Modern Signal Aspects *on the Boston & Maine*

An explanation of the operating conditions under which the use of multiple aspects improves safety and expedites trains

THE SYSTEM of color-light signal aspects, as used on the Boston & Maine, is fundamentally based on the A. A. R. Code Rules and Aspects as shown in the Signal Section Manual. These have been modified or added to in certain instances where it has been felt that improvements could be made or local operating conditions warranted such changes. It is primarily a speed-signaling system, although to a certain extent it might be considered as a combination of speed and route signaling, inasmuch as all diverging routes require aspects indicating reduced speeds.

Signaling to Meet Conditions

Local operating conditions, as mentioned above, include such factors as traffic density, size of turnouts and crossovers, types, weight and speeds of trains, physical conditions such as grades and curves, and climatic conditions such as fog, sleet, and snow. Traffic on the Boston & Maine involves a wide range of equipment, speeds, and density. Some lines have to be signaled to handle tonnage freights at 50 m. p. h., as well as high-speed passenger trains and a heavy local suburban traffic. Gas-electric motor trains and the new high-speed stream-line diesel train—The Flying Yankee—also operate over some of these routes.

Automatic in approach to home interlocking signal

This wide range of conditions necessitates, at some locations, three-block four-indication, or four-block five-indication signaling, to avoid delaying traffic and to provide safe braking distances. The indications for three-block and four-block signaling are used only as required, and the system is flexible enough to permit passing from a two-block installation to a three-block or four-block installation, or vice versa, without any confusion or difficulty.

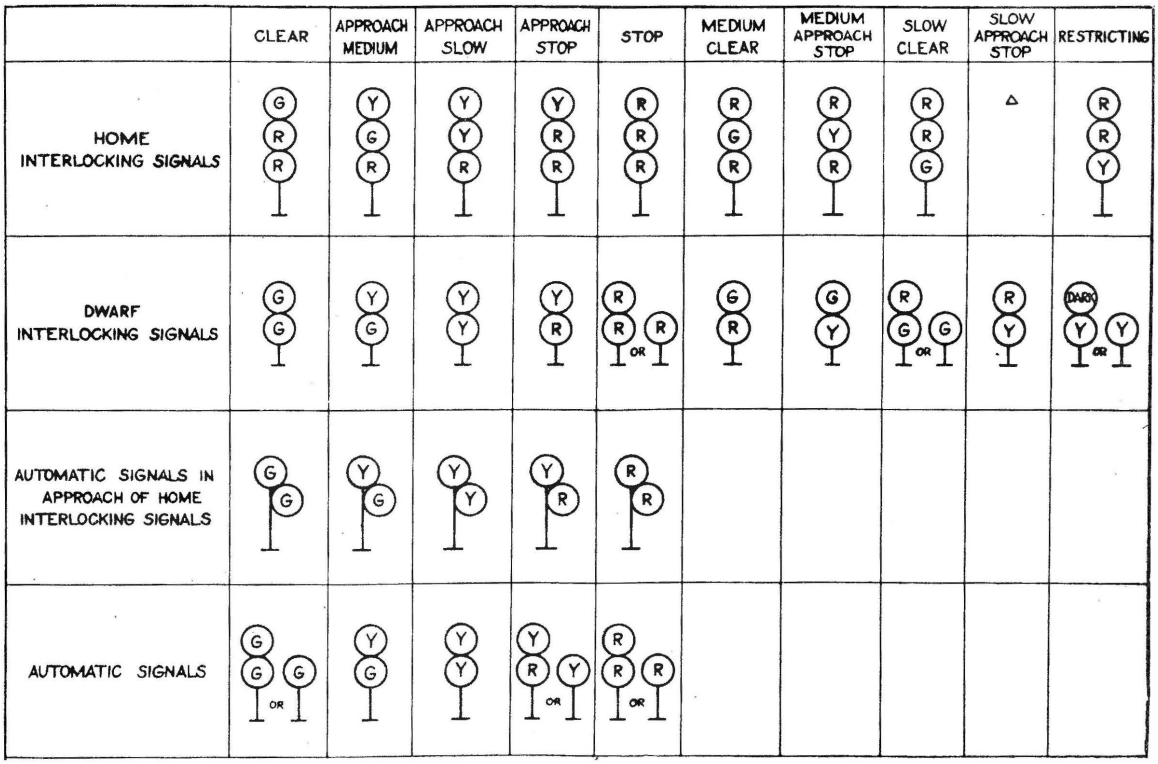


Fig. 1—Chart of aspects for color-light signals

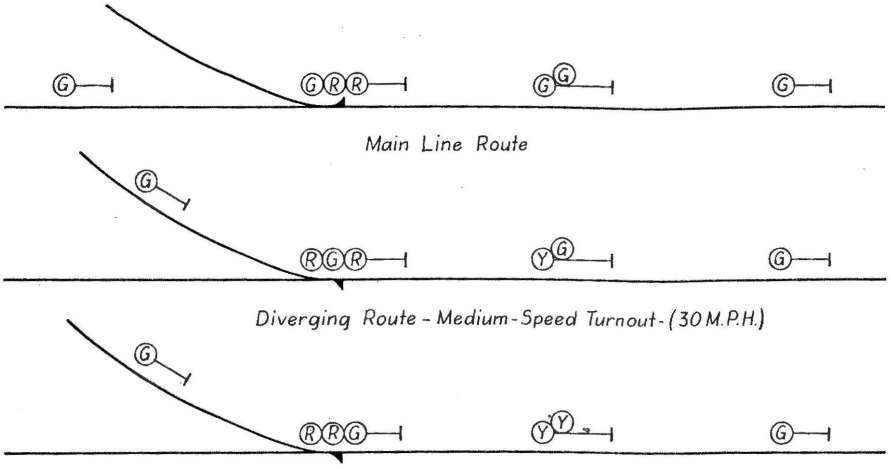


Fig. 2

All main-line turnouts and crossovers installed in recent years are No. 15 or No. 20, permitting a speed of at least 30 m. p. h. for the diverging move. However, there are still many of the older No. 10 or No. 12 turnouts and crossovers in service, particularly on secondary main lines and branches, which, therefore, are safe only for speeds in the 15 to 25 m. p. h. range. Hence it was deemed advantageous to give the engineman an indication, together with the proper approach signal, as to whether he was being routed over a medium speed (30 m.p.h.) crossover or turnout, or a slow-speed one (15 m.p.h.)

Home Interlocking Signals

With respect to home interlocking signals, the system is based on the following principles:

1—All high interlocking signals have three lights.

2—Top light, green or yellow—main-line normal speed route.

3—Middle light, green or yellow (with other two lights red)—diverging medium-speed route.

4—Bottom light, green (with other two lights red—diverging slow-speed route.

5—Interlocking signals also act as automatic block signals and as an approach signal for the next signal in advance.

The three sketches shown in Fig. 2 illustrate the application of these principles for an interlocking in two-block, three-indication territory where there is full braking distance between all signals. It will be noted that the position of the green light drops as the allowable speed drops. Figure 3 shows the corresponding layouts when the automatic signal in advance of the interlocking signal is red. It is to be understood that the green aspect is only used when the next signal in advance is green or yellow, with full braking distance between the yellow signal and the Stop signal.

One important change from A.A.R. Code Rule 287 has been made in connection with the bottom green "Slow-Clear" signal. The code rule reads "Indication—Proceed at not exceeding slow speed." Inasmuch as the interlocking signal forms part of the automatic block system and the next signal on the diverging route may be several thousand feet distant, observance of the code rule would require the train not to exceed 15 m.p.h. for that distance even though the track and signal ahead were entirely clear. Consequently the rule has been revised to read as follows: "Proceed through crossovers or turnout at not exceeding slow speed, then resume normal speed." A similar change has been made in connection with Code Rule 283 governing the use of the middle green "Medium Clear" signal. The revision of these rules has proved to be very beneficial in speeding up traffic, and has eliminated the necessity for an automatic block signal at the leaving end of the interlocking.

In using the aspect and rule in this manner, care must be taken that a "resume normal speed" signal cannot be given when the signal ahead requires a restrictive speed at that location. An example of this would be two successive home interlocking signals possibly 8,000 ft. apart with no intermediate automatic signal on a double-track line signaled for either-direction movements, with a route set up for a "run-around" move, that is from an eastward track to the westward one at one interlocking signal and back to the eastward track at the next interlocking signal. If this type of move is made, the installation of an intermediate automatic approach signal will take care of the situation.

Dwarf Signals

Color-light dwarf signals, as first used, consisted only of two-indication (yellow or red) non-track-circuited signals. With the development of C.T.C. and remote-control interlockings, it was often found desirable to use a dwarf signal to let a road train move from a passing siding to a main track with the next automatic block signal 5,000 to 9,000 ft. distant. Constantly to run trains, either passenger or freight, on a yellow dwarf indication, without track-circuit protection or advance information of the indication displayed by the next signal, was obviously not good practice. Consequently the dwarf signals in such locations were made three-position, the green indication being track-circuited and acting as an approach for the next automatic signal. Also the rule was revised to permit resuming normal speed after clearing the crossover or turnout. In other words, the single-unit green dwarf and the bottom green signal of a three-unit home signal are identical so far as indications and rules are concerned.

At the time Tower "A," Boston, was rebuilt in 1931, new single-unit searchlight dwarf signals, displaying

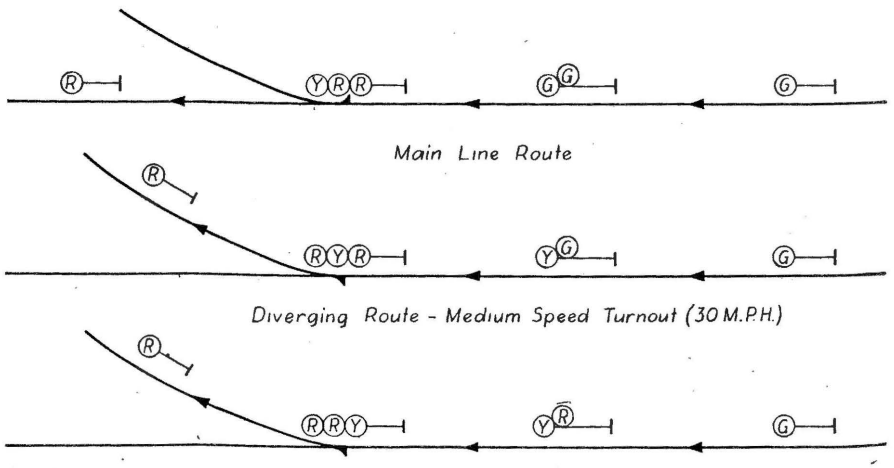


Fig. 3

three indications were installed. This is the first interlocking located just outside of the terminal station where moves are not very fast, and has worked out quite satisfactorily. Due to this success, it was desired to use dwarf signals on the revised layout at Tower "C," to avoid installing signal bridges in the multiple-track territory. On account of the higher speeds in this territory (40 m.p.h. for passenger trains), it was realized that the single-unit dwarf signal displaying the same indication for either a straight or a diverging route would not do. Accordingly, the two-unit dwarf signal, as shown on Fig. 1, was adopted for use in layouts of this type. The aspects used are consistent so far as possible with the corresponding aspects on the home signals and on the automatic signals. Provision is made to give either normal-speed, medium-speed, slow-speed or restricted-speed signals. The proper approach indication is given by a standard automatic approach signal, except that it is a dwarf-type (two-light) signal—with a number plate.

Automatic Signals

Where two-block three-indication automatic signaling is in service, a single-unit signal is used, according to universal practice, displaying green, yellow or red. Where three-block signaling is required, the signals are two-unit, and the combination of green-green, yellow-green, yellow-red, and red-red is generally used, although local physical or operating conditions sometimes call for the use of the yellow-yellow in place of the yellow-green. For four-block signaling, all five two-light indications are used as shown on Fig. 1. The colors taper down from high speed to stop in a logical sequence.

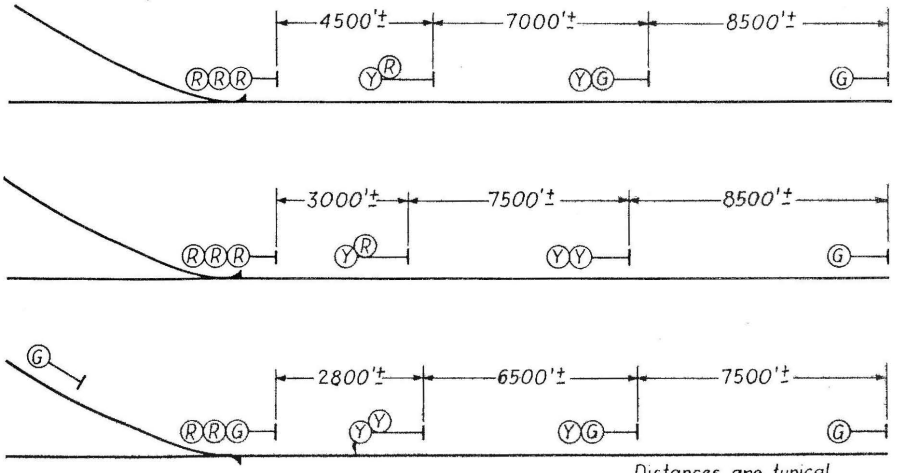


Fig. 4

Names of Aspects

The names of the signal aspects have been changed from the code nomenclature in a few instances. The code name for the red-green-red signal is "Clear Medium," whereas for the corresponding red-yellow-red signal is "Medium Approach." The transposition of the word "medium" has been quite confusing, particularly as there is also an "Approach Medium" signal. Bearing in mind that the red-green-red and red-yellow-red signal should never be passed at more than medium speed, it seemed more consistent to have the word "medium" come first; hence the change from the code "Clear Medium" to "Medium Clear" for the red-green-red indication. Similarly the name of the red-red-green signal has been changed from the code "Clear Slow" to "Slow Clear."

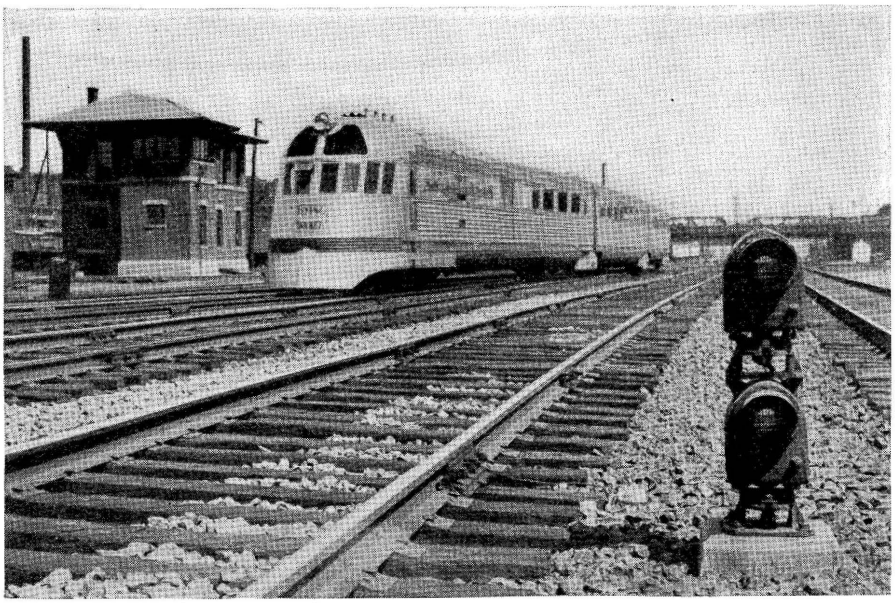
The code names "Approach Medium" and "Approach Slow" are properly descriptive. To be consistent with these terms, it appeared that the name "Approach" for a yellow-red-red signal should be changed to "Approach Stop" and this was done.

The automatic signal in approach of a home interlocking signal is exactly like any other automatic signal except that it is always a staggered two-light signal, the staggered lights serving to indicate to the engineman that the next signal is an interlocking signal. In some cases, where two-block signaling is satisfactory between interlockings, it is desirable to provide three-block aspects approaching interlockings, to permit trains closing up. Figure 4 shows some typical automatic signal layouts. The indications given on the first two-light signal depends on the actual location of the staggered two-light signal with relation to the home signal, or, in other words, the amount of braking distance required.

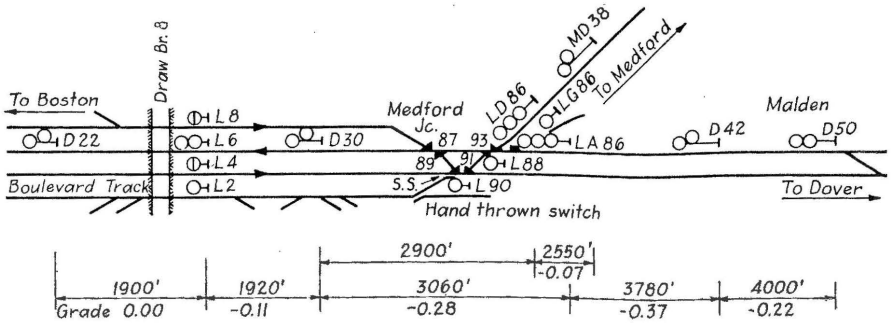
Unsignaled Territory

In entering unsignaled territory, which happens always to be single-track on this railroad, a green signal is given, either top, middle or bottom unit, according to speed permissible for the location. This green indication is only given, however, when there are unoccupied approach track circuits for the opposing direction. A train entering unsignaled territory must have either time-table authority or train orders to do so; hence, it did not mean much or seem logical under these circumstances to advance a train under a yellow signal as had formerly been done. In many instances a yellow indication unnecessarily slowed up traffic.

In connection with this system of signaling "Signal Aspects" sheets are used. This is a small sketch showing all combinations of aspects used on a particular territory, together with the



The Flying Yankee at Tower-C with a multiple-aspect dwarf in foreground



D22	L6	D30		LD86	LA86	MD38	D42	D50
G-G or Y-G	G-G							
Y-Y	Y-G	G-G			G-R-R			
Y-R	Y-Y	G-G						
R-R	Y-R	Y-Y		R-R-G	Y-G-R	Y-Y	G-G	
R-R	Y-R	Y-Y						
	R-R	Y-R		R-R-G	Y-Y-R	Y-Y		
	R-R	Y-R					Y-G	G-G
		R-R		R-R-Y	Y-R-R	Y-R		
		R-R					Y-Y	Y-G
				R-R-R		Y-R		
					R-R-Y		Y-R	Y-G
							R-R	Y-R

Signal aspect sheet V-73 for westward signals

Based on 70 m.p.h. Pasg'r. and 50 m.p.h. Frt. actual speeds except 30 m.p.h. actual speed (Timetable restriction 20 m.p.h.) at Draw 8, 45 m.p.h. Pasg'r. and 30 m.p.h. Frt. actual speeds on Medford Branch. Approach indications for R-R-R same as for R-R-Y. Sigs. LD 86, LA 86 and L88 not to route to E.B. track or Boulevard Track. Sig. L90 to clear to "Y" automatically when H.T. switch is reversed.

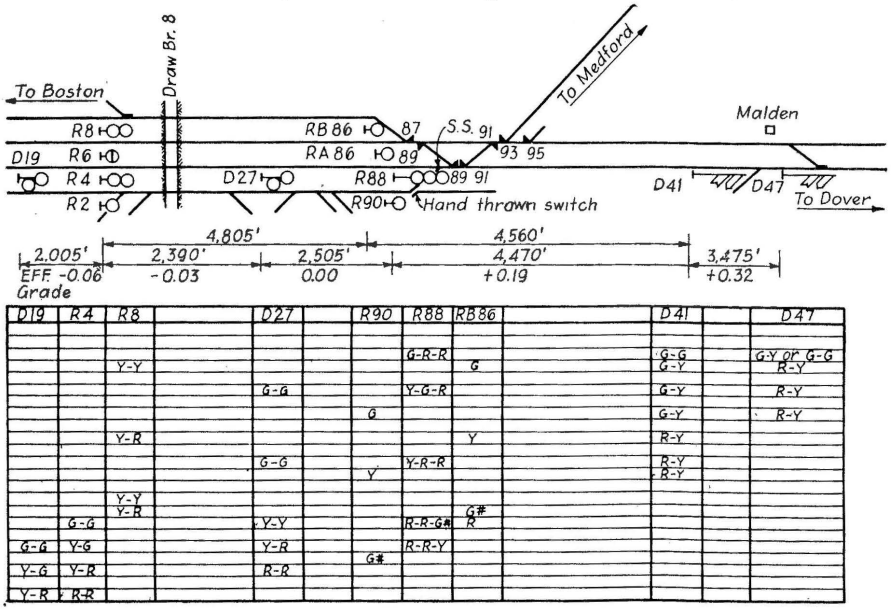
track, switch, and signal layout, distances and effective average grades between signals, and speed restrictions. This type of plan was originally developed for the use of the circuit engineers in drawing up the circuits, and the construction forces in making field checks. However, they have since proved to be very useful not only as originally intended, and as a permanent signal department record, but also for reference purposes by operating department superintendents, trainmasters, rules examiners, train dispatchers, etc.

Two typical plans V-73 and V-74, covering the eastward and westward signaling in the vicinity of Draw-bridge 8 and Medford Junction on the Terminal division are shown herewith. These plans illustrate the use of the green dwarf and the red-red-green interlocking signal, each with the corresponding yellow-yellow approach signal. They also show the use of the two-light dwarf signals which are used in this territory west of Medford Junction. Practical applications of methods of tapering down train speeds are also covered on these plans.

A study of the aspects shown on Fig. 1 will reveal that the color schemes very closely harmonize between different types of signals giving the same indication, and also that the color scheme follows a logical sequence as permissible speed decreases.

Enginemen are enabled to handle tonnage trains confidently at high speeds. Trains are not unnecessarily slowed up, and full advantage in speed is obtained from the long crossovers and turnouts, yet proper warning is given of approach to short crossovers and turnouts.

Signaling of this nature is particularly effective in C.T.C. territory where fast trains are run around slow trains; also to keep trains moving at high speeds in dense traffic terminals which, of course, in all systems adds to the track capacity. It is the intention of the Boston & Maine to make changes in the near future so that no red aspect will be given except to slow down or stop a train.



D19	R4	R8		D27		R90	R88	RB86		D41		D47
							G-R-R			G-G		G-Y or G-G
		Y-Y						G		G-Y		R-Y
				G-G			Y-G-R			G-Y		R-Y
						G				G-Y		R-Y
		Y-R						Y		R-Y		
				G-G			Y-R-R			R-Y		
						Y				R-Y		
		Y-Y										
		Y-R						G#				
	G-G			Y-Y			R-R-G*	R				
G-G	Y-G			Y-R			R-R-Y					
Y-G	Y-R			R-R		G#						
Y-R	R-R											

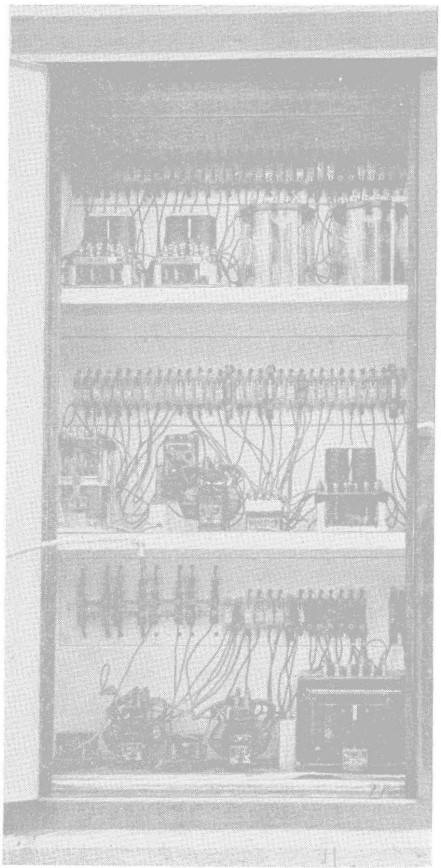
Signal aspect sheet V-74 for eastward signals

*—To Medford bridge, with approach unoccupied.
Based on 70 m.p.h. Passenger and 35 m.p.h. Freight Actual speeds, except—30 m.p.h. actual speed (Timetable restriction—20 m.p.h.) at Draw "8." Approach indications for R-R-R same as for R-R-Y. Sigs. RB86, R88 and R90 not to route to w.b. track.

Crossing Signals on Reading

(Continued from page 360)

is made up with Kerite insulation with "mummy" exterior finish. A single conductor No. 9 underground track wire extends from the case to



each rail connection, using a Raco bootleg outlet and rail connections. These installations were planned and installed by signal department forces of the Reading.