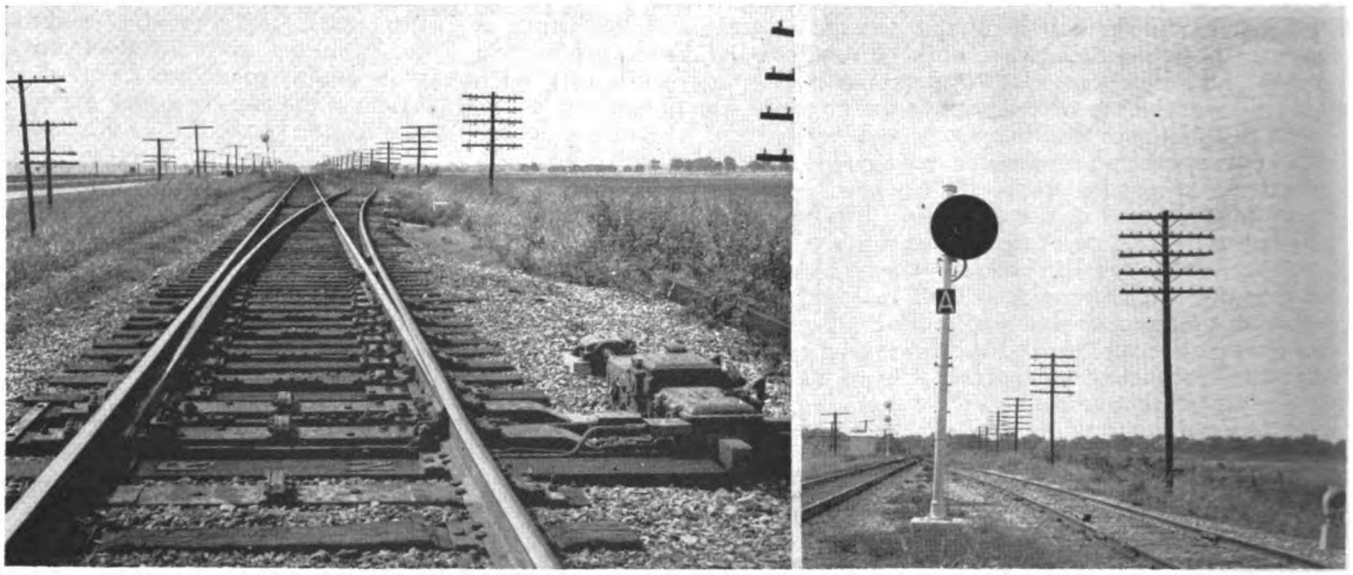


Power switches installed at 4 passing tracks; one end being thrown over to clear main track signal

CTC Improves Train Operation

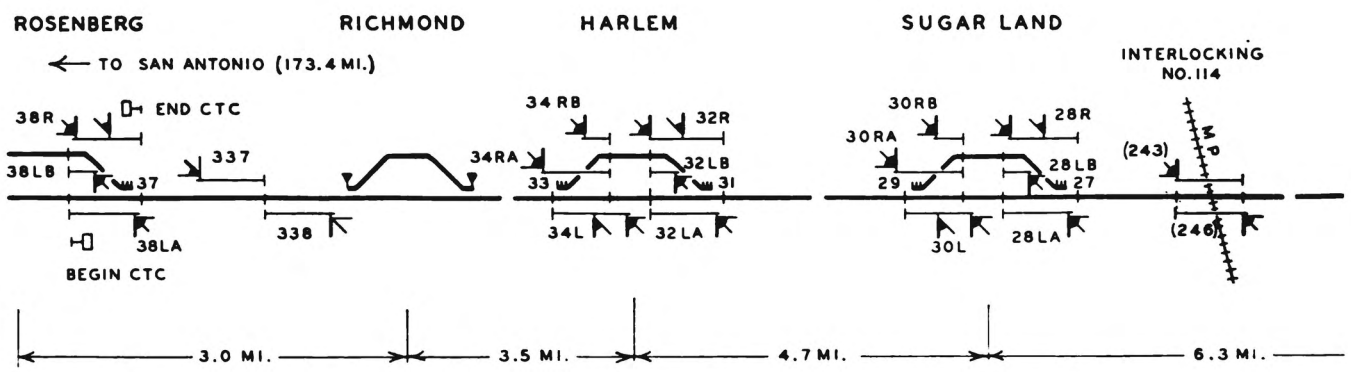
Savings of 1600 train hours annually result from CTC operation on 35 mi. installation in Texas on SP lines

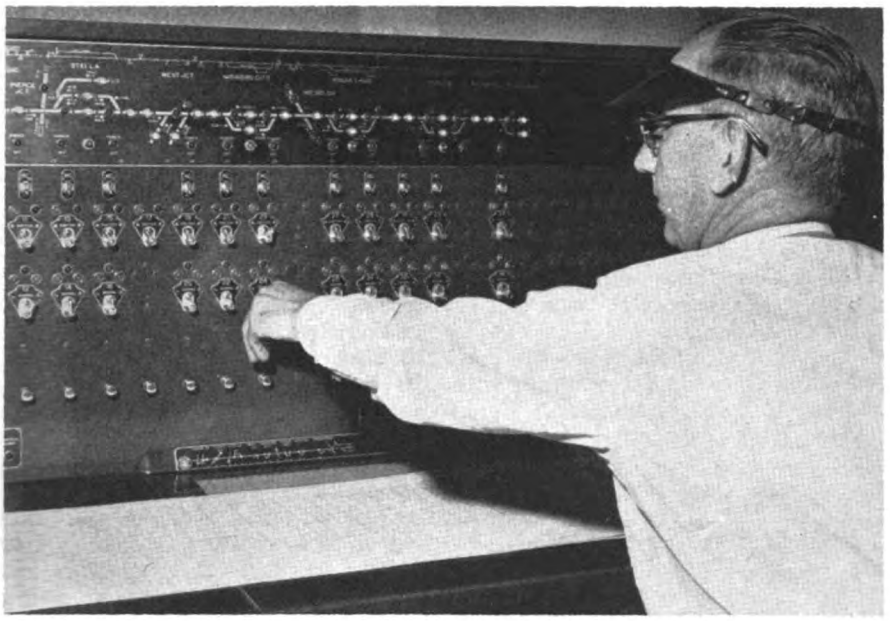
THE TEXAS & NEW ORLEANS has installed centralized traffic control on 35 mi. of single track between Harrisburg (Houston) and Rosenberg, Tex.; the line being part of the Sunset Route between New Orleans, La. and Los Angeles, Cal. The controlled territory is at the east end of the San Antonio division which stretches for 825 mi. across central and west Texas from Houston west through San Antonio (division headquarters) to El Paso. From Rosenberg, another line extends into the Texas vegetable and citrus fruit belt, which is a source of much traffic. During winter months, perishables are shipped north in trainloads being run as extras, via Rosenberg and Houston for cities in northern and eastern United States.

The controlled territory is through practically level country with only 12 curves in the 35 mi. ranging from one curve of 4 deg. 49 min. down to one curve of 45 min. The rest of the curves are 1 deg. or 2 deg. The 113 lb. head-free rail, crushed rock ballast, few curves and practically level terrain are conducive to fast train operation. The maximum permissible speed for passenger trains is 79 m.p.h. and for freight trains it is 60 m.p.h.

Sixteen Trains Make Ten Meets

Traffic consists of 16 regularly scheduled trains daily; 3 Gulf, Colorado & Sante Fe passenger trains each way; 2 Southern Pacific passenger trains each way; 2 SP freight trains each way, and one local SP freight each way. The Houston-Ft. Worth GC&SF passenger trains operate for 33 mi. over the T&NO between T&NO Jct and Rosenberg. Traffic is concentrated during two periods of the day; from 7 a.m. to 12:15 p.m. and from 5 p.m. to 10:30 p.m. During these times, however, the 16 trains make 10 meets in two 2-hour stretches from 7-9 a.m. and 7-9 p.m. Seven trains make 8





Control machine is at San Antonio, 173 mi. from CTC territory

meets in 2 hours in morning. Not only is the 35 mi. section "busy" for these two relatively short periods of time, but five of the seven morning trains are passenger trains which cannot be delayed in making meets. Emergencies, extra trains or delays to a regularly scheduled train often result in congestion and delay to trains, particularly during the two rush periods. Perishables, sulphur, sand and gravel are often handled in trainloads, being run as extras. These trains often amounting to 10 or more a day, provide an average traffic density of 26 trains per day. When the extra trains are operated, for example, oil or citrus fruit trains, they present no problem if they are run over the line during the two "quiet" periods of train operation: early afternoon, 1 p.m. to 5 p.m. and early morning, midnight to 6 a.m. But they can't always be run over the CTC territory during the "quiet" periods. These extras can and often do "hit" the CTC section during peak traffic hours.

To aid in keeping every train on time, and to reduce congestion during peak traffic hours, as well as getting trains over the road in less time than was previously required with train orders and block signals, centralized traffic control was installed. Under the new operation, annual savings of 1600 train hours and about 3,000 freight car days have been realized. Schedules of regular trains have been speeded up, as a result of the CTC operation, despite the two peak periods of heavy traffic. Extra trains are handled promptly and do not interfere with regularly scheduled trains. More efficient use of the track has also increased the track capacity. Less over-the-road time for trains between terminals, has brought about greater utilization of motive power and freight car equipment. The more efficient operation with CTC is resulting in a savings of $85,000 annually.

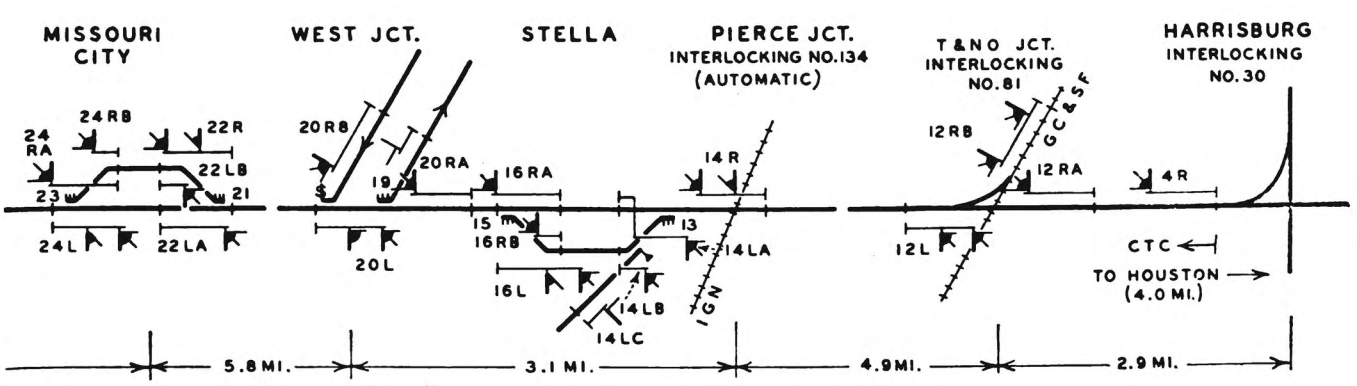
Longer But Fewer Passing Tracks

Of the seven passing tracks used with block signaling and train order operation, three have been removed as passing tracks. Two of these have been removed completely and one siding at Richmond has been electrically locked for local use. The siding at Sugar Land was left in place because it held 153 cars. Three sidings, one each at Stella, Missouri City and Harlem were lengthened to 7,000 ft. to hold 125 cars. These four sidings were equipped with power switches and dispatcher controlled signals. The turnouts at the ends of all passing tracks were changed from No. 9 to No. 14 with 24 ft. switch points. At Harlem, Sugar Land and Missouri City one end of the passing track was thrown over to a 20 ft. center with the main track to allow for clearance of the main track high signal. At the east end of the siding at Stella the main track signal is on a cantilever bracket.

Interlockings Modernized for CTC Operation

Three interlockings in the controlled territory have been modernized as part of the new signaling installation. Mechanical interlockings at Pierce Jct. (IGN crosses T&NO) and Sugar Land (MP crossing) have been removed because they were in need of repair, necessitating either rebuilding or replacement. The westbound interlocking home signal at Pierce Jct. is also the station-entering signal for the Stella passing track. The eastbound interlocking home signals are also the station-leaving signals at Stella. Thus the dispatcher has control of the interlocking home signals on the T&NO. The interlocking, however, is automatic with approach clearing for the T&NO trains if the dispatcher has lined a route through Stella. The interlocking for the MP is approach clearing.

T&NO Jct. interlocking includes a crossing, and connection with the GC&SF over which their passenger trains operate. The interlocking home signals on the T&NO are joint controlled with dispatcher and towerman, as well as the southbound interlocking home signal on the GC&SF which directs their passenger trains out onto the T&NO for movement west to Rosenberg.



These signals are controlled by the dispatcher, but the local operator controls the switches under the dispatcher's direction.

At the beginning of CTC at Harrisburg, the dispatcher has control of a westbound absolute signal. The interlocking, tower 30, is locally controlled. At Rosenberg, the switch and signals at the east end of the passing track are dispatcher controlled. The switch and signals at the west end of the passing track and the crossing and junction with the GC&SF are controlled locally from interlocking tower 17.

Control Machine at San Antonio

A unique feature of this installation is that the control machine is in the dispatcher's office at San Antonio, 173 mi. west of Rosenberg which is the west end of the CTC. Controls and indications are carried over the railroad's communications circuits between San Antonio and Rosenberg, at which point they are put on the CTC code line.

Another feature of this project is that it includes the first installation of the new 514 code control system, which permits any desired number of functions at a location to be handled with one code using only one station assignment. The 514 system is a 35-station time code control system, the basic coding equipment providing 7 code steps for station selection and 7 code steps for controls and indications. Where additional facilities are needed at a field location, extension units are added which increase the number of code steps and thus increase the number of controls and indications that can be handled without using additional station assignments. The coding equipment is arranged so that the control and indication codes can be independently terminated on any even code step after station selection, thus permitting the code length to be limited to the number of steps required to handle the functions. Consequently, control codes and indication codes from the same station need not be the same length, and codes from different stations can be different in length.

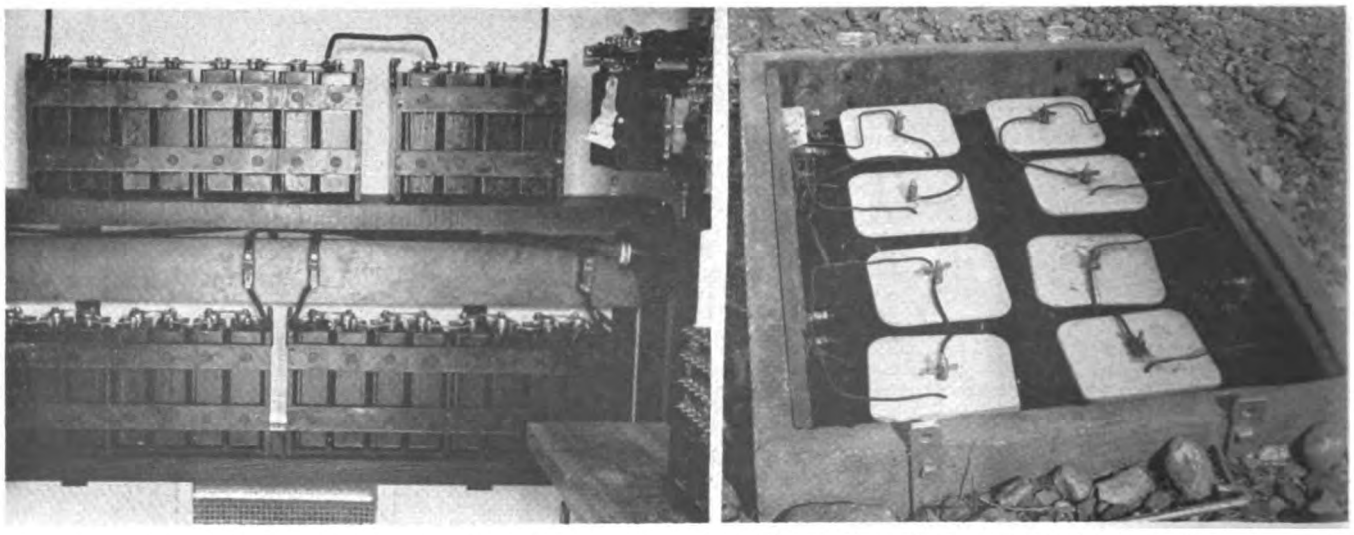
The control machine has the conventional track model diagram with indication lights, switch and signal levers with associated indication lamps, and toggle levers for maintainer's call. The sidings are not track circuited, but an indication lamp is located near the center of each siding on the track model diagram which is controlled by a toggle switch. When the dispatcher puts a train into a passing track, he moves the toggle in the direction which the train is moving, and the light is illuminated, reminding him that a train is in the siding. After the train leaves, he moves the toggle to center position and the light is extinguished. In the desk portion of the control machine is a 16-pen train graph which records the passage of trains over the CTC territory.

Searchlights Replace Semaphores

The semaphores formerly in service as automatic signals were removed. The new signals on the entire CTC territory are the H-5 searchlight type.The masts, ladders and cases of the semaphore signals were cleaned, remodeled and repainted for use on this project. In many instances the signal cases are used to house relays at a signal location and also act as a support for intermediate and absolute signals. On those signals which are not supported by a case, a WRRS junction box is mounted on the signal mast in which the underground cable is terminated. From this junction box, the wiring to the signal operating unit is run up inside the mast. Main track signals are approach lighted and the dwarf signals are continuously lighted. Absolute signals are identified by a white "A" on a black rectangle mounted on the signal 10 ft. above the rail. All intermediate signals are identified by a number plate consisting of white numbers on a black rectangle. Intermediate signals can display three aspects: red, yellow, and green. The restricted speed aspect, red over yellow, is used to direct trains to enter the passing tracks. Leave-siding signals can display three aspects.

The switch machines are style M23A low-voltage, dual control. The switch machines are mounted on top of two ties, with offsets in the throw, lock and point-detector rods. Adjustable rail braces were used on seven ties. All main track hand-throw switches leading to house tracks were equipped with style SL-6A electric locks, with a semaphore-type indicator, mounted on a pedestal in a cast iron case. Atop this indicator is another case which holds a telephone handset which is on the code line. The unlock for the hand-throw switch is effected by use of a short-release track circuit. All switches except three, have a pipe-connected derail.

The signal pole line was rebuilt with 40 poles per mile. Power at 110 volts a.c., is purchased commercially at several locations and feeds both ways from these points on a pair of No. 9 copper wires. This power



Storage battery supplies power for code units and switch machines; primary battery supplies track circuits

circuit is not continuous, thus resulting in a saving of wire. The code line from Harrisburg to Rosenberg is a pair of No. 8 Copperweld wires transposed for 3 kc. The code line is protected by Westinghouse RVS arresters.

CTC Codes on Communication Line

From Rosenberg to San Antonio, the CTC codes are carried on the railroad's communications circuits. The wire pair over which the CTC codes are transmitted is transposed for 30 kc. From Rosenberg to Glidden, these CTC codes are on a wire pair with a message circuit with selectors and an H carrier. A wire pair from Glidden to San Antonio carries the CTC codes, a message circuit (physical), an H carrier and the third story of a Lenkurt carrier.

A complete set of normal and standby CTC carrier terminals was installed at San Antonio and Rosenberg. Also complete sets of normal and standby coded carrier repeaters were installed at Glidden and Lulling. Controls are sent from San Antonio at 18 kc which is normally on and the indication codes are sent from Rosenberg at 14.3 kc which is normally off. If the 18 kc fails for more than 45 sec. the standby equipment is automatically cut in, the changeover being normally controlled by telephone selectors on the dispatcher's line.

The power level for the normal and standby equipment at each repeater station is 18 dbm. Losses are 12 db between Rosenberg and Glidden and 16 db for the line between Glidden and Lulling and between Lulling and San Antonio.

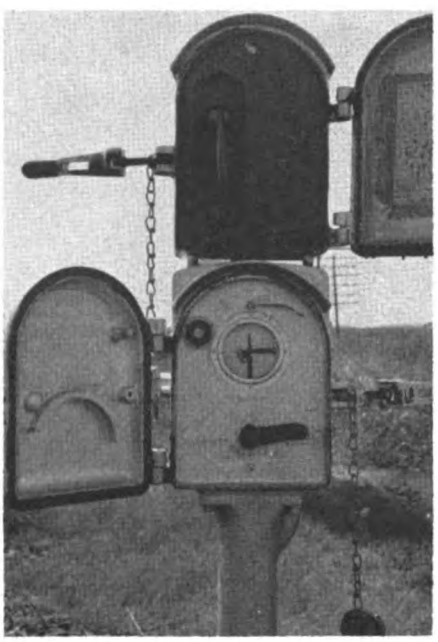
The track circuits are the conventional d.c. neutral type with four-ohm relays using 4 cells in multiple of Edison 500 a.h. primary battery for each track circuit. Eight cells of 80 a.h. Edison nickel-iron alkaline storage battery are used for the operating battery at each intermediate location. This same type of battery is used for the operating battery of the control machine, being cells of 280 a.h. Eight cells provide d.c. line battery at each end of a passing track and 20 cells split in groups of 12 and 8 cells provide code unit and switch machine power. These storage batteries are in the concrete bungalows at the ends of the passing tracks, but at the intermediate locations they are in concrete battery wells. The primary battery for the track circuits are also in concrete battery wells. The operating battery for the control machine which also provides standby power for the carrier equipment, is in a room below the dispatcher's office in the San Antonio station.

Manual Control for Emergency

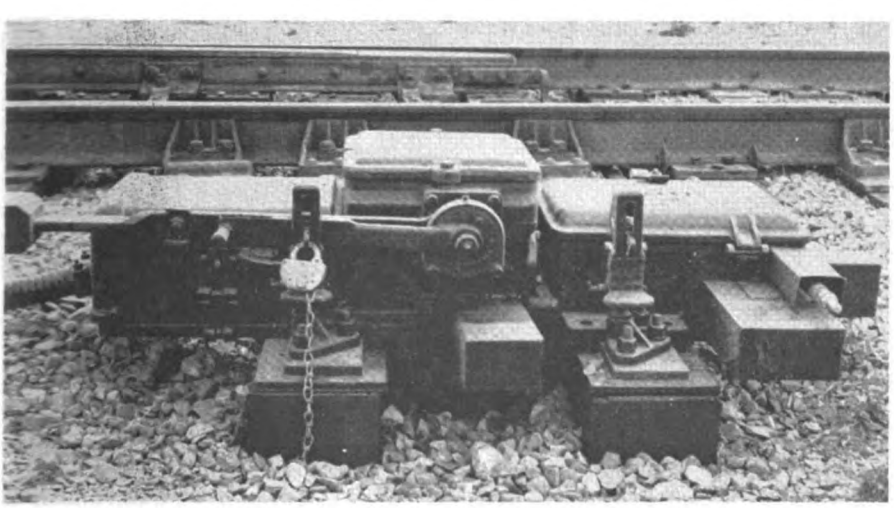
The concrete bungalows at the ends of the passing tracks are 6 ft. by 8 ft. and they house storage battery, relays, terminal board, a telephone handset and a manual control panel. The switch and associated signals at the end of the siding can be locally controlled in an emergency from this manual control panel. The telephone handset on the inside of the instrument house door, is on the CTC code line. The phone is accessible from the outside by a small door which is locked by a switch padlock. Similar telephone handsets are in boxes at electric lock locations.

All wire and cable was furnished by the Kerite Company, underground cable included 14-conductor No. 14 to the headblock signals. Four-conductor No. 10 cable is run to the switch machines as well as for to the switch machines as well as being used for the lighting circuits.

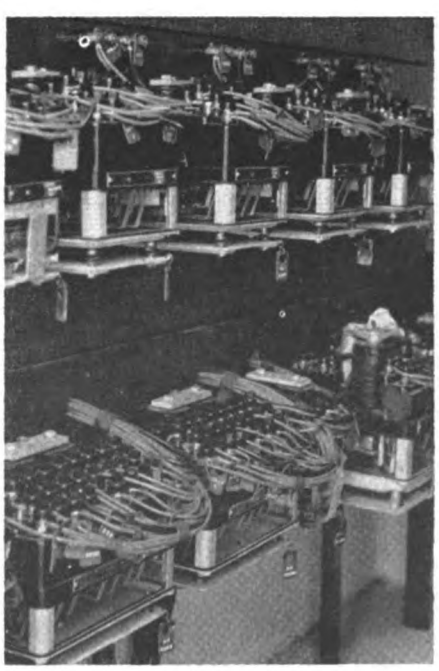
Planning, engineering and installation were carried out under the direction of W. R. Smylie, signal engineer. In charge of construction were R. J. Nester, assistant signal engineer and D. W. Morris, supervisor of signal construction. The work in the field, including case wiring, was done by a special CTC signal construction gang of 15 men, under foreman A. J. Masek. The major items of signal equipment were furnished by the Union Switch & Signal division of Westinghouse Air Brake Company.



Handthrow switches have electric locks



Low-voltage dual-control switch machines are mounted on top of two ties



Conventional relays are wall-mounted