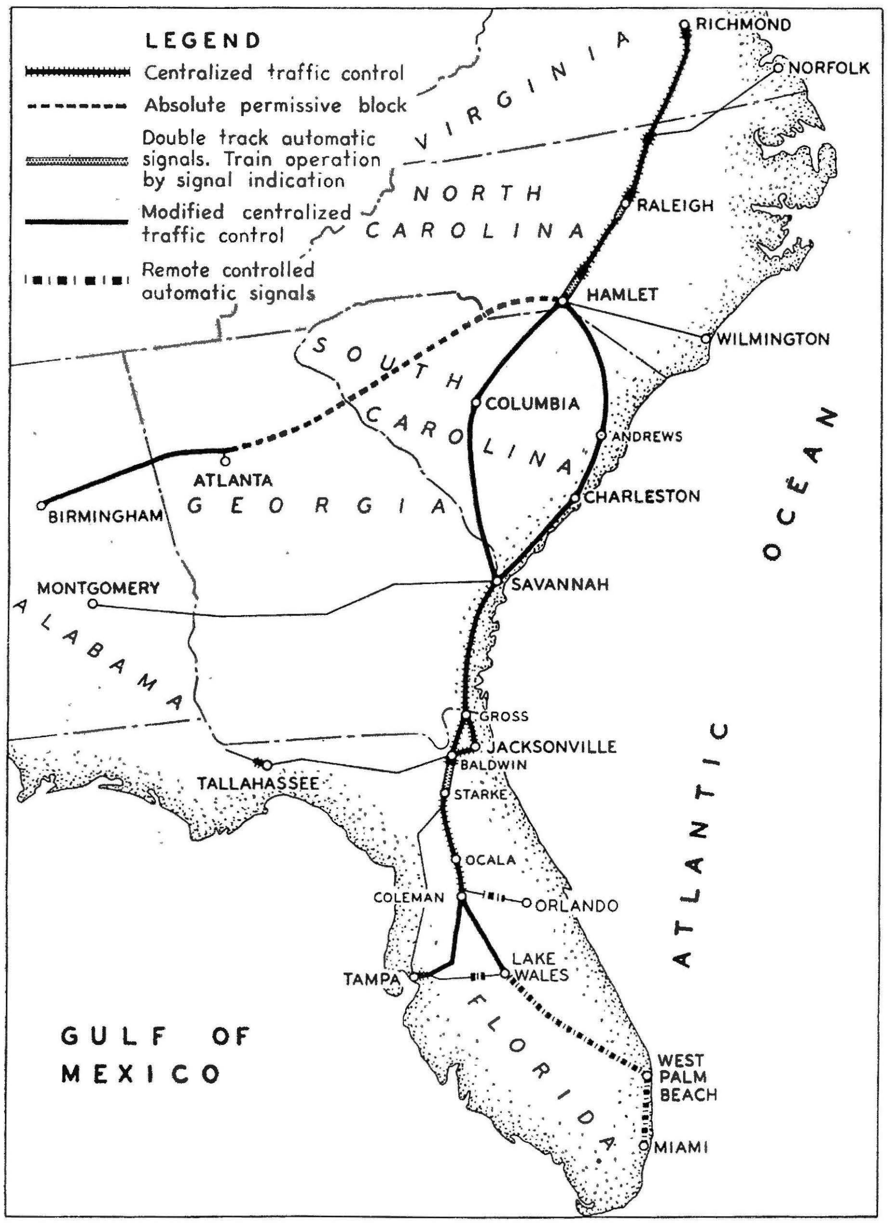
Railway Signaling and Communications

How to Get Maximum Capacity of Single Track

- **Let trains go at once, when ready to leave yards**
- **Make meets non-stop or on very close time**
- **Eliminate stops and delays of time table, train order method**
- **Centralize the dispatching of extensive mileage in one office**

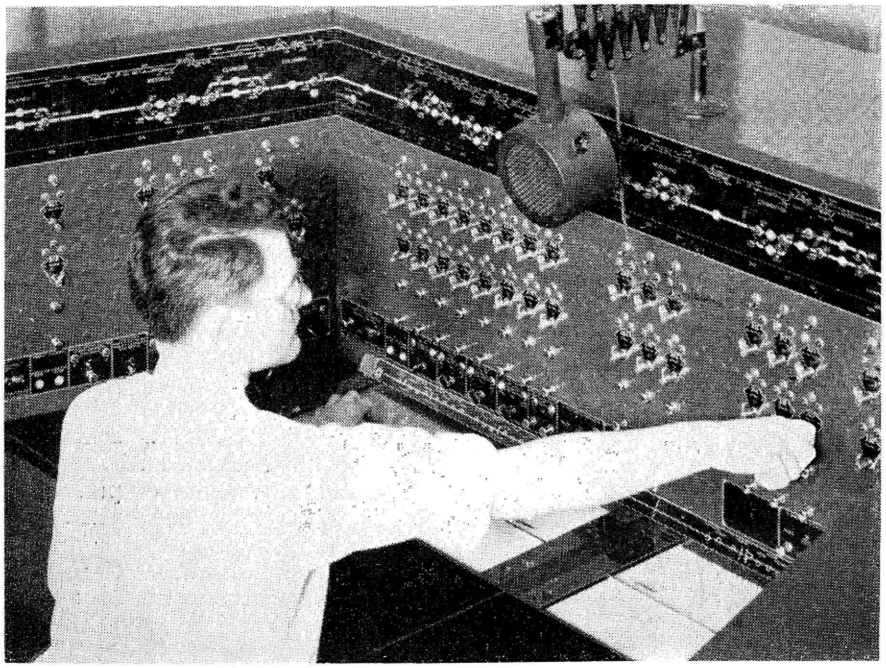


The Seaboard has 1,500 miles of single track, on principal routes, equipped with controlled signaling for authorizing train movements

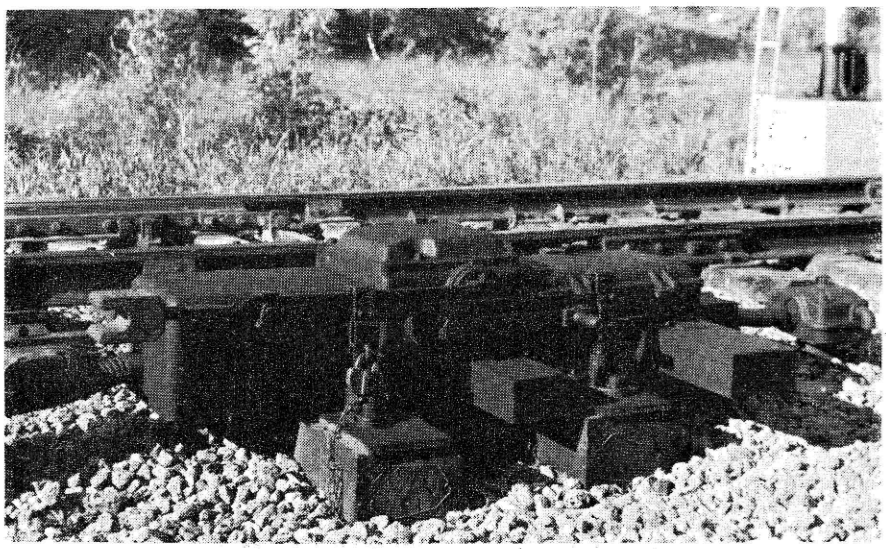
THE OUTSTANDING characteristic of the Seaboard Air Line is that a large volume of passenger and freight traffic is handled efficiently on a railroad that is practically all single track. The main routes from Richmond to Miami and Tampa, as well as Hamlet to Birmingham, total 1,607 road miles which include 12 short sections of double track, near junctions and terminals, totaling 107 road miles, thus leaving 1,500 road miles of single main track on these principal routes.

In some sections, this single track handles up to 14 passenger trains and 16 freights daily. As many as 1,000 freight cars are moved north and the same number moved south daily, on some divisions. Gross ton miles, per mile of road, range up to 50,328 per day on some divisions. Fast passenger trains make the 1040-mile run Richmond to Miami in approximately 18 hours. Through freights provide a fast, dependable service for Florida fruits and vegetables to both eastern and western markets. How is this good job being done on single track?

The Seaboard serves six southeastern states in which the population, as well as manufacturing and agricultural production, has been increasing rapidly during the last decade. These increases have been the greatest in Florida, where the Seaboard has 1,410 route miles, serving not only the major cities such as Jacksonville, Tampa, Tallahassee, St. Petersburg, Sarasota, Orlando and Miami, but also extensive vegetable and fruit growing areas, as well as phosphate mines. Seaboard freight traffic to and from points in Florida, except Jacksonville, is funneled through Baldwin, and is routed over the cutoff via Baldwin, Nassau and Gross, thus avoiding delays in Jacksonville. Thus most of the traffic to and from Florida, including that in and out of Jacksonville, must move over the 104 miles of



Dispatchers at Savannah control 820 road miles



Power switch machines are the dual-control type

single track between Gross and Savannah. An exception is that some traffic goes west from Baldwin, on the line through Tallahassee to Columbus, Ga. and Montgomery, Ala.

A main line from Montgomery, Ala., eastward through Americus, Ga., connects with the main line at Savannah. Between Savannah and Hamlet the Seaboard has two routes, both single track. The line via Columbia, S. C. includes some grades and curves, especially on the portion north of Columbia. The line via Charleston has very light grades and curvature. Considerable traffic comes from an important line which starts at Birmingham and extends east through Atlanta and Monroe to connect with the north and south lines at Hamlet, N. C. as well as the line extending from Wilmington to Rutherfordton, N. C.

Thus the major portion of the Seaboard's traffic from Florida, Alabama, Georgia and South Carolina, feeds into Hamlet, and from there north over 189 miles of single track and 64 miles of double track to Richmond. Likewise, this section handles the southbound traffic to the Seaboard's lines in the states mentioned.

Lots of Trains

On the 253 miles between Richmond and Hamlet, the Seaboard operates an average of 14 passenger trains and 16 through freights, totaling 30 trains daily in addition to switch runs that represent two trains over each subdivision. Between Hamlet and Savannah, via Columbia, the traffic includes 10 passenger trains and 3 freights daily. Via Charleston, the traffic includes about 12 freight trains and two local passenger trains. The Savannah-Gross section handles 10 passenger trains and about 10 through freight trains daily. On the line from Baldwin via Wildwood to Miami, the traffic includes 8 passenger trains and about 14 to 16 freight trains daily. The line between Coleman and Tampa handles 8 passenger trains and about 8 freights daily.

Passenger Trains Make Good Time

Fast passenger train No. 21, the Silver Star, makes the run from Richmond to Miami, 1,040 miles, in 18 hours and 22 minutes, an average of 56.9 mph. This overall time includes six scheduled station stops and two service stops, totaling about 1 hour. Also the schedules include 16 conditional stops. On the 101.4 miles between Gross and Lane (near Savannah) this train is scheduled at an average of 66.9 mph southbound, and 71.6 mph northbound. The fact that the schedules are fast, and that the trains have good on-time performance, is proof that no time is lost in making meets.

Fast Through Freights

On the various Seaboard lines that serve the fruit and vegetable areas in Florida, outgoing loaded cars are picked up in the late afternoon or evening, and are moved to Baldwin, 18 miles west of Jacksonville, by early morning. Likewise through freights from Miami and Tampa arrive in Baldwin in the morning.

During busy seasons, from three to five sections of northbound train No. 80, the Marketer, are operated out of Baldwin between 8 a.m. and 11 a.m. All trains are hauled by diesel locomotives. Three motors will handle up to 7,500 tons and two motors up to 5,000 tons, on the section Baldwin to Savannah. Fast freights make this 139 miles in about 3 hours, an average of 46.3 mph. These trains make the run from Savannah to Hamlet, 261 miles, in about 6 hours, 30 minutes, including a stop at Andrews to change crews. The run of 253 miles from Hamlet to Richmond is made in about 7 hours, 30 minutes, including 25 minutes in Raleigh.

Thus this No. 80, the Marketer, which leaves Baldwin as late as 11 a.m., as for example on Tuesday, arrives in Richmond, 653 miles via Charleston, at 12:01 p.m. Wednesday and provides a dependable fast freight service to eastern Seaboard cities such as Washington, Baltimore, Philadelphia and New York. And the on-time performance of these trains is good.

Southbound fast freight Nos. 75 and 27, the Merchandiser and the Capitol, leave Richmond 11:45 a.m. and arrive Hamlet 6:00 p.m. where No. 27, the Capitol, diverges for the run to Birmingham, Ala., arriving that city 8:00 a.m. No. 75, the Merchandiser, leaves Hamlet 8:15 p.m. and arrives Jacksonville 7:00 a.m., consuming 19 hours 15 minutes on the 649-mile run from Richmond to Jackonville, including 2 hours 15 minutes at Hamlet, a stop at Andrews S. C. for a crew change, and at Savannah to get a connection from the west.

Volume of Freight Traffic

On the average, the Seaboard moves about 500 loads north, and the same amount south daily on the 105 miles of single track between Savannah and Gross. In a typical 31-day month the 98 mile sub-division between Hamlet and Raleigh handles an average of 14.5 passenger trains and 16.2 freight trains. Also, each day except Sunday, three road switchers, each make a turn run on separate sections of the sub-division, thus making the equivalent of a local freight each way daily on the entire sub-division. During that month the ton miles between Raleigh and Hamlet totaled 152,896,000, an average of 4,932,129 ton miles daily for both directions on 98 miles.

Train Operation by Signal Indication

One of the important reasons why the Seaboard can do such a good job of transportation on a railroad that is practically all single track, is that the entire route from Richmond to Miami and Tampa, including both lines between Hamlet and Savannah, are equipped with modern signal systems, including dispatcher-controlled signals for authorizing train movements, thereby obviating numerous train delays which are inherent in the time table and train order practice, on either single or double track. When discussing this subject, J. T. Mitchell, Division Superintendent at Savannah, said: "Formerly I was a dispatcher on this railroad, and I know from experience that we could not handle the present traffic efficiently without the traffic control signaling. Previously, if a train was not ready to depart from a yard at the expected time, the dispatcher had to get out a new set of train orders, thus causing further delay to the departure of the train, 30 min. or more. Now, with TC, he can give the train a signal to go practically any time, when it is ready to roll. This saves a lot of time that is not evident on the train sheets or train graph, but I see it every day.

"Our dispatchers know how each individual engineer will handle his train over every section of road, and by control of the signals, the dispatchers can direct trains to make very close meets, in fact many meets are made with neither train being required to stop. When a passenger train is to go around a freight of the same direction, we use our TC on single track to make such a move with less delay to the freight, than would be the case for such a move on double track with hand-throw siding switches and operation by train order. I remember numerous instances, when I was a dispatcher using train orders, several freights and perhaps a passenger train would get 'in the hole' to clear for some passenger train that was losing time. I could not get orders to those trains to pull out and move on, therefore they waited. Now, with TC, the dispatcher controls the signals to keep the trains all moving for close meets. The dispatchers for our entire Carolina Division of 820 road miles are located right here in this office building. This is an important aid in coordinating operations, and in keeping touch with any trouble that develops."

Dispatcher-controlled Signaling Includes Three Variations

Including these three variations, the Seaboard has a total of 1565 miles of single track equipped with dispatcher-controlled signaling for authorizing train movements by signal indication without train orders. On 56 miles of double track, train operation is by signal indication both ways on each track. On the remaining 19 miles of double track, signal protection is provided for movement with direction of traffic.

Thus the Seaboard has had extensive experience in the use of three different layouts of signaling controlled by dispatchers to authorize train movements, the type of layout depending on the density of traffic.

Dispatcher control machines in the office at Savannah control the TC on (1) 259.4 miles north to Hamlet via Charleston; (2) 249.5 miles north to Hamlet via Columbia; (3) 134.3 miles south to Jacksonville, and (4) 34.5 miles Gross to Baldwin, totaling 677.7 miles controlled from one office. Machines in the office at Jacksonville control the 405.9 miles from there through Baldwin, Wildwood and West Palm Beach to Miami. Machines at Raleigh control the Hamlet-Richmond territory. Thus 1312.5 miles are controlled from three offices. A machine at Howells, near Atlanta, controls the 169.8 miles between Emory and Birmingham, and a machine at Tampa controls the 77.3 miles between Tampa and Coleman.

Change-Over from Dispatcher Control to Local

A special feature of signaling on the Seaboard is that if the TC code circuit from the dispatcher's office fails, the system automatically changes over to a form of approach-clearing, siding-to-siding train operation by signal indication. When the TC line fails, the line relays at the field stations affected by the interruption are released. This change from normal condition operates the station-disconnect relay, which establishes connections by means of which an approaching train, if a safe route is available, automatically clears its

Three Methods of Controlled Signaling

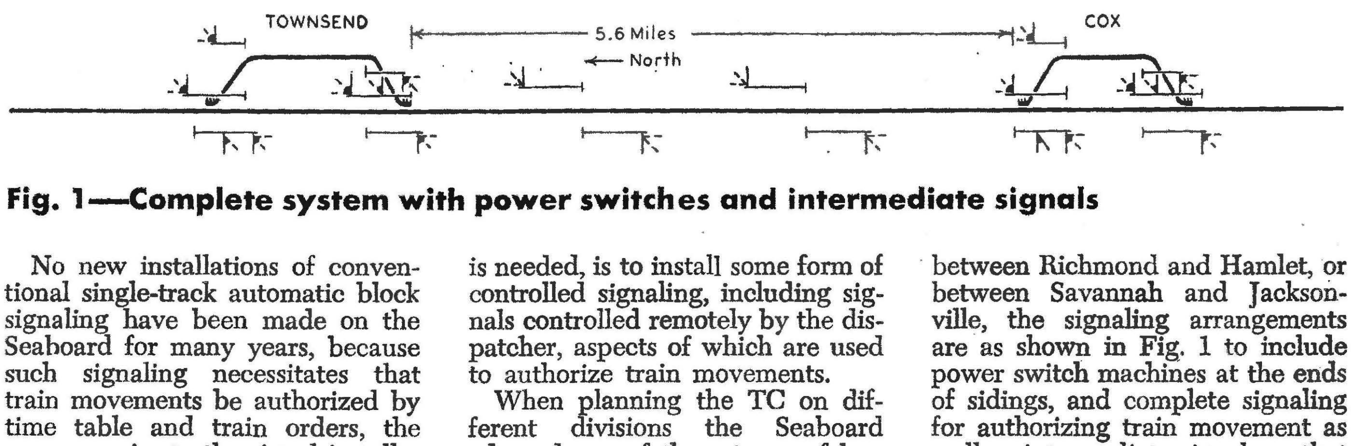


Fig. 1—Complete system with power switches and intermediate signals

No new installations of conventional single-track automatic block signaling have been made on the Seaboard for many years, because such signaling necessitates that train movements be authorized by time table and train orders, the same as prior to the signal installation. Therefore the Seaboard policy, as applying to any single track main line where signal protection is needed, is to install some form of controlled signaling, including signals controlled remotely by the dispatcher, aspects of which are used to authorize train movements.

When planning the TC on different divisions the Seaboard adopted one of three types of layouts, depending on the volume of traffic to be handled. On the heavy traffic single track sections such as between Richmond and Hamlet, or between Savannah and Jacksonville, the signaling arrangements are as shown in Fig. 1 to include power switch machines at the ends of sidings, and complete signaling for authorizing train movement as well as intermediate signals so that two or more trains of the same direction can occupy the same siding-to-siding block.

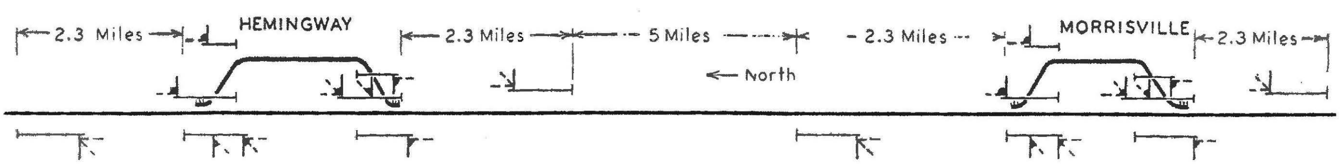


Fig. 2—Power switches, but no intermediate signals for following moves

On other territories where traffic is such that there are not many occasions for operating following trains on close headway, such as between Hamlet and Savannah, either route, the Seaboard installs the TC as shown in Fig. 2, which includes power switch machines at sidings, and dispatcher-controlled signals for authorizing train movements, but no intermediate signals, as such, are provided to allow a following train to occupy the same siding-to-siding block with the preceding train.

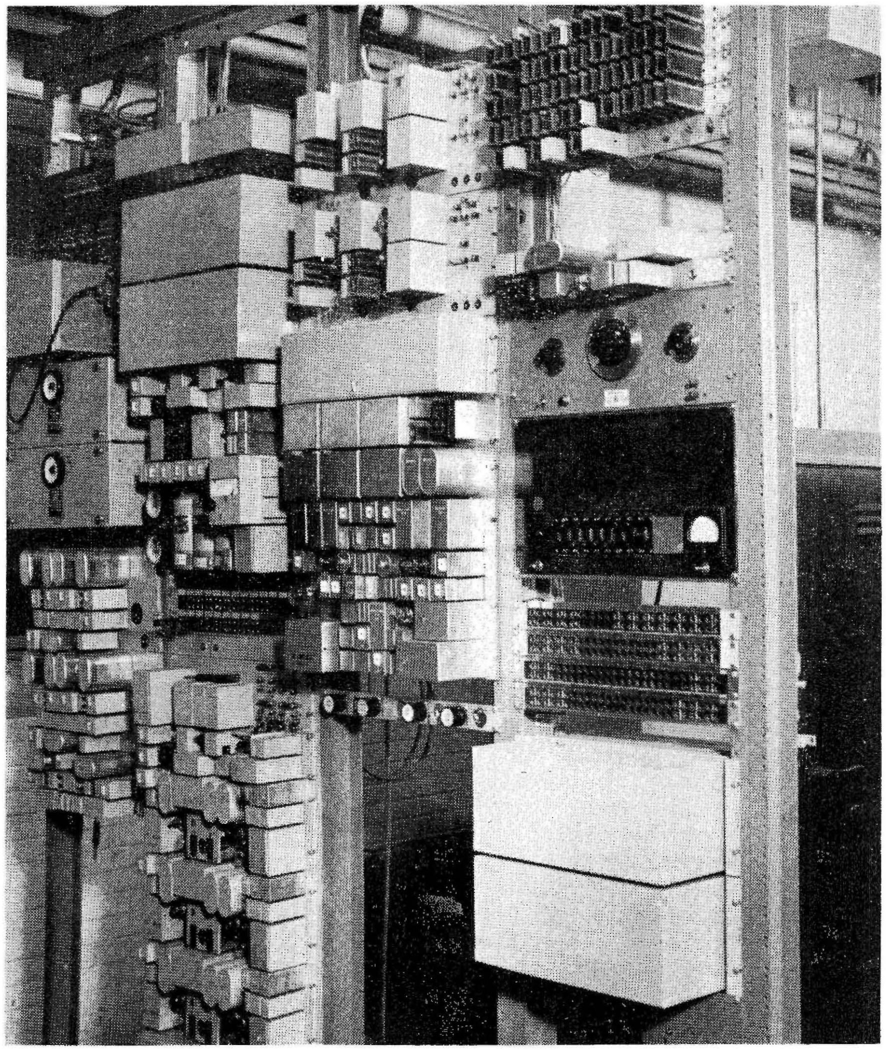
own signal to authorize the train movement, just the same as if the dispatcher had cleared it.

When this system is in operation, the power switch machines at the sidings may be controlled locally by trainmen. On the instrument house near each power switch is a small cast-iron controller case, the door of which is locked with a regular switch padlock. For example, if a westbound train on the siding is to use a switch, a trainman opens the door of the case. Inside each case there is a panel with two key holes which fit standard switch padlock keys. To cause the switch to operate from normal to reverse, the key is placed in the key hole marked "Switch Reverse" and turned clockwise. Or, to operate the switch from the reverse to the normal position, the key is used in the key hole marked "Switch Normal." To leave a siding, a similar procedure is followed.

This change-over arrangement came into use last February 26 when the TC code line and telephone communications on 67 miles between Hamlet and Shepard were temporarily out of service. During that time trains on the territory kept moving and a southbound freight departed from Hamlet.

Signaling No Wind Can Harm

No sleet storm or hurricane can damage 1064 miles of code line cir-



Carrier is used on the traffic control (CTC) code line

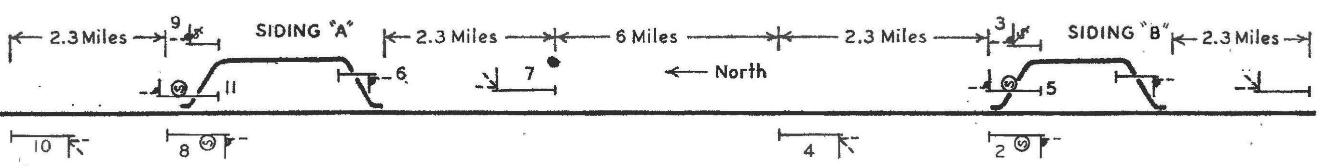


Fig. 3—Dispatcher-controlled signals with hand throw siding switches

Prior to 1947 the traffic on the line from Coleman to Miami which included about 4 to 6 passenger trains and 4 to 6 freights, train movements were authorized by time table and train orders, and no automatic block signaling was in service. At that time, the supply of signal materials was limited, and signal construction men were scarce. In order to provide signal protection on the entire 274 miles as quickly as possible, in spite of restrictions in materials and men, the Seaboard installed signaling laid out as shown in Fig. 3.

This arrangement includes complete automatic positive block signal protection for each north-end-of-siding to north-end-of-siding block. Also the project includes dispatcher control of the signals at the ends of the sidings to authorize train movements, as in traffic control, an exception being that the siding switches are hand operated, and special aspects are used to direct the hand operation of switches before entering or leaving a siding.

Referring to Fig. 3, if a southbound train is to be directed to enter siding "B", the dispatcher sends out a control that causes the S sign on signal 2 to be illuminated (under a red aspect in the signal head), and approach signal 4 displays yellow. This indicates that after the train stops at signal 2, the trainman is to reverse the hand-throw switch, and then the train enters the siding. If a northbound train on siding "B" is to be directed to depart, the dispatcher sends out a control that causes an "S" sign on leave-siding dwarf signal 3 to be illuminated. This directs the trainman to reverse the hand-throw switch, after which the dwarf signal No. 3 displays a green aspect, which authorizes the train to pull out onto the main line and wait until the rear brakeman places the switch normal. Then the train departs. In recent years, as materials have become more plentiful, the Seaboard is gradually installing power switch machines at sidings.

cuits of the Seaboard TC system which are in underground cable. These circuits, as well as several telegraph and telephone circuits, are on a two-conductor No. 10 copper cable that is buried about 2 ft. in the berm, approximately 1 ft. beyond the toe line of the ballast. This cable has two No. 10 copper wires which are twisted at a pitch of 5½ in. to keep the circuits balanced. The insulation and outer protective covering on cable installed in infested areas include bronze tape that prevents moles and pocket gophers from gnawing the insulation. This cable is placed 2 ft. in the ground by a special plow, pulled by a beam extending from a flat car in a work train. The Seaboard now has about 1800 miles of this cable in code line and other signal use, some of which has been in service for 9 years.

The two wires in this buried cable handle various circuits, including conventional d.c. codes for the TC controls; the coded carrier operating between 250 cycles and 2750 cycles for TC codes to sections beyond uses one channel of the three channel carrier; the two remaining channels handle 2 telephone conversations simultaneously, or as many as 18 printing telegraph circuits simultaneously for each channel.

In these TC territories, the Seaboard has applied modern coded track circuits for local signal controls, so that no local line wire circuits are required. Normally the track circuits are de-energized. They are "turned on" to feed through an entire siding-to-siding block, as a preliminary part of the controls when lining up to clear a signal.

The book of Operating Rules used on the Seaboard includes a special set of rules which are applicable on traffic control territory. For example Rule 543 reads in part as follows: "On portions of the road designated by time table or special instructions, train and engine movements may be authorized by block signals whose indications supersede the superiority of trains for both opposing and following movements on the same track and take the place of train orders, except Forms F, V, Slow Orders and Bulletin Orders. Such system will constitute a Traffic Control system and rules governing Traffic Control system will apply in such designated territory, in addition to all other operating rules not inconsistent therewith."

Gate 5A protects westbound traffic on Fifth Avenue

Gates at 21 Crossings

Safety increased and train movements expedited by automatically controlled system with special cut-outs, restarts and pre-warning

IN TAMPA, FLA., the Atlantic Coast Line has installed gates with flashing-light signals at 11 crossings, making a total of 21 consecutive crossings with this form of protection, within 3 miles, all in the metropolitan area.

The double-track main line of this railroad extends north and east from the Tampa Union station through a residential and industrial area. About 2 miles east of the station there is a wye junction with a single-track main line north through Vitis and Dunnelon. Within the 3 miles from the Union Station there are 21 street crossings at grade on the double track main line and three crossings at grade on the wye.

This terminal territory handles about 18 passenger trains daily, including switching movements as well as 20 or more transfer moves to the docks. Switching moves are underway much of the time. Because of the numerous street crossings, train speeds are limited to 20 mph maximum by city ordinance.

Manually-controlled pneumatic gates were in service at Twenty-second street prior to 1941, at which time automatic gates with flashing-light signals were installed at 9 consecutive crossings—Fifteenth street through and including Twenty-third street. Automatic gates and flashing light signals were installed at 50th street in 1948. In 1954 and 1955 gates with flashing-light signals were installed at Thirteenth street, Fifth avenue, Fourteenth street, Twenty-fourth, Twenty-fifth, Twenty-sixth, Thirty-first, Thirty-fourth, Thirty-fifth, Thirty-sixth and Thirty-ninth streets. Flashing-light signals were installed on the wye tracks at Thirty-sixth, as well as at two crossings on Seventh avenue. Thus, on the double track main line all the 21 crossings in the metropolitan area are protected by gates with flashing-light signals and bells, and the three crossings on the junction wye are protected by flashing-light signals with bells.

As shown in Fig. 1 three crossings—13th Street, 5th avenue and 14th street—are all in one group. Traffic is heavy on 5th avenue and 13th street. These three crossings were protected by pneumatic gates controlled locally prior to 1954, at which time these old gates were replaced by modern short-arm gates with flashing-light signals, controlled automatically. The problem of locating gates to protect these crossings is complicated because the tracks are on a 3-deg. curve to the left looking west. The crossing