



Signal heads on the famous Norfolk & Western Blue Ridge Grade east of Roanoke, Va., are installed so as to only be able to show possible aspects through the single crossover in the interlocking. Norfolk Southern train 236 is behind Canadian National power in 2014.

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Signals can add magic to night scenes like this one at Onondaga Yard. The mounting up on the bracket mast at left ensures operators can see their aspect over the equipment in the foreground.



1

Extra 1585 west takes coal loads through downtown Thurmond, W.Va., on Ted Pamperin’s beautiful Chesapeake & Ohio. The home signal has been cleared for an eastbound as well, showing a “clear” indication.



2

Signals come in many different shapes and sizes, and are mounted in different ways. Here, GRS searchlights are mounted on a bridge over the Rio Grande main line through Ironton, Utah. *James Belmont*

Before signals

In the era when a railroad only ran one train at a time, there was no need for a signaling system. As soon as a railroad began to operate two trains at a time, it realized the need to keep each train movement separated—using “smoke signals” to apprise yourself of

the location of the other train only goes so far on sharp curves, or in wooded terrain, or at night. To address this need, railroaders developed some basic operating principles. Each train movement required two preconditions: (1) authority to occupy the main track, (2) assurance that no other train was

authorized to occupy that track—what railroaders call protection against other movements. Each of those have different requirements. There’s a simple acronym that railroaders use to keep this straight:

- C: Condition of the block, communicated by signal or by paper (order)
- R: Representation of superior trains—paper (timetable or train order) or signal
- A: Authority (signal, timetable, or train order)
- P: Permission to enter block (signal, verbal, timetable, or train order)

The original authority and protection scheme was the railroad’s published timetable issued to each employee: a paper document that provided for temporal separation



3 The special instructions section of employee timetables typically contains a wealth of information of use to modelers, including the names and locations of a wide variety of industries.

Tony Koester

of trains, 3. As long as a train crew abided by a document that authorized each train to proceed between defined locations at a certain time, and proscribed meeting locations and times with other trains, a train crew had both an authority to occupy a main track and proceed, and assurance that no other train would surprise it around a sharp curve, 4.

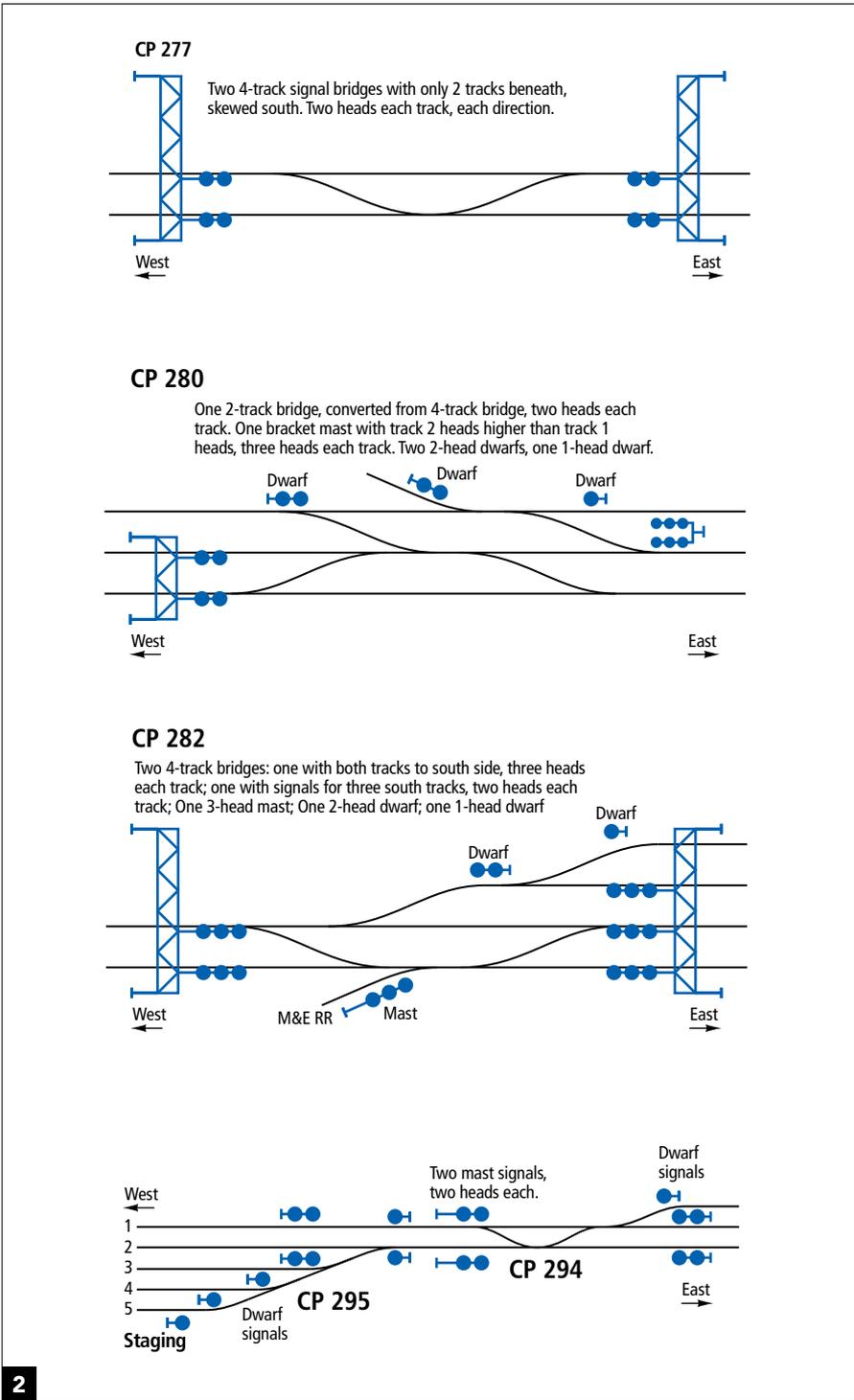
Each train crew handled its own switches, and simply left its initial station when it was time to do so. If a train ran late, the timetable handled that eventuality too, by prohibiting an opposing train from leaving the meeting point until its counterpart arrived.

For the first few decades of North American railroading, the timetable was absolute. Only scheduled trains ran, regardless of circumstance. Each train had a published schedule. Each train would wait for an opposing train at a pre-determined spot designated in the schedule. Flagmen walked back from a train that had stopped to manually flag any following train, in order to protect the rear of their train from a following train. But if there were delays, whether mechanical or bad track, very soon all trains came to a standstill unless one of their crewmen walked forward and worked out an ad

4 Timetables come in multiple formats. The Conrail timetable is a loose-leaf binder with plastic covers. The Penn Central is loose-leaf as well, but with heavy paper covers. The Norfolk Southern timetable is bound with staples. Eric White

5 This is St. Croix train order number 2 ready for delivery with a clearance card attached. The clearance here serves as a receipt or invoice showing the train crew what's being delivered.

6 Here's an example of a Form S-A train order, delivered by the Santa Fe operator at Holliday, Kan., in 1945. It tells the conductor and engineer of the second section of the westbound Grand Canyon (No. 23) to meet the eastbound Ranger (No. 6) at Lawrence. The engine numbers in the body of the order help crews identify the trains they meet.



2

goals. The larger the interlocking, the more complicated and larger the limits will be, 3.

These signals that guard the entrance to the interlocking are called “home signals” and govern movement into the interlocking. Each track entering the interlocking will need its own home signal. These can be located all at the same point, or can be staggered as each track approaches the first turnout in the plant.

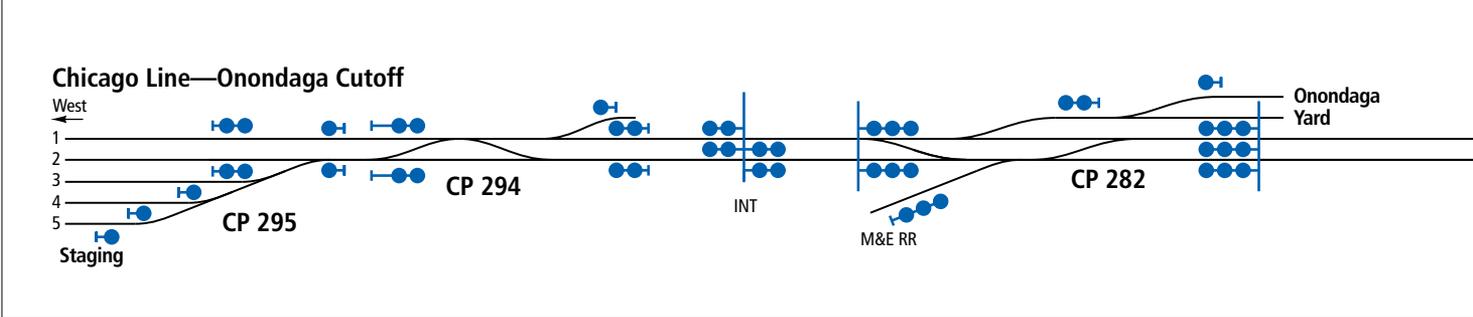
One beauty of a manual signal system is that it allows you to develop a basic understanding of how the interlocking will look and function, including locations for your insulated joints and installing signals, without the expense of purchasing signals, wiring, and control boards.

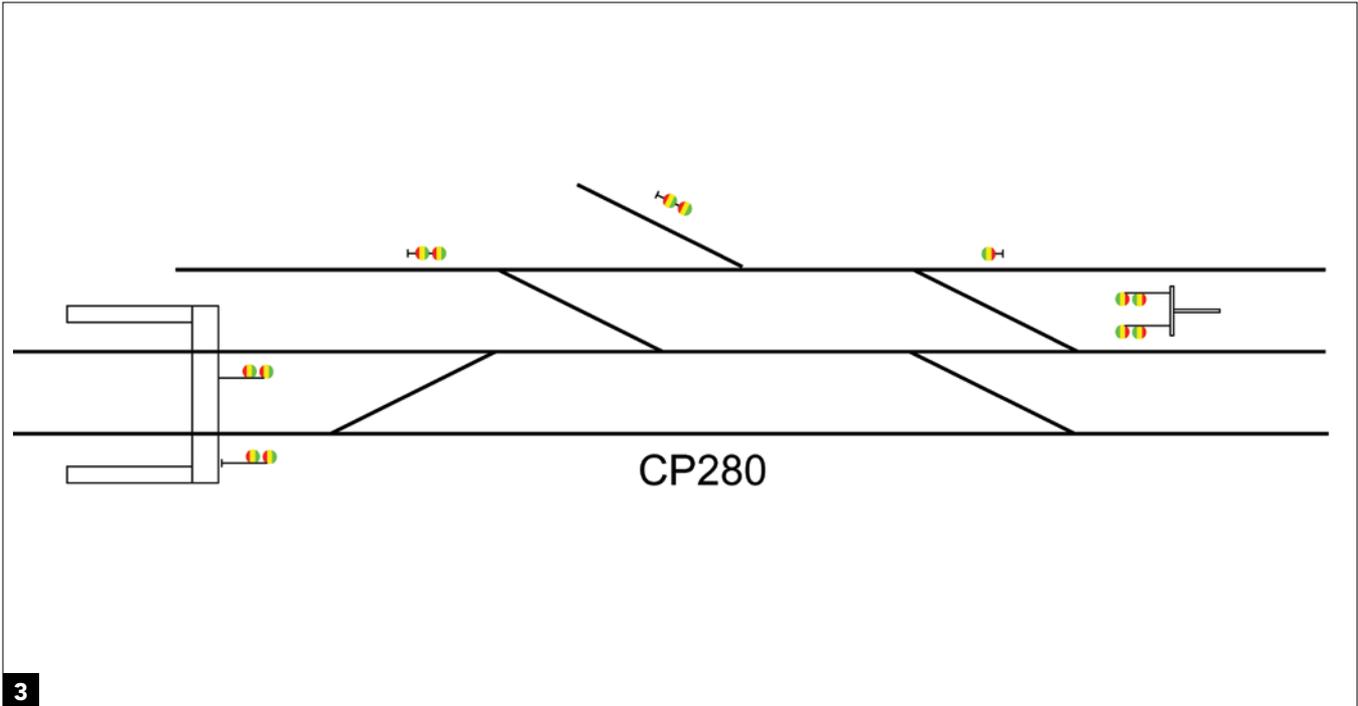
Essentially, the manual or paper approach allows you to make changes and adjustments, and to discuss your particular setup as you get more comfortable with the concepts, 4.

Mistakes in locating manual signals are simple to rectify, especially as compared to actual working signals, since moving a working signal generally requires rewiring that signal.

For example, on the Onondaga Cutoff, significant changes were made to several interlockings after a few nights of operating trains with friends. Jack Trabachino, lifelong friend and rail-planning mastermind, acted as dispatcher by walking around the layout, deciding what would run where, lining the routes and displaying the manual signals.

Several days later he advised we needed to add a new crossover within the limits of CP 294, as well as change the limits of that interlocking and the limits up at CP 282. With manual signals, that simply meant drilling





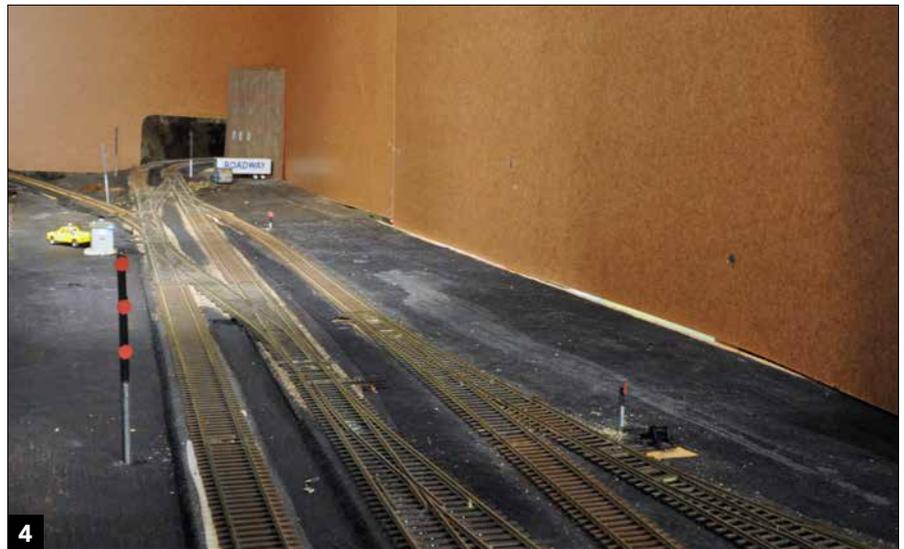
3

some new holes in the subroadbed after installing the new switches. It was additional work, but far less than would be required to move scale brass signals and redo their wiring!

Jack also recommended installing controlled signals and powering the turnouts at each end of the staging yard. We had originally designed those as manual, lined by crews as needed. The manual signal system allowed Jack to see the benefit of these being part of the controlled system in the future, 5. Just as the prototype learns from planning and experience, including adding track and turnouts as needed, your plan will grow as you experiment and learn, 6.

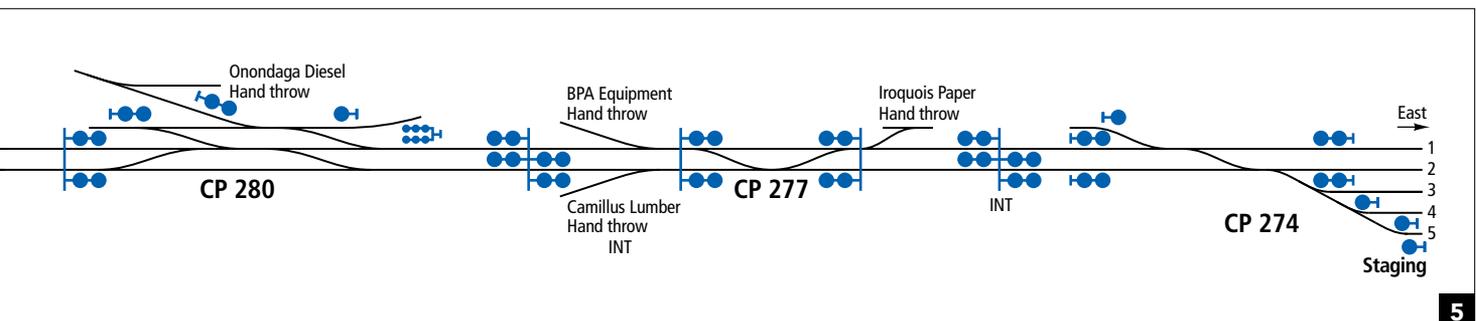
David Olesen, who models CSXT's early years on the former C&O Allegheny Subdivision, is in the process of designing and installing his signal system. His long term goal had

Manual signals allow for extra time to plan what colors or aspects are needed where, as Dave did with Integrated Signal Systems on this simple diagram for CP 282 on the Onondaga Cutoff.

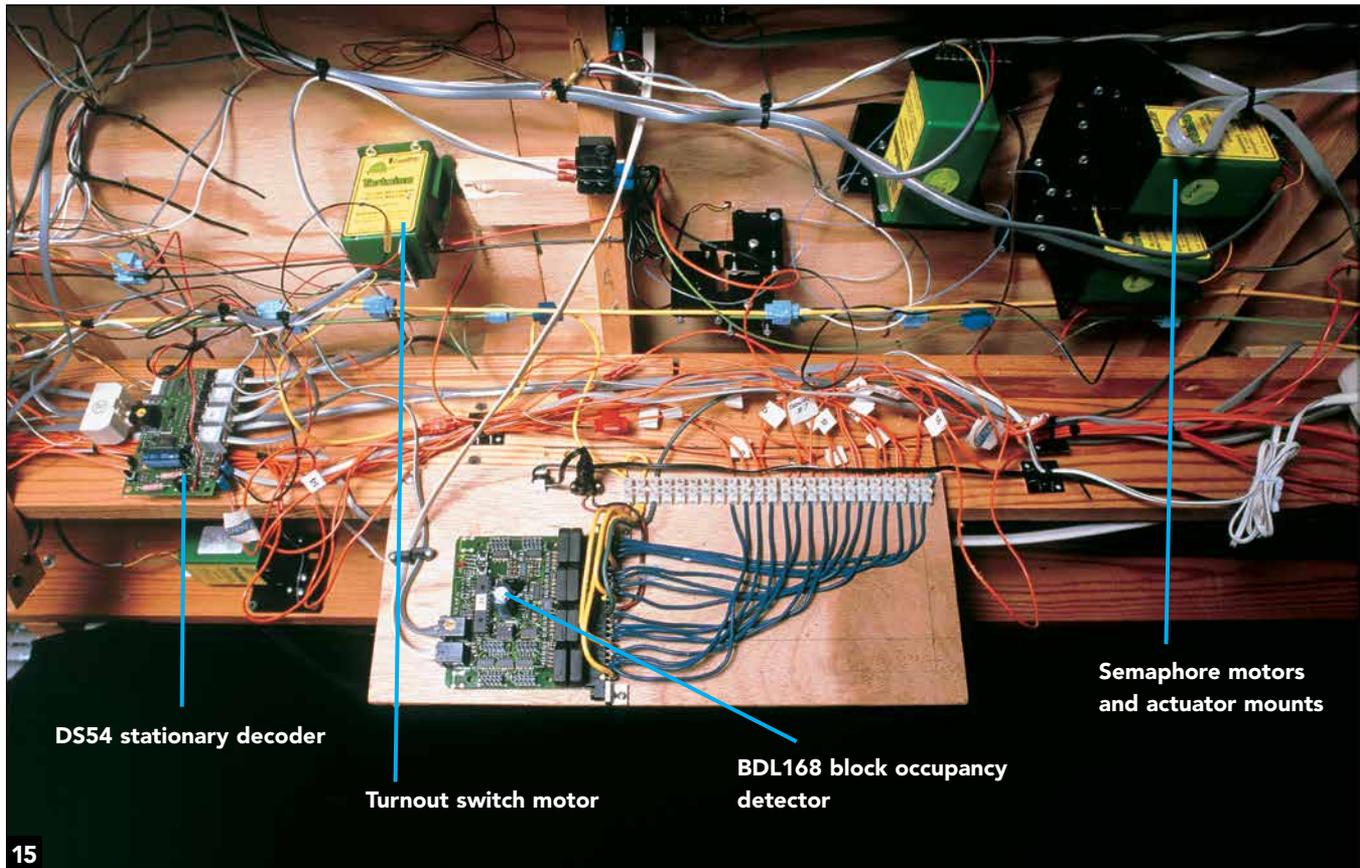


4

Manual signals guard the interlocking at CP 282 on the Onondaga Cutoff. The low cost of these signals makes them ideal to move as needed to determine their best locations.



5



15

Many companies offer all of the components necessary to create an integrated signal system.



Rio Grande train No. 100 races eastward across Utah's desolate Green River Desert and passes into the interlocking at East Sagers, Utah, the morning of Oct. 2, 1987. The controlled siding at Sagers is protected by GRS Type D signals, which were common on the Rio Grande. *James Belmont.*

method is very useful for a train order or manual-block signal, 13.

The new release of the Atlas system in 2018 has allowed additional features. These include a setting on the board to allow for simulating "Approach Lit" aspects, where the signal heads are dark until a train is nearby, as well as flashing aspects where certain signals are displayed as a flashing color instead of a solid color. On some railroads, in order to increase the number of indications available to train crews, such as intermediate restrictions, certain flashing aspects are used. These aspects are now supported with flashing yellow and green options and are automatically enabled for certain prototypes by a single jumper setting.

Many of the ABS installations across the country started as semaphore installations. Thankfully, resources exist on how to use semaphores instead of color-light or position-light signals, 14.

While automatic signals are easier to set up using the off-the-shelf components, 15, it is important to remember that by design ABS systems



16

Canadian Pacific AC4400CW 9781 leads oil loads under the unique modified signal bridge at CP 286 in East Syracuse, N.Y., in 2014. Railroads modified the original signal structures as needed when tracks were moved or as operational changes required. This bridge is the prototype for the bridge holding the eastward home signals at CP 280 on my Onondaga Cutoff.



Amtrak 276 meets Conrail TV-13 at CP 280 on the Onondaga Cutoff.

cannot display a stop indication, and therefore cannot support a true interlocking without additional effort. Adding controlled signals at those interlocking locations is entirely possible and we will look at that next, but it is another considerable layer of complication, 16. If you're ready to take the plunge, let's turn the page!