The Keystone Modeler

Pennsylvania Railroad Technical & Historical Society

No. 105 Summer 2018

Inside:

The Keystone Modeler
Pennsylvania Railroad Technical & Historical Society

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NUMBER 105 **CONTENTS** **SUMMER 2018**

FRONT COVER

(Clockwise from top) Working HO dwarf signals on Jack Consoli's layout made from 3-D printed components. *(Jack Consoli)* • Joe DeFrancesco's prize-winning HO diorama of PRR's Altoona Master Mechanic's Building – the current home of the Railroaders Memorial Museum *(Tim Garner and Jim Hunter)* • Gus Minardi's HO Railworks model of an F37 well pocket flat with a scratchbuilt load. *(Tim Garner and Jim Hunter)* • Gus's Sunshine HO resin kit of an F30A flat with a kitbashed Laserkit load. *(Tim Garner and Jim Hunter)*

The Keystone Modeler

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Please contact the editor for information and guidelines for submission. Photo files 800x600 pixels or larger in JPG format are preferred. Statements and opinions made are those of the authors and do not necessarily represent those of the Society.

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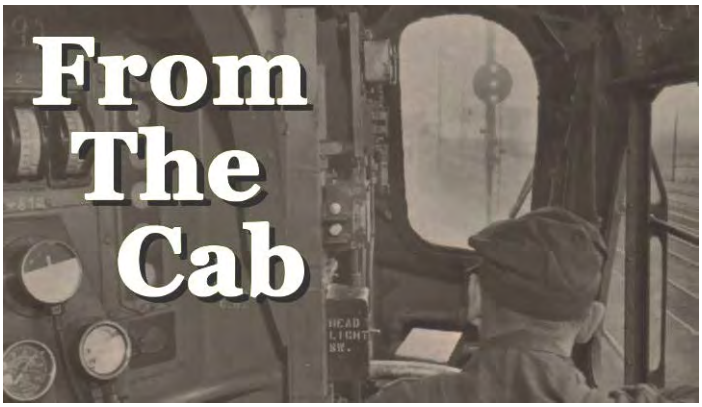


There is much talk on modeling sites and in discussion groups just now about the problems American model companies are having with Chinese factories. No one knows exactly what is going on. Is this related to the possible trade war with China? Have Chinese factory bosses just decided to make something else? I don't have the answers, but I do know that something like this has happened before. Some years ago, when I was starting to build my current layout, there was a shortage of Atlas code 83 track. Eventually, Atlas found a new factory, and the track reappeared. Some of the models and kits we were looking forward to are going to be delayed, but I am hoping that this is only a temporary situation. Please check out Steve Hoxie's comments at the beginning of his column.

In this issue we have another amazing article by Jack Consoli. He has used 3-D printing and tiny LEDs and wiring to make working dwarf signals. We also have David Wilson's report on his survey about the models most desired by Pennsy modelers. Of course, we are including some of the models that were seen at last spring's annual meeting. More of these will appear in our next issue.

Jim Hunter, Editor

Pennsylvania Railroad Technical & Historical Society

The purpose of the Pennsylvania Railroad Technical & Historical Society is to bring together persons interested in the history and modeling of the Pennsylvania Railroad, its subsidiaries and its acquired companies. Our goals are to promote the preservation and recording of all information regarding the organization, operation, facilities, and equipment of the PRR.

The Society's quarterly illustrated journal, *The Keystone*, has been published continuously since 1968. Each issue of 64 or more pages contains illustrated original authoritative articles about locomotives, cars, other equipment, facilities, and operating practices of the PRR. The Society also publishes its own thoroughly researched books and other materials concerning PRR history. *The Keystone Modeler* is also a quarterly special 30-plus page online publication of the Society.

The Society meets annually, usually during a weekend in early May, providing an opportunity for its members to get together and learn more about the PRR. Local chapters around the country also provide members and guests with regular meetings that feature PRR related programs.

Information about our Society may be found on our website – www.prrths.com. To join the Society, send $40.00 to:

PRRT&HS
PO Box 54
Bryn Mawr, PA 19010-0054

All memberships are for a calendar year, back issues of The Keystone for the current year are sent upon joining. Overseas membership has added postage fees.

PRRT&HS Interchange

Selected Society Merchandise of Interest to Modelers

PRR Equipment Drawings on Microfilm

Copies of PRR equipment drawings are available from the Society's microfilm collection. To order drawings, you must know the drawing number and title. Ordering information and lists of arrangement drawings are available on the Society's website. Go to www.prrths.com, select National Society, and then The Interchange. If you require a printed copy of this information, please send your address and a check for $2.00 made out to PRRT&HS to:

Richard C. Price
779 Irvin Hill Road
McVeytown, PA 17051

The Keystone Modeler
NEWSWIRE
With Steve Hoxie

Industry News

For those that don't know, once again there has been upheaval in the hobby with the closing of a Chinese factory which produced models and parts for Atlas, Bluford Shops, Bowser, Eastern Seaboard Models, Exactrail, Fox Valley, Intermountain, Spring Mills Depot, Tangent, Trainworx, Wheels of Time, and possibly others. Athearn, Bachmann, Broadway Limited Imports, Rapido, and Walthers are not affected. The factory closed suddenly without notice to its clients. Atlas track products are not affected; they are produced elsewhere. It is my understanding that the Bowser RS-3 program is affected only for painting and assembly since all tooling and parts production is in the US.

Representatives from the affected companies are scrambling to re-obtain tooling held in this factory and then find replacement manufacturing capacity. Apparently, the factory owner is getting older and wanted to retire, but his children do not want to take over the business. At least that is a story going around. Surely by now we realize that businesses in China flourish or fade at the whim of the government. Also, there is plenty of available information about the Chinese government's policies and practices imposed on foreign companies desiring to do business in China. That these activities have contributed for decades to a trade balance unfavorable to the US is unassailable fact. That we are now addressing this imbalance may or may not have been a factor in this factory's closing. It is only reasonable to expect that there will be perturbations as rebalancing comes about. Time will tell.

PRR Product News

ARROWHEAD MODELS
https://arrowheadmodels.com/
PRR H39 Open Hopper RTR—HO Scale

Arrowhead Models

This is a new company. The owner, Blaine Hadfield, formerly was with Exactrail and is well experienced to operate his own company and develop some outstanding models. Their first model is the H39 open hopper.

ATHEARN
http://www.athearn.com/
PRR GP9 (ES-17) – HO Scale

Athearn

Athearn now has available as part of the Genesis line GP9 models with DCC/Tsunami2 sound or standard DC. The model represents the railroad's first order of GP9's with 36" fans and Trainphone antenna.

ATLAS MODEL RAILROAD CO.
https://shop.atlasrr.com/
PRR Alco RS-1 Road Switcher—HO and N Scales

Atlas

Atlas is planning another run of this favorite model in both HO and N. Both DC and DCC/Sound versions will be available in HO. The N scale model will be available in DC only. Models are expected in the first quarter of 2019.

BOWSER MFG. CO.
http://www.bowser-trains.com/
PRR H21A Open Hopper RTR – N Scale

Bowser

Bowser is taking orders for N scale H21A hoppers in several PRR paint schemes. They are expected to be available in March 2019.

BROADWAY LIMITED IMPORTS

http://www.broadway-limited.com/

PRR T1 Steam Locomotive — N Scale

Broadway Limited Imports

BLI is expecting delivery of the N scale T1 this month, August 2018.

PRR P5A Electric Locomotive—HO Scale

BLI has slipped the delivery date for the HO P5A slightly to September 2018.

CENTRALIA CAR SHOPS

https://www.intermountain-railway.com/distrib/ccs/ccsn.htm

PRR 10-5 Lightweight Sleeping Car RTR—N Scale

Centralia Car Shops

CCS is planning to have this model available later this month, August 2018. It will be available in both Fleet of Modernism and the Tuscan Red three-stripe schemes.

CMR PRODUCTS

https://www.cmrproducts.com/

PRR RS3 Hammerhead Body Shell Kit—HO and N Scales

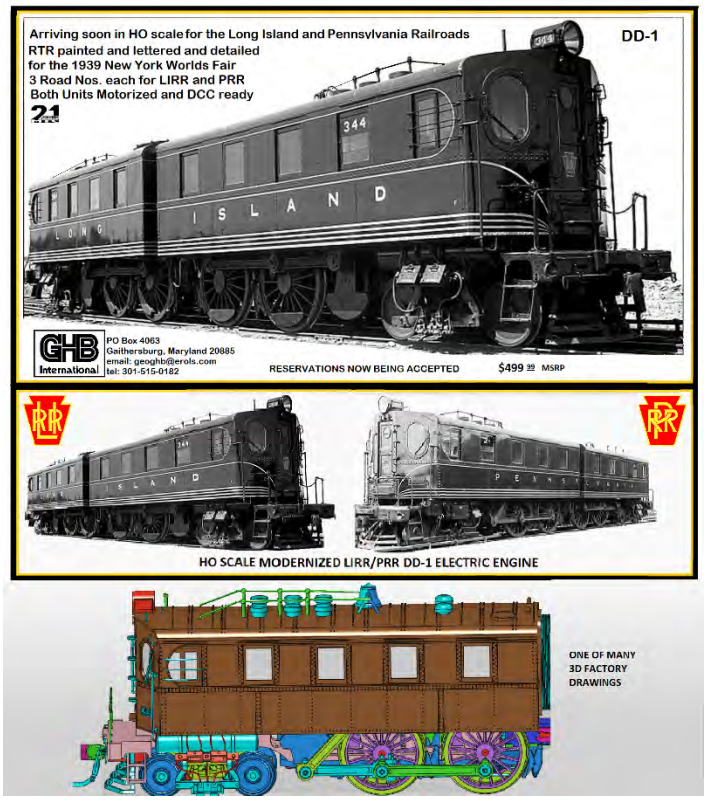
CMR Products

As part of their Puttman Locomotive Works line, **CMR** has available these polyurethane body shell kits for use on Atlas HO and N chassis.

GHB INTERNATIONAL

PRR DD1 Electric Locomotive—HO Scale

http://www.ghbintl.com/



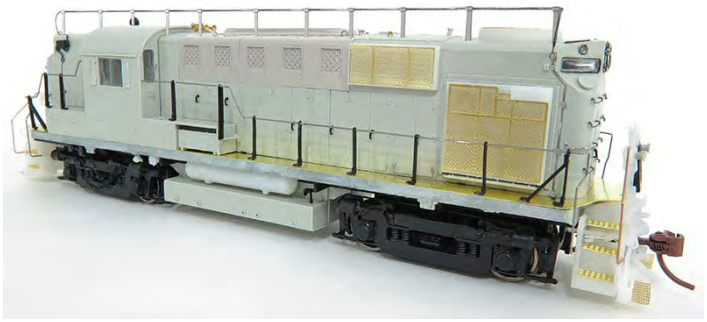
GHB International

GHB is developing DD1 models. Production is in China, but not affected by the recent factory closing. First test shots have been received, and the project is said to be on schedule. The model is constructed of a die cast frame and injection molded body and will be ready-to-run as it appeared in 1939. The DD1 operated as two units and that is how the model will be offered.

RAPIDO TRAINS INC.

https://rapidotrains.com/

Alco RS-11 Road Switcher—HO Scale



Rapido

Rapido is taking orders for and tooling up for production of a well detailed RS-11. Available in both DC and DCC/Sound versions. The sound version will have a Loksound decoder. Orders are being taken now with delivery expected in the middle of 2019.

THE N SCALE ARCHITECT
http://thenarch.com/
PRR F22 Gun Flat Car Kit (3 Pak Box Set) – N Scale
USN 16" Naval Gun Load—N Scale

N Scale Architect

Available by direct order only, **The N Scale Architect** has F22 flat cars and a separate 16" Naval gun load. These gun tubes were used on Iowa-class battleships during and after World War II. All mounting hardware is included with the load. The models are made primarily of Frosted Ultra Detail (FUD) 3-D printed parts and metal details.

WALTHERS
https://www.walthers.com/
EMD F7 (EF-15A) Diesel—HO Scale

Walthers

Walthers has in stock F7 A and B models as part of the Main-line line. Offered as single A units, powered A and B sets, and powered A and dummy B sets with DCC/Soundtraxx sound as well as standard DC.

BACHMANN TRAINS
http://www.bachmanntrains.com
PRR Streamlined K4—HO Scale

Bachmann

Bachmann announced a model of a streamlined K4s at the National Train Show. Expected in November 2018, it will be offered with a dual mode DC/DCC Sound TCS WOW decoder including Keep Alive capability. Four road numbers will be available.

Upcoming Events

August 5-12, 2018 Kansas City, Missouri
NMRA National Convention and National Train Show
http://www.kc2018.org/

September 8, 2018 Evanston, Wyoming
Mountain States Railroad Prototype Modelers Meet
https://www.facebook.com/MountainStatesRPM/

September 21-22, 2018 Baltimore, Maryland
Mid-Atlantic Railroad Prototype Modelers Meet
https://www.marpm.org/

October 6, 2018 Bellflower, California
LA Area Railroad Prototype Modelers Meet
http://www.laapm.org/

October 18-20, 2018 Lisle, Illinois
RPM Chicagoland
http://www.rpmconference.com/

October 19-20, 2018 Winston-Salem, North Carolina
RPM Carolinas: School of Railway Prototype Modeling
https://sissonstony.wixsite.com/rpm-carolina

Advance Planning

November 3, 2018 Scotch Plains, New Jersey
Garden State Railroad Prototype Modelers Meet
http://gsrpm.org/

November 10-11, 2018 Benton, Kansas
Mid-Continent Railroad Prototype Modelers Meet
https://www.facebook.com/Mid-Continent-Prototype-Modelers-1876840179207723/?ref=page_internal&mt_nav=1

January 10-12, 2019 Cocoa Beach, Florida
Prototype Rails
http://www.prototyperails.com/

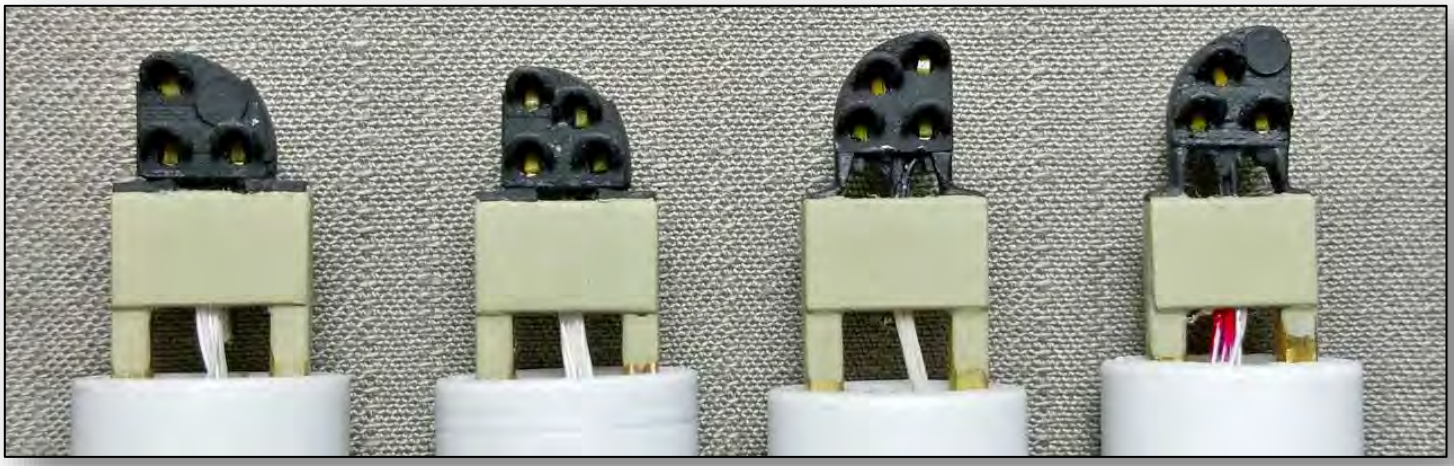
March 22-23, 2019 Greensburg, Pennsylvania
RPM-East
http://hansmanns.org/rpm_east/index.htm

May 15-18, 2019 Strasburg, Pennsylvania
PRRT&HS Annual Meeting
http://www.prrths.com/conventions/PRR_Annual.html

July 7-13, 2019 Salt Lake City, Utah
NMRA National Convention and National Train Show
http://www.nmra2019slc.org/

Modeling HO PRR Position Light Signals
Part 8 – Dwarf and Pedestal Signals

by Jack Consoli – All photos by the author unless otherwise specified.



Construction of PRR Position Light Dwarf signals concludes this series. Examples of the four types described herein from left to right are the 2- and 4-Aspect older style and 4- and 2-Aspect newer style signals.

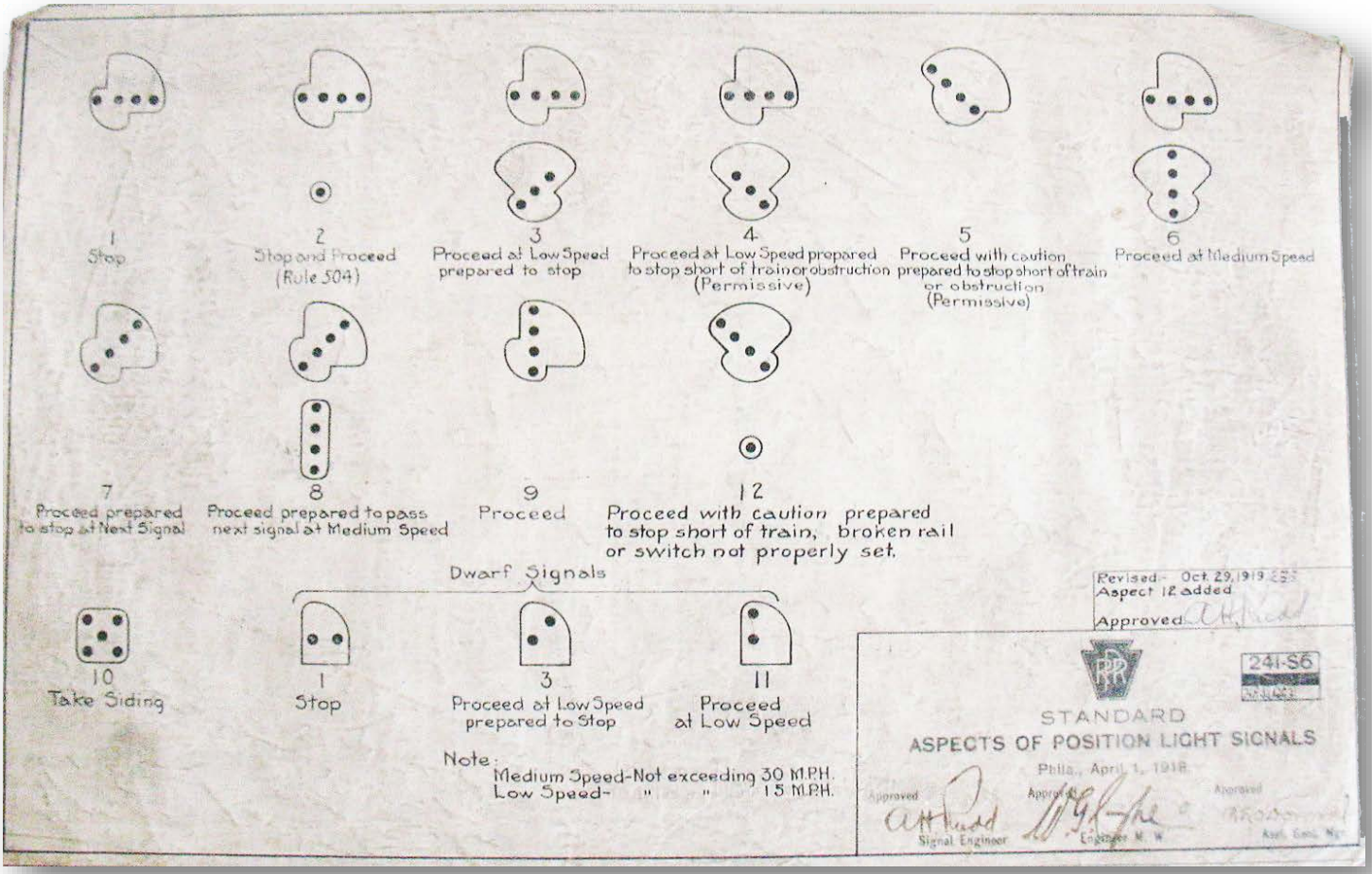
I completed my series of articles on the construction of the high PRR position light signals back in issue #43, the February 2007 *TKM*, promising to extend the series to cover PRR dwarf and pedestal-type signals when reasonable methods of producing scale models of them evolved. I, like others, had previously made attempts to produce working versions but were discouraged by either the difficulty in making such small, accurately scaled signals or by more manageable methods that yielded unacceptably oversized results. The good news is that technological advances have come to our rescue in this hobby once again. It seemed only a matter of time until further developments in LED (Light Emitting Diode) and 3-D printing technologies yielded a workable solution. A PRR Product News item back in issue #100, the Spring 2017 *TKM*, identified an answer to the Dwarf Signal dilemma. These dwarf and pedestal signal housings are available on Shapeways.com, an online business that allows you to have your own parts 3-D printed or to buy parts developed by other members of their user community. The member's store location that offers these parts is:

https://www.shapeways.com/shops/lgrfbs

The owner of the site, who identifies himself as Igrfbs, is a European modeler who developed these parts to meet his needs for similar signals used on railways in Sweden, but which may be a Norwegian, Danish or other design. (I saw similar signals on a recent trip to Tokyo, Japan.) Note that these signals are *similar* to the PRR prototypes, but not exact matches for them. He offers both the older and newer style dwarfs as well as a pedestal signal. The dwarfs are offered for sale in various quantities, offering savings to those of us that need more than a couple for our layouts.

The Prototypes

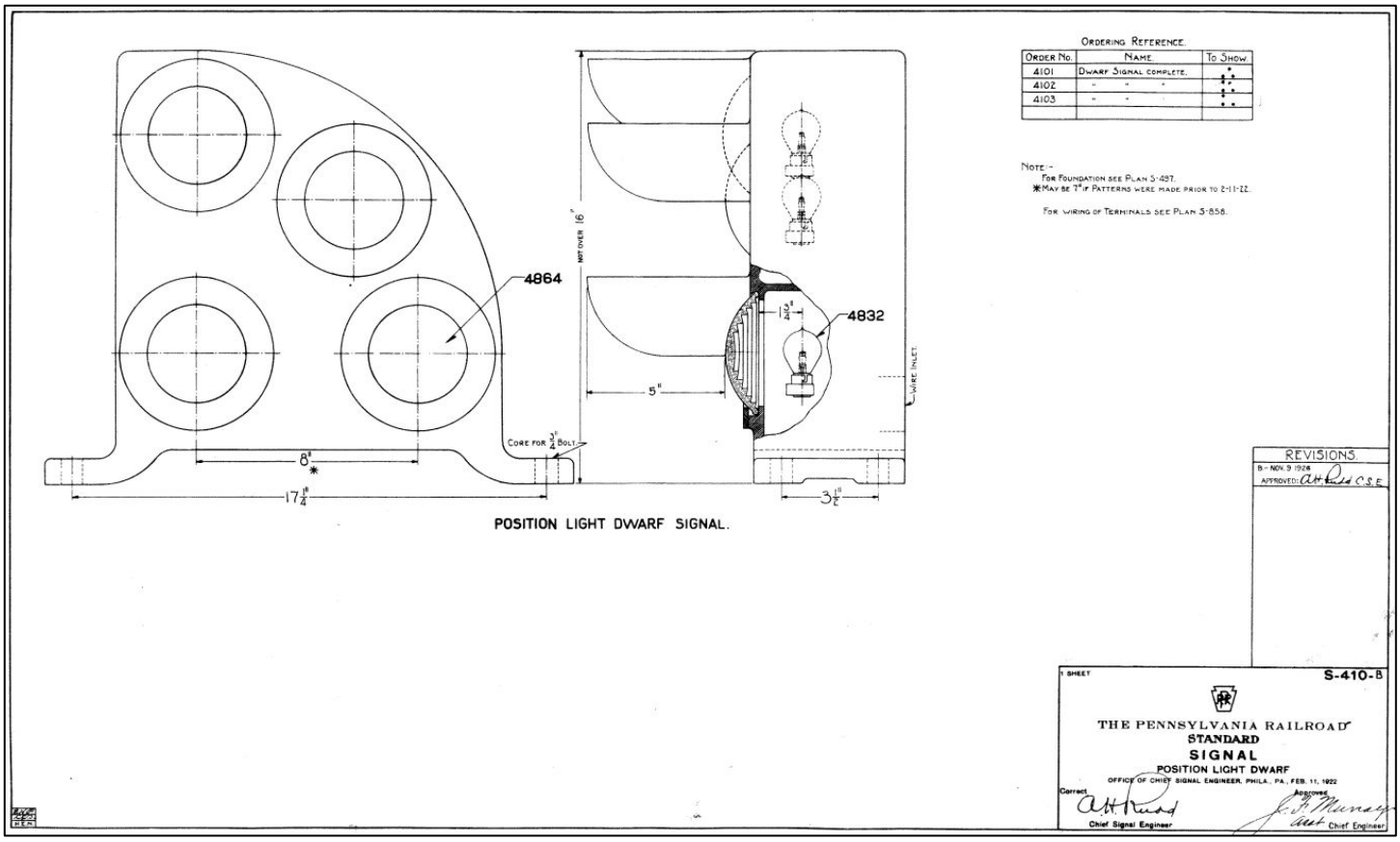
As always, it is helpful to know what you are trying to model before embarking upon a project. The simplified story is that the PRR, like other railroads developed "high" signals – mast, bridge and cantilever signals for trackside indications to trains that could be passing "at speed". The large size of the lamp display and high mounting afforded visibility from a distance sufficient to allow adjustment of train speed prior to passing the signal, when required. Simultaneously, they also developed "low" or "ground" signals for situations where a large, high signal was not necessary. These were much smaller signals that were mounted on, or very close to the ground, to be used in locations where trains would not be approaching at higher speeds, and thus a smaller, low signal would offer sufficient visibility to affect the necessary train control. As always, it was about cost: why use an expensive signal where a cheaper one would do the job?



Signal Department tracing S-410-B 1922 revision illustrates this early incarnation of the position light dwarf. This version was constructed of a large casting with separate cored-out areas for each of the four lamp positions. The lenses were inserted from the front and held in place by the hoods. Positions not used in a specific location were to be blanked with a circular plate covering the lens opening. Cover plates were applied to openings in both the vertical and curved sides, each providing access to two light positions. The back of the unit was flat, and the conduit access entered a raised area at the lower rear when they were mounted on a flat foundation on their comparatively short legs. Photos of a restored S-410-B dwarf appeared in Tim Garner's article in issue #70, the Summer 2009 *TKM*.

The high position light signals were developed to offer safe visibility at the necessary distances and various environmental conditions, first utilizing four lamps per arm/row/position in the older "Tombstone" style signals, then later refined to the longer-lived three lamps per row configuration covered in my previous articles. Low signals were found to only require two lamps per row/arm/position to yield sufficient visibility in the situations for which they were intended to be used. PRR tracing 241-S6 above, issued in 1918, illustrates the original 3 aspects to be displayed by the Dwarf Signals, later renamed STOP-SIGNAL, SLOW-APPROACH and SLOW-CLEAR. (I will use the circa 1950 aspect names here as they changed over time.) Note the curved side is on the right and mimics the shape of the Tombstone-style position lights they were developed in conjunction with.

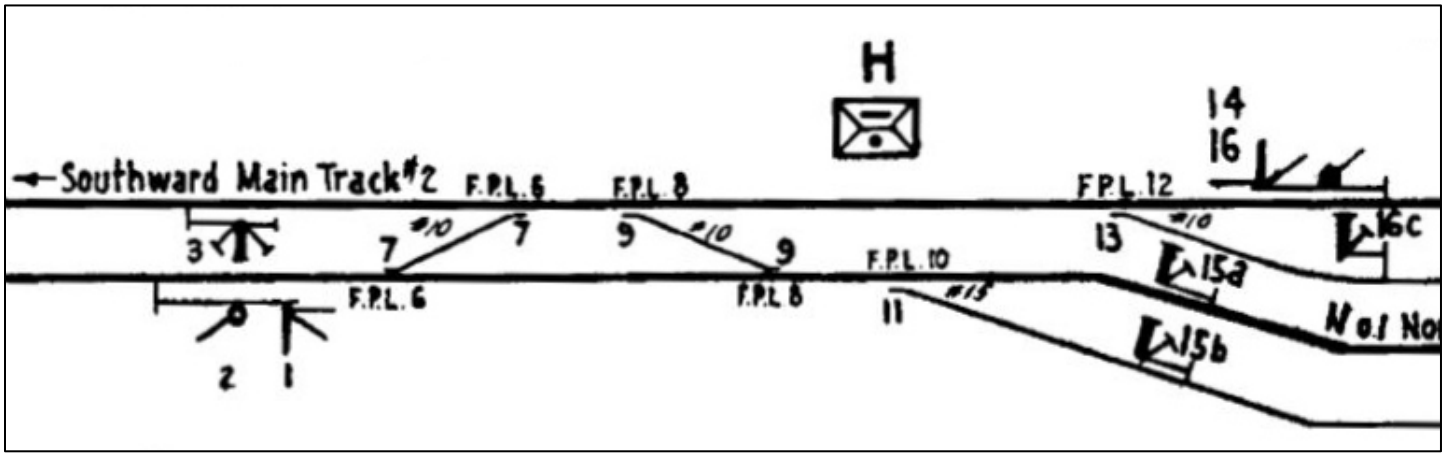
Rear view of an S-410-B illustrates the short legs and rectangular conduit running up the back of the concrete foundation and into the signal back via a rounded elbow fitting, Pittsburgh, 5/6/28. Wiring to the signal is shown connected via the partially buried (as specified on tracing S-186) wooden "trunking and capping" wiring channels.



S-410-B dwarf tracing revised to 1928 shows the three versions could be configured fully lighted (4102), or with either the top (4101) or middle-of-the-curved side (4103) lamp blanked. *(Courtesy Rob Schoenberg)*

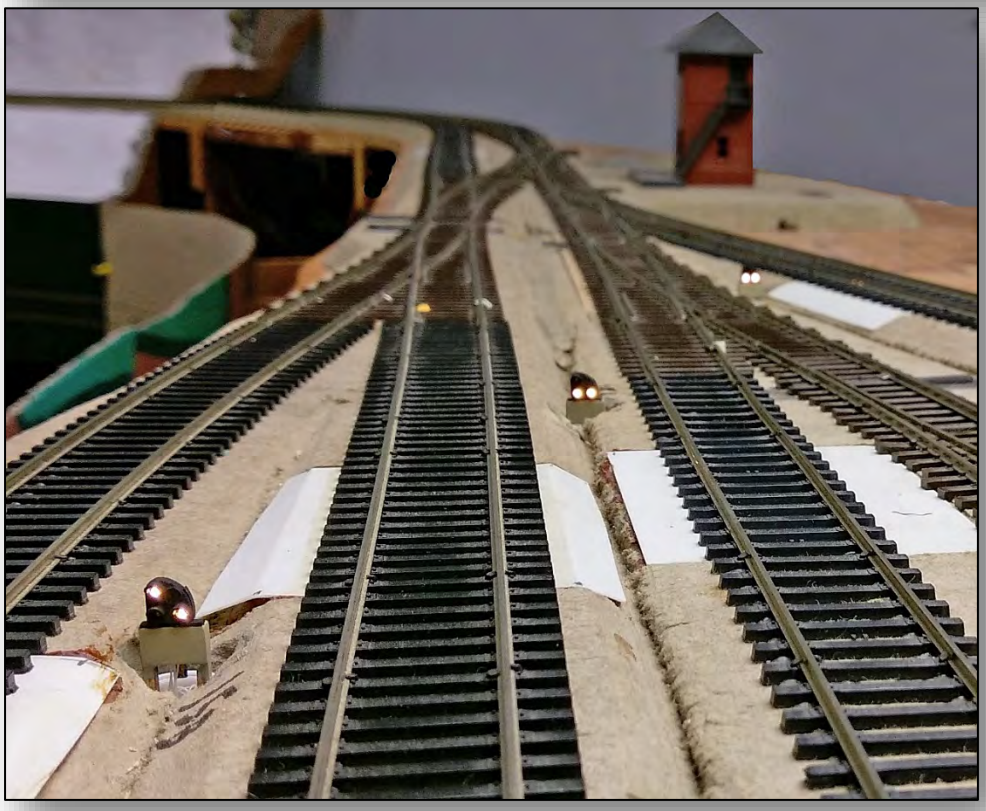
Left side view of an S-410-B dwarf with the access panel removed shows the dual bulbs in each lamp position. At right is an example of a 4103 option, with its short legs and curved side center position blanked allowing it to display aspects RESTRICTING and STOP-SIGNAL. Source unknown.

June 6, 1988 view northward at former H Interlocking at the south end of Shire Oaks yard shows 4-aspect (4102) older style S-410-B Dwarf signal #3 displaying its normal aspect: STOP-SIGNAL (as denoted by the heavy line on its stick-figure schematic on the excerpt from H interlocking diagram of 10/49 below). This signal still has its original low mounting. Since it is intended for northward trains running A.C.T. (Against the Current of Traffic) at slower speed than on the normal track, a dwarf is used here on track #2 instead of a high signal as on adjacent Northward Main Track #1. These Home signals are the line of demarcation of this south end of the interlocking limits. H Block and Interlocking Station used to sit adjacent to the distant silver instrument house in the center of the interlocking, before it was remoted to MC, 3.8 miles to the south.



To reduce (or increase) possible confusion here, note on the H Interlocking diagram excerpt above, that under normal conditions if this interlocking was in ABS (Automatic Block System territory) southward dwarf #15a would have been a mirror-image 4-aspect signal like northward #3 (and similarly #14/16 to #1/2). The situation here at H was not normal however, as it was the transition point between ABS to the right/north and MBS (Manual Block System territory) to the left/south on the Monongahela Division. The southward signals thus display only the appropriate MBS territory aspects. The stick figures illustrate which arms were operative on each of the signals.

In 1933, a new design for the dwarf signals was issued with tracing S-410-D. Similar in overall size, a number of changes had been implemented. Most noticeably, the curved side switched from the right to the left. The new casting still had the four partitioned lamp compartments, but easier access was afforded by a removable full back cover plate. This back piece was gently curved across its limits and a hasp protruded through the center for application of the security padlock. The cast-on legs were significantly taller than the earlier style and the conduit access was up through the center of the bottom between the legs. By this time the dwarfs were capable of displaying 4 aspects instead of the original three. This could be accomplished in either style signal by illuminating the three normal radial rows with the 4th aspect being displayed via the two "corner" lamps. With this capability available, however, the drawing notes that all indications not used shall be blanked.

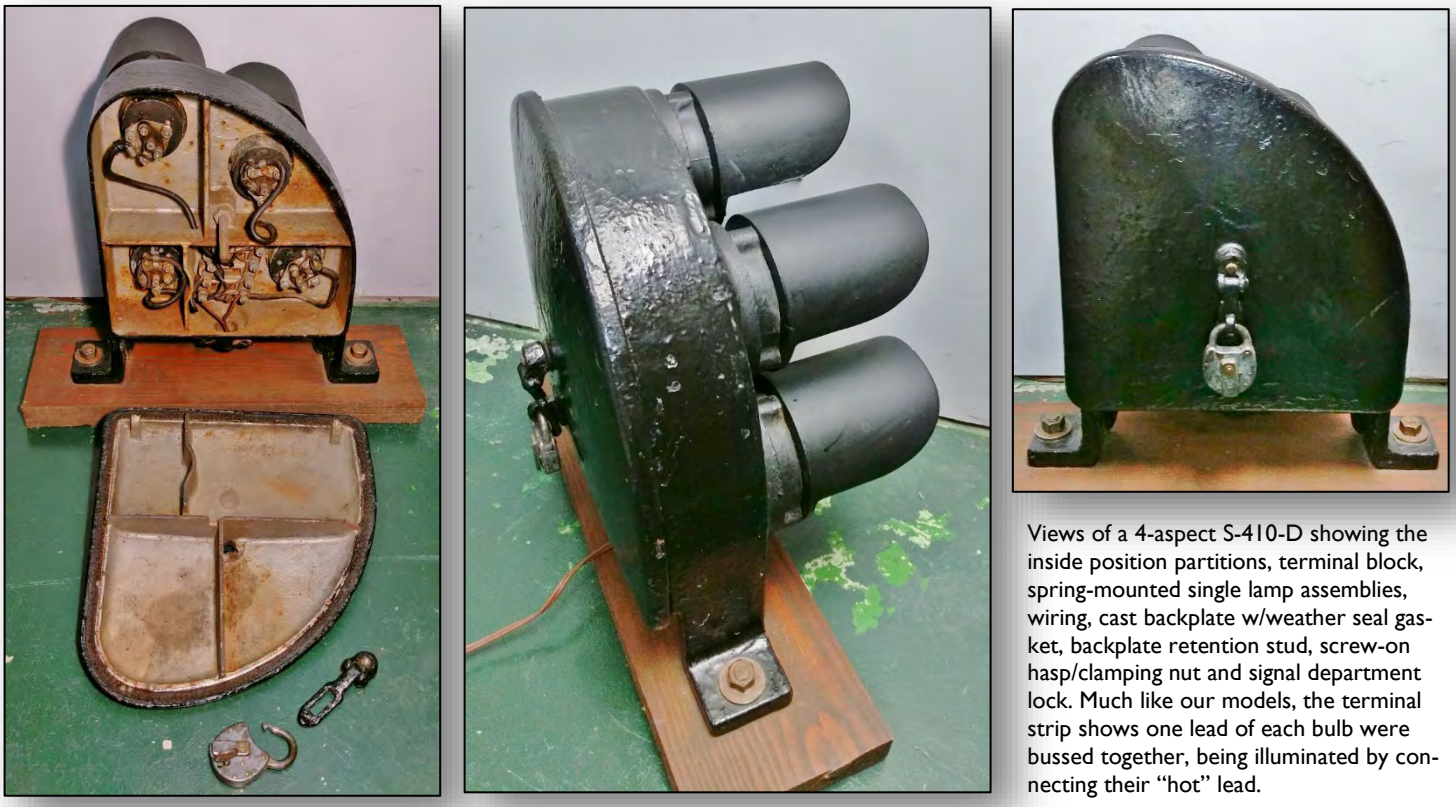


▲ View northward at the north end of H Interlocking 12/31/90 shows the rear of the two remaining southward 2-aspect Dwarfs, #15a and #15b, but both are newer style S-410-D signals. These are intended for slow speed moves backwards out of the northward receiving yard lead at far right and for southward trains running slowly A.C.T. on the northward main (second track from right). #16c, since removed, controlled the third track from right which was the southward classification yard pull-out track onto the southward main at far left. Both Dwarf styles could and did exist side by side as here at H, through to the end of the PRR era. Note a new southward main track home signal #14/16 has been installed and is being cutover from the old signal temporarily still standing next to it at left.

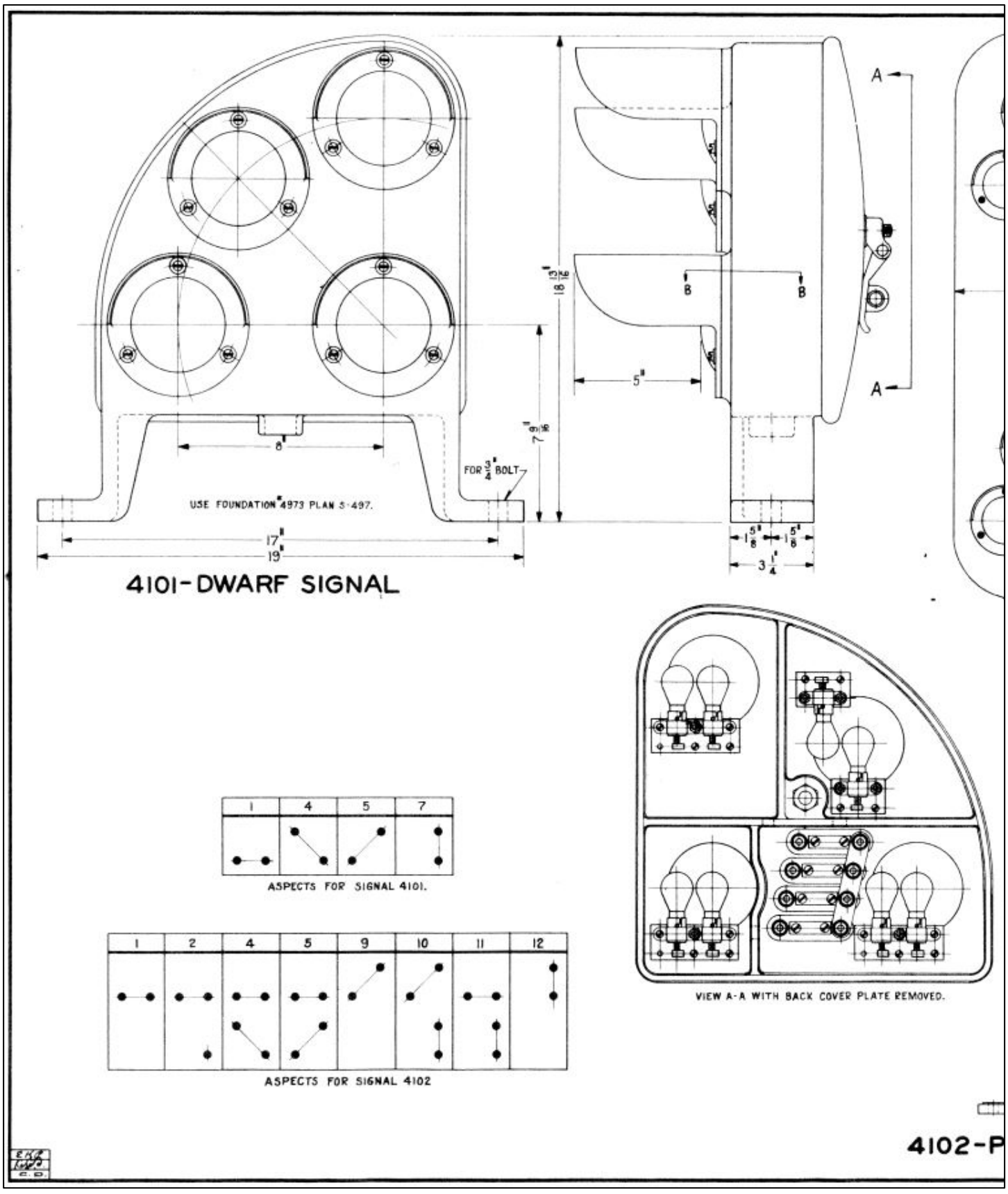
◀ Model-under-construction view, same location looking southward, shows the three southward 2-aspect Dwarfs, #15a, #15b and #16c, displaying their two possible aspects: RESTRICTING at left and STOP-SIGNAL at center and right. I chose to backdate the models to use S-410-B dwarfs.

The earlier style dwarfs were not necessarily removed from service, rather were augmented by the new style, with many still operating past the end of the PRR era. Interestingly, some of these survivors were remounted on foundations with leg extensions to stand taller like the newer style units. I do not know if the dual bulbs per position in both styles were intended for higher light output and/or the dual bulbs provided redundancy if one burned out. Unlike the high signals where when one lamped burned out, you could still determine which row was illuminated from the remaining two lamps, the intended aspect of a dwarf with a burned-out position could not always be positively determined. Later, single bulbs in spring-mounted sockets were used: likely the resulting reduction of bulb vibration improved reliability, eliminating the need for dual bulbs.

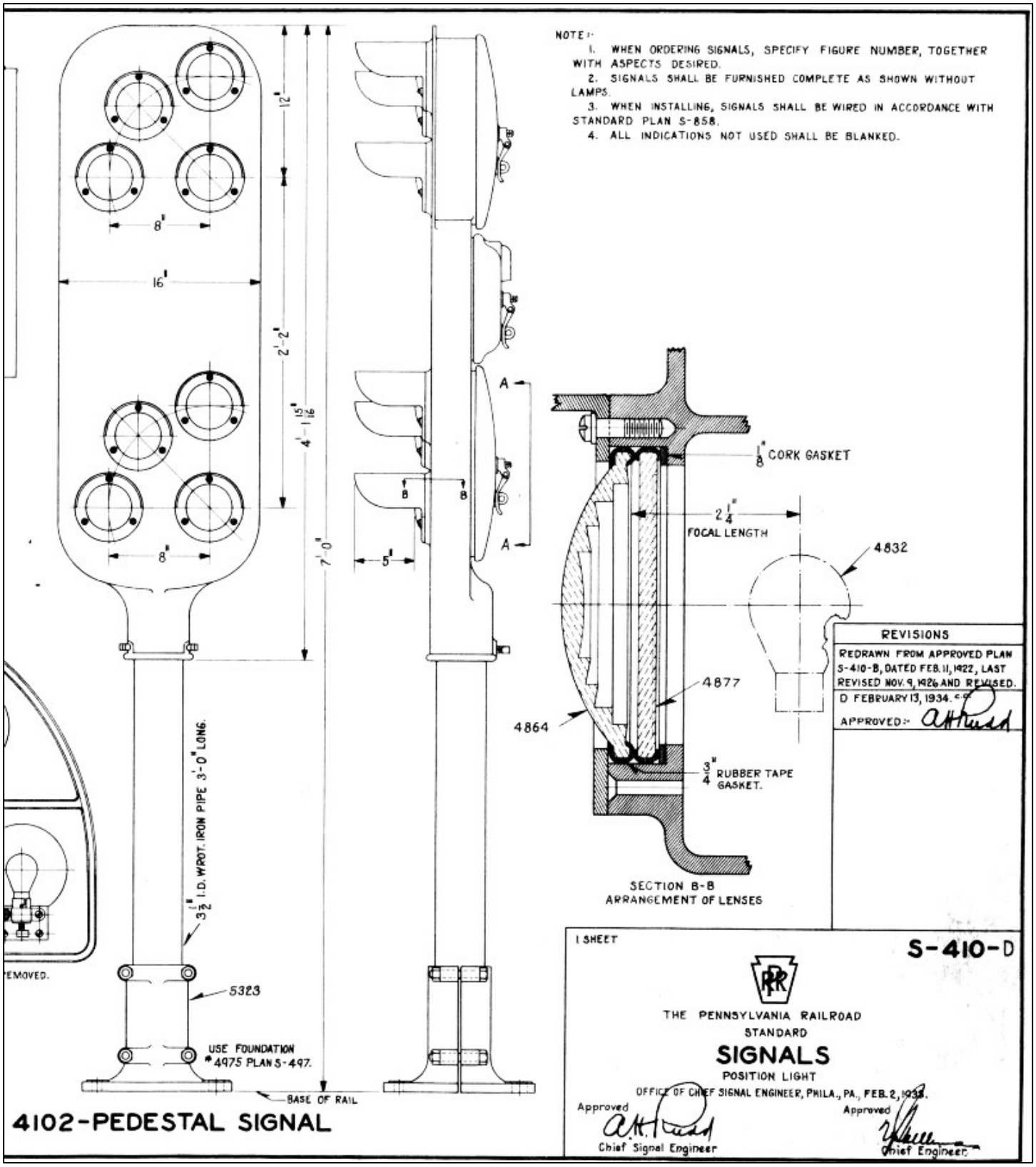
Typical mountings of S-410-D signals: a 4-aspect version displaying SLOW-CLEAR on a concrete foundation at left and at center, one displaying STOP-SIGNAL on a fabricated metal foundation at Northumberland. A 2-aspect signal also on a metal foundation displays STOP-SIGNAL. A former Signal Department employee related that they referred to these as "dumb" Dwarfs, since they could only display STOP-SIGNAL and RESTRICTING, i.e., stop or go (slowly). The three- or four-aspect Dwarfs gave more information on what was ahead.



Views of a 4-aspect S-410-D showing the inside position partitions, terminal block, spring-mounted single lamp assemblies, wiring, cast backplate w/weather seal gasket, backplate retention stud, screw-on hasp/clamping nut and signal department lock. Much like our models, the terminal strip shows one lead of each bulb were bussed together, being illuminated by connecting their "hot" lead.



Tracing S-410-D of 1933 illustrated the modernized version of the dwarf signal as well as its extended height, dual arm sister, the Pedestal signal. The fully lighted dwarf could display 4 aspects, the fully lighted Pedestal could display 12 aspects. The tracing shows that initially, the later style signal had the dual bulbs like the early style.



The other half of tracing S-410-D illustrates the 4102 Pedestal signal, which was effectively two Dwarfs repackaged in a combined housing, mounted on a short mast. The plan numbers were revised since the earlier revision.

The pedestal signals were basically dual arm low interlocking signals that could be used in special situations where low speeds were involved, again to save the expense of a high signal. Unlike the high position light signals that typically used a yellow roundel in front of the lamp that gave the yellow cast to the lights when viewed from trackside, the dwarf and pedestal signals incorporated clear roundels and lenses as shown on the pertinent excerpts from the applicable tracings below. Thus, in our modeling, whereas we typically use yellow or "golden white" LED's to simulate the yellowish cast on the high signals, the light from the ground signals is purer white.

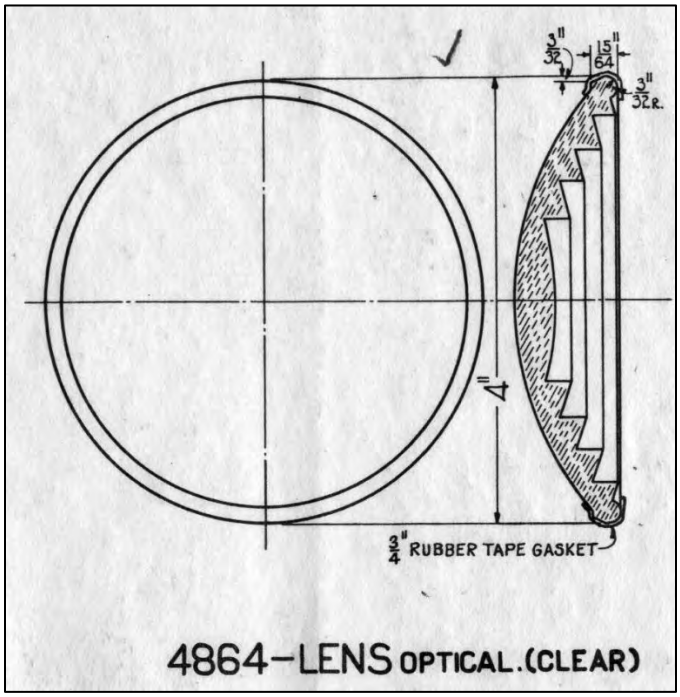


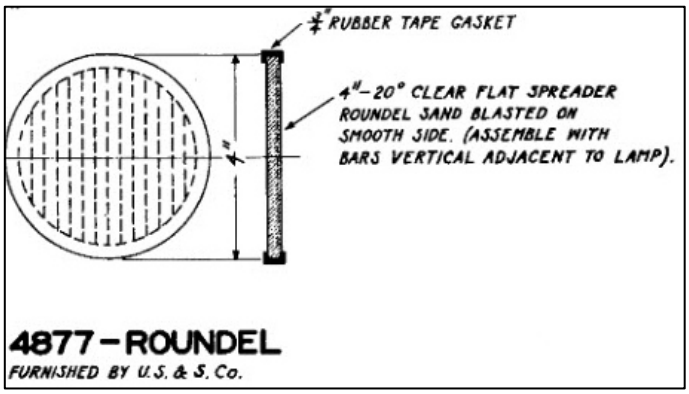
FIG.	USE.
4861	High Position Light Signals.
4862	Flag Station and Scale Signals.
4864	Dwarf & Pedestal Position Light Signals.
4866	High Position Light Signals.
4869	Flag Station and Scale Signals.
48610	Flag Station.
48612	Distant Switch Indicator
48613	" " "

D-FEB. 5, 1934.
APPROVED:- A.H. Rudd

1 SHEET S-486-D

THE PENNSYLVANIA RAILROAD
STANDARD
COVER GLASSES AND LENSES
FOR POSITION AND OTHER LIGHT SIGNALS
OFFICE OF CHIEF SIGNAL ENGINEER, PHILA., PA., MARCH 15, 1921

Correct A.H. Rudd Chief Signal Engineer
Approved Chief Engineer

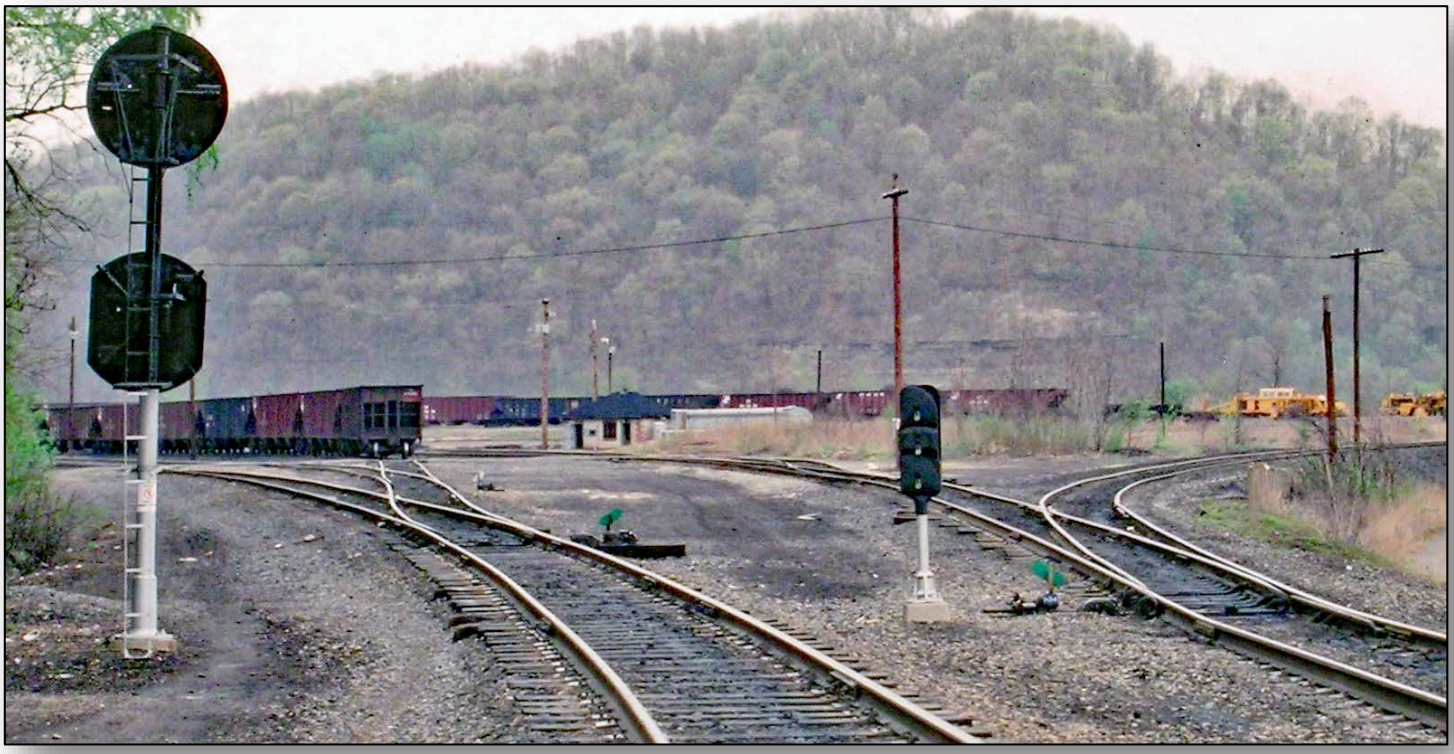


1 SHEET S-487-E

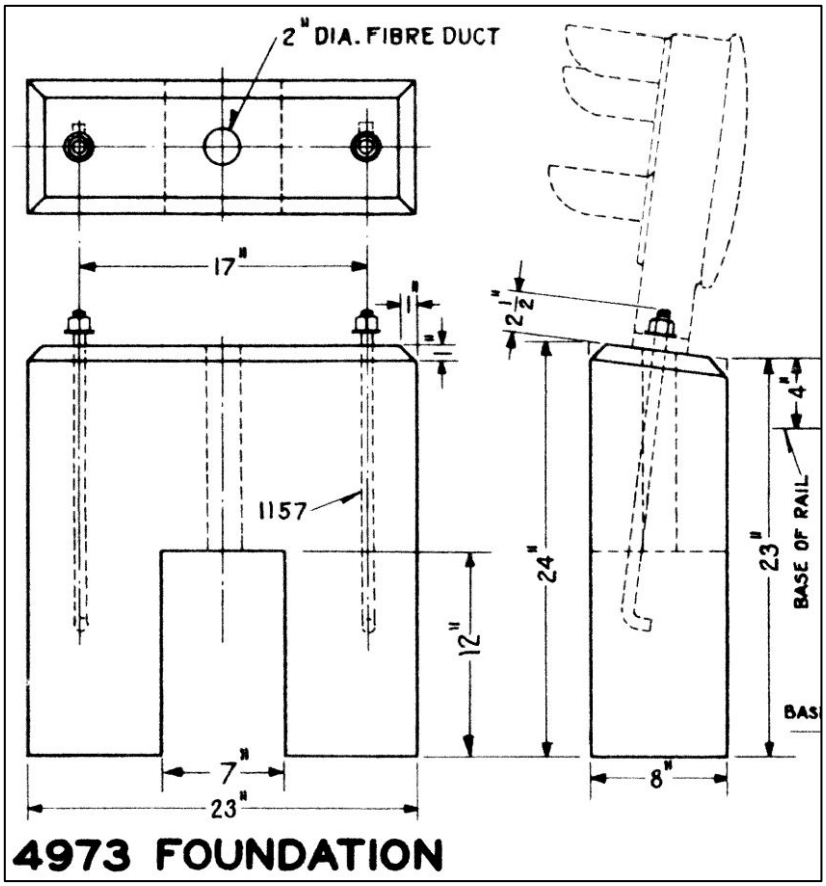
THE PENNSYLVANIA RAILROAD
STANDARD
ROUNDELS & LENSES
OFFICE OF ASST. CHIEF ENGINEER-SIGNALS, PHILA., PA. JULY 24, 1937.

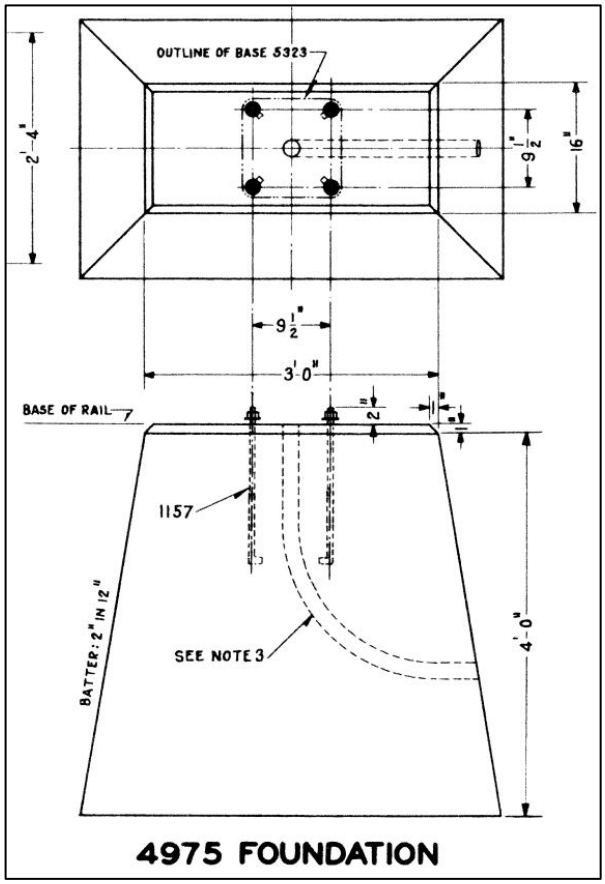
APPROVED: N. L. Stanton ASST. CHIEF ENGINEER-SIGS.
APPROVED: W. W. Wiggins CHIEF ENGINEER

Preserved S-410-D displaying all four possible aspects: 1,4,5,7. From left to right: STOP-SIGNAL, RESTRICTING, SLOW-APPROACH, and SLOW-CLEAR. Note how white the light appears when the lenses are clean.



▲ Looking northward from the south end of the wye at West Brownsville Junction on the former Monongahela Division on 4/21/91. The southward main track at left is controlled by the dual-arm high home signal, however, the south leg of the wye converging from the right is the slow speed leg and joins the yard lead and thus only rates a low home signal. Since this diverging (converging) track ends behind the photo and thus requires a two-arm signal, a 2-aspect Pedestal type was used here. Note the wiring and lamp components are contained within the three locked compartments on its rear side. ▼ View southward from the same spot on 9/4/83. The northward high dual-arm home signal at the far end of "BROWN" interlocking can be seen in the distance beyond where the tracks converge. Like the high home signals, Pedestals also received "red eyes" on the upper arms later in the PRR era, this one displaying its STOP-SIGNAL aspect.





The Dwarf and Pedestal signal tracings referenced mounting them on concrete foundations 4973 and 4975 respectively, buried trackside as illustrated on signal tracing S-497 (pertinent excerpts from revision E of July 1934 shown here). Few of the Dwarf foundations I have observed have the angled top to tilt the signal upwards, so that may have changed on a later revision or been a location-dependent option.

FOUNDATION	FOR USE WITH
4972	SIGNALS 4062, 4063 INSTRUMENT CASES 4081, 4083
4973	SIGNAL 4101
4974	SIGNALS 4001, 4061
4975	SIGNAL 4102

NOTE:-

1. CENTER OF FOUNDATIONS 4972, 4974 AND 4975 SHALL BE 7FEET 6 INCHES MIN. FROM GAUGE LINE OF RIGHT HAND RAIL OF TRACK GOVERNED.
2. CENTER OF FOUNDATION 4973, WHEN BETWEEN TRACKS, SHALL BE LOCATED ON THE CENTER-LINE OF INTER-TRACK SPACE; WHEN OUTSIDE OF TRACK NOT LESS THAN 4 FEET 3 INCHES FROM GAUGE LINE OF RIGHT HAND RAIL OF TRACK GOVERNED.
3. 2 INCH DIA. FIBRE DUCT WITH 18 INCH RAD. BEND. THE LOCATION OF DUCT MAY BE CHANGED TO SUIT LOCAL CONDITIONS.
4. CONCRETE SHALL BE IN ACCORDANCE WITH A.R.A. SIGNAL SECTION SPECIFICATION NO. 1111.

1 SHEET S-497-E

THE PENNSYLVANIA RAILROAD

STANDARD

FOUNDATIONS

FOR POSITION LIGHT SIGNALS AND INSTRUMENT CASES

OFFICE OF CHIEF SIGNAL ENGINEER, PHILA., PA., FEB. 15, 1934

Approved Chief Signal Engineer

Approved Chief Engineer

A dwarf, illustrating a special mounting on a short mast to provide adequate visibility based on the local conditions, displays RESTRICTING at the west end of the Rockville Bridge, 5/20/84.

Dwarf signal stockpile at Logansport, IN, 6/30/85. Three S-410-B are in front: two 2-aspect and one 4-aspect versions; the rest are the later S-410-D's, some without their lamp hoods. Two styles of metal foundations are at the rear; fabricated and cast. These were buried in the ballast about two-thirds of their depth, as illustrated by the black painted portions that were exposed. Some dwarfs were painted silver or white on their back-side, supposedly either to avoid confusing trainmen that they weren't seeing a non-functioning front view of an opposite "hand" style signal or as a safety precaution to help persons walking amongst the tracks at night avoid tripping over them.

Fortunately, all three styles of ground signals described above are available through Shapeways. As of this writing…

The early PRR **S-410-B** style with the curved side on the right is offered as:

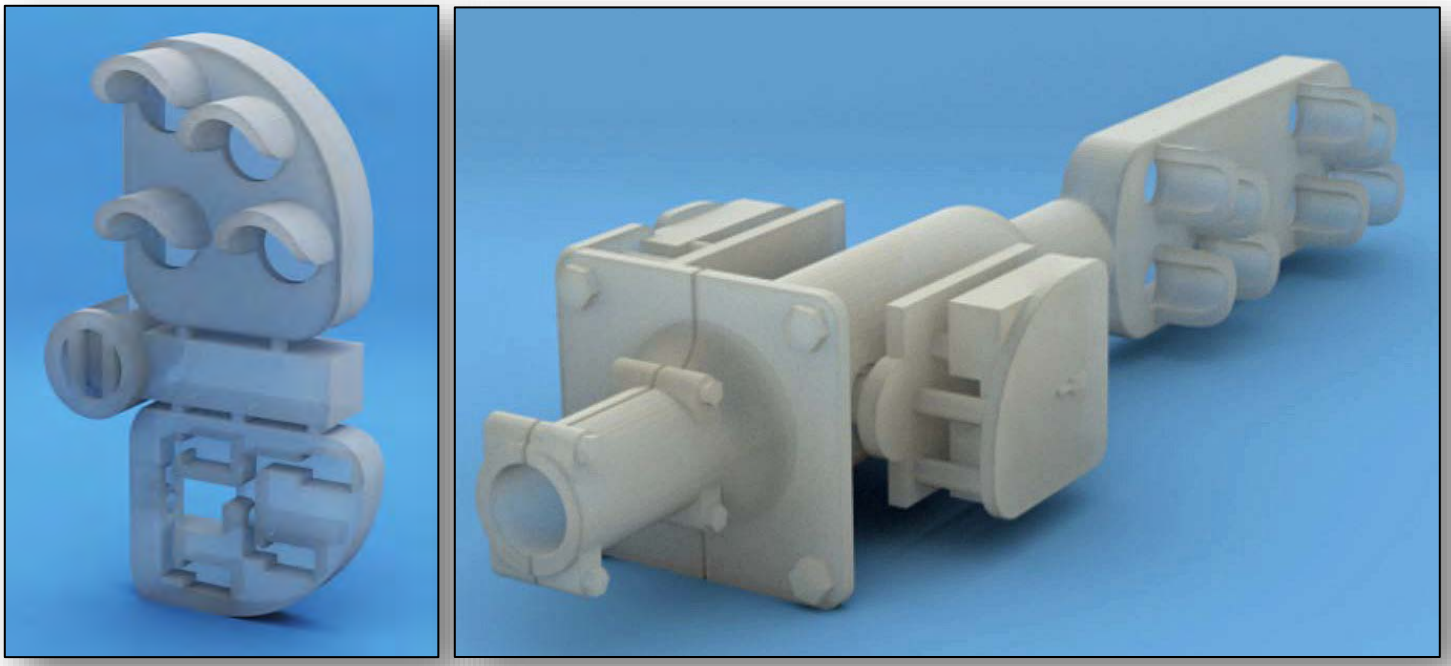
- Single JHDD101: https://www.shapeways.com/product/532988UQ5/ho-dwarf-signal-jhdd101?optionId=43306453
- 5-pack JHDD101: https://www.shapeways.com/product/UGTAKWFWM/ho-5x-dwarf-signal-jhdd101?optionId=60585958
- 10-pack JHDD101: https://www.shapeways.com/product/YQTJFTKDB/ho-10x-dwarf-signal-jhdd101?optionId=60584873

The later PRR **S-410-D** with the curved side on the left is offered as:

- Single JHDD111: https://www.shapeways.com/product/65TY256NP/ho-dwarf-signal-jhdd111-old-type?optionId=61578166
- 6-pack JHDD111: https://www.shapeways.com/product/NXFJPCUYT/ho-6x-dwarf-signal-jhdd111-old-type?optionId=61580276
- 8-pack JHDD111: https://www.shapeways.com/product/LJ8K54YUA/h0-8x-dwarf-signal-jhdd111-old-type?optionId=61580272
- 10-pack JHDD111: https://www.shapeways.com/product/2W7DKCC6V/ho-10x-dwarf-signal-jhdd111-swe-usa-version?optionId=62525587

The **Pedestal** signal is offered as:

- Single USA Dwarf Signal Standard 4102: https://www.shapeways.com/product/JGLDQRP66/ho-usa-dwarf-signal-standard-4102?optionId=63163529



Shapeways images of single JHDD101 early style S-401-B Dwarf and a 4102 Pedestal signal as-printed. Drawer for dwarf is attached to sprue below housing; drawers with back covers and mounting base for Pedestal are attached to bottom of signal.

All styles consist of an outer housing plus what I will refer to as a "drawer" insert. The dwarf housings are hollow with an opening on the bottom and the pedestals have an opening to the rear behind each group of lights. The drawer parts for the dwarfs are flat pieces with openings for positioning the LED's which slip up into the housings, Similarly, the pedestal drawers hold the LED's and press in from the rear. There are some additional parts with the pedestal signal for the mast. All the necessary parts for a given signal come joined together on the equivalent of a sprue we are familiar with on molded plastic models. I have not built any of the Pedestal signals, but it appears their construction should be much like the Dwarfs described below.

As mentioned earlier, the prototypes for these signals are not exactly the same as the PRR signals but can be improved with a few simple steps. One overriding comment relative to the prototypical accuracy of these signals is that, despite their tiny size, they are *still* oversize for HO scale. Comparing the parts to the drawings shows that they are properly proportioned but are 25% oversize. Most modelers however, will probably view this as a positive rather than a negative, as the size discrepancy doesn't jump out at you looking at them in place on your layout, and they are already plenty challenging to see while operating your trains and to work with at 125% of scale.

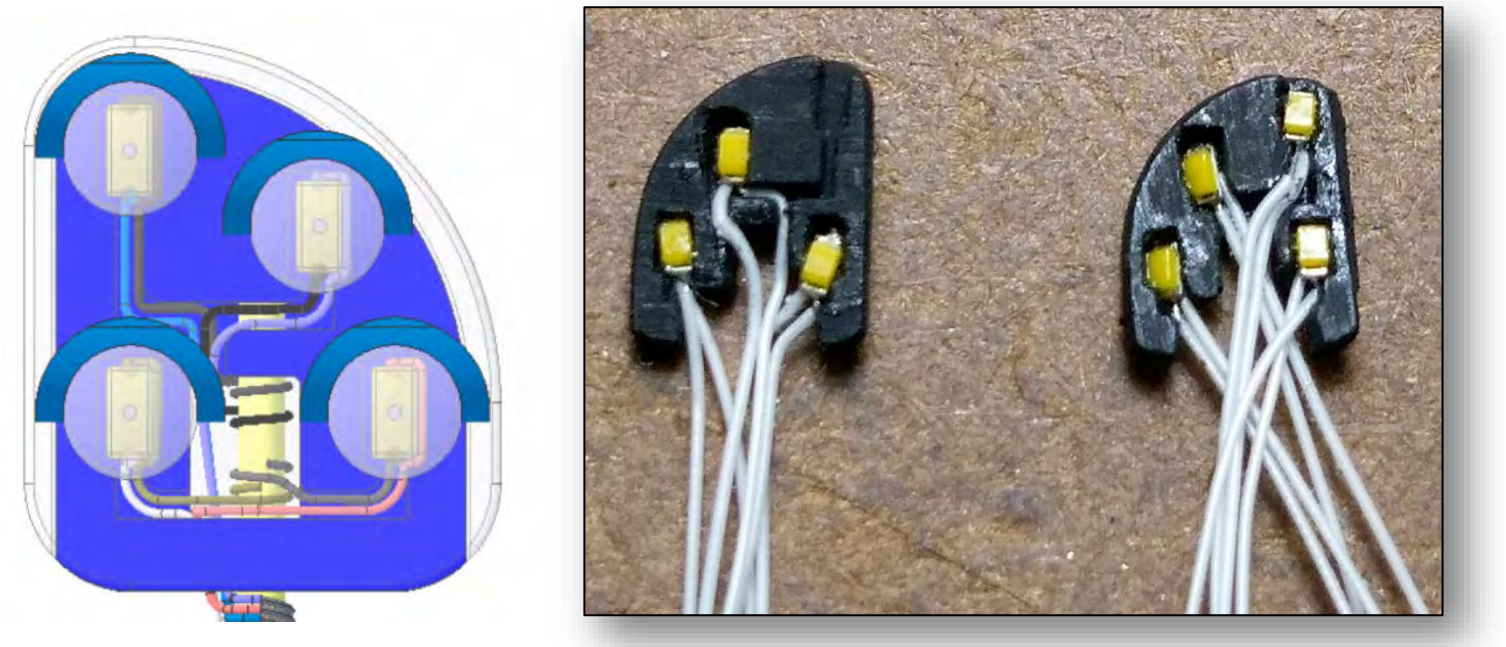
"Sprues" of the signals as-received: 2 sets of ten late S-410-D at left and one set of early S-410-B Dwarfs at right. Housings are on the right side of the sprues, drawers are on the left.

First, remove the housing and drawer from the "sprue" with a sharp razor blade. The biggest issue with the housings of these European prototypes is that the housing extends down below the bottom row of lamps farther than on the PRR signals and has large radii on the bottom, outer corners. This can be easily remedied by filing off the bottom of the housing until the overall height from top to bottom is 0.207" (to maintain the proper proportions). I scraped the outer edges of the housing and the top of the lamp hoods with the edge of a #11 blade to smooth these surfaces a bit, removing some of the roughness of the printing process. As the above tracing and photos shows, the later S-410-D signals had a curved, removable back plate to access the interior. For these signals, I filed the back to mimic this curvature and glued a small length of .010" x 0.020" styrene strip in the center to represent the hasp and lock. On the earlier S-410-B signals file the back smooth while leaving it flat. These housings were thicker than the later design and so I glued an oversize piece of .015" thick styrene sheet to the back. Once dry, I chopped it roughly to shape with a razor blade then filed it until it matched the outline of the printed housing. I glued a piece of 1" x 6" styrene strip, 8.5" long and pointed at the top to the bottom center of the back to represent the raised conduit exit attachment area and strips of .005" styrene strip onto each side of the housing to represent the access covers.

If you are modeling either of the 3-lamp versions of the signals, slice off the unneeded lamp hood as shown in the prototype photos above: the top lamp on S-410-D, but the middle lamp on the S-410-B, so they can display STOP-SIGNAL and RESTRICTING. The hoods are .080" outer diameter so I found a piece of thin-wall brass tubing that was .093" (3/32") O.D. and .080" I.D. (Special Shapes p/n TT-63). I sharpened the end of a short piece by filing a taper on the outside while turning it in my drill press until it was sharp. I then used this to drill out the blanking plates for the unused lamp positions from .005" thick styrene. Smooth the front of the lamp hole and glue on the plate.

The 3-D printing process used to generate these parts imparts a layered texture to the surfaces that were vertical when the parts were being printed. It is generally a good idea to smooth the exterior surfaces of parts where possible to improve their appearance. In the case of the drawer, the interference of the striations on the part surfaces make the parts potentially difficult to assemble. To prepare the drawer, first file or sand the front face just enough to make it smooth as you don't want to measurably reduce the depth of the pockets for the LED's. Once the front is smooth, test fit the drawer into the housing just far enough to determine if it will slide in with minimal force as you progressively file the back side and reduce its thickness as needed. I painted these later, so I made sure the fit was not at all snug at this point. Clean up the upper edges of the drawer and even file a small chamfer or radius along the upper corners to help avoid interference with the inside of the housing. I assumed that after the parts were painted and the LED's assembled I would not be able to pull out the drawer once it was inserted so I better make sure it was going to fit properly the first and only time. Like the housing, there is too much material along the bottom of the drawer. The drawer is designed with a hole vertically up from the bottom that appears to be intended for a mast or conduit. There is also an opening in the center of the drawer near the bottom. There are small slots from each of the rectangular pockets for the LED's that lead to this opening for routing the wires. The images on the website make it appear that the design intent is to run the common wires from each of the LED's into this recess and then wrap their stripped ends around the brass rod and solder them to make the common connections to all the LED's. The other "hot" wire for each LED is shown in the diagram on the website to exit the housing recess alongside the mast and continue down to the mounting structure for connection to their individual activation wires.

Top left shows the early style parts as-removed from the sprue. Below them are parts modified to reduce the height of the housings and drawers and details added. At center, the styrene added to represent the hasp added to the curved back of the late style signal and to increase the thickness and add the access plates to the early style signals are shown. At right, sharpened tube used to drill blanking plates.



Intended wiring diagram from the Shapeways website at left and one each of my drawers cleaned up, with the legs cut, painted and the LEDs in place for a 2-aspect and 4-aspect S-410-D.

I could see that with what I had planned, this was never going to happen in this way. First, the PRR signals don't need a mast. A tube could be used here instead to act as a conduit to feed the wires down out of the signal, but even with thin-wall tubing the physical size of the tube would occupy most of the space available for running the wires. Even more importantly, the bottom of the drawer needs to be cut off to the same height as the housing was previously so it doesn't stick out un-prototypically. This cut removes all the material below the recess and the support for the rod. Before I cut off the bottom of the drawer however, I determined how I was going to support the signal once assembled. The result was that I left a small angled "leg" at each corner of the bottom of the drawer for both styles of the signals only cutting out the center section: see above. With the bottom cut out, I worked to open the wiring channels a bit with the tip of a #11 blade and a small file to make dressing the wires easier at assembly. At this point I spray painted the housing and drawer black and covered every surface possible to help make the parts opaque to avoid light leaking out the signal housing.

THE LED'S

The signal housings and drawers are intended to work with 0402 SMD LED's that have lead wires attached to them. This is shorthand for Surface Mount Device Light Emitting Diodes in an EIA standard 0402 package size. They are essentially a small brick with metalized end caps that are intended to be automatic machine-placed directly into small deposits of solder paste on the conductive pads on a Printed Circuit Board and then run through an oven to make the electrical connections when the solder paste reflows, untouched by human hands. The Electronic Industries Alliance 0402 package standard defines the parts to be 0.040" long by 0.020" wide by 0.020" tall (and yes, there are even smaller packages). So what we are doing here is not at all the intended use for these components. However, the extremely small size of these parts enables us to make these (near) scale size operating signals. If you buy these LED's directly from the manufacturer or a distributor like Digi-Key, they are inexpensive, but you will have to attach the wires to the end terminals yourself: a challenging task to say the least. (Alternately you could make a small circuit board and surface mount the components to it and insert it into the housing instead of the drawer.) The LED's can easily be destroyed by the heat of soldering, they are very difficult to handle and even stripping this small size wire is a challenge, so I highly endorse the signal maker's recommendation to buy the slightly more expensive LED's that already have lead wires hand-attached by someone more skilled at it than you or me. Note that the wires are soldered to a very thin metallization layer on the ends of the LED's which can be torn off the package without much force, so try to apply as little force as possible on the solder joints while you are handling them. The signals are set up to use LED's where both leads exit from the same (small) end of the component. I found at least one other seller of such LED's on eBay but purchased mine from the signal maker's recommended seller: "ledbaron", as the other supplier appeared to have much larger diameter wires which are likely to be a problem when assembling these signals.

https://www.ebay.com/sch/ledbaron/m.html?item=322908609054&hash=item4b2eda5a1e&rt=nc&_trksid=p2047675.l2562

This vendor offers options in the type of wire attached, quantities and the "white" color emitted. The vendor is German and some of the information provided is in German so the best I could determine was the following. They offer two types of wires attached to the LED's: 1) Wire alternately called "solid copper wire/copper magnet wire/enameled magnet wire/Cu-draht" which is clear lacquer-coated single solid strand 0.1mm diameter (.004"), or 2) "Micro litz" wire, a soft multi-stranded wire with Teflon insulation that is 0.2mm overall diameter (.008"). I chose the wire with Teflon insulation as although it is twice as large. It is more flexible and the insulation is much tougher and less likely to get accidentally cracked or scrapped off during handling and cause a short and thus signal intermittency or failure. As I mentioned with the mast signals, I only intend to build these once.

The choice of white colors was more confusing. They offer LED's inconsistently named: "cool cold white/Kaltweiss", "Pure White/Pur Weiss", "Sunny White/Warmweiss", "Golden White (described as a very strong warm white)" & "Super Golden White". I have arranged the above names in what I believe is the order from purest white, to most yellow-white based on the rather vague information provided and the photographs. As I mentioned above, I didn't want a harsh cold white as they were incandescent bulbs nor a very yellow white, so I guessed the "Sunny White" might be the best option, as it is noted as being warm, but not golden.

A bundle of the as-purchased pre-wired 0402 LED's shown next to the signal housings and an HO wheelset for scale.

(Please excuse the following discussion if you are math- or electronics-averse, but there is a salient point here that may make a difference whether this project works satisfactorily for you or not.) The technical data provided with the Sunny White LED's purchased listed the Forward operating Voltage as VF = 3.1v typical, with a corresponding Forward Current of IF = 20mA. Whatever electronics you use to drive your signals thus need to be tailored to work properly with whichever particular LED's you purchase as they are not all the same. Typically, this means the resistance value of the "dropping" resistor that feeds each LED needs to be calculated and adjusted accordingly. For example, my circuits provide 9.9volts at each LED output. Ohm's Law tells us that V = IR or thus R = V/I, where R is the resistance in ohms, V is the voltage in volts and I is the current in Amps. My "dropping" resistor thus needs to drop the available voltage from 9.9v to 3.1v while providing 20mA of current. So R = (9.9-3.1)v/.020A = 6.8v/.020A = 340 Ohms. I chose a slightly larger stock carbon resistor value of 390 Ohms to limit the current slightly over the calculated value.

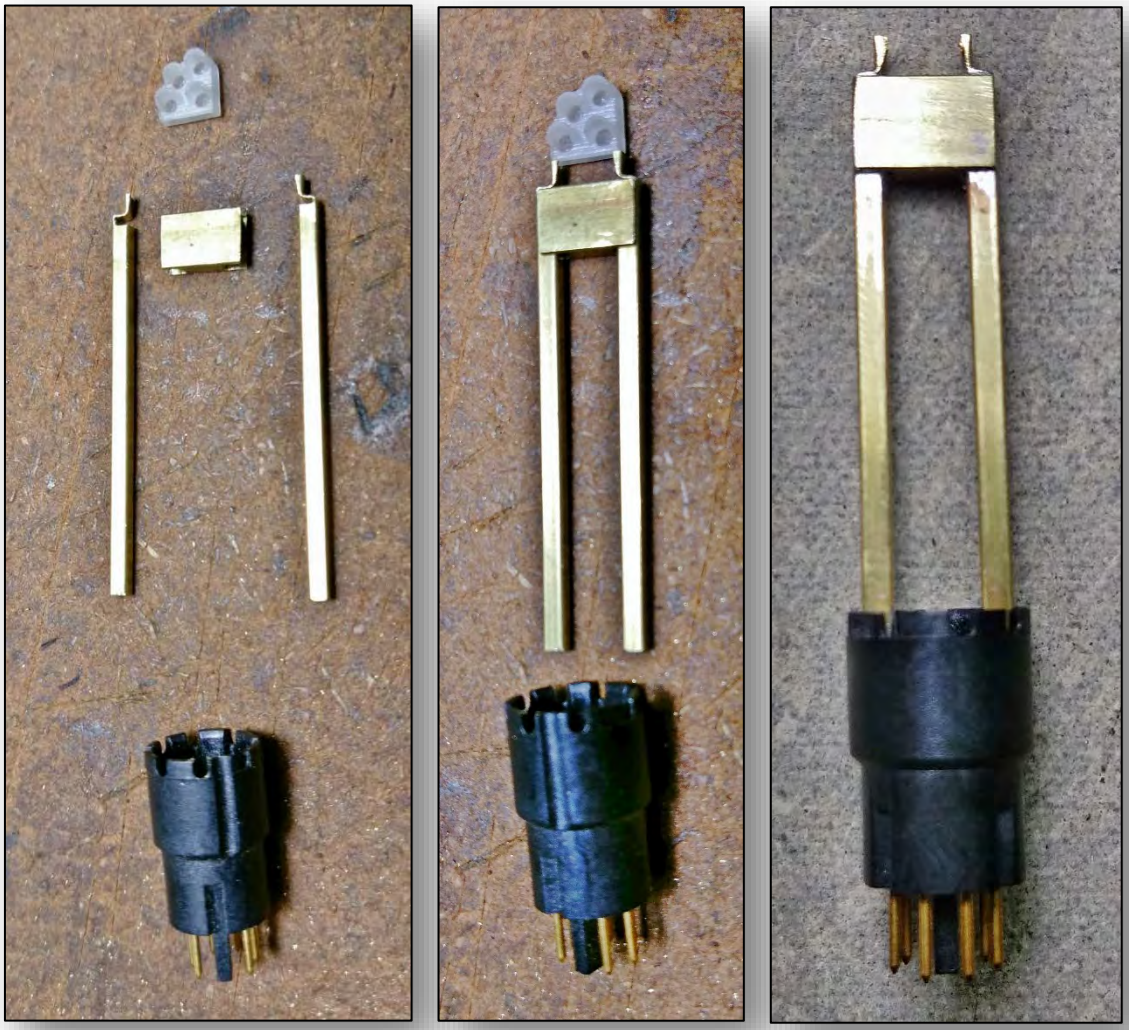
I bring all this up because doing this as I was "supposed to", wasn't the desirable answer. When I tested the 390-ohm resistor in the circuit, the LED's burned EXTREMELY brightly. Either these little buggers are indeed as-advertised and emit a "very high brightness level" or I was overdriving them, or both. Running LED's at their maximum or overdriving them results in shortened life expectancy; again not at all what we want for long signal life. The other problem I noticed was that with two of these test LED's temporarily inserted into one of the Dwarf housings to form a 2-light aspect, they were so bright and so close together, I could not discern their "position" – it just looked like a small supernova between the tracks. After some experimentation increasing the resistor value, I effectively de-rated the spec.'s for these LED's to get them to burn considerably less brightly, thus extending their life expectancy and making them become visible individually in the signal housing. A side effect was that when burning less brightly, the color tends to be slightly more yellow and thus a better match with signals I have observed in the field. To illustrate the severity of this change, my final resistor value increased to 13,000 ohms which had the LED's operating at 2.62v on only 0.56mA of current, 1/35 of their advertised rating. So if you build these signals, be prepared to at least check or adjust your signal circuits to suit.

The Base and Mounting

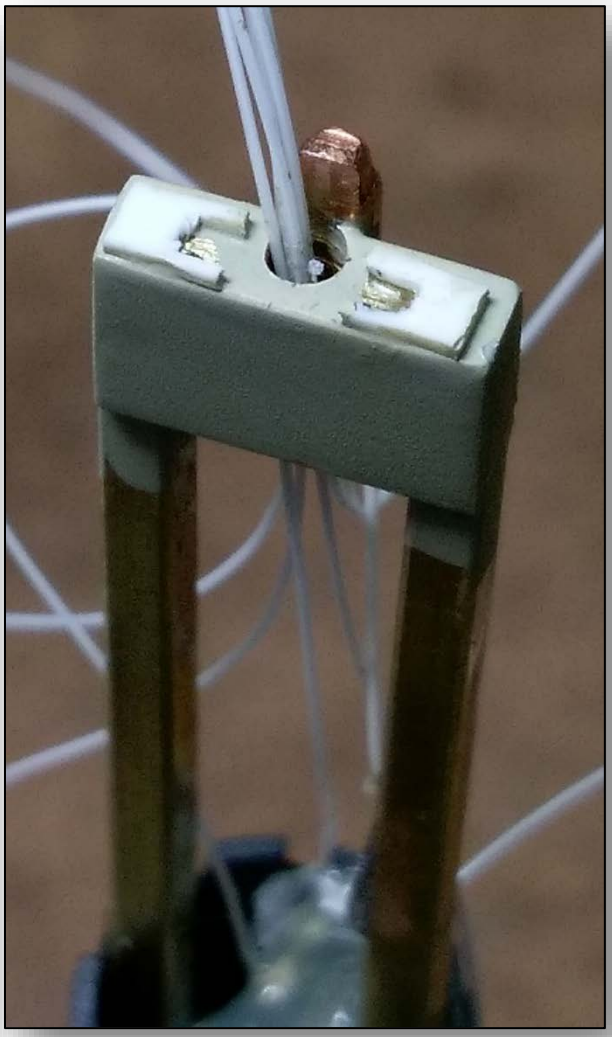
This part of the project is strictly up to the desires of the modeler. You can simply make some type of base with a hole through it, bury it in your ballast at the appropriate spot and attach the signal. The ends of the leads can then be attached to some type of terminal strip beneath your layout to make electrical connections to your driver circuitry. As I described in the mast signal installments of this series, I did not want to "hard wire" my signals in place, but rather use some type of

connector for ease of installation, removal, troubleshooting, etc. I also wanted to protect the delicate wires from possible abuse from below that might result in a problem up inside the signal. The scheme I came up with is by no means the best possible, but I found it to be workable for both the mast and dwarf signals. I chose to use a family of electronic connectors most often called "Mini-Din" style. These are small and circular, are made in 6 and 8 pin versions and are available from houses such as Digi-Key. The 6-pin is sufficient for either the 3-light or 4-light Dwarfs. Like our favorite prototype, standardize on some arrangement of wiring which signal lead to which connector pin and be consistent with all your signals.

My signal base/connector mounting was built up from brass shapes for strength and several sections of Evergreen telescoping styrene tubing. The depth dimension is not critical and should be adjusted to what works well with the construction and thickness of your layout. One typical mounting method was to bolt the feet of the cast iron Dwarf signal housings to a concrete foundation called out on tracing S-497, plan #4973 (see above). Since the 3-D printed signals do not incorporate the proper legs for either version, I built them as part of the foundation. First I cut a length of .093" x .187" rectangular brass tubing .300" long, standing on edge, to approximate a 125% oversize 8" x 23" concrete foundation. For the newer S-410-D style signals, I took two pieces of .063" square brass tubing and filed one end so there was a straight section and a triangular section, fully removing one wall of the tubing in that area. I filed away the top and bottom flanges of the ends of the foundation rectangle so that the square tubes fit flush into the ends. I then bent over the notched section of the leg tubes on top of the rectangle so the straight section formed the feet and then reverse-bent the angled section upward to look like the tapered signal legs. I repeated on both sides and soldered the square tubes to the rectangle. The leg sections sticking upward conveniently are partial channels into which those "legs" I left remaining on the signal drawer fit down into. This forms a slightly stronger joint between the brass base and the signal than a straight butt joint would. The square tubes are cut long enough to reach down through my roadbed/sub-roadbed structure to position the connector in open space where it can be mated to a socket connected to the signal circuit. The ends of the tubes are fit down into the plug connector and are soldered to the two opposing terminals I designate as the common return pins. Drill a hole down through the center of the rectangular tube between the legs large enough to route all the LED wires.



Individual parts for creating S-410-D foundation and mounting at left, soldered together at center with signal housing held in place to show proper leg spacing and base soldered into 6-pin Mini-Din plug connector at right.

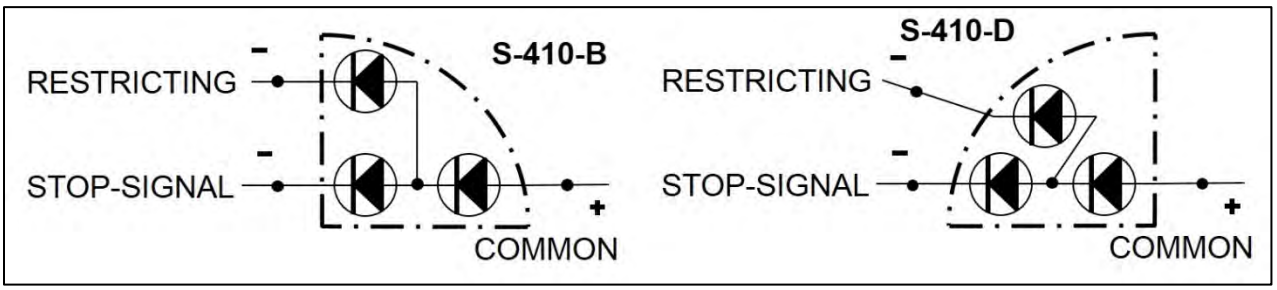


S-410-B mounting parts at left with simulated conduit soldered to foundation and raised piece added to back of signal housing. At right foundation assembly showing wire routing hole adjacent to conduit and foot pieces glued in place.

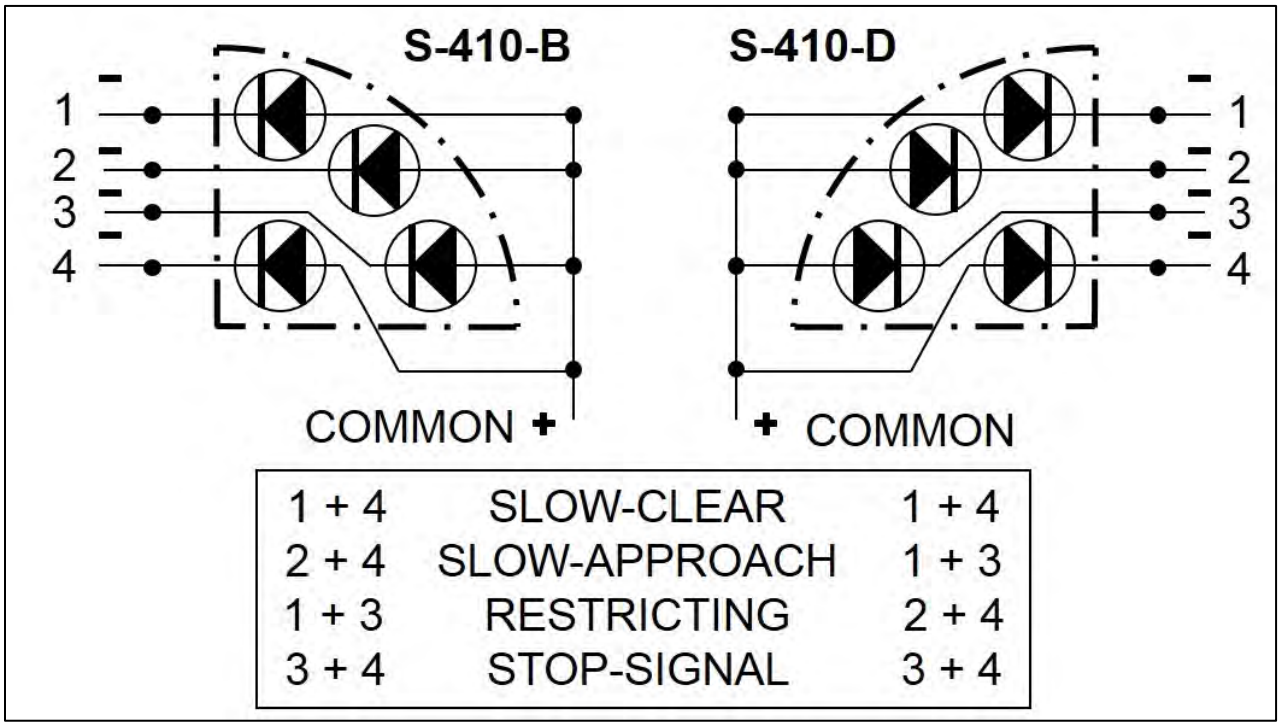
For the older S-410-B style, I used similar pieces of brass tubing, except the .063" square brass tubing did not require the modified end to form the legs. I thus only needed to file away the bottom flanges of the ends of the foundation rectangle so that the square tubes fit flush into the ends and soldered them in place. Again, being concerned with the prospect of just gluing the signals to the top surface of the foundation, I created some additional support via the wiring conduit. Some photos show a squarish conduit running up the back of the concrete foundation with a rounded, right angle fitting at the top connecting to the back of the signal housing. I decided to make this from metal so I could solder it to the foundation and thereby provide some rigid support for the housing. From the photos it scaled out to be roughly 4.5" square. I didn't have any square or sheet brass stock close to that 0.052" HO equivalent size, so I played blacksmith and gently hammered some bare 14-gauge round copper electrical house wire into the short lengths of square conduit needed. I filed a rounded contour on the top end and then soldered these to the backs of the foundations. Drill a hole down through the rectangular foundation tube adjacent to the square conduit to route all the LED wires. Like the other versions, the ends of the tubes are then soldered into the plug connector terminals. I temporarily inserted the drawers into housings and filed off the bottoms of the legs so they protruded about 1.5 scale inches, about the thickness of the cast feet. I notched rectangles of 0.15" x 0.060" styrene strip to fit around the drawer legs and glued them to the top of the foundation while temporarily holding signal in place to locate them.

Final Assembly

Once the painted signal parts have dried, assemble the LED's into the drawer. The wires are soldered to the LED's so both exit at one end of the part. Push the LED's down into the pockets with the wires exiting towards the bottom of the signal, routing them through their designated wiring channel. Before seating them, apply some small drops of CA adhesive into the pockets to secure them in place. I clamped a piece of a craft stick over the LED's/front with a spring clothes pin to hold the LED's down in place and let them dry overnight.



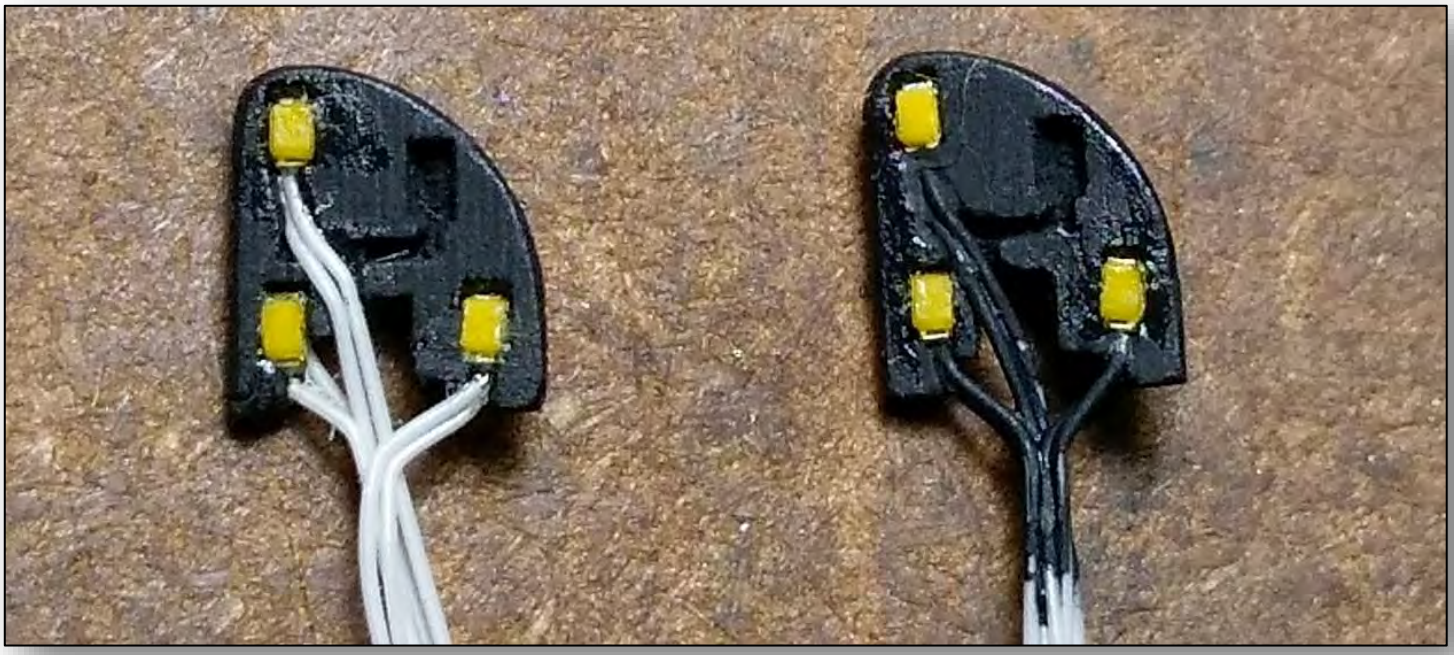
I wired my 2-aspect dwarf LED's together as to their "positions" since the circuitry to operate these can then be very simple: effectively a 2-position switch. The dropping resistors for these connections must handle 2 LED's in series (mine were 10KΩ).



Note that the 4-aspect wiring is more complicated since 2 LED's are used for two aspects, 1 is used for one and 1 is used for three (and they are different for the old and new style signals!). I thus wired the LED's individually for my 4-aspect dwarfs so the logic/driver circuitry could power the proper pairs of LED's for the desired aspect. The dropping resistors for these connections must handle only 1 LED (mine were 13KΩ, as discussed earlier).

I then fed the wires down through the hole in the foundation. I had tried to pre-color the ends of the LED wires with permanent markers so I could easily identify them once fed into the foundation, but marker doesn't adhere to Teflon either. So then instead of trying to carefully trace each the LED's wires, in sequence I held one of the longer anode leads to the positive terminal of two AAA batteries (in series) and cycled through touching the negative terminal with each of the shorter cathode leads until an LED lit. Once identified, I soldered its pre-stripped end to the appropriate terminal in my connector. The as-purchased LED leads are longer than I needed, but there is a large amount of space in my final assemblies between the signal and the connector for the excess lead length to accumulate so I didn't trim their length at all (after the first one), as striping a cut end is very delicate work. I soldered the wires for COMMON to one of the brass tubes leading down into the connector. With all the connections made I plugged the signal into one of the sockets under my layout and operated the interlocking above to check if all LED's were functioning properly. Working properly, I squirted some hot melt adhesive down into the connector to act as a strain relief for the fine wires and their soldered connections as well as to insulate them from each other.

With the wires all connected, I then gently lassoed them all with fine thread in the recess area at the bottom of the drawer to bundle them temporarily while I applied some CA adhesive to the bundle to help keep them together. This bundle will exit the bottom of the signal and simulate the appearance of the conduit down into the foundation on the S-410-D (they are mostly invisible on the S-401-B). When dry, I applied black paint to the exposed wires so none would show through the signal lamp openings or at the bottom.

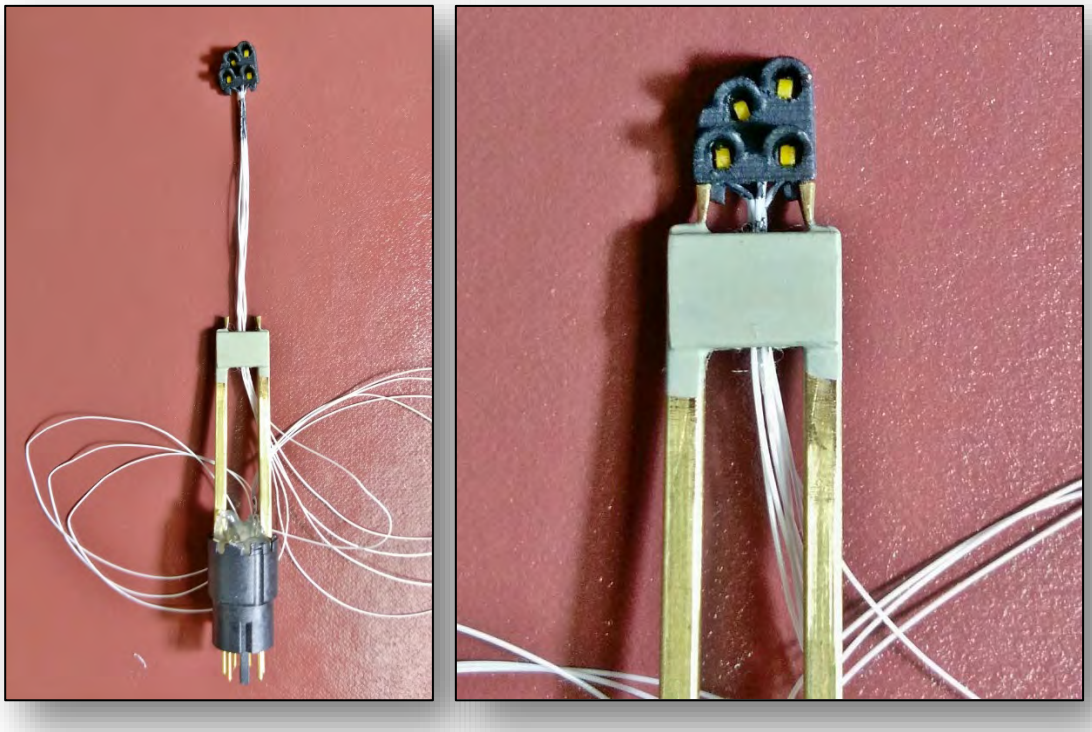


Two-aspect S-410-B drawers with LED's mounted and wires gathered and then painted, ready for assembly into housing.

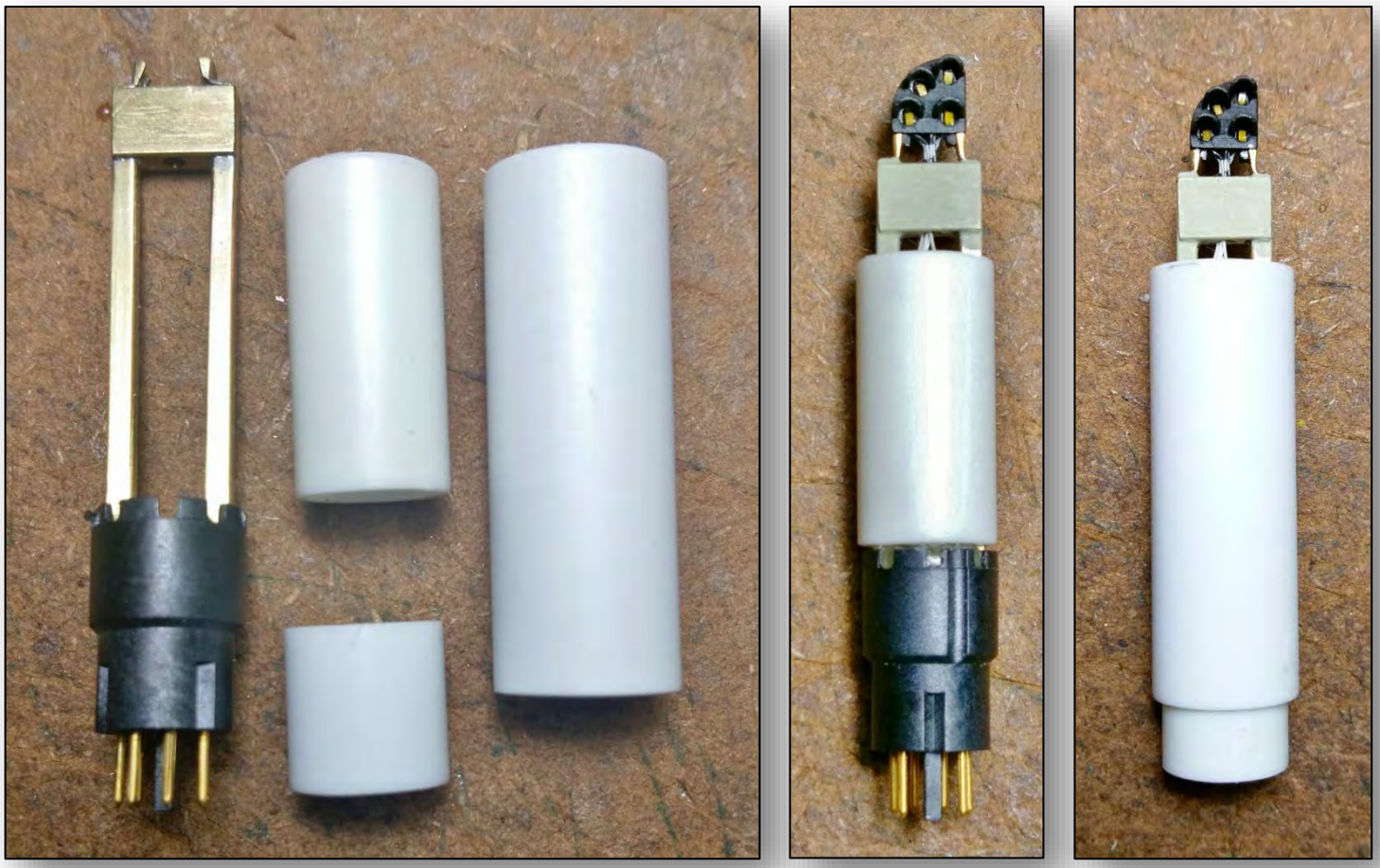
At this point, I painted the brass foundation rectangles an old cement color and let dry. I slid the completed drawer up into the signal housing and glued it from the bottom. I then pushed the signal drawer legs of the assembled signal down into the brass foundation legs on the S-410-D's and into the foot notches on the S-410-B's and glued them in place. Gently pull the wires down through the foundation taut to make them appear as a rigid conduit and glue at the bottom of the foundation. Once the foundation is dry, touch up the legs, feet, wiring and bottom of the signal with black paint.

I considered seeing if simulating lenses in front of the LED's had any value, contemplating placing a drop of canopy cement on top of the LED, filling the opening formed by the lamp hood. The thought was that this would help secure and protect the LED's and possibly form a more prototypical lens appearance than the little yellow rectangles visible when the signals are dark. However, the old "if it ain't broke, don't fix it!" adage got the better of me and I never risked it.

To finish the hidden part of my signal base, I cut a piece of .4375" (7/16") O.D. styrene tube, 1.25" long, for the main outer tube as well as a filler tube .770" long and a sleeve .400" long both cut from .375" (3/8") O.D. tube. The plug connectors I used just fit inside the 7/16" tube and get captivated by the 3/8" tube pieces.

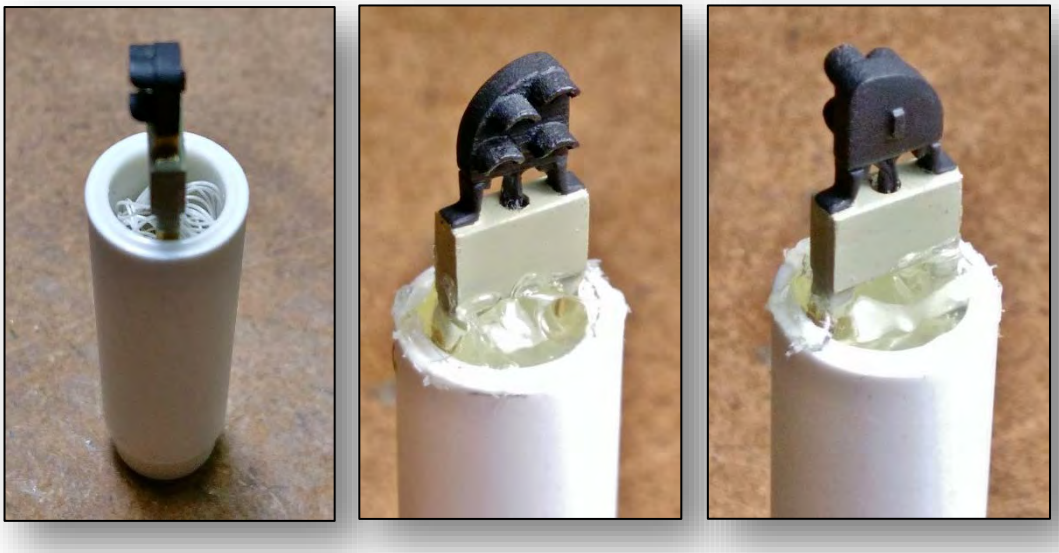


S-410-D with completed drawer assembled into housing at left with wires fed through center hole in painted foundation, soldered to connector terminals and potted with hot-melt adhesive, fully assembled signal at right.



Base assembly and tube pieces at left; signal slid onto legs with wires fed through foundation, filler tube slid in place down over signal with wires tucked inside at center; outer tube and sleeve assembled and all glued at right. The two smaller tubes inside the large tube trap the connector body inside and make a robust package that serves to protect the connector pins and signal wires.

Slide the filler tube down over the signal, concrete base and wires until it touches the connector body. Stuff the excess wires into this tube as you slide it on. Mark a line on the sleeve .210″ from the outer end and slip it over the end of the plug connector. Slide the outer tube down over all the parts until the end of the outer tube reaches the mark on the sleeve. Now glue the outer tube to the sleeve and filler tube by wicking some liquid plastic cement into the joints and let dry. The plug is now effectively locked into the outer tube and the wiring is encapsulated. Squirt some hot melt or RTV down into the spaces around the foundation and the top of the tube to seal in the wiring and seal out the ballast that will fill in the hole in the roadbed above. The bottom sleeve serves to protect the connector pins from damage and helps alignment with the socket.



S-410-D Signal assembled with wires stuffed into tube at left; front and rear views of completed signal after sealing opening with hot melt adhesive at right. Wires exiting down between legs simulate wiring conduit on the prototype. Curved back and simulated hasp and lock are visible at right.

Completed S-410-B signal showing shorter legs and rear exit conduit.

Touch up any necessary spots on the signal including any light "leaks" with a soft, weathered, flat black color. When dry, hand paint the back of the signal silver if this was appropriate for your modeling era and area. The signal is now complete.

Solder the mating receptacle socket connector under your layout to the wires from your signal driver circuit leaving some excess length. It is not critical that you use a receptacle connector specifically designed to be a cable connector – I used PC Board version and just soldered the leads to the tails coming off the bottom of the connector and insulated them with a blob of hot melt: it will only be mated or unmated at most a couple times. Drill a 7/16" hole through the roadbed/sub-roadbed/scenery at the appropriate point you want to locate the signal. Slide the base down through the hole and plug the receptacle onto the bottom of the signal. Hold the signal in its final position and take a rope of modeling clay and press it around the base where it comes down through your layout. The clay will hold the signal in position but will allow it to move if accidentally bumped. Bury the signal base as desired with ballast.

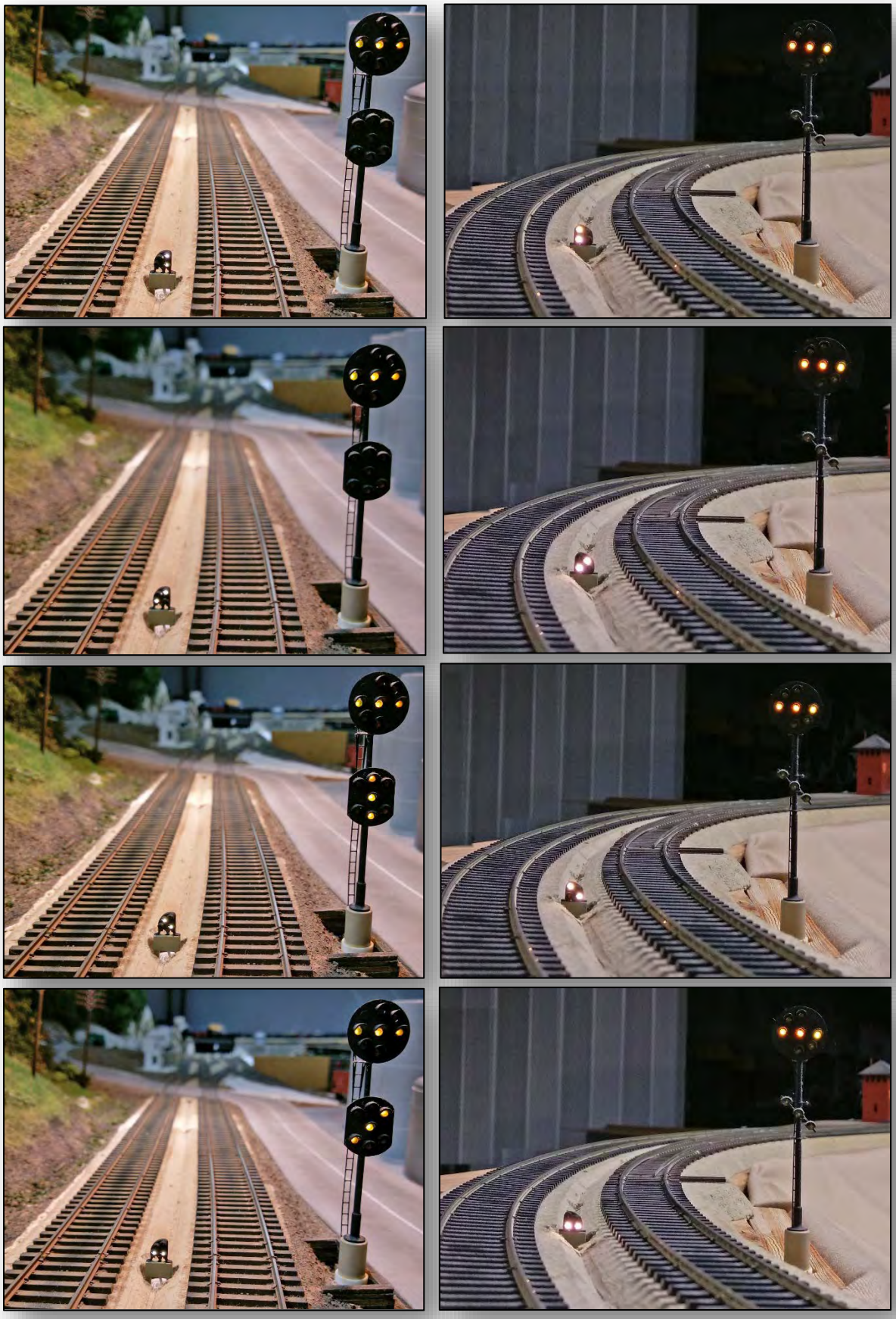
Building these "simple little" dwarf signals turned out to be a much more complicated project than it seemed like it would be before starting, but the completed working signals are a great addition to making your layout more operationally functional as well as to make it look more "Pennsy".

Parts List

- Shapeways: JHDD101 and JHDD111 Dwarf signals and USA Dwarf Signal Standard 4102 (Pedestal) signal.
- Special Shapes: .093" (3/32") O.D. thin wall brass tube
- K & S Metals: .063" square brass tube, .093" x .187" rectangular brass tube.
- eBay (ledbaron) SMD LED 0402 Sunny White warm Weiss +Microlitze
- Evergreen Scale Models #232 – 3/8" & #234 – 7/16" styrene tube; .015" & .005" styrene sheet.
- DigiKey: Mini-Din 6-pin connectors

References

- A Short Course in PRR Signals, Bill Strassner, *The Keystone*, March 1999, pps.57-62.
- *TKM issues: 35-41, 43-44, 70.*
- PRR Signal Rule Book
- PRR Employee Timetables
- Online: PRR signaling Group: http://groups.yahoo.com/group/PRRSignaling/
- Drawings for much of the PRR's signaling equipment are available on a CD entitled *Pennsylvania Railroad Standard Signals Plans 1920-1950* from Robert Schoenberg at Robs@Railfan.net.



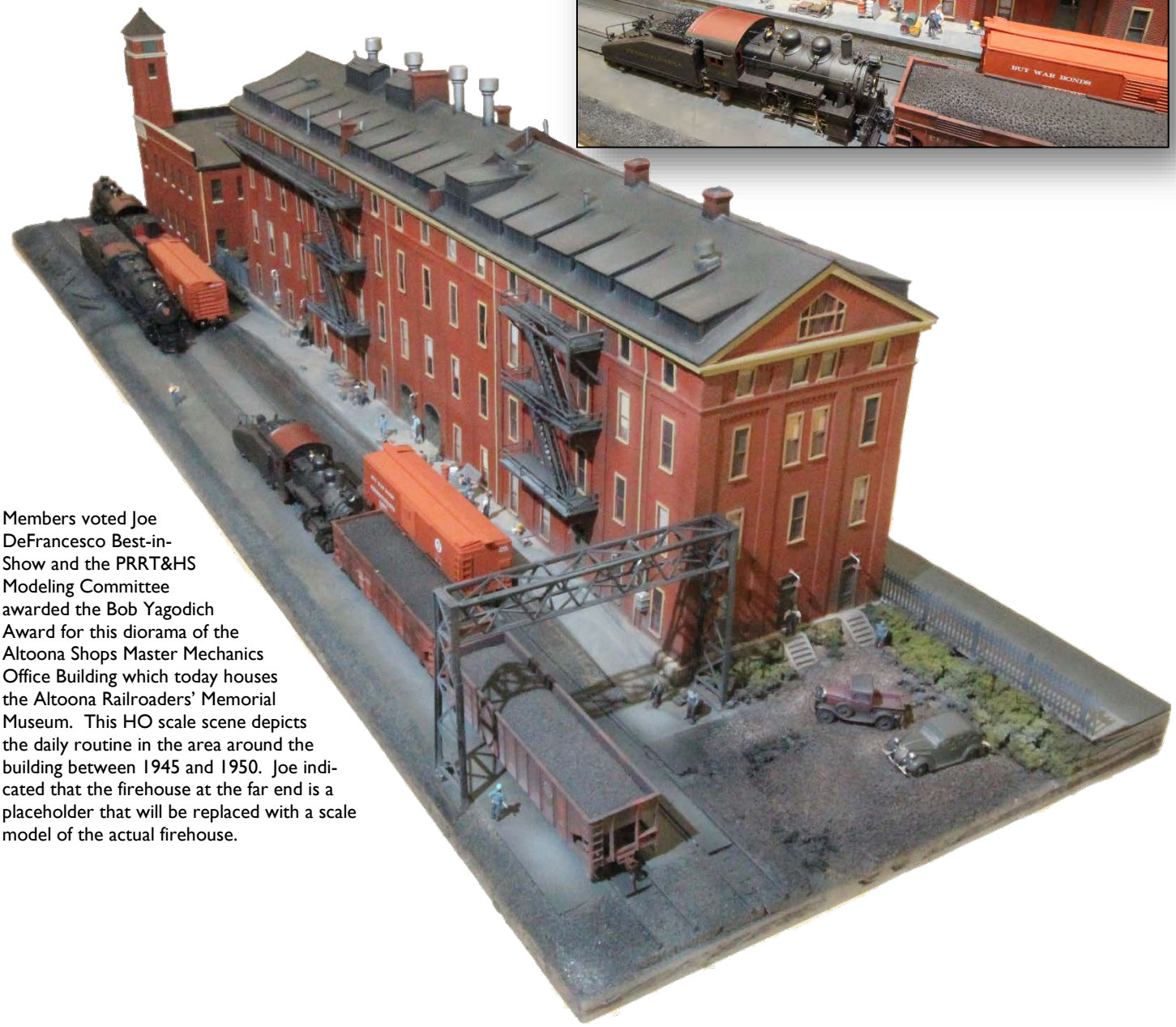
Photos of operating dwarfs displaying aspects SLOW-CLEAR, SLOW-APPROACH, RESTRICTING, and STOP-SIGNAL from top to bottom. The S-410-D style at left is the northward Home signal at CR interlocking and the S-410-B style signal at right is the northward Home signal at H on my layout.

Home signals at the north end of CR interlocking where the four track Monongahela Division mainline constricted down to a two-track mainline. The track assignments here were not of the normal arrangement, instead, from left to right were: #1 Northward freight, #2 Southward freight, #3 Northward passenger and #4 Southward passenger. The dwarfs control A.C.T. southward movements on the northward tracks while the high signals control normal southward movements on the southward mains. The S-410-D dwarfs are displaying RESTRICTING and STOP-SIGNAL while the high signals show STOP-SIGNAL and CLEAR. The limits of the interlocking were protected by a Home signal on each track entering it.

Models from the 50th Annual Meeting – Part 1

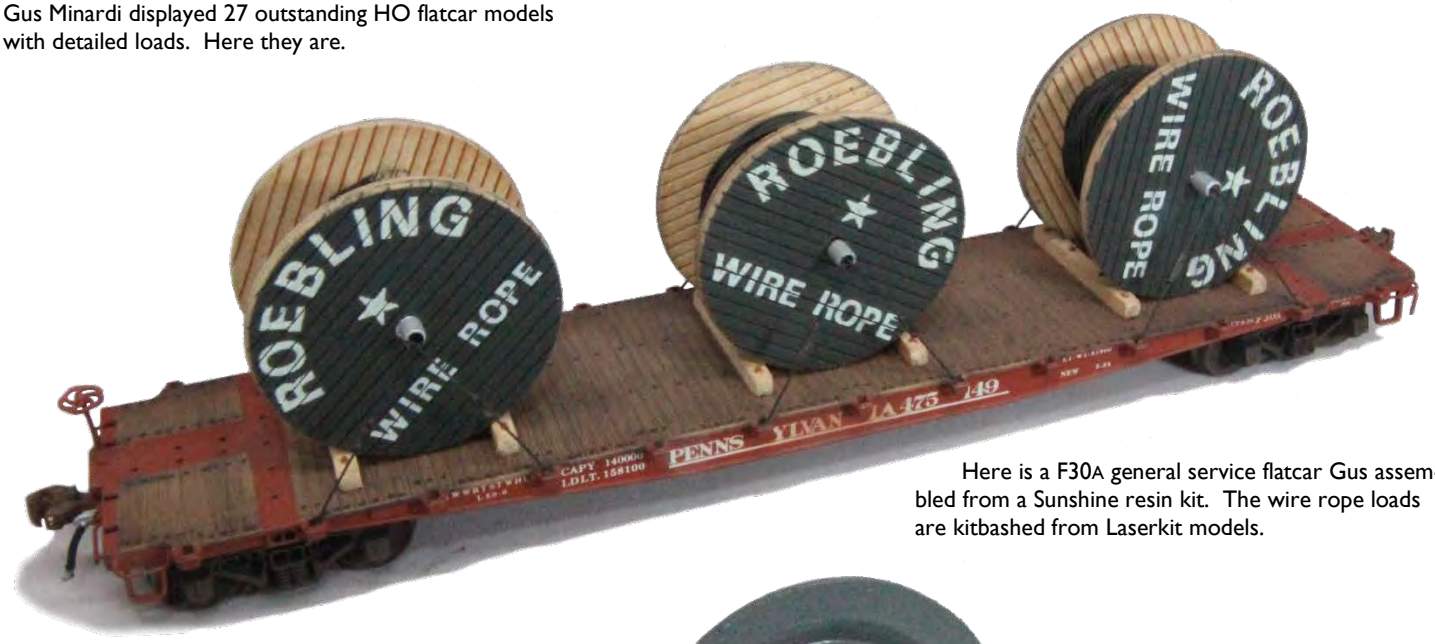
The TKM Staff

In May, the Pennsylvania Railroad Technical & Historical Society held its 50th Annual Meeting in the PRR shop town of Altoona, Pa. In the model room, there was a large assortment of quality models on display. By far, freight cars made up the largest category. In this issue of *TKM*, we share the combined winner of Best-in-Show and the Bob Yagodich Awards and several of the excellent freight car models on display. We'll share more in a future issue.



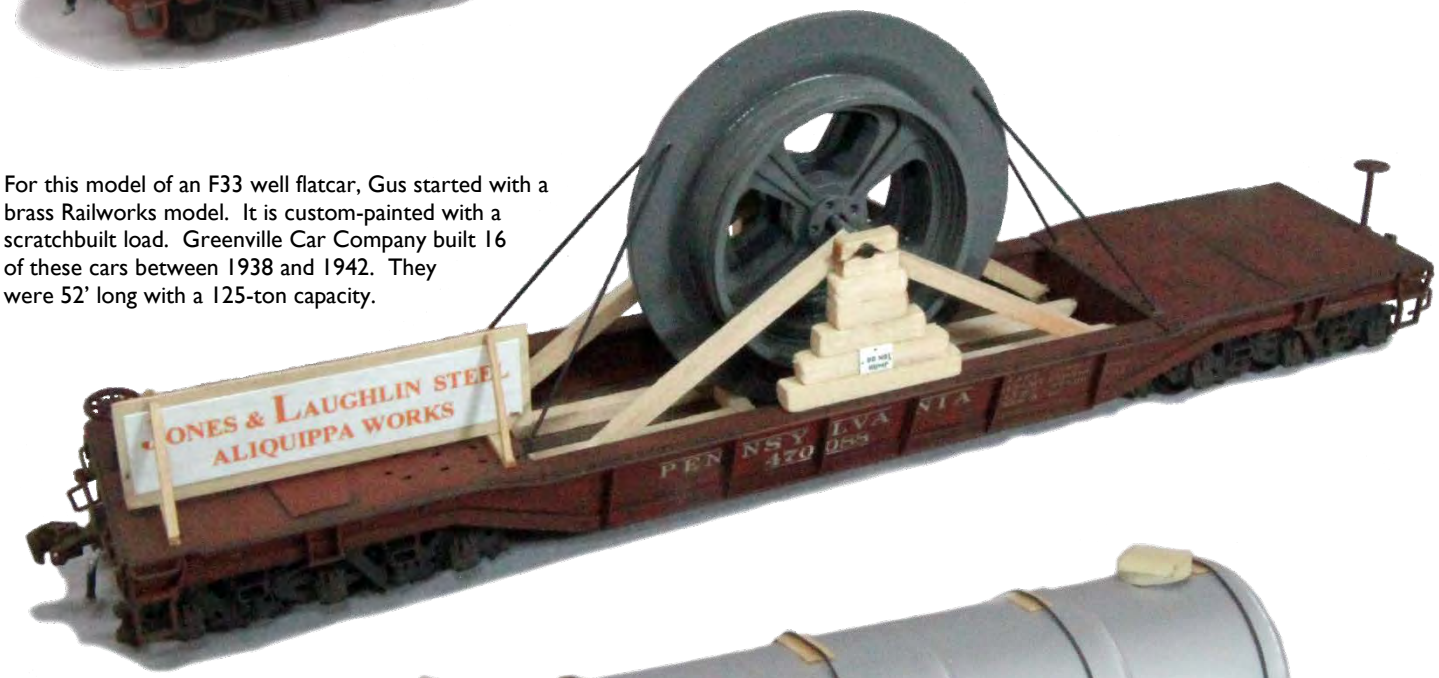
Members voted Joe DeFrancesco Best-in-Show and the PRRT&HS Modeling Committee awarded the Bob Yagodich Award for this diorama of the Altoona Shops Master Mechanics Office Building which today houses the Altoona Railroaders' Memorial Museum. This HO scale scene depicts the daily routine in the area around the building between 1945 and 1950. Joe indicated that the firehouse at the far end is a placeholder that will be replaced with a scale model of the actual firehouse.

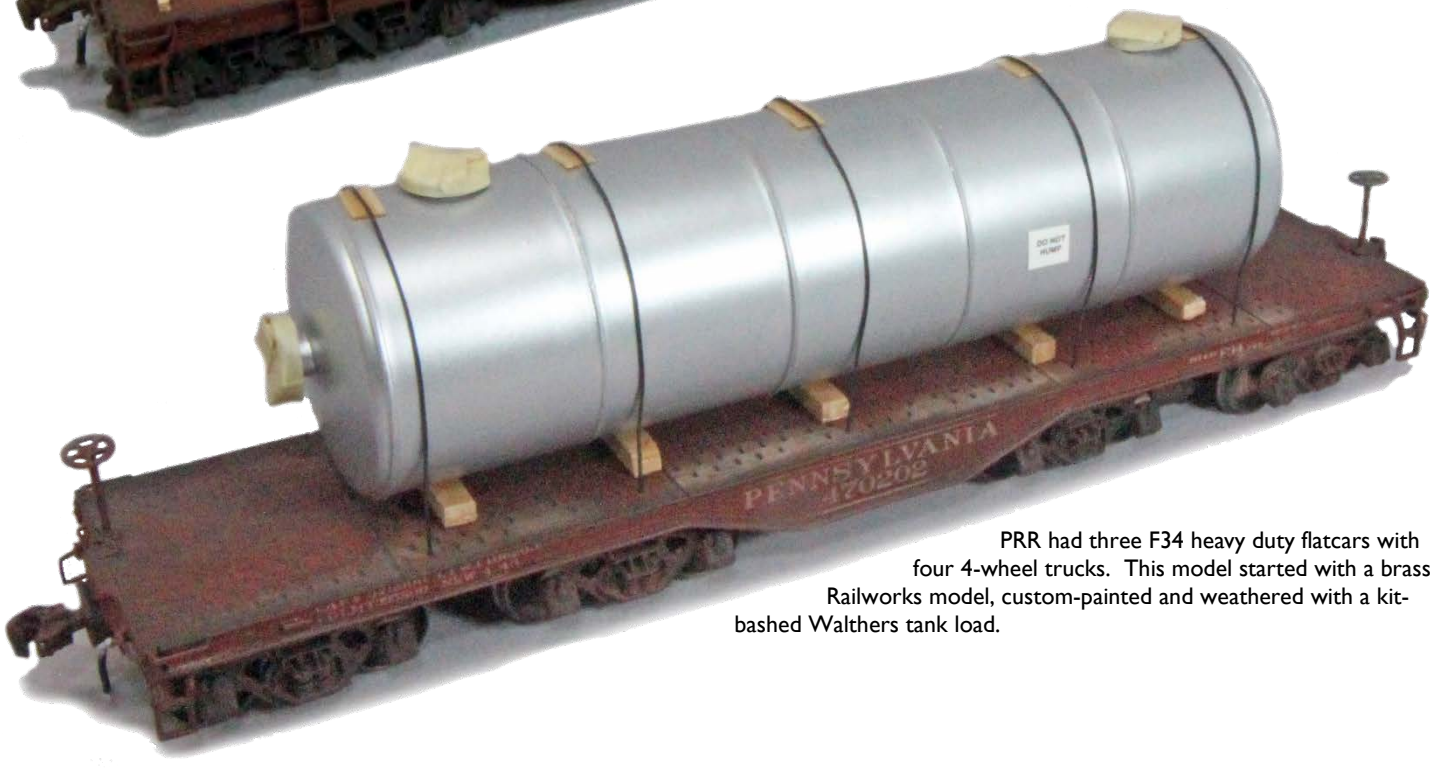
Gus Minardi displayed 27 outstanding HO flatcar models with detailed loads. Here they are.



Here is a F30A general service flatcar Gus assembled from a Sunshine resin kit. The wire rope loads are kitbashed from Laserkit models.

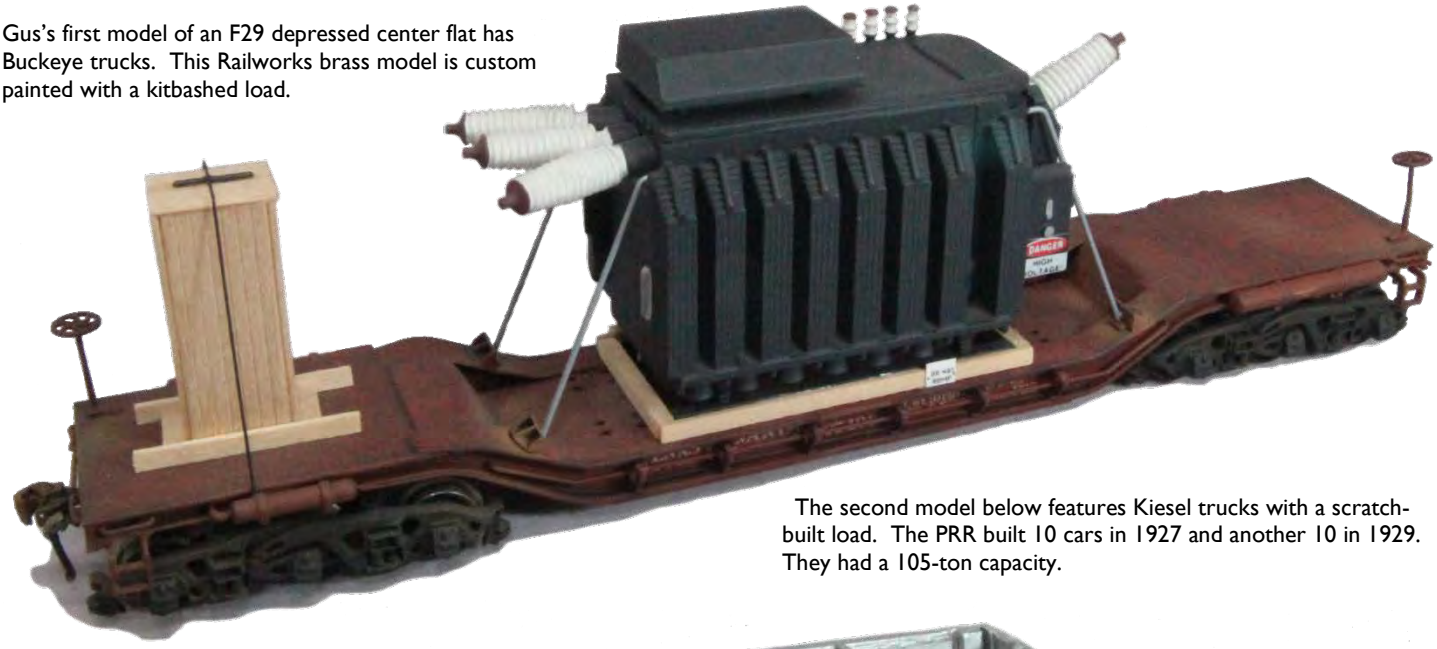
For this model of an F33 well flatcar, Gus started with a brass Railworks model. It is custom-painted with a scratchbuilt load. Greenville Car Company built 16 of these cars between 1938 and 1942. They were 52' long with a 125-ton capacity.





PRR had three F34 heavy duty flatcars with four 4-wheel trucks. This model started with a brass Railworks model, custom-painted and weathered with a kitbashed Walthers tank load.

Gus's first model of an F29 depressed center flat has Buckeye trucks. This Railworks brass model is custom painted with a kitbashed load.



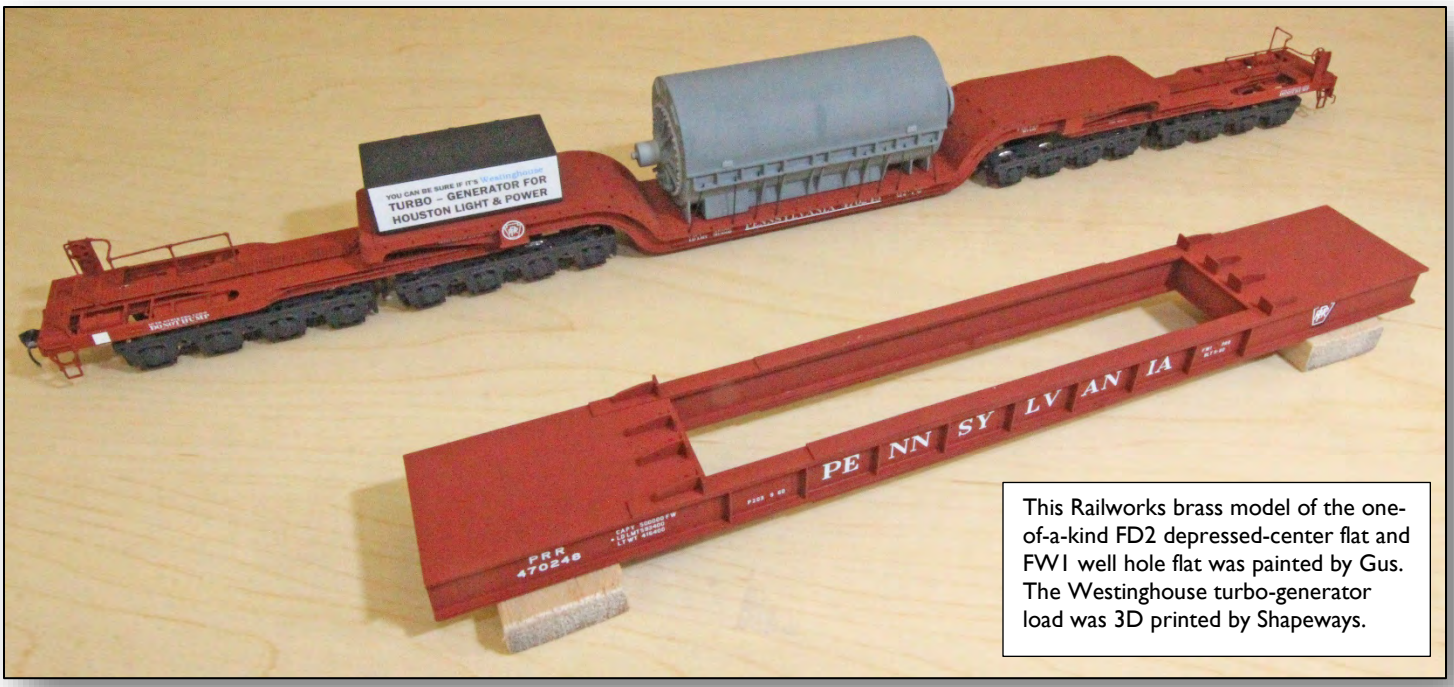
The second model below features Kiesel trucks with a scratch-built load. The PRR built 10 cars in 1927 and another 10 in 1929. They had a 105-ton capacity.

PRR built only 2 of the F28 depressed well cars in 1927 with a capacity of 125 tons. Gus's model of this car is a brass Railworks model, custom painted and weathered with a kit-bashed AHM transformer load.

Altoona Car Shops built 27 of these F25 well flats in 1916. This is a custom-painted and weathered brass car from Railworks. Gus scratchbuilt the load.

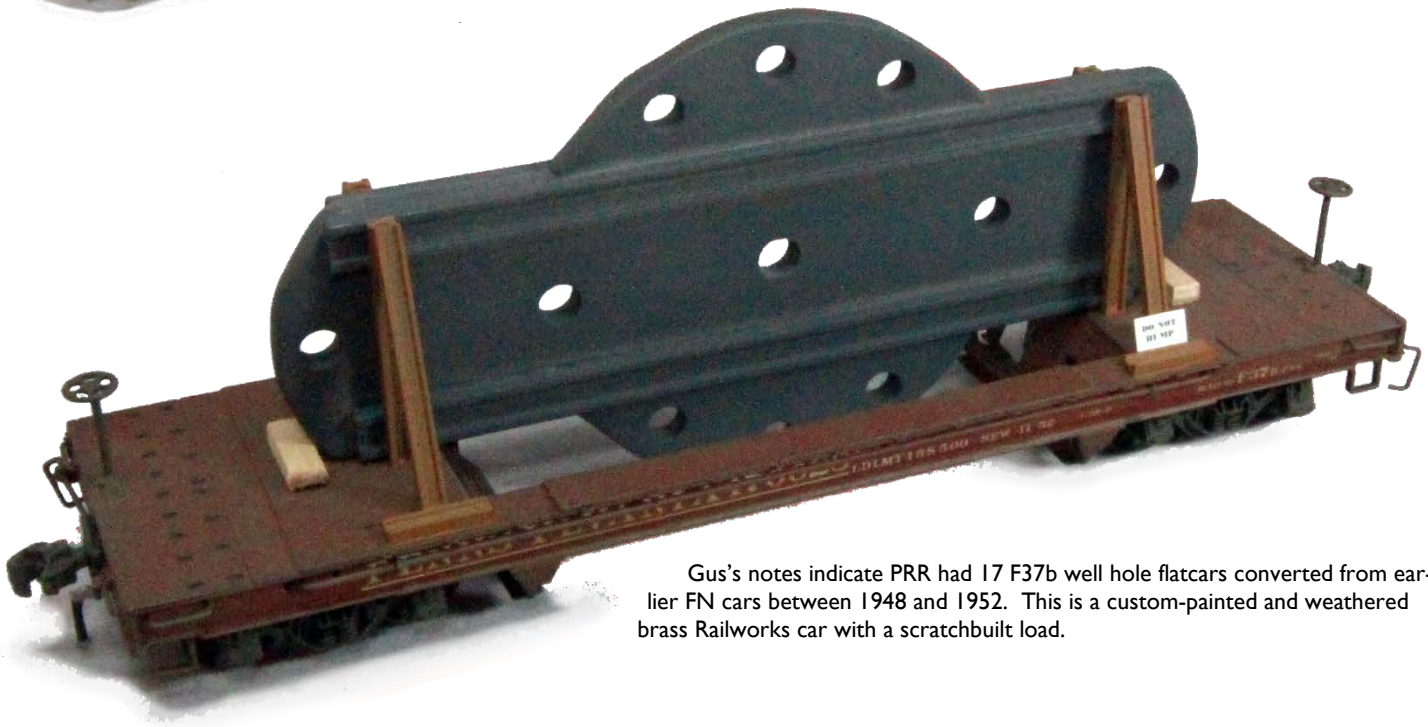
These two F22 "gun flats" are custom painted brass Railworks models with a beam load kit from Laserkit.

The 40' steel FM flats numbered 3,661 cars built between 1902 and 1913. Gus built this from a Sunshine resin kit with a custom-built girder load. The FM has a 50-ton capacity.



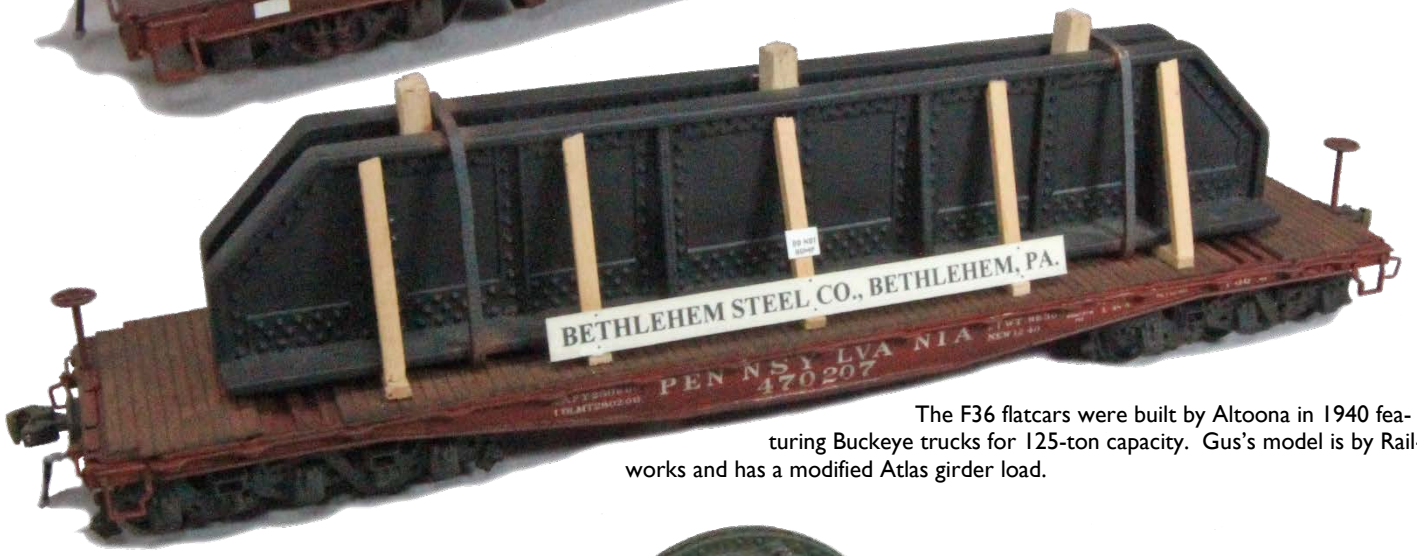
This Railworks brass model of the one-of-a-kind FD2 depressed-center flat and FW1 well hole flat was painted by Gus. The Westinghouse turbo-generator load was 3D printed by Shapeways.

This FD1 depressed-center flat is another Railworks model. Gus scratchbuilt the load – a model of a 310,000 lb. 70' forged steel tie rod by Bethlehem Steel for the E. W. Bliss Co. in Canton, Ohio, shipped the day after Christmas in 1952.



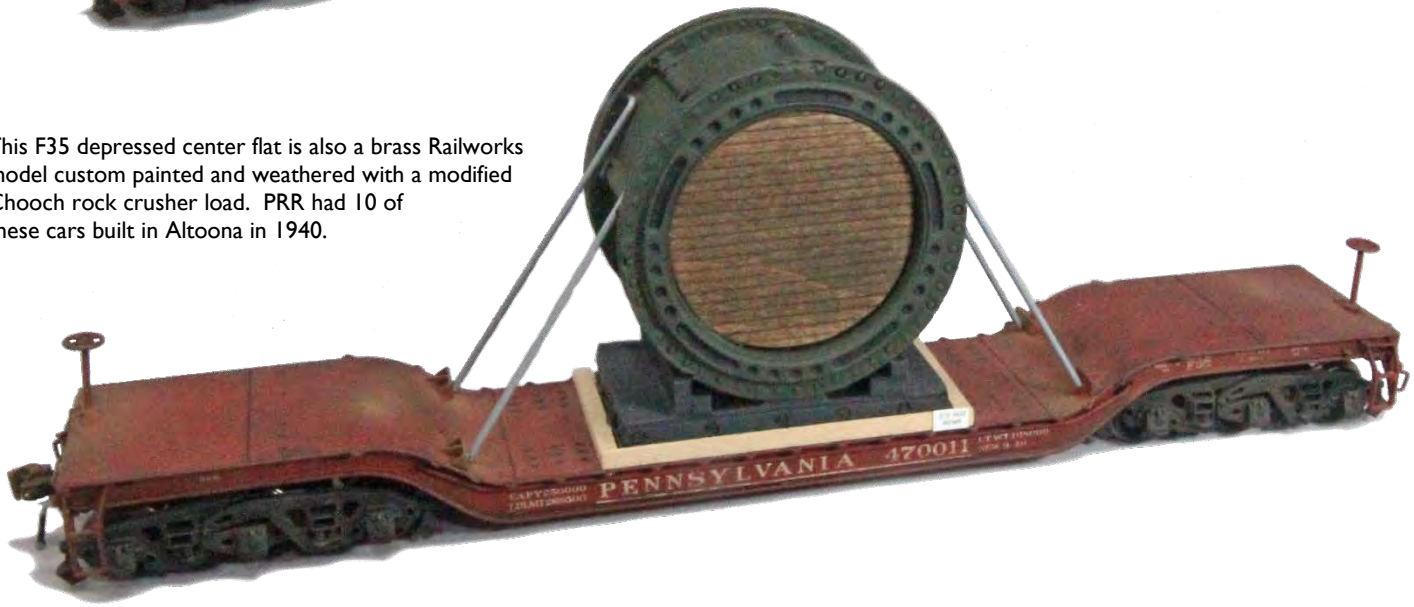
Gus's notes indicate PRR had 17 F37b well hole flatcars converted from earlier FN cars between 1948 and 1952. This is a custom-painted and weathered brass Railworks car with a scratchbuilt load.

There were 20 F37 well pocket flatcars on the PRR built in 1942. This is a Railworks brass model with a very interesting scratchbuilt load.

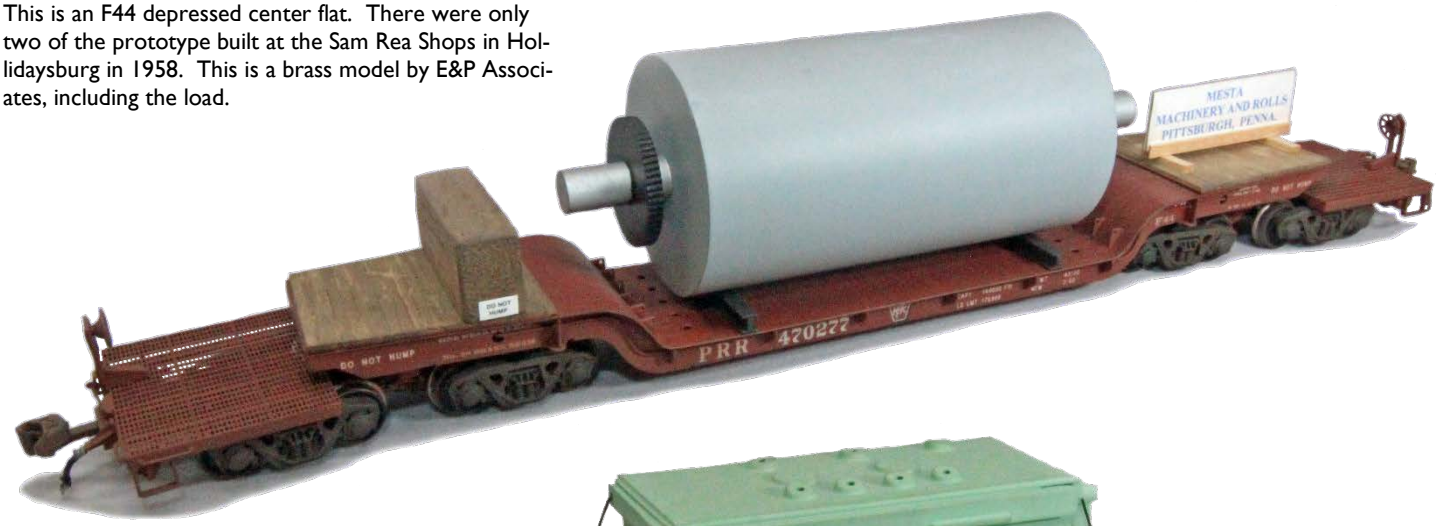


The F36 flatcars were built by Altoona in 1940 featuring Buckeye trucks for 125-ton capacity. Gus's model is by Railworks and has a modified Atlas girder load.

This F35 depressed center flat is also a brass Railworks model custom painted and weathered with a modified Chooch rock crusher load. PRR had 10 of these cars built in Altoona in 1940.



This is an F44 depressed center flat. There were only two of the prototype built at the Sam Rea Shops in Hollidaysburg in 1958. This is a brass model by E&P Associates, including the load.

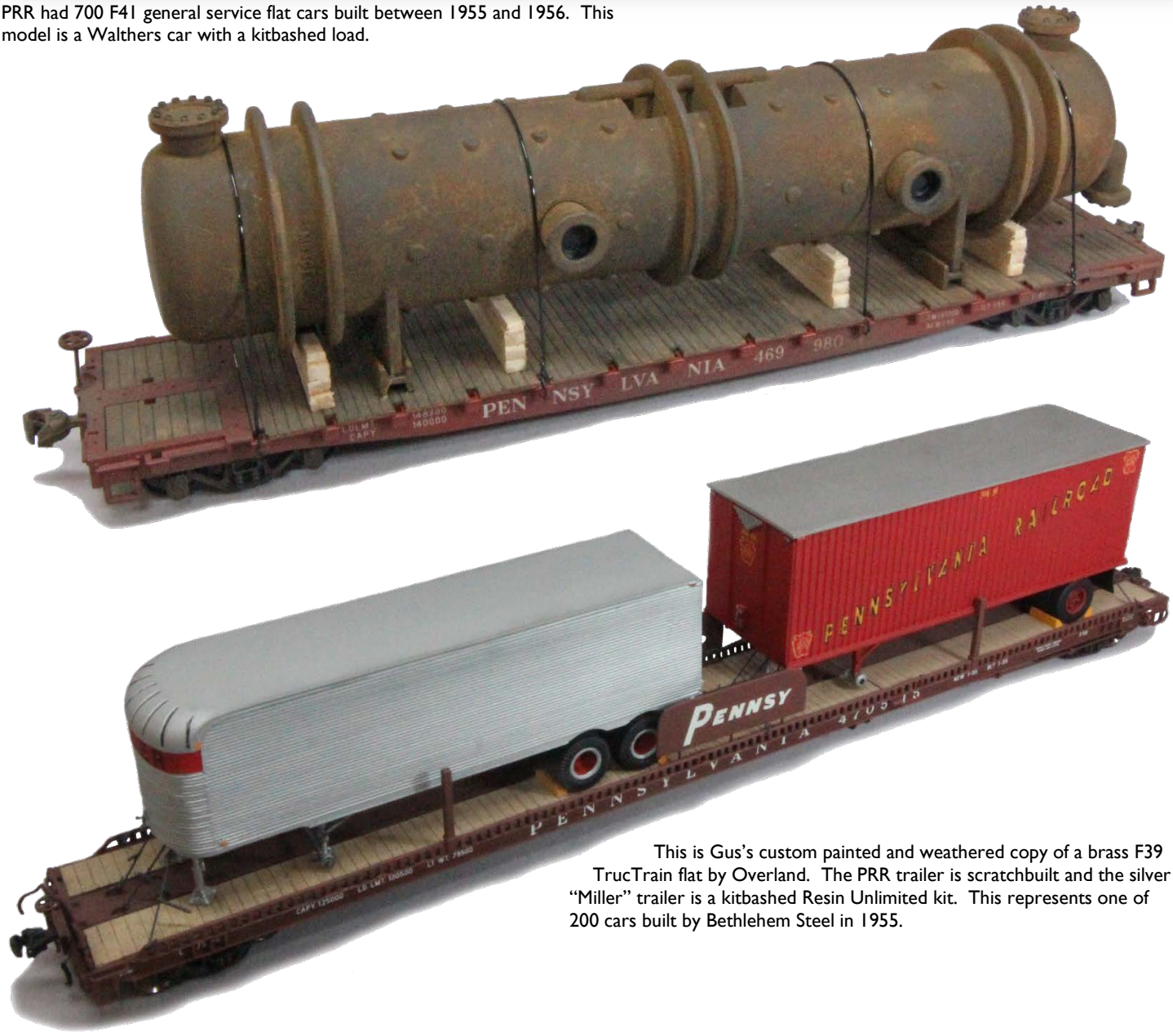


This is a Railworks brass model of the F43 depressed-center flat built by the PRR in 1958. There were 6 of the prototype. This has a Walthers transformer load.

This unusual-looking F42 depressed-well flatcar represents one of 20 built at the Sam Rea Shops in 1958. It only has a capacity of 50 tons. This is a Railworks brass model with a scratchbuilt load.

This model of F40-class heavy-duty well flatcar is a factory painted car and load from RailClassics. This was a one-car class built at Altoona Car Shops in October 1954 to carry six turbines for General Electric.

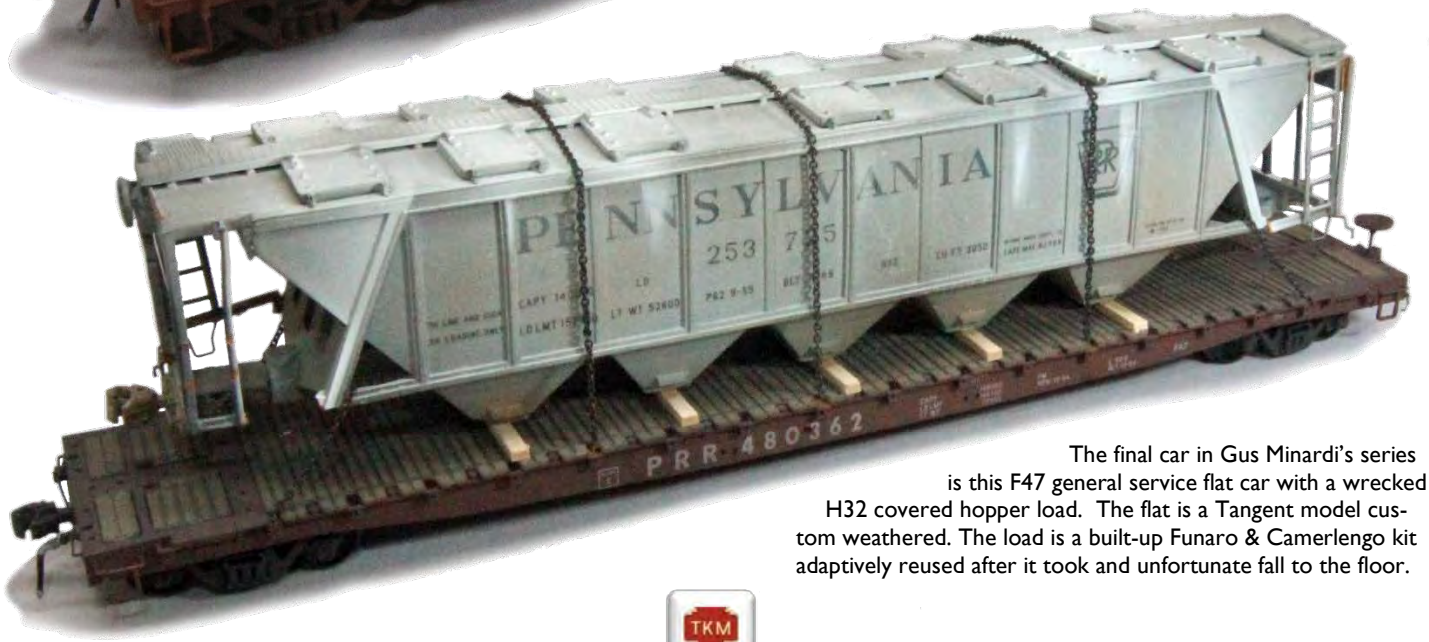
PRR had 700 F41 general service flat cars built between 1955 and 1956. This model is a Walthers car with a kitbashed load.



This is Gus's custom painted and weathered copy of a brass F39 TrucTrain flat by Overland. The PRR trailer is scratchbuilt and the silver "Miller" trailer is a kitbashed Resin Unlimited kit. This represents one of 200 cars built by Bethlehem Steel in 1955.

Here is a factory-painted brass F38 flatcar and load by RailClassics. It represents one of only two built by Altoona shops for the railroad in 1954. It has a 250-ton capacity with two pairs of Buckeye trucks.

This is a brass model made by Overland. Gus supplied a kitbashed load made from PVC pipe. This represents one of 10 F49 will flatcars built for the PRR in 1965. It had a capacity of 95 tons.



The final car in Gus Minardi's series is this F47 general service flat car with a wrecked H32 covered hopper load. The flat is a Tangent model custom weathered. The load is a built-up Funaro & Camerlengo kit adaptively reused after it took and unfortunate fall to the floor.

PRR HO Modeling Survey

By David Wilson

I conducted the HO-scale PRR modeling survey for 2018 to determine the Pennsylvania Railroad models that were most wanted or needed by the modeling community. Additionally, I set out to collect statistical information to supply the Modeling Committee with data that it could present to manufacturers about models that might sell well. First, I divided the survey into 14 categories covering the locomotives, rolling stock and structures of the Pennsylvania Railroad. The respondents could vote for as many models in each group as they wanted, and in all, we had 199 individuals fill out the survey and together, they cast 4,037 individual votes. To determine which models were the most popular in each group, I imported the data into Excel and used the "quartile" formula to split the data into four quartiles. I deemed those in the top quartile, or top 25% to be the most popular and most likely to garner attention from manufacturers. For those categories where there were not enough models to generate meaningful results, I used only the top one or two suggestions.

For the locomotives, I split the categories into steam, diesel, and electric. The steam survey had 19 unique entries with some of the choices including subclasses of locomotive classes. Those in the top 25% included the E6, B6 (and subclasses), G5s, M1 (not M1A or M1B), and H9 (and subclasses). The E6 and the B6 received the most votes with 70 and 69, respectively. The next closest was the G5s with 57. In the past, Bowser had offered a rather crude, cast metal version of the E6, and several importers, Gem (1966), Alco (1981) and Key (1989) have offered the E6 in brass. Next, Bowser, Red Ball, Sunset, Overland, and Key released several versions of the B6 and subclasses. For both the E6 and the B6 steam locomotives, there is a demand for an updated, affordable, and ready-to-run plastic model.

For the diesel locomotives, the BP-20, BS-24, LS-25, and FS-20 rounded out the top 25%. The BP-20 (DR 6-4-2000) locomotives were by far the top vote; however, the BS-24 and LS-25, which were a very similar, yet markedly different diesel would have surpassed the BP-20 if they were combined. The BP-20 is the last signature PRR passenger diesel locomotive that needs to be mass-produced in plastic; the passenger shark was previously released in brass by Alco and Oriental. Manufacturers have only produced the BS-24 and LS-25 in brass. The BS-24 had been modeled as recently as 2004 by Division Point, but the more well-known and more numerous models are the BS-24 and LS-25 produced by NJ Custom Brass models. There were twenty-two LS-25 units that were all built for the PRR. The BS-24 (RT-624) units were improved versions of the Baldwin BT 6-6-2000 purchased by the AT&SF, EJ&E, Cotton Belt, DSS&A, Soo Line, MN&S, and Trona Railroad. The FS-20 (H-20-44) rounded out the top four and has only been produced in brass by Alco models. The PRR, AC&Y, NYC, P&WV, and UP owned all 96 of the units constructed.

Finally, the electrics garnered two locomotives in the top 25%, however, since the B1 was only 1.25% away, I have included it here. Therefore, the first three electrics were the P5, the E44, and the B1/B3 locomotives. The P5 will hopefully be produced by BLI shortly. Since it was the top vote-getter, maybe, we will see models running under the model catenary soon! In 1970, ALCO models produced the only E-44 available today, so an updated version painted in PRR, PC, Conrail, and Amtrak livery would satisfy many of the modern juice jack aficionados. Finally, ALCO imported 1300 of the B1's in 1973, and Alpha models added another 200 models to the mix in 1984. A smooth running and nicely painted model of the little rats could be a successful model.

The freight car category had entries for gondolas, hoppers, boxcars, flatcars and cabin cars. Of the nine gondolas, the G22 (and subclasses), G29 and G32/G32A garnered the top spots. The G22 was a large class of gondolas on the PRR and a mass-produced kit or ready-to-run plastic model is needed. The Pennsy rostered over 5,700 gondolas of the G22, G22A, G22B, and G22C. The G22B cars were modified to carry containers, which would be an attention-getting addition to our model freight trains. The G29 came in second place. These were a group of 2,000 46' foot cars built by Altoona in 1941. In 1949, the PRR started to build 2,100 of the G32/G32A 46' cars.

In the realm of Hopper cars, the GLCA and a retooled GLA were the top vote-getters with a retooled H21A/B and E coming in a bit short of the cutoff mark. A ready to run plastic model of the GLCA would be a welcome addition. The PRR owned 20,000 of these cars, and around 10,000 were still in service in the late 1940's. A retooled high-quality GLA with separate ladders and grab irons would also be a welcome addition. The GLA was the most numerous hopper car on the Pennsy. They rostered a total of 30,000 cars and still had 20,000 in service from 1936 to 1955. Bowser has produced kit and ready-to-run versions of the GLA and Westerfield has manufactured a quality resin model of this car. Last, the Pennsy rostered a total of 39,000 H21 hopper cars at their peak. After looking at some of the original Bowser H21 models, a high-quality car with separate grab irons, ladders, and a better interior would be a welcome addition.

Four boxcars, the X23, X29, X31/X31A, and X41(A, B, and C) made the 25% cutoff mark. The X23 was a wooden boxcar produced by the PRR in the early 20th century. Westerfield has provided an excellent version of the X23 in several variations, including work cars and the NX23 caboose. The X29 was by far the most numerous boxcar on the Pennsy. The railroad acquired three lots of the cars in the 1920s and 1930s and utilized them in freight and passenger service. Red caboose produced the best plastic models of these cars; however, they are no

longer manufactured and have become difficult to find. The X31 and X31A were then next highest vote-getters on the survey. These cars have been produced in plastic by Bowser. However, an updated version with more accurate details, separate grab irons, and ladders would be a welcome addition. The X41 A, B, and C were 50' boxcars produced by the PRR in starting in 1945. Sunshine manufactured each version of the cars, but they have since gone out of business. A plastic or resin model of this car would be an excellent addition for modelers.

Since there were only four entries in the flatcar group, the F30D made the cutoff, and the FM missed it by one vote. The 250 F30D cars were very similar to the late F30A. The PRR converted many to TOFC service in the 1950's, and Trailer Train eventually acquired several of them. The FM was the workhorse flat car on the PRR. The best model of these cars is the Funaro & Camerlengo resin kit. It is an easy-to-build model; however, a plastic ready to run model would be a welcome addition for those not adept at working with resin.

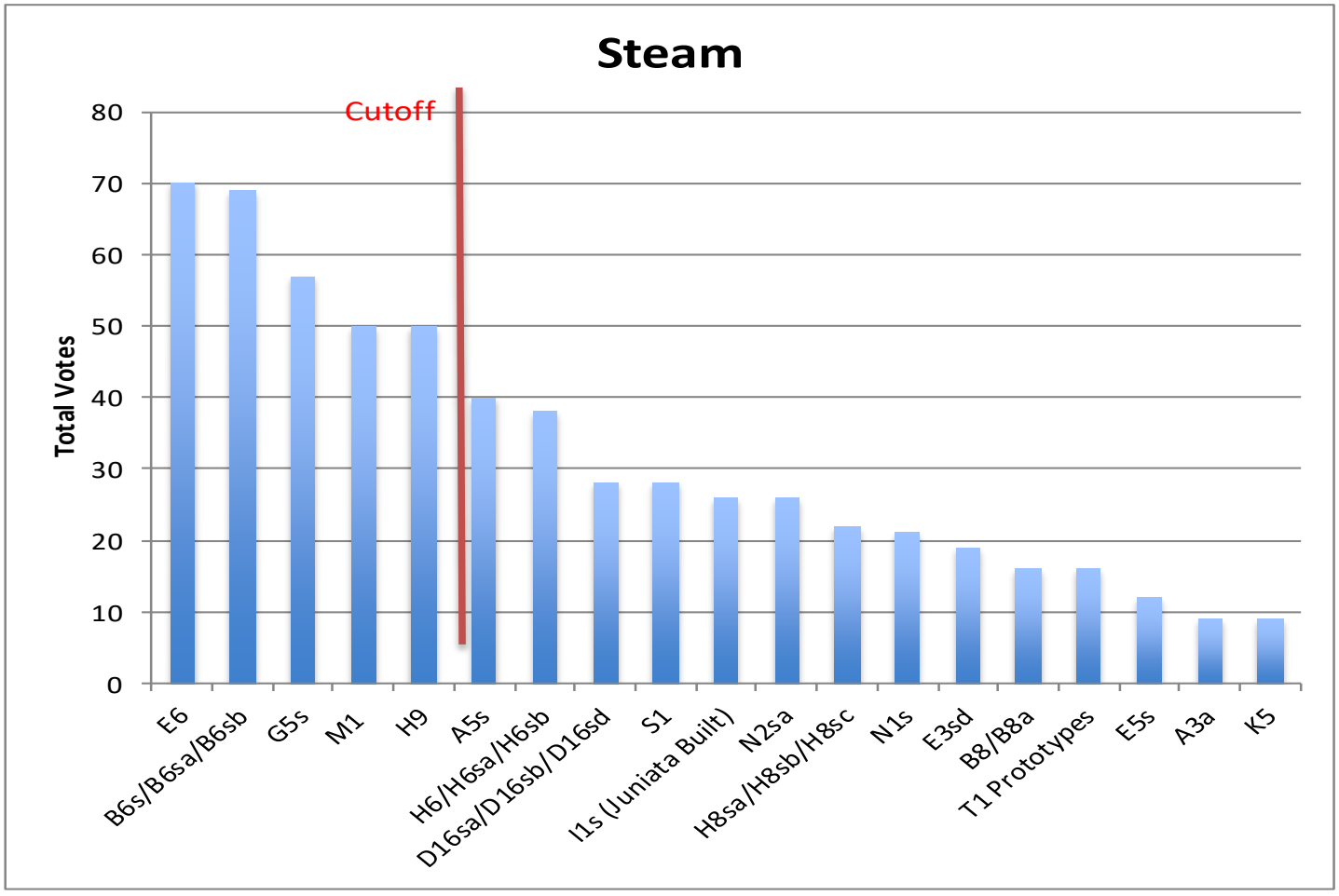
Last, at the end of the train, we found that the N5 was the highest vote-getter. The available plastic and brass models all have issues that have been documented by several modelers. A thoroughly researched high-quality model is needed. The ND almost made the cutoff. Manufacturers have offered this car in brass, wood, and resin for years, so, a modern ND would have to be a ready-to-run plastic model.

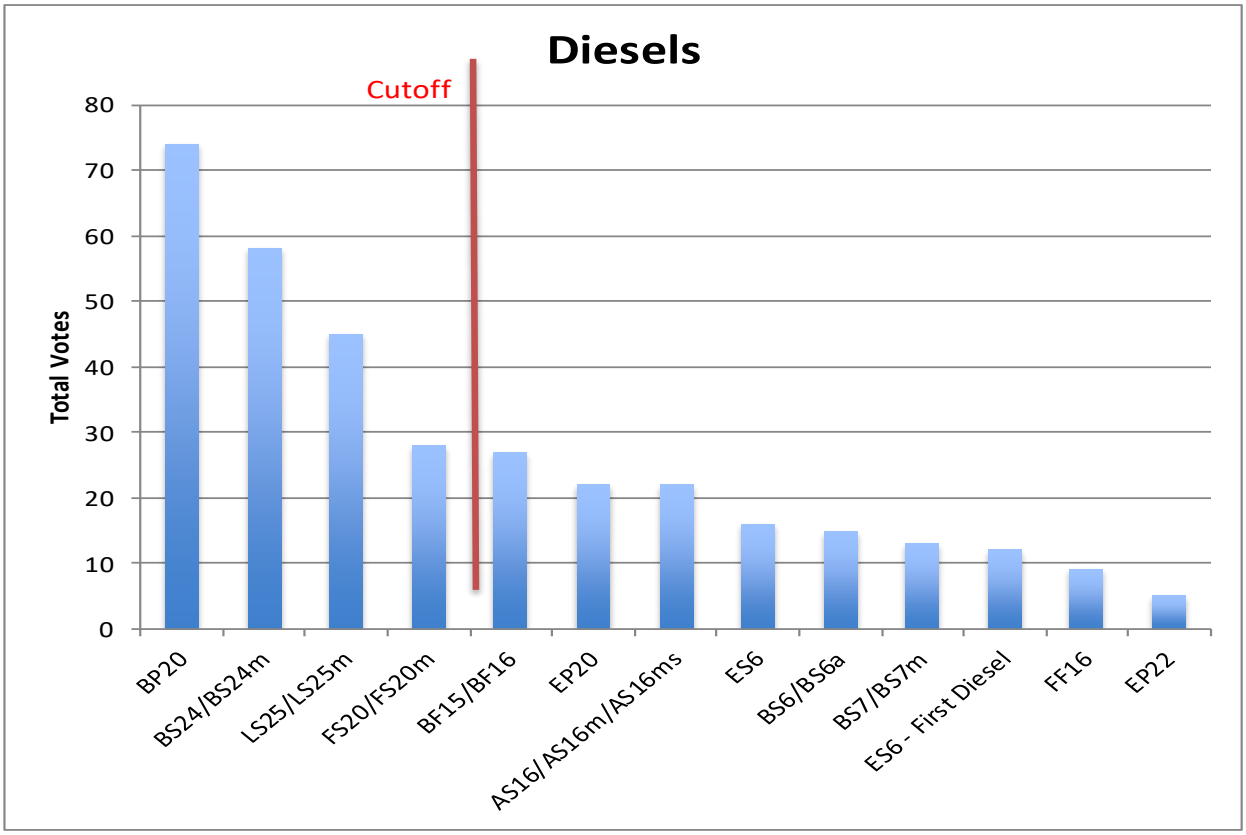
Next, for the survey, I split the passenger equipment into three categories: head end cars, passenger cars, and passenger trains. For the head end cars, the BM70 and B60 made it into the top 25%. Manufacturers have only offered these cars in brass or as craftsman kits.

For the passenger cars, The P70FBR, P70KR and the P70GSR garnered the top spots. The PRR modeler needs these P70 variants to model the passenger operations on the railroad accurately.

Next, for the passenger trains, the 1938 *Broadway* surpassed the 1930 *Congressional* and the 1939 ACL *Champion*.

In the structure category, the general wooden PRR interlocking tower blew away the competition and got over twice the votes as its next competitor, which was a modular PRR roundhouse. The W250 and W150 wreck derricks were the tops for the MOW category and working LED dwarf signals, and prototypical switch machines were the leaders in the "other" group. A PRR modeling compendium was close behind; however, *The Keystone Modeler* e-magazine is by far the best modeling resource for the PRR modeler, and these magazines are available on CD from the PRRT&HS.




Diesels
Cutoff
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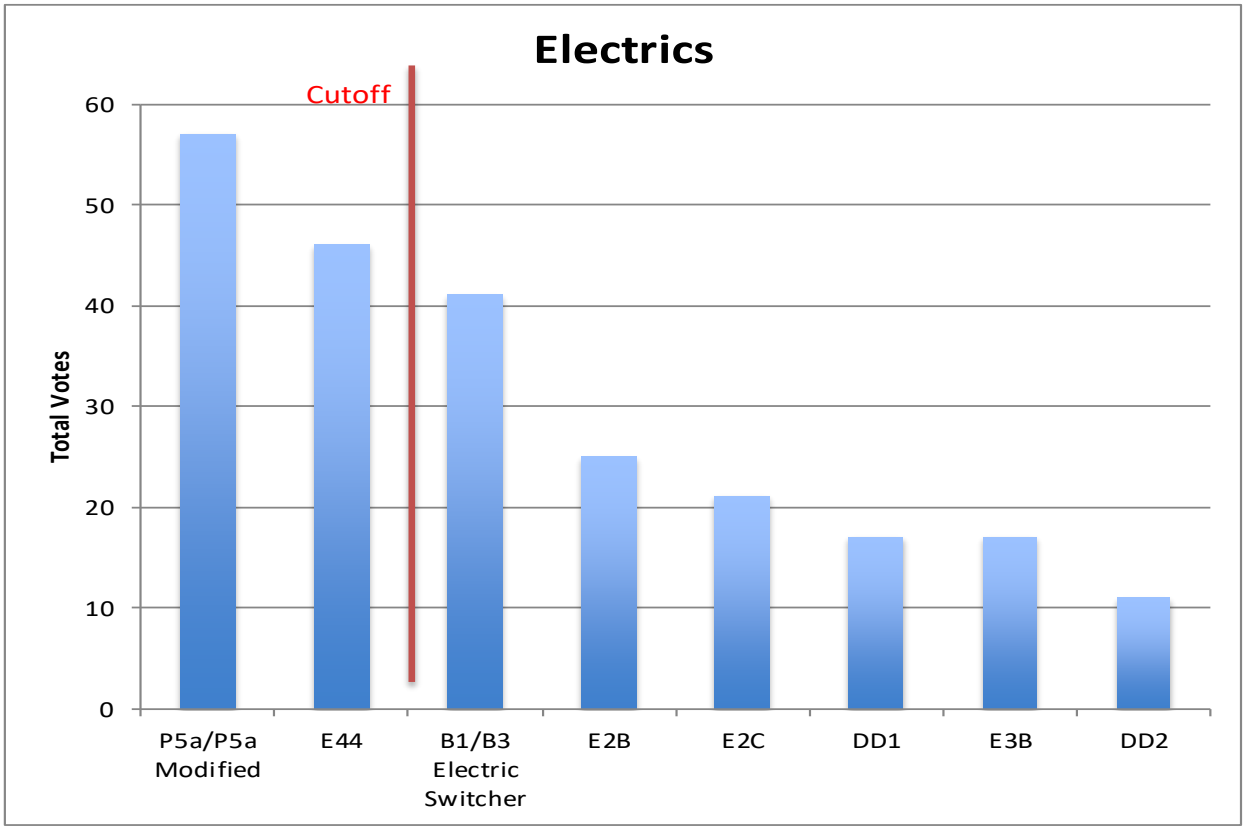
70
60
50
40
30
20
10
0
BP20
BS24/BS24m
LS25/LS25m
FS20/FS20m
BF15/BF16
EP20
AS16/AS16m/AS16ms
ES6
BS6/BS6a
BS7/BS7m
ES6 - First Diesel
FF16
EP22


Electrics
Cutoff
Total Votes
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50
40
30
20
10
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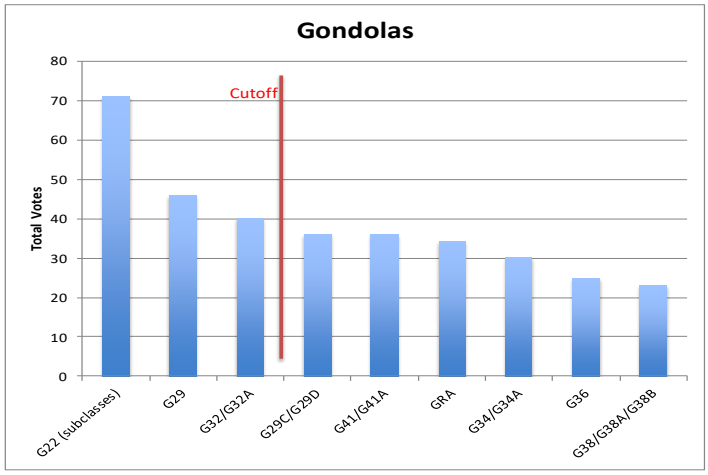
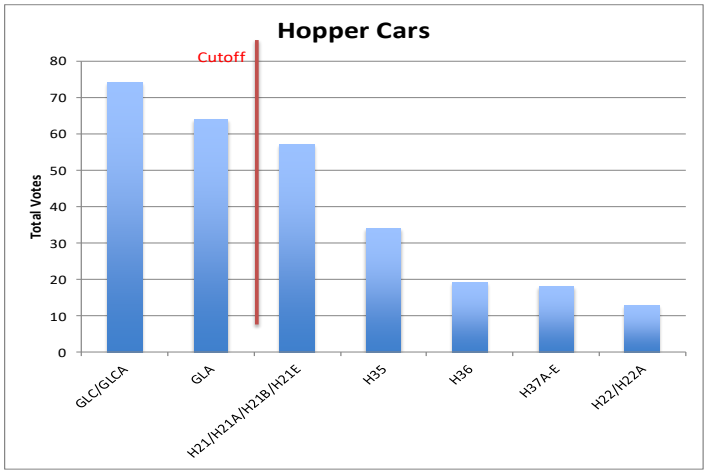
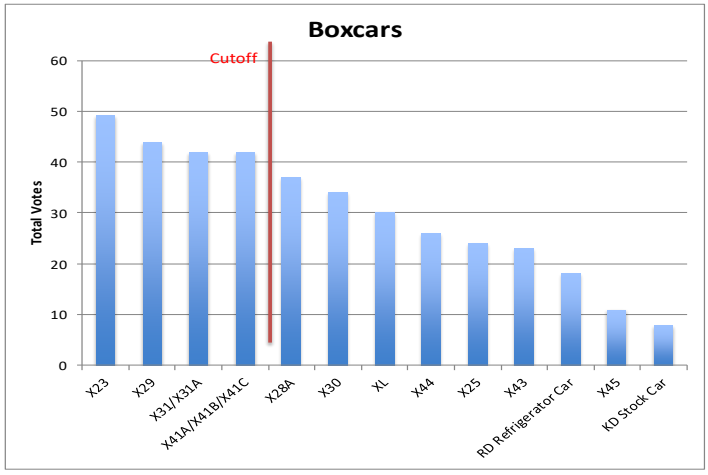
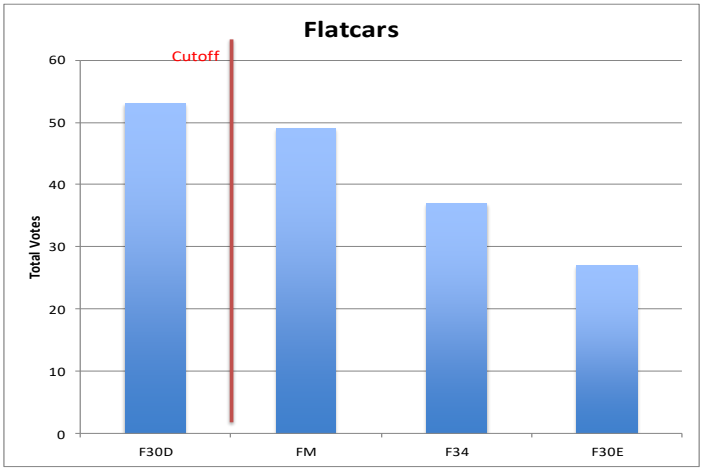
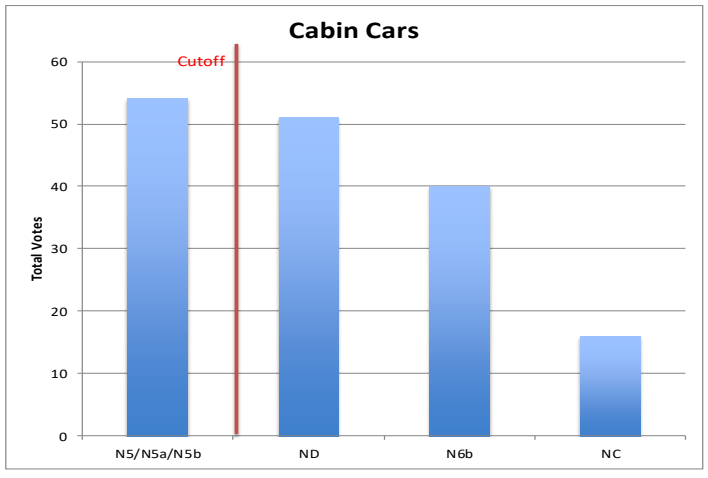
P5a/P5a Modified
E44
B1/B3 Electric Switcher
E2B
E2C
DD1
E3B
DD2

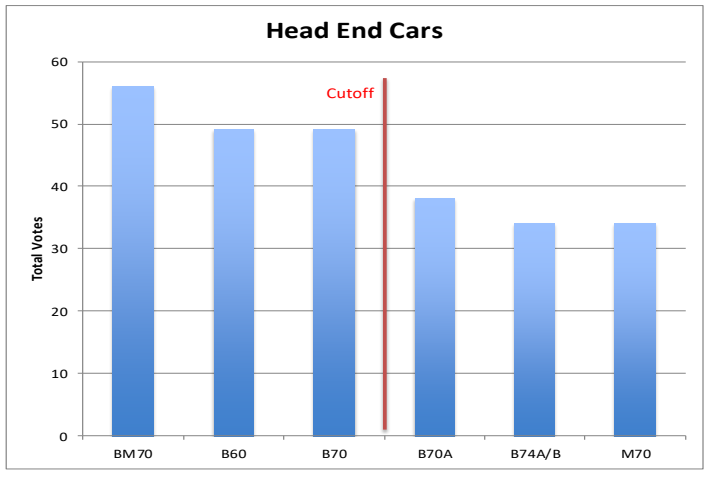

Gondolas
Total Votes
Cutoff
0
10
20
30
40
50
60
70
80
G22 (subclasses)
G29
G32/G32A
G29C/G29D
G41/G41A
GRA
G34/G34A
G36
G38/G38A/G38B

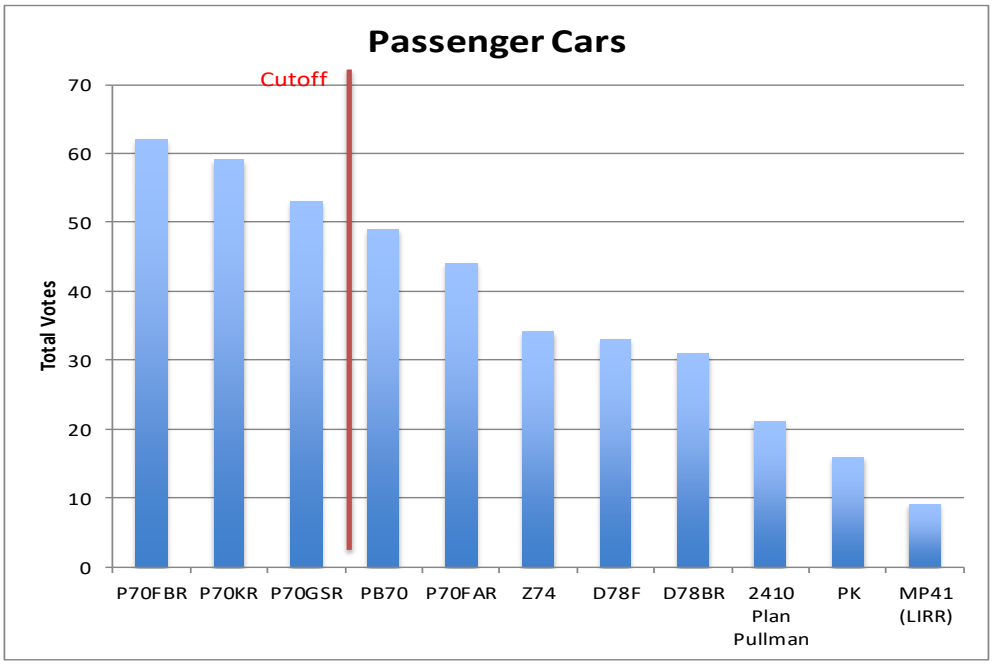

Hopper Cars
Total Votes
Cutoff
0
10
20
30
40
50
60
70
80
GLC/GLCA
GLA
H21/H21A/H21B/H21E
H35
H36
H37A-E
H22/H22A

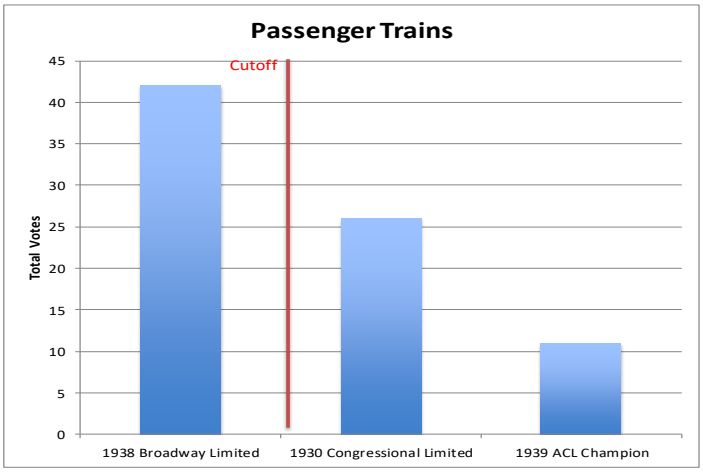

Boxcars
Total Votes
Cutoff
0
10
20
30
40
50
60
X23
X29
X31/X31A
X41A/X41B/X41C
X28A
X30
XL
X44
X25
X43
RD Refrigerator Car
X45
KD Stock Car

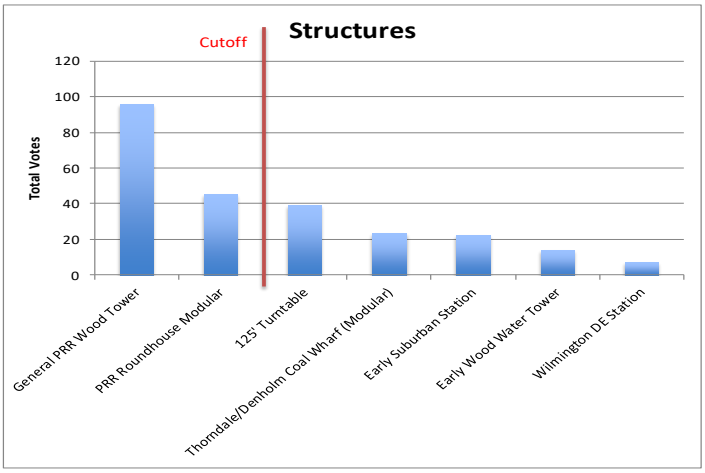

Flatcars
Total Votes
Cutoff
0
10
20
30
40
50
60
F30D
FM
F34
F30E

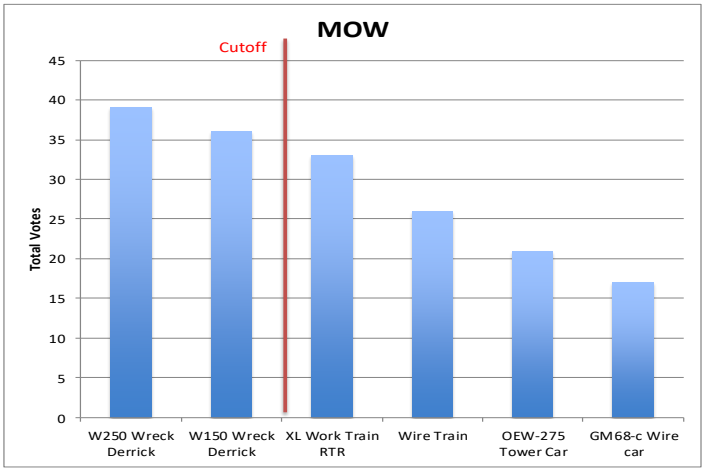

Cabin Cars
Total Votes
Cutoff
0
10
20
30
40
50
60
N5/N5a/N5b
ND
N6b
NC

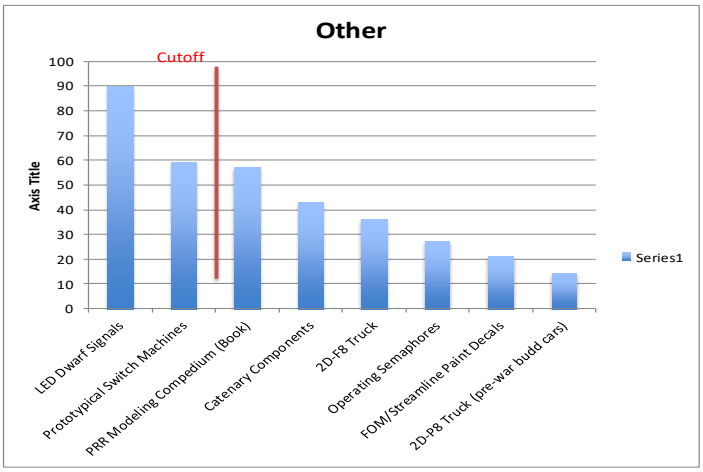

Head End Cars
Total Votes
Cutoff
0
10
20
30
40
50
60
BM70
B60
B70
B70A
B74A/B
M70


Passenger Cars
Cutoff
Total Votes
70
60
50
40
30
20
10
0
P70FBR
P70KR
P70GSR
PB70
P70FAR
Z74
D78F
D78BR
2410 Plan Pullman
PK
MP41 (LIRR)


Passenger Trains
Cutoff
Total Votes
45
40
35
30
25
20
15
10
5
0
1938 Broadway Limited
1930 Congressional Limited
1939 ACL Champion


Structures
Cutoff
Total Votes
120
100
80
60
40
20
0
General PRR Wood Tower
PRR Roundhouse Modular
125' Turntable
Thorndale/Denholm Coal Wharf (Modular)
Early Suburban Station
Early Wood Water Tower
Wilmington DE Station


MOW
Cutoff
Total Votes
45
40
35
30
25
20
15
10
5
0
W250 Wreck Derrick
W150 Wreck Derrick
XL Work Train RTR
Wire Train
OEW-275 Tower Car
GM68-c Wire car


Other
Cutoff
Axis Title
100
90
80
70
60
50
40
30
20
10
0
LED Dwarf Signals
Prototypical Switch Machines
PRR Modeling Compedium (Book)
Catenary Components
2D-F8 Truck
Operating Semaphores
FOM/Streamline Paint Decals
2D-P8 Truck (pre-war budd cars)
Series1