

Santa Fe and Southern Pacific Signal Practices

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Each railroad has its identifying features. These obviously include such things as the paint schemes on locomotives, cars, and buildings, but also extended to the types of cars and locos purchased and the architectural style of railroad structures. There has been a trend in the past years toward more accurate modeling, with a greater emphasis to getting the details correct. Although the general application of signals was much the same on all railroads, the details, such as the type of hardware applied on each signal mast, varied from railroad to railroad. Each had its own practices which help to identify the railroad and make the scene look "right". Knowing about the practices used by the railroad you are modeling will let you choose and build details that are correct for your layout. No one clinic could hope to cover all the railroads in America, so I am limiting myself to the Santa Fe and Southern Pacific, two railroads I have personal experience with. Even if you are not modeling either of these railroads, you can still learn a little of their history.

Train Order Signals: Most modelers think of block signals when signals are mentioned, but prior to October 1985 every open Train Order Office had a Train Order signal to let train crews know if orders were to be handed up to them. Santa Fe's standard Train Order signal was unlike the Train Order signals used by most railroads. It was a red board, rounded on the ends, mounted on a vertical shaft so it could be rotated 90 degrees by the Train Order Operator. If orders were to be handed up it was set perpendicular to the track, so it could be seen by an approaching train. When there were no orders it was set parallel to the track so it was seen edge-on, and effectively disappeared from the viewpoint of a train. It was non-directional, and the same signal indicated for both directions of traffic. Santa Fe also used more traditional Train order signals at some locations, with both lower quadrant semaphores and red/green vertical color lights used. In these cases separate signals were used for Eastward and Westward trains. The classic Southern Pacific Train order signal was a pair of lower quadrant semaphores mounted on the same mast. In later installations SP used a pair of red/green vertical color lights, and always included a pair of illuminated "TO" signs to distinguish the Train Order signals from block signals.

Signal Types: Like most railroads Santa Fe originally signaled their lines with Semaphore signals. Santa Fe used upper quadrant semaphores giving three aspects. Semaphore blades always had a squared off end. The blade was painted by the following standard: Solid black, unless the background (as seen by the engineer of a train) was dark, then white, unless the background varied between light and dark, then diagonal black and white stripes were used. The rear of the blade was always black.

As semaphores became obsolete ATSF began installing Color Light signals, with the lights in a vertical row with green on top. When Searchlight signals became available the US&S H5 became Santa Fe standard, but many Color Light and some Semaphores remained in service. A few years before the BNSF merger Santa Fe (and most other railroads) had adopted the Safetrans modular Color Light signal as standard for replacements and new installations. All Santa Fe Safetrans signals I have seen were in the vertical lights configuration.

SP also used semaphores in their early installations, but they used lower quadrant blades. These require two blades to give a full set of three aspects, although SP installations often had some individual signals that had only the home blade. SP changed to the US&S H2 searchlight signal as a standard directly from the lower quadrant semaphores, and I know of only one documented installation where SP

used color lights (East from Black Butte). SP did finally go to the Safetrans signals around 1990, but used the triangular configuration for most installations (but not all) made prior to the UP merger.

Santa Fe normally provided their maintainers a platform, with railing, for work on the signal. The exact railing style varies greatly, but Santa Fe signals without a service platform are very rare. Santa Fe signals were mounted below the top of the mast, generally on the track side of the mast to give easy access from the rear. SP on the other hand did not use platforms, with just a ladder and two small foot rungs on the side of the mast for maintainers. The searchlight signals were mounted at the top of the mast and in line with the mast (no left or right offset). Where two or three heads were required SP spaced the lower head(s) forward from the mast to allow access to the rear for changing mechanisms, but kept all signal heads in line with the mast.

Before the mid 1970s both Santa Fe and SP required that all signals be to the right of the track they governed, and did not hesitate to install cantilever or full signal bridges to accomplish this. After low nose diesels became the standard locomotive, both railroads began using field side signals on two tracks, and placing signals for both directions on a single mast on single track. Santa Fe was faster to begin installing field side signals, but SP used them as well.

Santa Fe and SP mast signals are painted silver, with a black target. However, signal bridges were painted all black. Both railroads used dwarf signals, often on sidings, but Santa Fe also often used dwarfs as main line signals. A dwarf has the same indications as a high signal on both railroads.

Number Plates: Most American railroads use the presence of a Number Plate to indicate the meaning of a Red Aspect. The absence of a number plate means an absolute signal, which requires the dispatcher's or tower operator's permission to pass when displaying a Red Aspect. SP also added an "A" plate to their absolute signals until Oct. 1986 when the GCOR was adopted. The "A" plates were removed soon after that date. Santa Fe never used "A" plates on absolute signals. Absolute signals are used at interlockings, and CTC control points, but also at head blocks in Absolute-Permissive ABS. A signal with a number plate is a permissive signal, and the indication of a Red Aspect is Stop and Proceed, allowing a train to proceed past the Red Aspect at Restricted speed after stopping. Southern Pacific based the signal number on the nearest milepost and tenth of a mile. Notice that there is no decimal point, so a signal at mile 185.3 would be signal 1853. The last digit on the number plate is always even for an Eastward signal, and odd for Westward, so the tenths of a mile are rounded up or down as necessary. Santa Fe used a similar numbering practice, but the last digit did not indicate tenths of a mile. The first Westward signal in a given mile has "1" for the last digit, the first Eastward has "2". If there are more than one signal in a mile, higher numbers are used. Thus, the first Eastbound signal in mile 145 would have 1452 on its number plate. When there are two or more tracks, each signal has a different number, with the North or Number 1 track having the lower numbers. Santa Fe also used a "G" on a round yellow or white plate to indicate a Grade signal, which could be passed without stopping when at Red. Santa Fe number plates were horizontal with black numbers on an off-white plate. SP in contrast had white or aluminum numbers on a black plate, also with the numbers horizontal.

There are other signs or 'plates' that can be attached to signal masts. A "G" plate indicates a Grade signal, and a Red Aspect may be passed without stopping by trains exceeding a specified tonnage. On SP a "P" plate indicates that there is a protective circuit that can drop the signal red, such as a slide fence or a washout detector. There will also be signs beside the track indicating the beginning and end of both ABS and CTC territory. Both railroads also used "D" plates to indicate a "distant" signal, which was an approach signal for an interlocking in non-signaled territory.

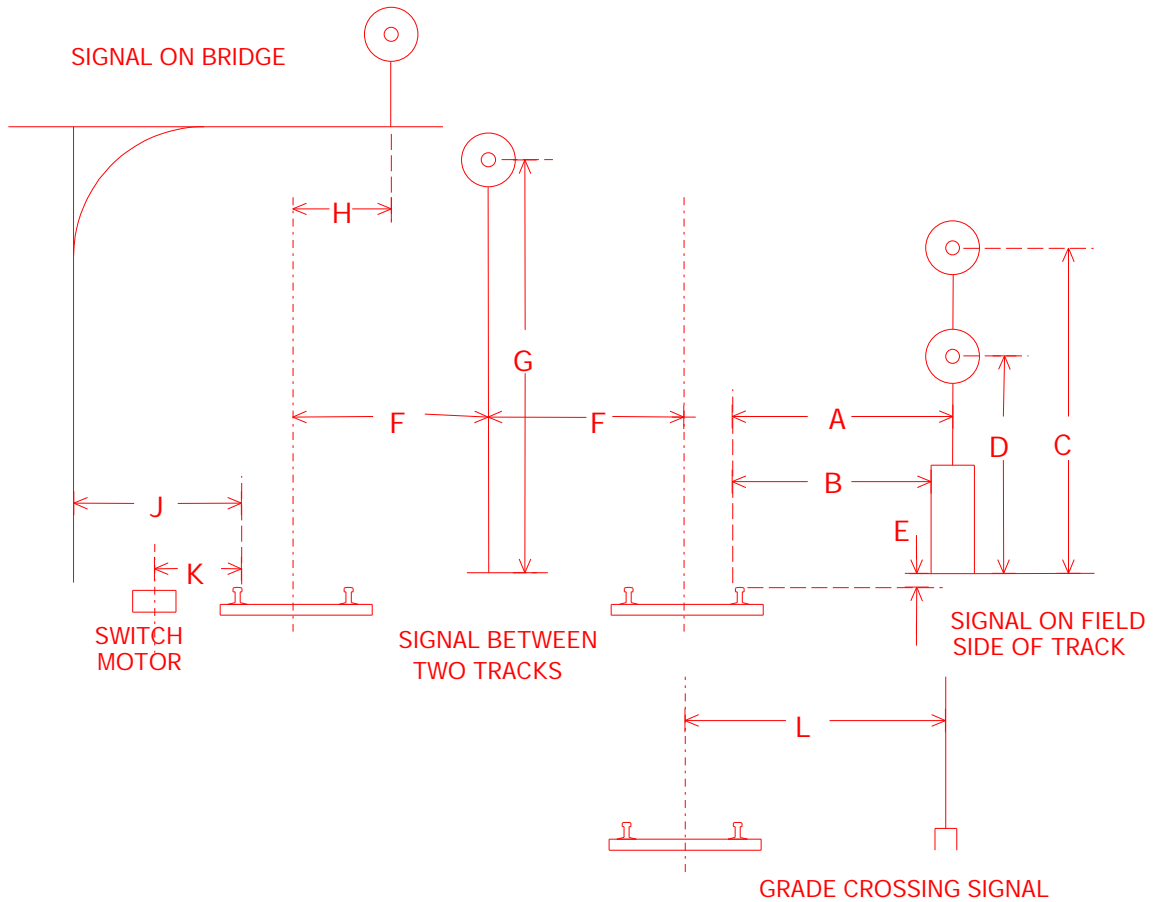
Signal Aspects: Santa Fe tended to have a simple system of signal aspects, using only one signal head whenever possible. In fact, prior to 1953 Santa Fe only had 6 aspects shown in its Rule Book. With the 1953 rules System Two was introduced, but Santa Fe never had more than two heads on a signal. Southern Pacific used true route signaling at interlockings and at Centralized Traffic Control (CTC) control points, using up to three heads if necessary. SP always used approach lighting, with signals only lighted when a train was in the block, although what is known as 'back lighting' was used in Automatic Block Signal (ABS) territory. Before the late 1980s Santa Fe signals were continuously lighted, with approach lighting being gradually applied after that date. On two head signals, the lower head was only lighted when needed; for stop Red over Dark was used, similarly Yellow over Dark for Approach, and Green over

Dark for Clear. Santa Fe also liked flashing aspects, with Flashing Yellow being equal to Yellow over Yellow. Flashing Red (generally hated by operating crews) was used to indicate Restricting, with some CTC sidings having a single head signal for entering the siding, using the Flashing Red when cleared into the siding. There was a period of time when Santa Fe preferred the term "Traffic Control System" (TCS) to CTC, but the signals were the same. SP also had a unique system of lighting at multiple head signals. At Stop all heads would be lighted Red, but when cleared lower heads were only lighted as needed, so a three head signal would display Green over Dark over Dark for a primary route Clear.

Signal Details: There are a number of details that go with any signal installation, and they tend to be much the same regardless of the railroad. I've already covered the signal itself and number boards when appropriate. Next is the question of relay cases. There are several possibilities here. A relay case may be used as the base of one or both of the signals, there may be a relay case separate from the signals, and at CTC control points there will usually be an equipment shed. The exact configuration varies with each location. As a general rule, intermediate and ABS signals will have at least one relay case, and control points will have a shed, and may also have relay cases. Signals need to have wires to connect them. Older installations used lineside wires between the blocks, and these needed 'drops' down to the signals. Sometimes a drop will go to the top of a signal, sometimes midway down the mast, and sometimes to a separate short mast, or to the CTC shed, with all wires to the signals themselves underground. Typically there is only one drop at each location, with the other connections made underground. Lineside wires are now being eliminated, with coded current on the rails and radio links replacing the costly to maintain pole lines.

Each location will have two or three battery boxes near the signals. Santa Fe used a unique round battery box built into the base of its semaphores, but otherwise the battery boxes are the standard rectangular concrete cases with a flat metal lid. There is often also a battery box located at the middle of each block, which will usually have a short mast with a drop from the lineside wires, and may have a small relay case. Even modern installations still have battery boxes since signals still have battery back up power. Note that grade crossing signals are tied into the track circuits so each grade crossing will also need a relay case or shed, battery boxes, and a drop from the lineside wires. Power switches at CTC control points or interlockings will of course have a dual-control switch motor at the points. Manual main line switches in any signaled territory will have an electrical switch attached to the points that drops the signals to red if the switch is not fully lined for the main track.

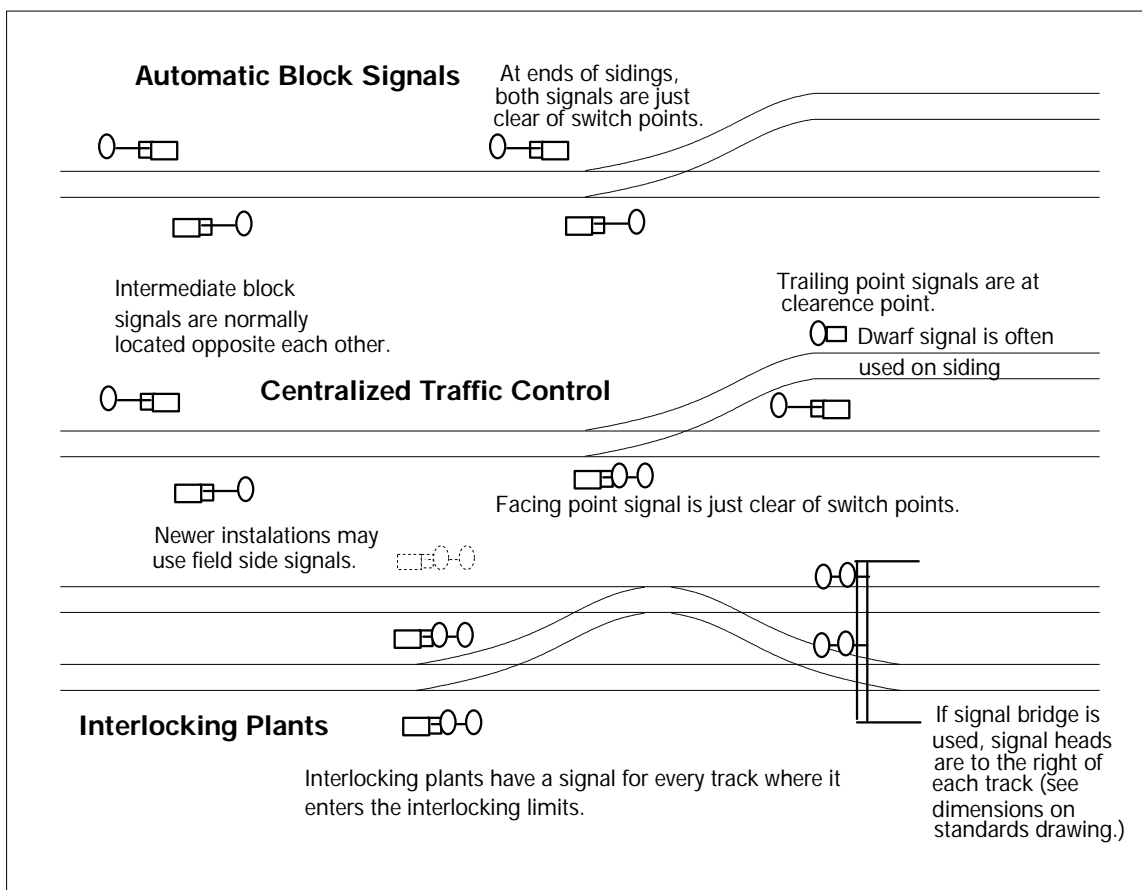
SYSTEM STANDARDS DIMENSIONS FOR THREE RAILROADS



	AT&SF	Southern Pacific	MKT
A	10'-0"	---	10'-5"
B	---	7'-0"	---
C	15'-0"	15'-0"	12'-2" Color Light; 22'-6" Semaphore
D	10'-0"	10'-0"	---
E	8"	0"	0"
F	9'-0"	9'-6"	---
G	19'-0"	18'-0"	---
H	4'-6"	5'-6"	---
J	7'-9"	---	----
K	4'-0"	---	----
L	15' to Flasher, 12' to Gates	----	---

NOTE: System standards are always subject to change to meet the needs of each installation; they are only a guide used by the Railroad's signal engineers when designing each installation.

Typical Signal Placement



Signal Rules for ATSF and SP, from the Indicated Dates

Explanation of symbols

ⓐ = Green light

● = Dark signal head

Ⓨ = Yellow light

☼ = Flashing aspect

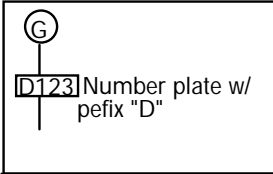
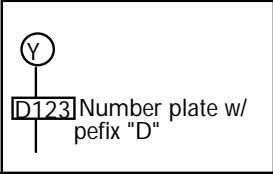
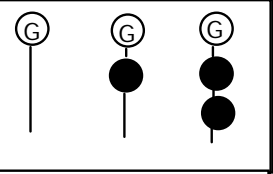
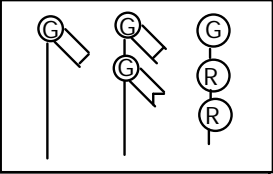
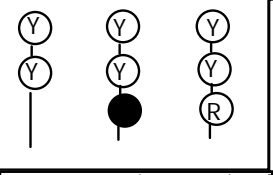
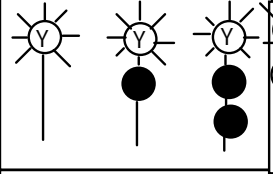
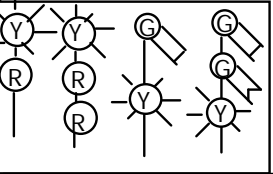
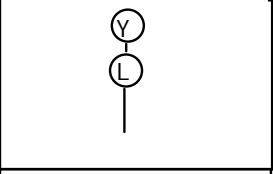
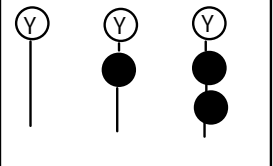
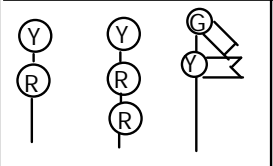
Ⓡ = Red light

Ⓛ = Lunar White light

ASPECT

RULE	NAME	INDICATION
9.50	CLEAR	Proceed
9.51	APPROACH LIMITED	Proceed prepared to pass next signal not exceeding 60 MPH on diverging route.
9.52	ADVANCE APPROACH	Proceed prepared to pass next signal not exceeding 50 MPH on diverging route.
9.54	APPROACH MEDIUM	Proceed; approach next signal not exceeding 40 MPH prepared to enter diverging route at prescribed speed.
9.55	APPROACH RESTRICTING	Proceed prepared to pass next signal at restricted speed.
9.56	APPROACH	Proceed prepared to stop at next signal; trains exceeding 40 MPH immediately reduce to that speed.
9.57	DIVERGING CLEAR	Proceed on diverging route not exceeding prescribed speed through turnout.
9.58	DIVERGING APPROACH	Proceed through diverging route; prescribed speed through turnout; approach next signal prepared to stop.
9.60	RESTRICTING	Proceed at restricted speed.
9.61	STOP AND PROCEED	With number plate: Stop, then proceed at restricted speed.
9.62	STOP	Without number plate: Stop

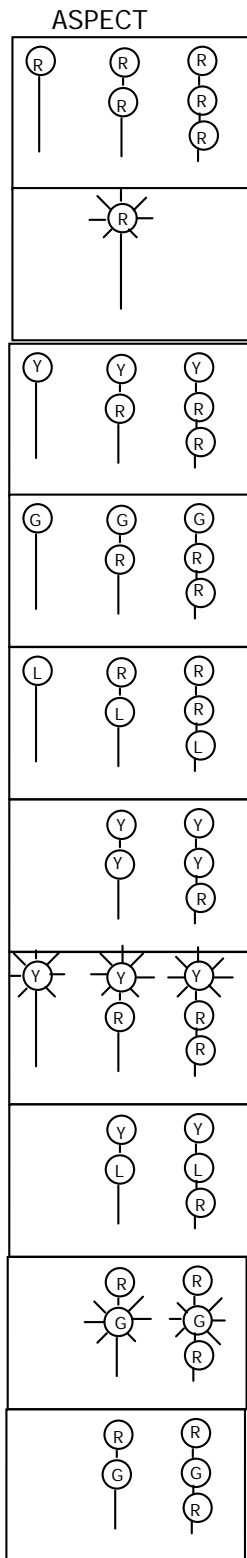
ATSF Signal Rules, in effect April 16, 1995.

ASPECT	RULE	NAME	INDICATION
	228	Distant Signal Clear	Proceed If train is delayed, it must proceed prepared to stop short of next signal.
	229	Distant Signal Approach	Proceed prepared to stop short of next signal or switch point indicator.
 	230	Clear	Proceed
	233	Approach Diverging	Proceed prepared to advance on diverging route at next switch at prescribed speed through turnout.
 	234	Advance Approach	Proceed prepared to stop at second signal unless the next signal displays a Clear, Approach Diverging, or Advance Approach.
	235	Approach Restricting	Proceed prepared to pass next signal at restricted speed.
 	236	Approach	Proceed prepared to stop at next signal.

Southern Pacific Signal Rules in effect November 24, 1990

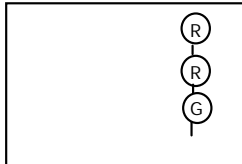
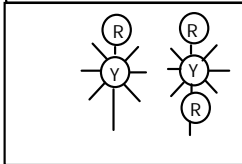
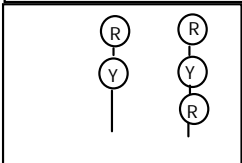
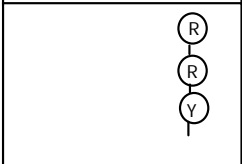
ASPECT	RULE	NAME	INDICATION
	237	Diverging Clear	Proceed on diverging route not exceeding prescribed speed through turnout.
	238	Diverging Advance Approach	Proceed on diverging route not exceeding prescribed speed through turnout and be prepared to stop at second signal unless next signal is less restrictive.
	239	Diverging Approach	Proceed on diverging route not exceeding prescribed speed through turnout prepared to stop short of next signal.
	240	Restricting	Proceed at restricted speed.
	241	Restricted Proceed	Proceed at restricted speed.
	242	STOP	STOP

Southern Pacific Signal Rules in effect November 24, 1990



RULE	NAME	INDICATION
245A	STOP	Without number plate: Stop before any part of train passes the signal.
245B	STOP AND PROCEED	With number plate: Stop then proceed at restricted speed through entire block.
245C	FLASHING STOP AND PROCEED	Stop before any part of train passes the signal. Block occupied. Proceed at restricted speed.
245D	APPROACH	Proceed prepared to stop before any part of train passes the next signal. Trains exceeding 30 MPH must immediately reduce to that speed.
245E	CLEAR	Proceed
245G	RESTRICTING	Proceed on route indicated at restricted speed. Speed through turnout must not exceed 15 MPH
245J	APPROACH MEDIUM	Proceed. Speed passing next signal must not exceed 30 MPH.
245F	APPROACH LIMITED	Proceed. Speed passing next signal must not exceed 40 MPH.
246K	APPROACH SLOW	Proceed. Speed passing next signal must not exceed 15 MPH.
245L	DIVERGING CLEAR LIMITED	Proceed on diverging route. Speed through turnout must not exceed 40 MPH.
245M	DIVERGING CLEAR MEDIUM	Proceed on diverging route. Speed through turnout must not exceed 30 MPH.

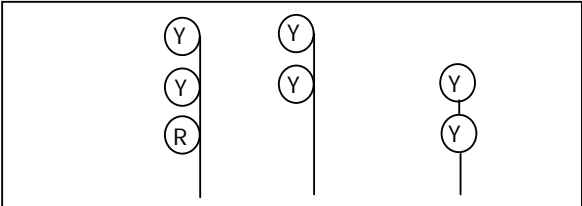
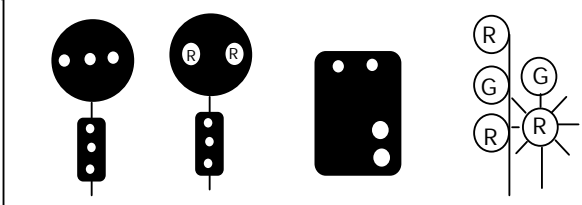
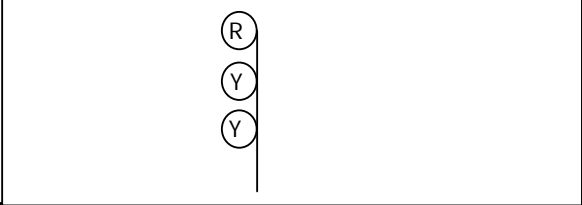
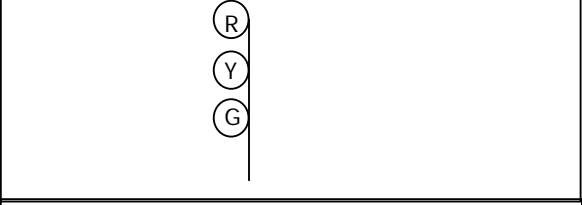
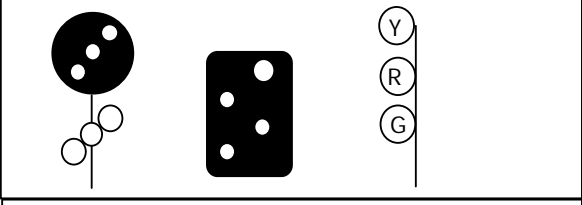
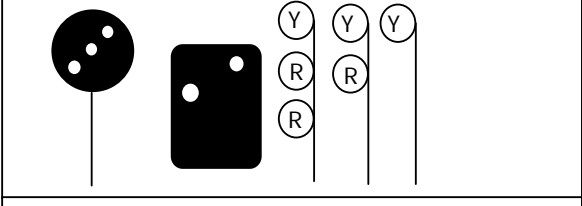
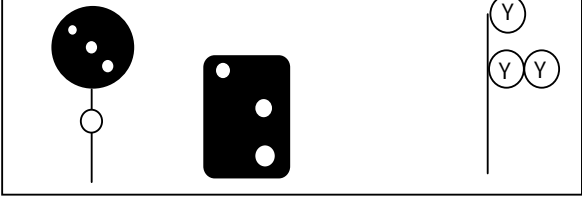
Union Pacific signal rules in Speed Signal Territory only. General Code of Operating Rules, April 28, 1985

ASPECT	RULE	NAME	INDICATION
	245N	DIVERGING CLEAR SLOW	Proceed on diverging route. Speed through turnout must not exceed 15 MPH.
	245P	DIVERGING APPROACH LIMITED	Proceed on diverging route. Speed through turnout must not exceed 40 MPH. Speed passing next signal must not exceed 40 MPH.
	245Q	DIVERGING APPROACH MEDIUM	Proceed on diverging route. Speed through turnout must not exceed 30 MPH. Speed passing next signal must not exceed 30 MPH.
	245R	DIVERGING APPROACH SLOW	Proceed on diverging route. Speed through turnout must not exceed 15 MPH. Speed passing next signal must not exceed 30 MPH.

Union Pacific signal rules in Speed Signal Territory only. General Code of Operating Rules, April 28, 1985

ASPECT	RULE	NAME	INDICATION
	280	Clear-block	Proceed; for passenger trains, manual block clear, for other trains, manual block clear outside yard limits.
	281	Clear	Proceed
	281(A)	Advance Approach Medium	Proceed approaching second signal at Medium speed.
	281(B)	Approach Limited	Proceed approaching next signal at Limited speed
	281(C)	Limited Clear	Proceed: Limited speed within interlocking limits.
	281(D)	Limited-approach	Proceed at limited speed preparing to stop at next signal
	282	Approach-Medium	Proceed approaching next signal at medium speed.

Penn Central signal rules effective April 28, 1968.

ASPECT	RULE	NAME	INDICATION
	282(A)	Advance Approach	Proceed preparing to stop at second signal. Train exceeding Limited speed reduce at once to that speed.
	283	Medium Clear	Proceed; Medium speed within interlocking limits.
	283(A)	Medium-advance Approach	Proceed preparing to stop at second signal; Medium speed within interlocking limits.
	283(B)	Medium-approach Slow	Proceed at Medium speed approaching next signal at slow speed.
	284	Approach-Slow	Proceed approaching next signal at slow speed. Train exceeding Medium speed must at once reduce to that speed.
	285	Approach	Proceed prepared to stop at next signal. Train exceeding Medium speed must at once reduce to that speed.
	285(A)	Caution	Train exceeding Medium speed must at once reduce to that speed. Where a facing switch is connected with signal, approach that switch prepared to stop. Approach next signal prepared to stop.

Penn Central signal rules effective April 28, 1968.

ASPECT	RULE	NAME	INDICATION
	286	Medium-approach	Proceed at Medium speed preparing to stop at next signal.
	287	Slow-clear	Proceed; Slow speed within interlocking limits.
	288	Slow-approach	Proceed preparing to stop at next signal; Slow speed within interlocking limits.
	289	Permissive-block	Block occupied: passenger trains, stop: other trains proceed not exceeding 15 MPH prepared to stop short of a train or other obstruction.
	290	Restricting	Proceed at restricted speed.
	291	Stop and Proceed	Stop; then proceed at restricted speed.
	292	Stop Signal	STOP

Penn Central signal rules effective April 28, 1968.