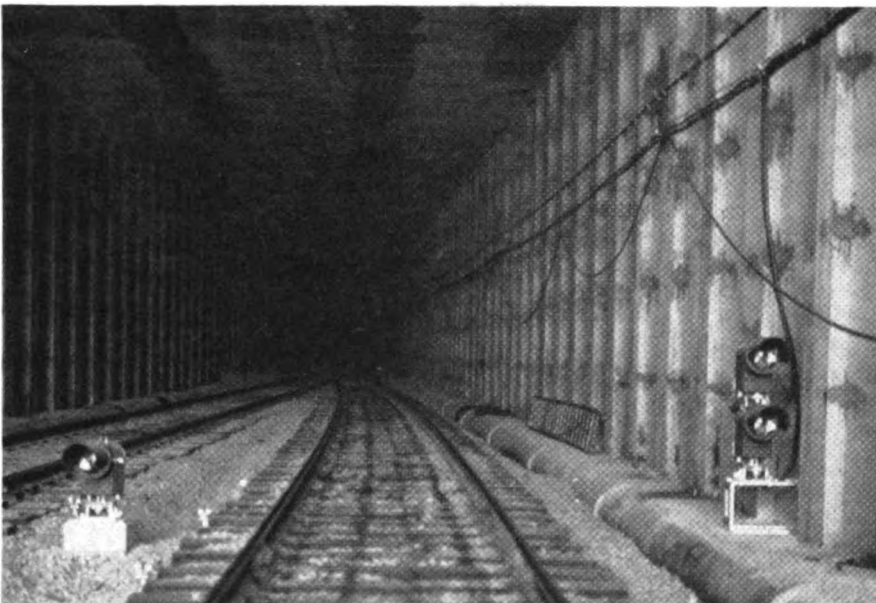


BEFORE: Boston & Maine mainline split Salem business district. Here it enters the old tunnel at Norman street

B&M Goes Underground



AFTER: Railroad goes under business district through new tunnel (not quite finished)

Extensive signaling changes were incorporated in a grade elimination project at Salem, Mass. Five-year program includes a new tunnel under major streets in downtown section of the city, with new signaling at Salem yard

THE BOSTON & MAINE signal department can now breathe a sigh of relief, for it was approximately five years ago that they made the first signal changes at Salem, Mass. Since that time considerable work has been carried on, and as one railroad man phrased it, "We are

now getting back to a semblance of normal operations."

A B&M commuter line runs north from Boston through Salem to Rockport and also to Portsmouth. Entering the city from the west, the double-track line went through the business district, crossing Mill

and Norman streets at grade. The passenger station was between these streets. Just east of Norman street the line went to single track and going slightly down grade, passed into an old tunnel under the main part of the Salem business district. Beyond the east end of the tunnel, the single track reverted to double track.

With the tremendous increase in vehicular traffic following World War II, the traffic problem in the Salem downtown area became quite acute. The city, state and railroad officials put their heads together and came up with a solution, which was to dig a new tunnel alongside the old one. The new tunnel is approximately 2,100 ft long, so that Mill and Norman streets, two heavily traveled streets in the business district, pass over the roof of the tunnel.

As the new line would pass under the old depot, a new passenger station was constructed west of the tunnel. The platforms are at track level in an open cut, with stairways leading up to the new passenger station at street level. Eighteen passenger trains in each direction pass through Salem daily, all trains making station stops. In addition to six freight trains daily, there are numerous switching moves. Maximum speed for all trains is 35 mph through the tunnel.

Castle Hill First

The first stage of the signal construction work was the installation

of a remote control interlocking at Castle Hill (see plan). The switches in this area were formerly hand-thrown by switch tenders. Just east of Castle Hill a lead track went into rather extensive coach yards. Until about four years ago, when the B&M purchased many Budd RDC cars, commuter trains were largely made up of coaches hauled by diesel locomotives. Salem, being approximately 16 miles from Boston, was an overnight storage point for many of the commuter coaches. Also, several of the commuter runs terminated at Salem. Thus there was considerable switching in handling cars to and from the passenger station.

With the coming of the Budd cars, the commuter trains are run to the end of the line, for example, to Rockport and Portsmouth. Being of the double-end type, they are simply reversed and returned to Boston. As far as commuter runs are concerned, the majority of them now make through moves at Salem. This, of course, has considerably reduced the amount of switching required at the coach yard west of the Salem tunnel, in

the Castle Hill area. As part of the new interlocking installation, considerable track changes were made, mainly to eliminate some storage tracks which are not now needed with the Budd car operation. The Castle Hill interlocking also includes the junction of the Marblehead branch with the main line. Two searchlight high signals and seven searchlight dwarf signals were installed. Four new power crossovers and one turnout switch are equipped with model 5D machines having 110-volt d.c. motors. The control of Castle Hill interlocking is by GRS type K2 CTC over aerial cable from the Salem interlocking tower (just east of the new tunnel). The control panel for Castle Hill was added to the existing Salem interlocking control machine.

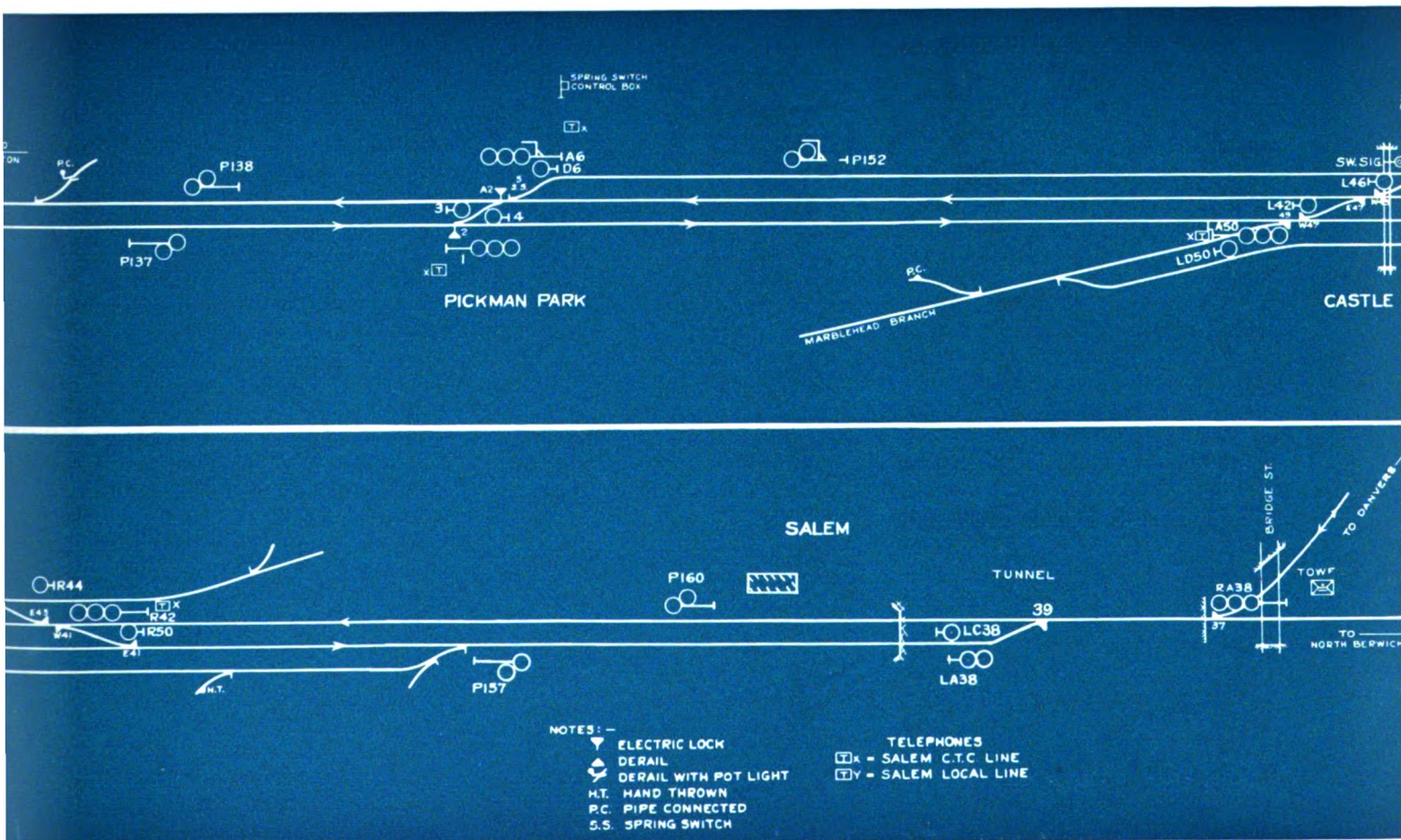
At about the same time the Castle Hill signal changes were made, an automatic interlocking was installed at Pickman Park. A hand-throw crossover was installed between the two main tracks, as well as a spring switch on the side track, where it enters the main line. The crossover switches are

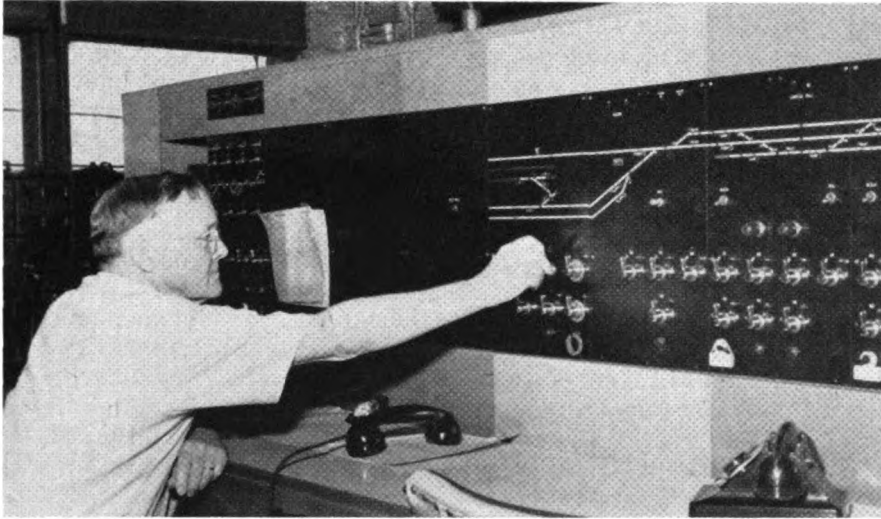
equipped with model 9B electric locks. The spring switch has a Pettibone-Mulliken spring-buffer mechanism. The two high and three dwarf signals are the type SA searchlight.

Diversion Track Was Next

A second stage of signal construction was to signal a diversion track to carry trains around a portion of the tunnel construction. As the new tunnel was built alongside the old tunnel, sheeting had to be driven alongside the old tunnel, to keep the old tunnel walls from caving in. The new tunnel was dug with the cut and cover method, similar to a trench, and then covered over. Trains used the line in the old tunnel, but at the west end of the old tunnel, the track had to be swung over to one side. During the three years of construction, track work as well as tunnel digging, etc., temporary signaling was installed to handle the numerous commuter trains and freights daily.

Just east of the Castle Hill interlocking, the two main tracks go down grade through a cut to the





Panel at far right controls the new interlockings at Salem

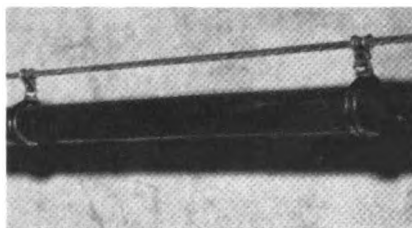
new tunnel. The No. 20 turnout was installed just inside the mouth of the tunnel at the west end. This turnout switch is powered by a 5D 110-volt d.c. machine. Two type SA searchlight signals govern train movements into the tunnel. As the line is single track through the tunnel and beyond Salem interlocking at the east end, no signal is at switch 39 to govern westbound movements. Westbound trains are governed by home signal RA38 at the tower east toward Beverly, as well as the interlocking signals RD38 and RG38 controlling movements coming off the Danvers branch.

To line up for a westbound move through the tunnel, the interlocking operator or leverman must have switch 39 normal, in order to clear signals RA38, RD38 or RG38. The controls for these signals and power switch 37 are part of the Salem interlocking, which was installed several years ago. Switch 39 and signals LC38 and LA38, installed as part of the new project, are direct wire controlled from the Salem interlocking machine. New searchlight automatic signals P160 and P157 were installed between Salem passenger station and Castle Hill interlocking. The double track from the tunnel westward is signaled for right-hand running.

Operating Economies Realized

The State of Massachusetts paid for the construction of the new tunnel and necessary track and signal changes connected therewith. The

B&M assumed the cost of the interlocking at Castle Hill. Substantial operating economies resulted from this project. Switches at Castle Hill were formerly hand-thrown by train crews, resulting in considerable delay. Mill and Norman streets, at either side of the old Salem passenger station, were protected by manually-operated gates and crossing watchmen. These watchmen were on duty around-the-clock, seven days a week. Norman street, which was at the entrance of the old tunnel and east of the old passenger station, has by far the heavier vehicular traffic of the two streets. This crossing required three watchmen on duty during the daylight hours. One man was stationed on one side of the track and, because of the peculiarity of vehicular movements, two men were stationed on the other side to protect this busy crossing. This was felt necessary, as a fence partially obstructed views of westbound trains coming out of the tunnel. With the construction of the new tunnel, Boston & Maine trains run under Mill and Norman streets,



Multi-conductor cable is hung from cable straps on 3/8-in. stranded messenger which is attached to the concrete walls of the tunnel and sides of the open cut

so the crossing watchmen were eliminated.

Multi-conductor cable for the control of Castle Hill interlocking, as well as the direct wire controls of the signals and switch 39 at the west end of the tunnel, are run aerially. Cables are supported by Raco cable straps, attached to 3/8-in. stranded Copperweld messenger, which is attached to the side walls of the tunnel and the concrete facing in the cut. The cable was furnished by Simplex Wire & Cable Co.

B&M Construction Practices

As the floor of the tunnel is concrete and covered with 18 in. of ballast under the ties, the cables to the searchlight dwarf signals and the bootlegs at the west end of the tunnel are placed in steel conduit, which is laid on the floor of the tunnel. Thus the cable is protected from abrasive action of the rock ballast. American Steel & Wire 35-in. stranded bonds are used. These bonds are pin driven into the web of the rail and laid across the top of the joint bar.

It is standard practice on the B&M to provide wiring for all routes within an interlocking. After field testing has been completed, the circuits which allow signals to clear against the normal direction of traffic are opened in accord with instructions on the circuit plans. This prevents accidental clearing of signals to such routes.

When circumstances arise which require temporary operation to such routes, the field forces are authorized to restore the disconnected circuits for a specific time. Reverse movements beyond the interlocking are, of course, protected by pilot or other means, and movements within the interlocking are authorized by signal indication. With the advent of mechanized track maintenance the ability to handle train movements in this manner has proved to be of substantial value.

Signaling equipment for the Salem construction project was furnished by the General Railway Signal Co., the installation work being performed by B&M signal department forces under E. N. Fox, Engineer of Communications and Signals, retired, and W. W. Hartzell, Mr. Fox's successor.