then reporting the results in various formats. Close examination indicated that it would be feasible to perform these functions with EDP. Much of the knowledge of systems requirements, design and translation was in the heads of long time employes who could draw manufacturing specifications based on their own experience. This information had to be documented before the program could be put into effect.



FROM TWO PRIMARY INPUT SOURCES, LOGICAL CIRCUITS AND REQUEST FOR OUTPUT, THE PROGRAMS ARE DESIGNED TO PRODUCE EIGHT MAIN OUTPUTS USED IN THE ASSEMBLY OF GENERAL RAILWAY'S SIGNAL'S PRODUCTS AND FOR SUBSEQUENT APPLICATIONS INCLUDING INVENTORY CONTROL AND PAYROLL.



CIRCUIT TRANSLATING AND CODING CLERKS CONVERT DATA FROM BLUEPRINTS TO PUNCHED CARDS.

REQUEST TO DESIGN AUTOMATION

Date: Requested by: Supvr.:

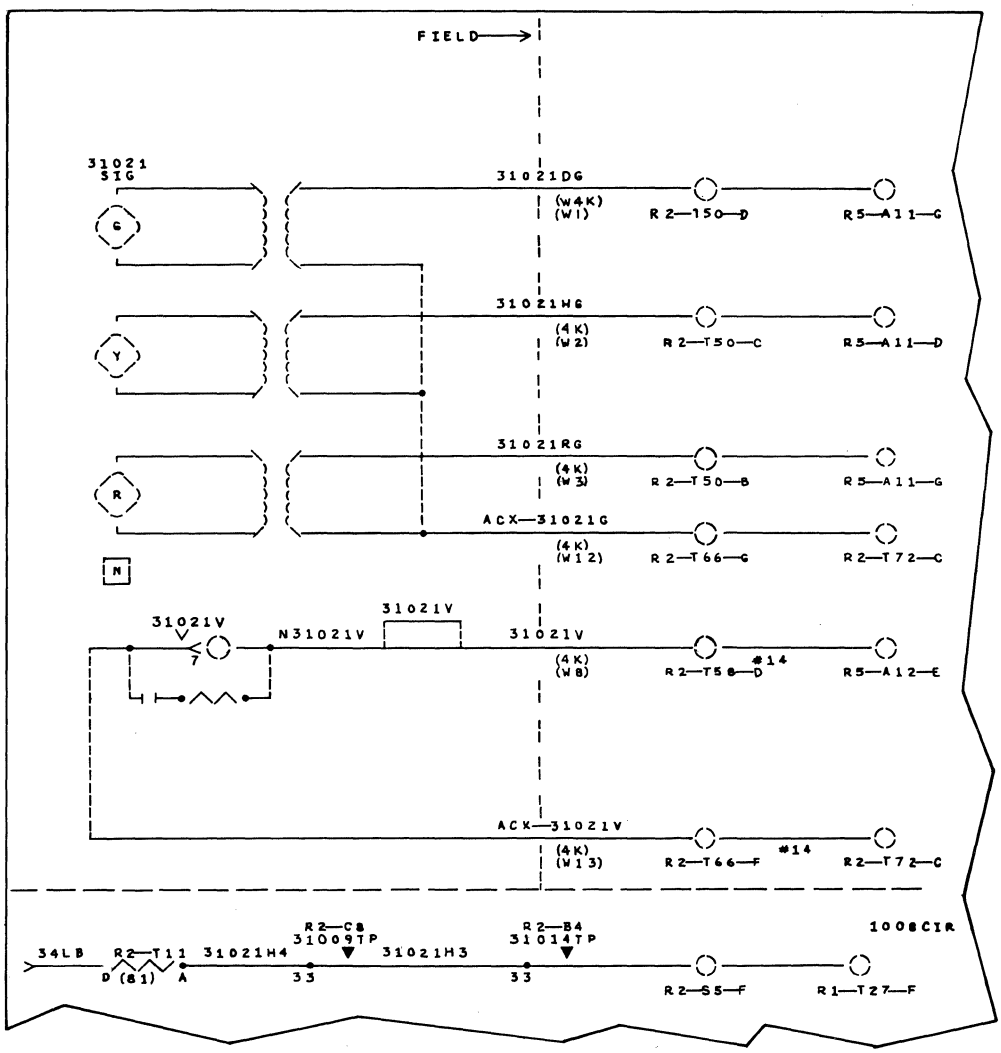
Contract No.		Unit Dash Number	
Railroad		Rack No. (if any)	
Location (Relay Rm., etc.)		Cabinet No. (if any)	
Unit Master No.		Ship Sched. (Form 34)	
Unit (70000) Key No.			

Standard Wire Drawing No. _____ Size _____

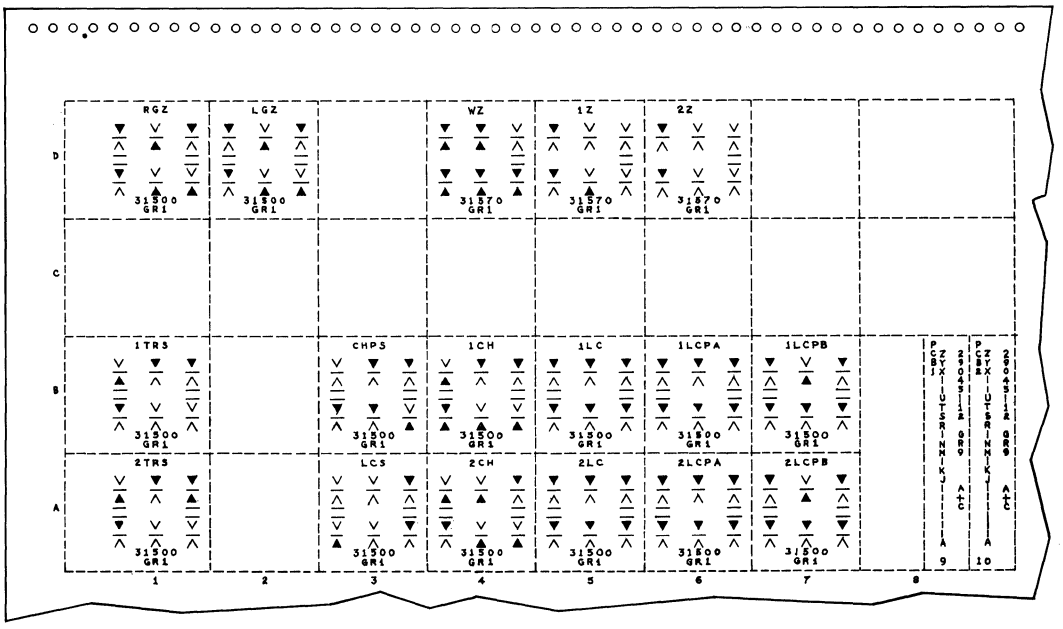
Other Wire Drawing No. _____ Size _____

Other Wire Drawing No. _____ Size

A REQUEST FOR OUTPUT ACCOMPANIES THE BLUEPRINT. DATA FROM THIS FORM ALSO IS KEYPUNCHED AND, IN EFFECT, TRIGGERS THE PROGRAMS REQUIRED TO PRODUCE THE DESIRED OUTPUT.



SPECIAL CHARACTER SETS ON THE IBM 1403 PRINTER ENABLE GRS TO PRODUCE SCHEMATICS USED TO ASSEMBLE THE CIRCUITRY IN THE SWITCHES AND CONTROL SYSTEMS IT MAKES. PRODUCTION OF THESE CHARTS BY MANUAL METHODS REQUIRED NEARLY SIX HOURS.



The goals of the new system, eight in all, were defined and programs written to carry them out. They were:

--Count relay contact requirements for control systems to be built and report them to aid in the production of equipment arrangement plans.

--Assign and report relay contact assignments.

--Assign and report rack terminal (racks on which the system components are mounted) assignments.

--Produce unit wire tables.

--Produce inter-unit wire listings (information to run wire from point to point).

--Produce wire identification tags for factory wiring.

--Produce field wiring lists.

--Produce wire identification tags for use in the field.

Meanwhile, other programs were developed to produce wire listings for the other types of systems being supplied to railroads.

In 1966, when IBM delivered the 360/30, a program was initiated to rewrite the original programs for the new computer. The chief objective was to maximize overall applications and reduce the emphasis on the engineering aspect of the business. EDP was to be expanded to practically every area. GRS also took a look at the accelerating rate of technology and emphasized the development of systems that would not be hardware bound in the near future.

THE SYSTEM

When a customer order is received a request for output and a hand-drawn logical circuit design blueprint are forwarded to data processing. The engineer has a number of alternative designs based on general physical environment of a geographic area. The request for output is a pre-printed form that contains specialized information on the wiring and circuit requirements for each job. These special requirements are pencilled in by the engineer in charge of the job.

In the data processing department, circuit translating and coding clerks convert data from the blueprint into punched cards. The cards are then run through the computer to produce a card listing printout--a list of the items required to build the system--which is checked against the blueprint.

After verification, the cards are run through the system again to produce the output information required to build the system. The prime piece of output is a schematic representation of the unit to be built. A special character set on the IBM 1403 printer enables GRS to produce this schematic which formerly was done manually. The schematic provides the factory with information to assemble the unit.

A bill of materials list is also produced. It lists all the components required to build the unit and is also produced in punched cards which are used for inventory control purposes.

A wiring table and wire point counts are also output and used in the factory to assemble the units required in the system.

Wire identification tags are also printed out by the computer. These are attached to the wires on the unit to facilitate hook-up.

All output eventually is put together in a packet that is sent to the factory. The packet includes a set of pre-punched cards covering each phase of assembly required for the unit. These cards include the pay rate for each operation; employes' pay is computed on the basis of their work output. When an assembly operation has been completed, the employe involved turns in the punched card--along with his own identification--and this data goes back to data processing to become input for the payroll program.

RESULTS AND FUTURE PLANS

At one time, General Railway Signal's programs were heavily engineering-oriented. As the company starts to approach a system that will eventually reach into nearly every aspect of the business, it is becoming apparent that limited use of the computer is no longer desirable or practical.

Probably the biggest factor in the EDP revolution at GRS is the time-saving aspects of the computer. The printed schematic graphic report once required six man-hours to compile by hand. Today it is done in six seconds. The number of steps necessary to complete a transportation control system remain about the same. However, they are performed infinitely faster because much of the work that was formerly done by hand is handled by the computer.

Another advantage has been documentation. Information that was once the private store of long-time employes is now committed to the computer's memory where it is available quickly and when needed.

At the present time, GRS is about 50 percent into the four-phase system which management has adopted. The present magnetic tape Bill of Materials system will be replaced by a more sophisticated disc oriented system. Presently implemented is an operations planning and labor loading system for the factory. By 1970, current plans call for a total manufacturing control system with no sharp dividing line between programs.

Management at GRS is aware of the computer's role in transportation control systems and fully intends to maintain the initiative and expand the benefits to be gained through its use.