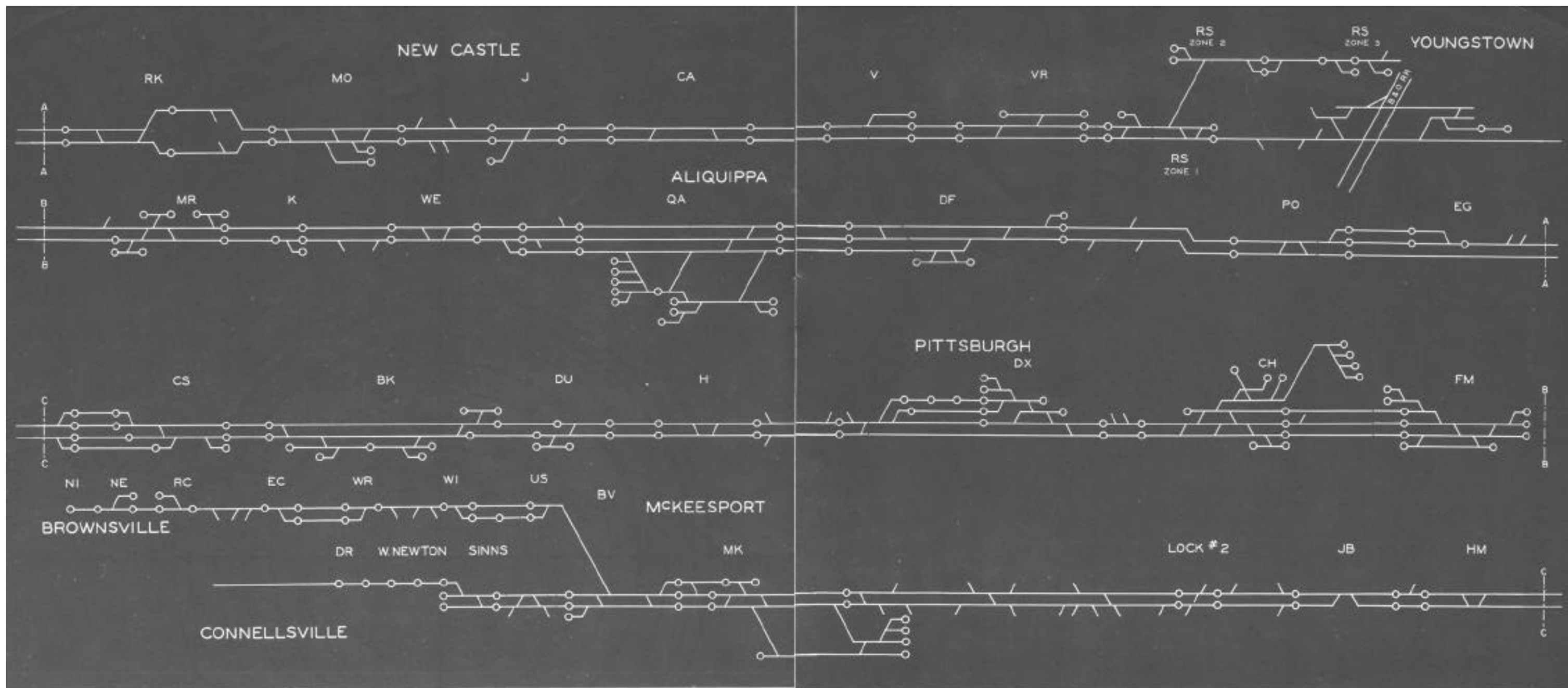


P&LE
centralizes
control of
its 180 miles
of mainline



Route-type control machine at Pittsburgh, Pa. will provide control of entire mainline. Pushbuttons (circles on drawing) will be pushed to clear signals at entrances and exits of routes aligned by operator.

P&LE centralizes control of its 180 miles of mainline

Planning is well along and some field work has begun on Pittsburgh & Lake Erie's centralized traffic control project that encompasses its entire mainline.

Sometime next year, one man seated at a control machine in Pittsburgh will be able to route trains on the P&LE's 180 miles of mainline by pushbutton control using a route control machine. At present this mainline is controlled from five in-

terlocking or CTC machines strategically placed along the railroad. P&LE will spend about \$1.8 million on this centralized control project, which will provide a reasonable rate of return, say road officials.

Essentially the railroad will be streamlined from a four and three-track mainline to double and single track mains. There will be about 80 miles of double-track mainline with either-direction running on

each track. This will cover the territory from Youngstown to McKeesport (15 miles east of Pittsburgh). The Youghiogheny branch (McKeesport-Connellsville) and the Monongahela branch (McKeesport-Brownsville) will be a single-track CTC except for 12 miles of double track. These sections will total about 65 miles of single track mainline.

This centralized control project will increase track capacity and pro-

vide for greater flexibility in handling some 200 mainline moves daily. Baltimore & Ohio has trackage rights from McKeesport to New Castle, about 58 miles.

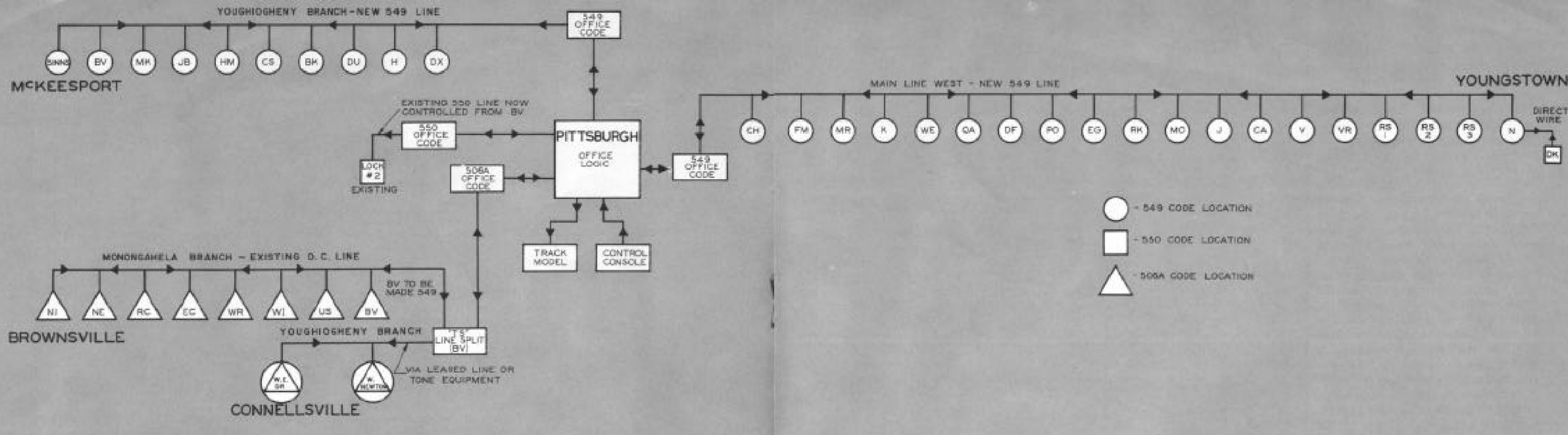
In a typical day, a traffic count revealed 44 trains operating. Traffic peaks appear between 3-8 pm and 6-9 am. On this typical day, when operation of the railroad was under the control of operators at five centralized traffic control or interlock-

ing machines, it was determined that these men made about 3500 movements to position switches or clear signals for trains in the 24-hour period.

To handle this traffic expeditiously, P&LE engineers working with the Signal & Communications division of Westinghouse Air Brake Co., determined that a route-type control machine would be practical. With such a machine, the operator

pushes only two buttons to route a train through an interlocking or over a controlled section of line. He presses a button where the train enters and pushes another button where it leaves. The control equipment selects the preferred route, positions switches, and when safe to do so, clears signals for the train.

The new route-type control machine will be located at Pitt tower in the railroad's general office building



Block diagram of code systems to be used. One will feed west of Pittsburgh, the other east. Initially, type 549 code system will operate at 400 bits per second, but it could be stepped up to handle 2,000 bits per second, if required.

in Pittsburgh. This control machine will consist of a 21-ft control section with a small track diagram and operative pushbuttons. A separate and larger track display panel will be located directly in back of the control machine to provide easy viewing by the operator.

The new machine will have 223 pushbuttons for the control of routes at 39 locations. This compares with 42 such locations formerly controlled from five P&LE CTC or interlocking machines.

It is proposed to have fleeting controls so that when following train movements are made on relatively close timing the operator need not re-establish the same route for the second train. Operation of the fleeting control will allow controlled signals to clear following a train movement provided it is safe to do so, and without the control operator's action.

At two locations, return-to-train signals will be provided where an engine has cut off from its train to do switching and later must return to its train. Changes in 1966 in the Signal, Rules, Standards & Instructions of the Department of Transportation permit this type of signaling. Formerly, dispatcher permission was required for a trainman to direct his engine to pass a controlled signal in the Stop position. On this P&LE installation, the control operator will be able to direct the engine to return to its

train by signal indication, which will be a restricting speed aspect.

The control machine will also be equipped with the usual peripheral control facilities required for train operation and control, such as individual auxiliary switch control levers, call-on buttons, train return and maintainers' calls.

The display of the indications for the controlled functions and track occupancy conditions are on a separate track model that is geographically oriented to the actual railroad and consists of multi-colored light segments. The placement of the light segments is such that routes that have been selected are displayed as a line-of-light of one distinct color, while routes that are occupied are displayed as a line-of-light of another color. Routes that are neither selected nor occupied remain dark. Further, for convenience of the control machine operator, the condition of signals which govern movements through selected routes are displayed by means of multi-colored light segments. These light segments coincide with the wayside signals and associated pushbuttons and display a distinct color when the push button to which it is associated has been operated to initiate a route and continues to display this color until the signal has actually cleared for the train movement, at which time a second color will be displayed. The second color will continue to display until the signals in

the field are set to stop, either by entrance of a train or by cancellation by the control machine operator.

As a part of the route interlocking system, numerous logical functions are performed at the central office. In general, these functions consist of selection of the routes, route preference, establishing and maintaining traffic direction and generating the controls for the field functions. In addition, information concerning the position of functions in the field is indicated to the office and these indications are stored and used for display on the track model and to affect the control logic.

Also included in the control console will be a communications panel with appropriate toggle switches, keys, etc., enabling the operator to have telephone or two-way radio communications throughout the system.

To assure good communications between trains and the dispatcher's office at Pitt tower, 12 wayside radio base stations will be provided with remote dispatcher-control equipment. Presently, these stations are locally controlled. The new control feature will enable the CTC operator or dispatcher to select a particular radio base station and control it for maintaining communications with a train crew.

Also, tone-coding equipment will be provided for P&LE locomotive radios so that a crewman will be

able to signal the dispatcher or CTC operator. Use of tone coding will light an indication lamp and alert the dispatcher as to which specific base radio station is calling.

A solid-state, high-speed type 549 code system will be used to send controls from Pitt tower control machine to each of the field stations over a wire pair on the pole line or in cable. Also, this duplex system will continuously scan these stations and transmit indications to Pittsburgh. The system is arranged to handle 400 bits per second, which is equivalent to 600 words per minute teletypewriter operation. In a typical operation, the system will be able to scan and receive reports from all 18 field locations between Pittsburgh and Youngstown in 5 seconds.

The importance of such speed and capacity can be appreciated by considering that more than 3500 switch movements and signal clearings will be required in a 24-hour period. Each of these functions will necessitate a control to and an indication from the field.

This new high-speed code system, type 549, will reach out to each of the field stations or controlled points as they will be called. While most existing signal equipment is being retained, the older time code control systems used for former mainline interlocking and CTC controls will be replaced with this 549 system. The higher speed is required for the greater density of controls

and indications to be handled in the consolidation project. However, the 506A code system now handling the CTC on the Monongahela branch (BV to NI) will be retained, but the 549 system will reach out to BV and pick it up. For the trains operating daily over this McKeesport to Brownsville line, the speed of the 506A code system is satisfactory.

As part of the new signaling changes are being made at New Castle, Aliquippa and McKees Rocks. (Mc K R yd. [CH] is 3½ mi west of Pittsburgh). The mainline is split at these locations with the yards located between east and westbound mains. To reduce congestion and delays, a maintrack will be moved so that the yards will be located on one side of both main tracks. Also, a controlled siding will be provided off the main tracks which will connect to the yard leads. Thus, trains and engines can work the yard leads without interfering with mainline traffic.

The controlled siding principle (power switches and controlled signals at the main track) will be used at other locations where there is considerable industry switching.

Although there is a streamlining of sorts, there is a considerable beefing up of the remaining trackage to provide greater capacity by installing reverse signaling so that trains can run both ways on the two main tracks. Approximately 101 miles of

mainline track will get reverse signaling.

Work is now progressing on the track and signal changes that are required. In some locations, former interlockings will be removed. Some power switches will be replaced with hand-throw switches and equipped with electric locks. At other locations, new power crossovers will be installed to provide greater flexibility of train operation.

Because of the reverse running on both main tracks, longer approach circuits are needed for highway crossings where the protection equipment was controlled by single-direction train movements. Audio frequency overlay track circuits will be installed to provide this additional protection controls.

In McKeesport where the B&O now runs through the center of the city, B&O will obtain trackage rights over the P&LE. This will eliminate 23 highway-railroad grade crossings. However, it will mean the installation of improved protection at three crossings on the P&LE.

Although not included in the present system, the logic at the control office and other features of the equipment including the expandability of the 549 code system from its present 400 bit to 2,000 bit per second operation, make certain additional features desirable. These can be added in a step or building block fashion. Thus, P&LE can achieve what might well be termed

total control without restructuring its centralized control project.

Inasmuch as there is considerable switching performed at various interlockings within the controlled territory, it is possible to offer additional facilities whereby the control machine operator, by manipulation of selecting devices, may describe by train number a train entering the control territory. This initiates action to store and transfer the train description automatically as the train progresses from point to point. The control machine operator may then be free to perform whatever duties are required for the various switching moves without regard to remembering the identity of the trains as they progress through the territory. Should a train approach a point, and the control machine operator require information or verification of its identity, then by manipulating the selecting devices, a visual display of the number (three decimal digits) of the approaching train is provided.

In order to provide a record of train movements, it is possible to provide an additional facility whereby the train number as stored by the control machine operator is automatically transferred to a paper tape or IBM card, along with the time of day of the transferral at each OS section as that section becomes occupied. With the paper tape, or card thus produced, a program can be devised for use with whatever type of "off line" computer the railroad may have available. The "off line" computer would be used to edit, collate, columnize and print out a sheet containing the entries and in the format usually found on a train sheet. Obviously by proper input from other sources, such information as crew names, consists and tonnage, caboose, etc., can similarly be processed to provide all information required to be entered on the train sheet.

Further with the use of an "on line" computer, the buffering of information as is provided by the paper tape, or punched card as described earlier may be eliminated and the train sheet logged in "real time". The logging would include such information as train number, location and time.

Other information could be processed by the computer such as train miles, ton miles, crew time. **RS&C**

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