Documentation Package

For

HO-Scale Box Car PRR 135499

Submitted as part of the NMRA AP

Car Certificate Requirements

By

J. Joseph Brann

NMRA 101103

PRR 135499 Steel Box Car

I am pleased to present my Merit Award Double-Sheathed 50-ton capacity Steel Box Car for evaluation. This car is a PRR Class X29 car and an AAR Class XM car.

History: As I did on prior Merit Award cars I relied on the very extensive and detailed drawings in various Train Shed Cyclopedias. These drawing contain many critical dimensions. I used Train Shed Cyclopedia #3 (TS-3) for my steel box car. Page 115 of TS-3 had a half-page photo, as shown below, of a PRR 568689 steel box car. This photo became my photo reference for conformity purposes.

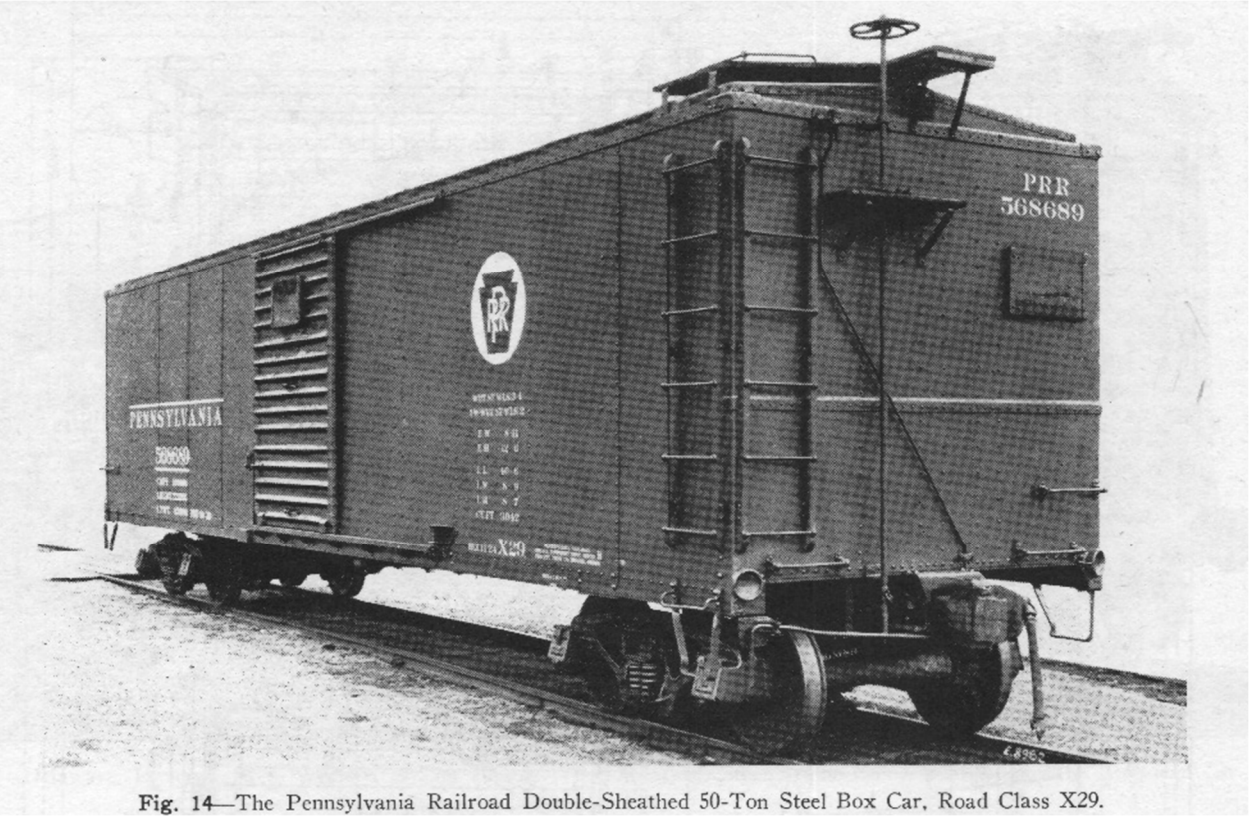


Fig. 14—The Pennsylvania Railroad Double-Sheathed 50-Ton Steel Box Car, Road Class X29.

Photo 1 PRR Steel box Car 568689

Plans: The plans for my steel box car include:

- Detailed drawings from Train Shed Cyclopedia #3 Pages 114 and 115. See Appendix pages 1 and 2.
- Cadrail drawings of most of the detailed parts for my steel box car. Included in the drawings are construction directions, part sizes, and material to be used. See Appendix pages 3 to 11

Notes:

1. Because of a critical shortage within the PRR system of steel box cars my car unfortunately missed its last maintenance /refurbishment shop visit. It has now been 27 months since

maintenance was last performed on my car and there are numerous places where my car needs urgent repair, realignment, refurbishment or rebuild work.

2. Pages 114 and 115 of TS-3 contain a plethora of excellent dimensions which I used extensively. However, there were numerous places where there were no dimensions at all, thus creating a quandary. My solution to this quandary was to measure with a dial caliper the dimension of a collection of dimensioned parts and then to create a "Scale Factor" and use this "Scale Factor" to determine the dimension of a non-dimensioned part. i.e.

   "Scale Factor" = measured dimension / stated dimension (this equation creates an inverse scale factor).

   To my surprise the "Scale Factor" on pages 114 and 115 were not the same. The inverse "Scale Factor" for dimensions from page 114 was 0.0172, and from page 115 0.021.

3. I presumed the panels on the prototype steel box car were secured to each other and to the supporting frame with rivets. Having sworn off ever installing individual rivets again, I chose to use MicroMark rivet decals which in general provided a very uniform appearance. I am not a rivet-counter, so I do not have any idea how may rivets are on my car.

4. While making measurements for my prior scratch-built cattle car it was brought to my attention that high level professional technical drafting such as for Model Railroader magazine etc. allows for "shadows" in the drawing. These shadows on TS-3 page 115 caused some uncertainty in the exactness of the measurements I was taking.

Conformity:

I used a set of Cadrail drawings to construct a steel box car that very highly confirms to the dimensions on TS-3 pages 114 and 115. See Appendix pages 3 -11 for a complete set of Cadrail drawings. On several large parts I created drawings in the stated dimensions I found on TS-3 pages 114 and 115. I then created HO scale drawings by scaling the full-size drawing by a factor of 0.0115 (ie.1/87). Cadrail permits dimensions to be expressed in 3 or 6 decimal places, or fractions. I chose fractions for my drawings which meant that the dimensions were expressed in 1/32" increments. That is pretty accurate !!

Construction:

My main construction materials were Evergreen Strip Styrene, Northeastern Scale Lumber (NSL), Plastruct Angle, and Evergreen Sheet Styrene. My main glues were Aleen's Tacky Glue, Methyl Ethel Ketone, and Gorilla brand CA. I began by building the sides of the steel box car. The Cadrail drawings, on Appendix page 4 -7, were my guides in developing the sides, ends and doors of my steel box car. The two doors on my steel box car are Youngstown style doors which presented a slight challenge.

I used pieces of 1 x 2 Evergreen Strip Styrene to represent the overlap ribs of one steel panel with the adjacent one as I constructed the side panels. Photo 2 shows one of the side panels including the

Youngstown door, door stops, door latch, and the door supporting mechanism for the top and bottom of the door. Also included are the rivet decals.

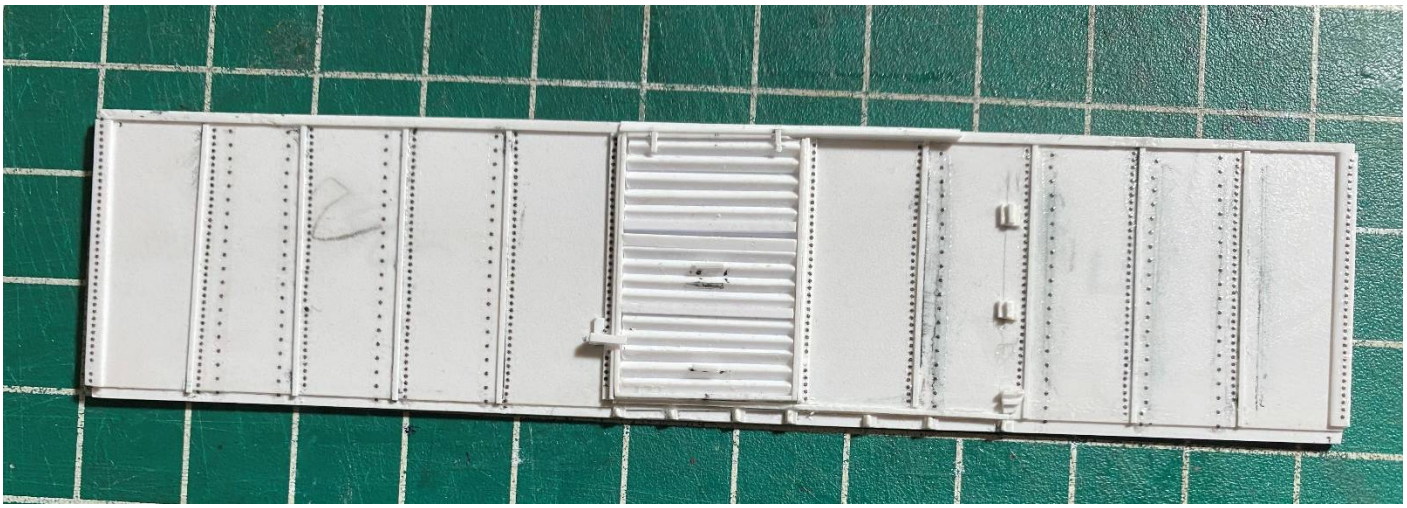


Photo 2 Side section

I continued in the same manner to construct the other side section and the 2 end sections. I then assembled the 4 sections as shown in Photo 3 below. The side sections overlap the end sections. I added 3 pieces of 0.030” sheet styrene as stiffeners to the inside walls. Photo 3 also shows the two end gable supports and the three internal roof supports as well as the ladders on the car.

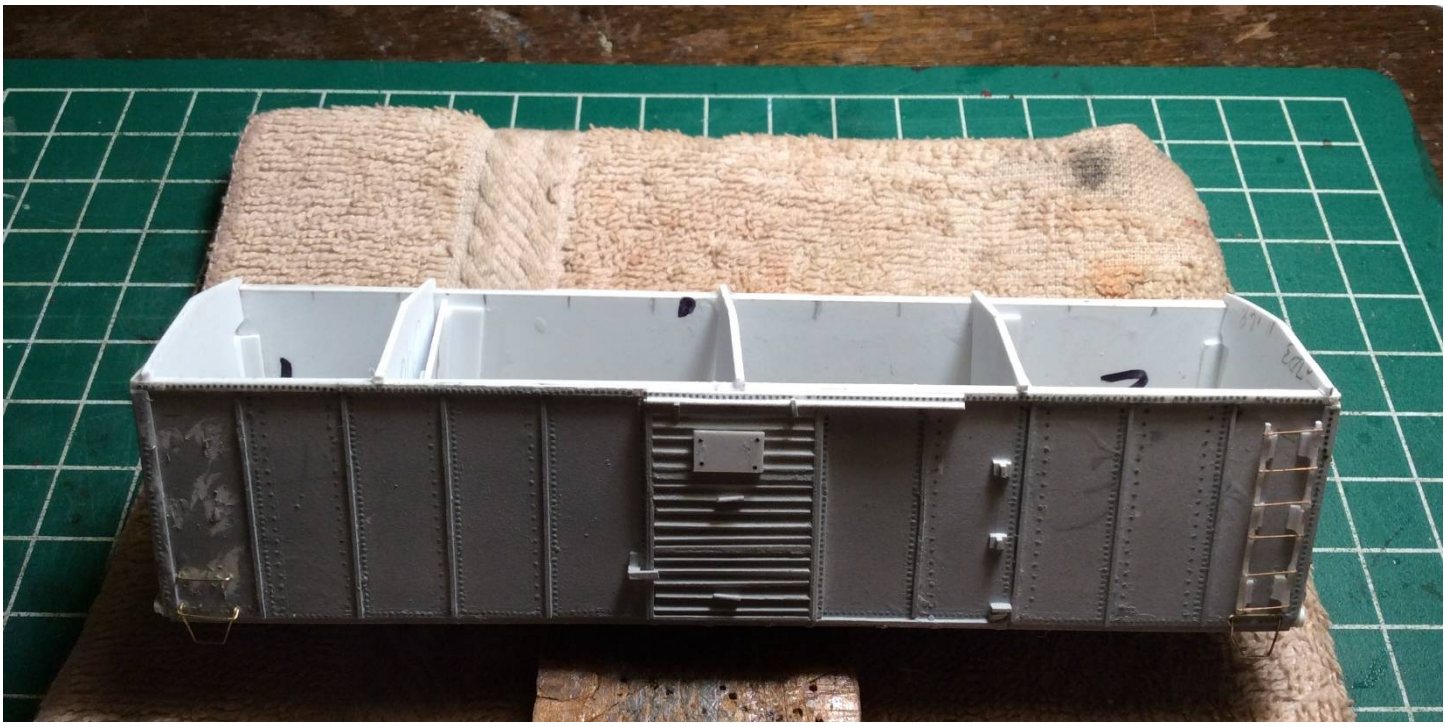


Photo 3 Assembled side and end sections with roof supports and ladders.

Photo 4 shows the jig I used for construction of the 4 ladders for my steel box car. Appendix page 8 shows the dimensional details for the 4 ladders.

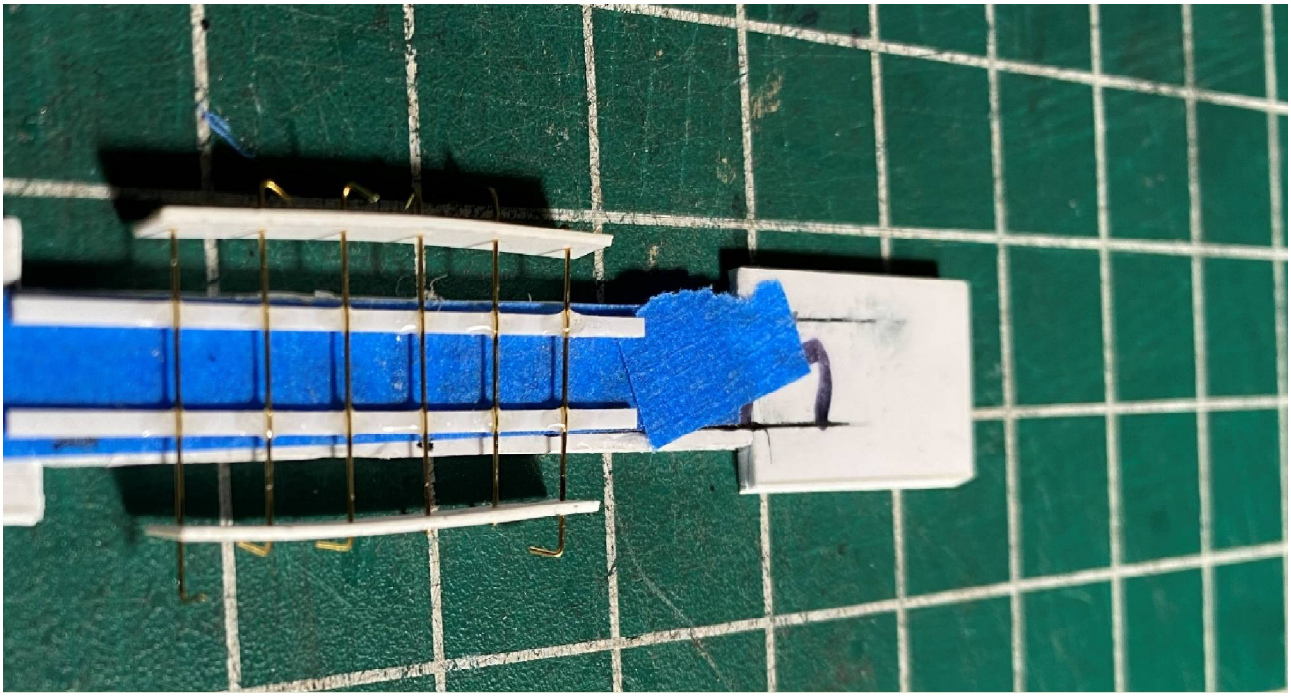


Photo 4 Jig used to construct the 4 ladders

Per TS-3 drawings the ladders are mounted on angle shaped brackets. I represented these brackets with pieces of Plastruct 3/64” angle. I then installed the ladders on the sides and ends of my steel box car.

Polling pockets, tack boards, and brake platform were the next items constructed and installed on my steel box car. See Appendix page 9.

Underside construction proved to be a little challenging, but also interesting. First as noted on TS-3 page 115, Appendix page 2, the two center beams are I-beams with the top inner flange of each I-beam removed. See Photo 5.

Photo 5 Center Sill I-beams with inner top flange of each I-beam removed

The prototype I-beams are mounted on a piece of 0.25” x 20” steel plate which is attached to the underside of the floor boards. I simulated the steel plate with a piece of 0.010” Evergreen Sheet Styrene. I used Tichy Train Group #8018 rivets to simulate the working end of the carriage bolts which were used to secure the steel plate and two center sills to the car floor. See Photo 6 below.

The design and construction notes for the truck bolsters and the cross bearers (i.e. cross member) are shown in the Appendix on pages 10 and 11. The ends of the bolsters and cross bearers are designed and constructed to fit inside the c-channel side sills. The diagonal slope on the cross bearers was hand sanded to get the correct slope.

The bolsters and cross members each had a piece of Plastruct 3/64” angle attached to each side to secure the cross bearers and bolsters to the car floor. Four pieces of Evergreen Strip Styrene 0.100” H channel were installed as the center sill internal cross members. See Photo 6.

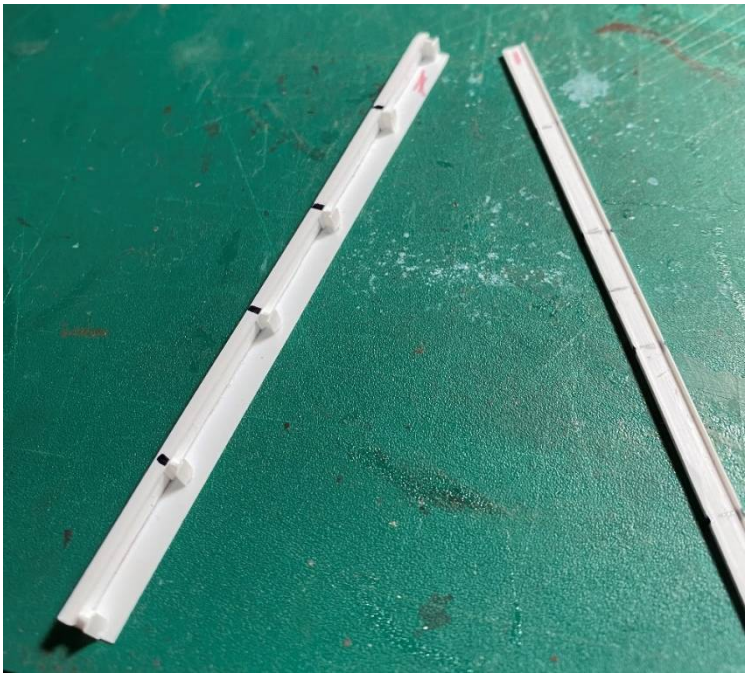


Photo 6 Center Sills with H-channel cross members

A photo of the completed underframe before it was primed, painted, and attached to my steel box car is shown in Photo 7. The AB brake system components needed to have support pieces installed and these are shown in Photo 7 also.

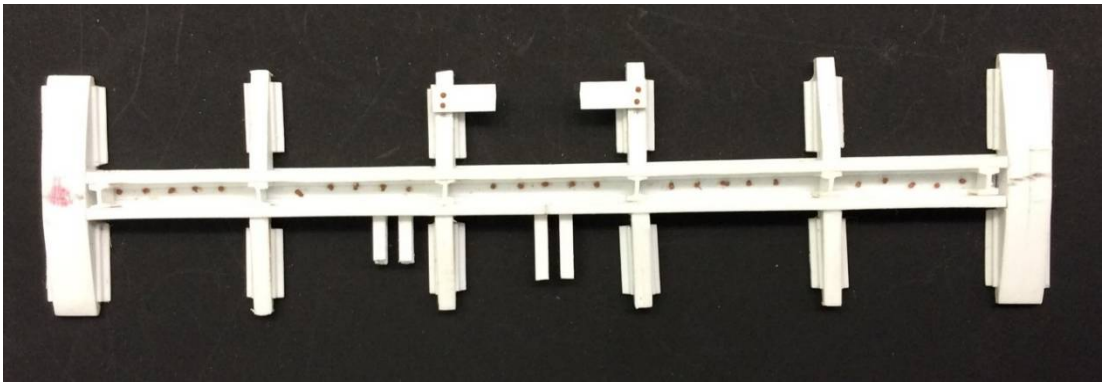


Photo 7 Underframe and AB brake system support pieces, note rivets on steel plate and on the air reservoir mounting supports

The brake system is a Cal-Scale AB Brake System, which was the post 1933 standard. I used Detail Associates 0.019" brass wire for the main air line which extends from one end of the car to the other. All other lines or metal rods, i.e. the brake shaft connections, are Detail Associates 0.012" brass wire. Couplings were installed where the main air line bends.

On my prior cars I was not satisfied how the main air lines, the line up to the air retained valve, brake lines etc. crossed the cross members and bolsters. It came to my attention that the bolsters and cross bearers of my steel box car did not, by design, come even with the top of the side sills when viewed from the bottom of the car. To correct this I cut V-shaped notches in the bolsters and cross bearers where the air lines and brake lines etc. crossed. After I had installed all the air lines and brake lines in their respective notches, I covered each cross bearer with a piece of 0.01" x 0.08" Evergreen Strip Styrene, which left a very credible appearance. The completed and primed underframe and AB Brake System prior to installation is shown in Photo 8. After installation of the underframe to the car floor pieces of Evergreen Strip Styrene 0.060" H-column were installed diagonally from the corners of the underside of the car to the nearest bolster to complete all the structural parts of the underframe.

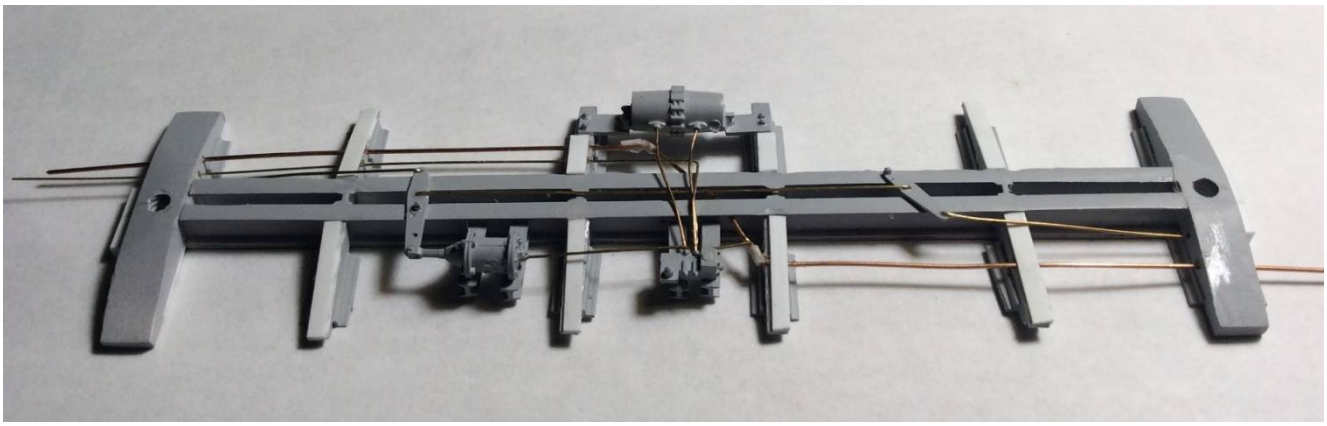


Photo 8 Completed underframe and AB Brake System

The floor of my steel box car sits on top of the two side sills. I used mixtures of black and brown India ink each mixture mixed with 1 ounce of alcohol to create the stains for the floor boards which are shown under construction in Photo 9.

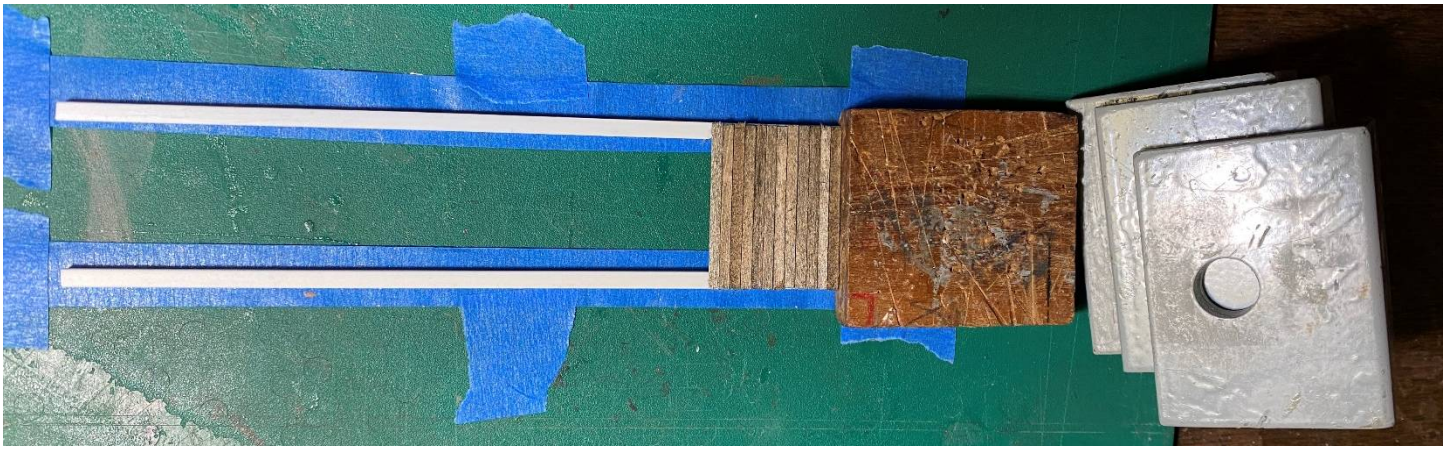


Photo 9 Wooden car floor under construction.

The last major piece of construction was the roof. The underside of the roof is supported by a set of carlines. (Carlines are the ribs that run from one side of the car to the other and serve to support the roof.) Carlines are frequently made from metal pressed in various shapes. I made my 20 carlines by MEK-ing two pieces of 0.060" angle together each about 0.5" long.

TS-3 page 114 shows that the roof is of the raised steel panel style. I used a piece of 0.030" sheet styrene to make each roof panel. Rivet decals were then placed where the edges of the raised panel roof sections would be.

The two roof hand grips on the roof platform leading up to the walkway were formed from 0.012" brass wire. As a change from my prior car the support legs for the hand grips were made from Tichy 3037 eyebolts instead of .012" brass wire. This change eliminated the need to solder the hand grips to the support legs. (I kinda like the change.)

The two roof panels were then CA-ed in place. Twenty walkway supports were then made from NSL 2" x 4" lumber each 1/8" long. After staining and installing the roof boards these stained support blocks were sanded flat before the running boards were installed. The walkway boards on the peak of the roof were made from pieces of stained NSL 1" x 6" lumber with gaps. Then a piece of Evergreen Strip Styrene 2" x 8" was CA-ed on the top of each car side just under the roof edge as the fascia to close off the opening created by the carlines. Finishing touches on the ends of the running boards which extend beyond the car end panels include 1) a crosswise board on the underside of the running boards to stiffen the ends, and 2) diagonal structural pieces to support the overhanging part of the running boards.

Details

A short list of the many details incorporated in my PRR 135499 Steel box Car is listed below, it is not meant to be a scavenger's hunt for the AP judges.

1. Gunk / dirt etc. on both faces of all eight wheels

2. Full AB Brake System
3. Brake system air retaining valve located adjacent to brake platform.
4. Underframe painted with Scalecoat Box Car Red #3
5. Underside and body of the steel box car weathered with Bragdon Dust Bowl Brown, Dark Rust, Grimmy Black and Soot weathering powders.
6. 37.83-degree elbow connectors installed on main brake line.
7. Grandt Line nut and bolt castings used to secure the brake levers to the mounting blocks.
8. COTS stencil located on the brake system air reservoir denoting the date and the railroad name where the last brake system Cleaning, Oiling, Testing and Stenciling (COTS) was performed.
9. Poling pocket on each corner
10. Mounting angle pieces attached to each side of both bolsters and all the cross members
11. Hand rails on corner of roof
12. Air hose at ends of car painted with Grimmy Black paint and the tip was painted with Pewter Gray
13. Grab irons and stirrups made from 0.012" brass wire
14. Main air line made from 0.019" brass wire
15. Corner reinforcements installed on each corner of the roof.
16. Rust along rivet lines

Finish and Lettering

The wheels were painted with Model Flex Shipyard Rust twice. While the paint was still wet on the second pass the same paint brush that was used to apply the Shipyard Rust paint was used to dab on Bragdon Soot weathering powder to create the textured appearance of dirt buildup on both sides the wheels.

The sides, ends and under frame were painted with Scalecoat Box car Red #3 paint.

The trucks were painted with Americana Raw Umber.

The roof was painted with Tamiya Matte Black. I then applied Bragdon Ash weathering powder to represent the bleaching of the black roof caused by the sun. Remember earlier in this tome I mentioned that maintenance on my steel box car is long overdue.

Bradgon Weathering Powders were used for highlighting and weathering all parts of the PRR 135499 Steel box Car. The powders used were Soot, Weathered Brown, Grimmy Black, Dust Bowl Brown and Dark Rust.

Testors Dullcote was used to seal the decals, and after various applications of the paints and/or weathering powders.

I could not find decals which contained the number 368689 as shown in Photo 1 above, but I did find a set of Champ Decals for PRR Steel Box Car 135499.

Various mixtures of Black and Brown ink mixed with one ounce of alcohol were used as stains on the floor boards and the roof walkway.

Scratch built

A detailed EXCEL spreadsheet, see Appendix pages 12-15, lists all of the 576 scratch built and 4 non-scratch-built parts used in the construction of my PRR 128265 Steel box Car. By broad category the part counts are as follows:

Category		Scratch built part count		Commercial part count
Northeastern Scale Lumber		107		
Evergreen Strip Styrene		248		
Detail Associates Brass Wire		32		
Evergreen Sheet Styrene		42		
Tichy Train Group		40		
Plastruct		108		
Non-excluded				5
Totals		577		5

The result shows that my PRR 135499 Steel box Car contains 99.14% scratch-built parts, which slightly exceeds the minimum acceptable percentage. It is understood that the following commercial pieces / components are exempt from the scratch-built parts count.

1. Trucks and wheels with axels
2. Couplers
3. Screws to attach the above two items
4. AB Brake System
5. Paint
6. Decals

Appendix

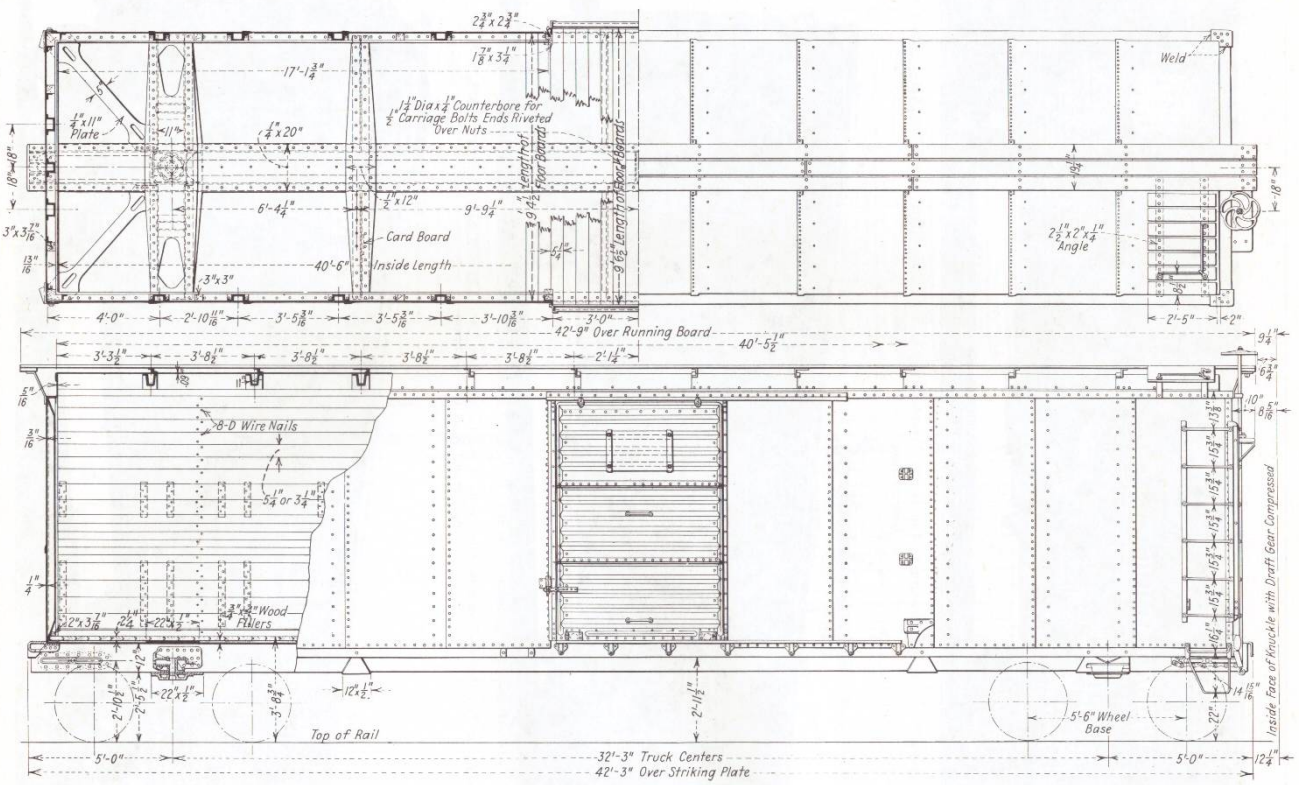


Fig. 13—Plan and Elevation of The Pennsylvania Railroad Double-Sheathed Steel Box Car—Steel Frame and Sheathing with Wood Lining—of 50-Tons Capacity. Road Class X29.
(*See also Figs.* 14 *and* 15)

Fig. 14—The Pennsylvania Railroad Double-Sheathed 50-Ton Steel Box Car, Road Class X29.

Capacity	100,000 lb.-3,056 cu. ft.	Axle journals	5½ in. x 10 in.
Load limit	123,000 lb.	Truck centers	32 ft. 3 in.
Light weight	46,000 lb.	Length over striking faces	42 ft. 3 in.
Length inside	40 ft. 6 in.	Width at eaves	9 ft. 5⅝ in.
Width inside	8 ft. 9⅛ in.	Height at eaves	12 ft. 1⅞ in.
Height inside	8 ft. 7⅜ in.	Height to top of floor	3 ft. 8¼ in.

(See also Figs. 13-15)

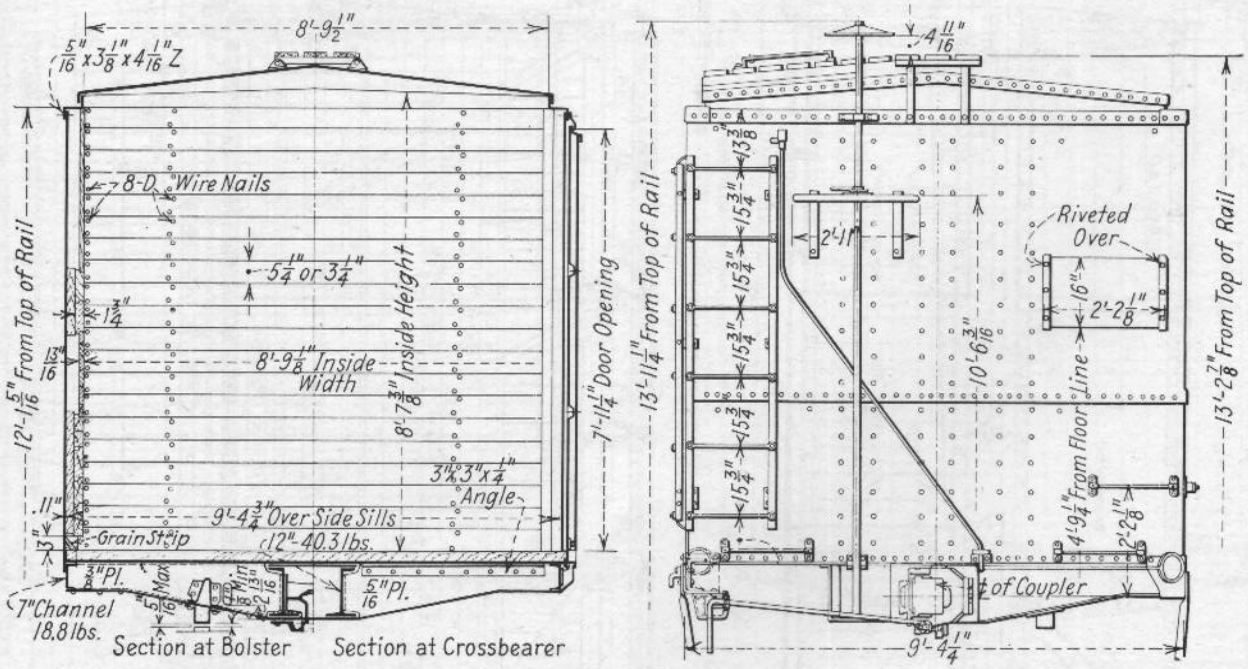


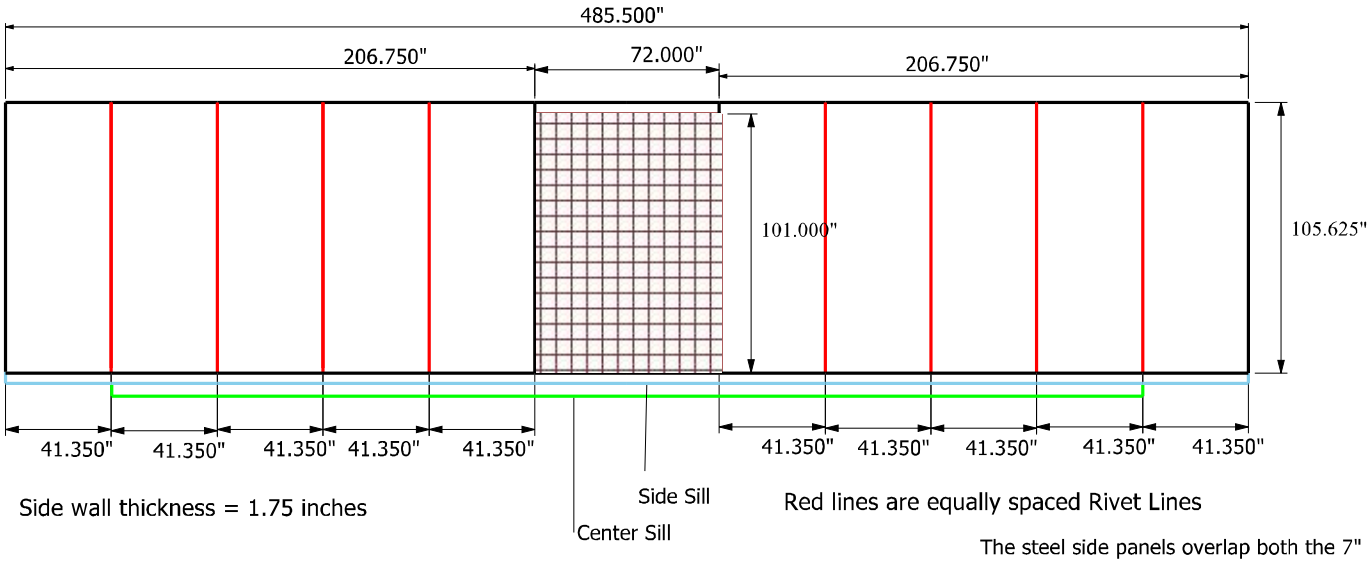
Fig. 15—Cross Section and End of The Pennsylvania Railroad Double-Sheathed Steel Box Car of 50-Tons Capacity.

(See also Fig. 13)

Full size drawing of PRR Box Car 568689.

All dimensions are expressed in prototype inches.

Side Panel View

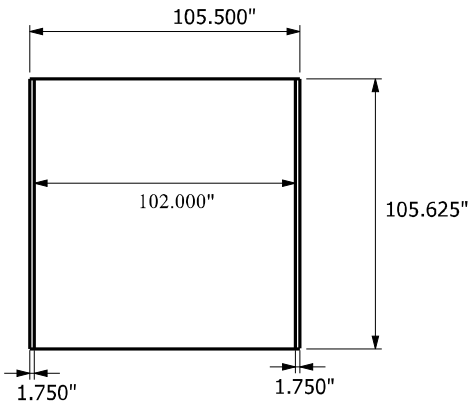


Side wall thickness = 1.75 inches

Red lines are equally spaced Rivet Lines

The steel side panels overlap both the 7" side sills and 12" center sill by 3".

End Panel View

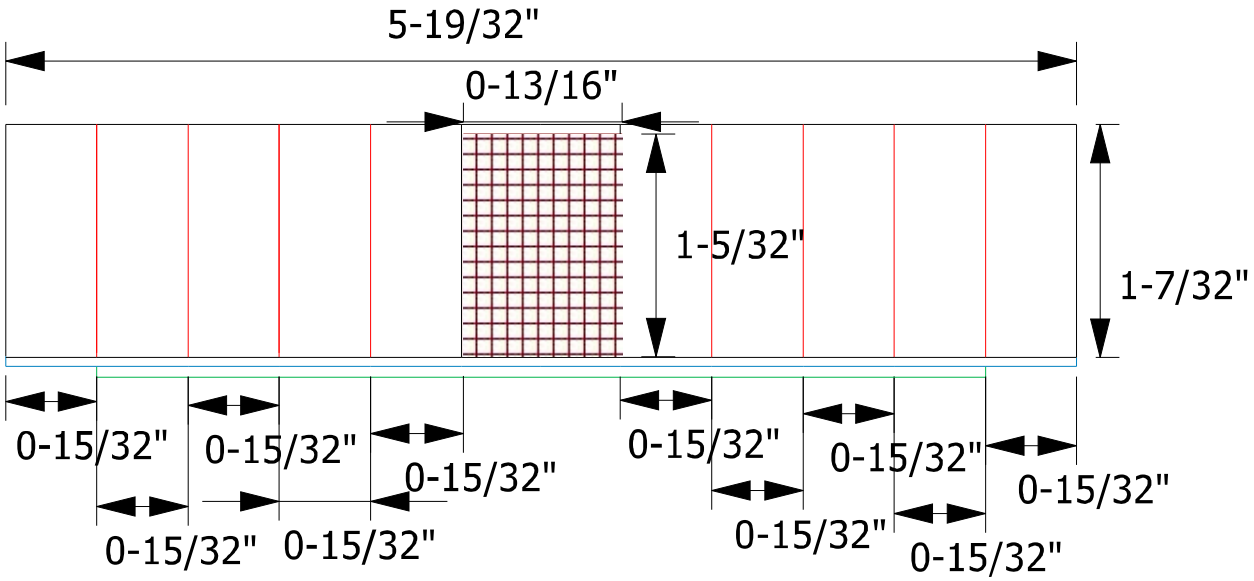


Side walls overlap the end walls

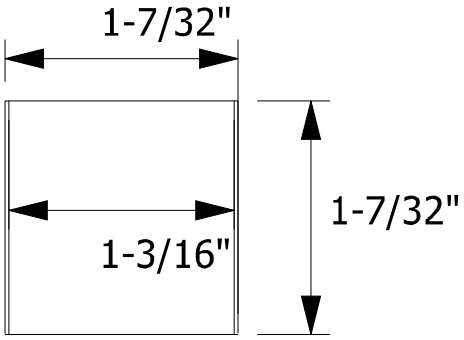
HO-Scale drawing as scaled by a factor of 1/87
from full size drawing of PRR box car 568689

All dimensions are expressed in 1/32-nd of an inch

Side Panel View



End Panel View

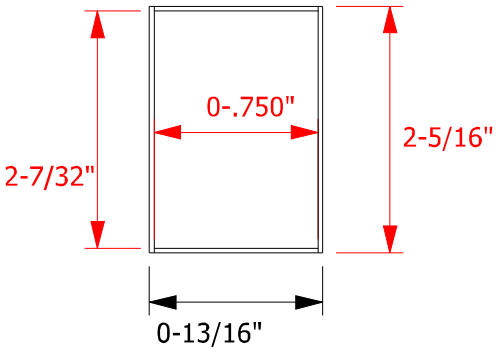


Assembly Notes and Dimensions

PRR 135499 Box Car Youngstown Door

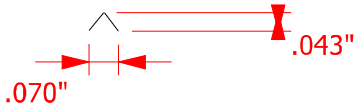
Box Car Door

(Image 2X)



End view of Plastruct PN 90501 3/64" angle

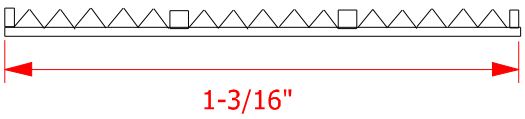
(Image 4x)



1. Install pieces of Evergreen 2"x4" Strip Styrene along edges of door. Glue on 2" side
2. Cut 15 pieces of Plastruct 90501 3/64" angle each 0-75" long
3. Cut 2 pieces of Evergreen 4"x4" strip styrene each 0-75" long
4. Glue 5 pieces of 3/64" angle between 2"x4" side edges starting at the top of the door
5. Glue one piece of 4"x4" below last piece of 3/64" angle
6. Repeat Step 4
7. Repeat Step 5
8. Repeat step 4

View of vertical center line of door

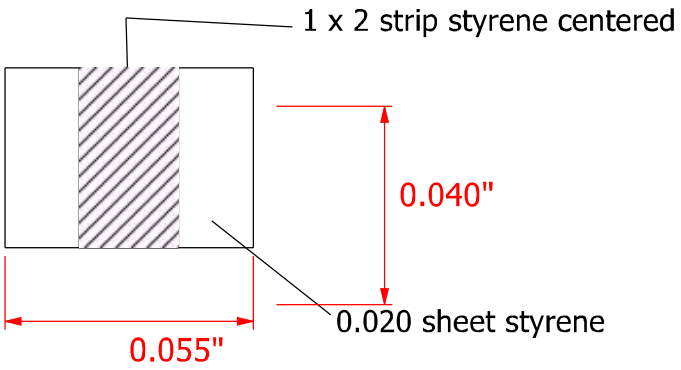
(Image 4x)



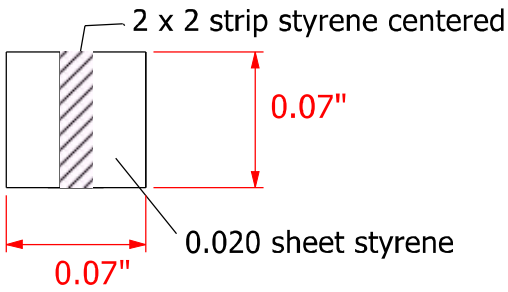
Door Stuff

Drawings not to size,
dimensions are correct

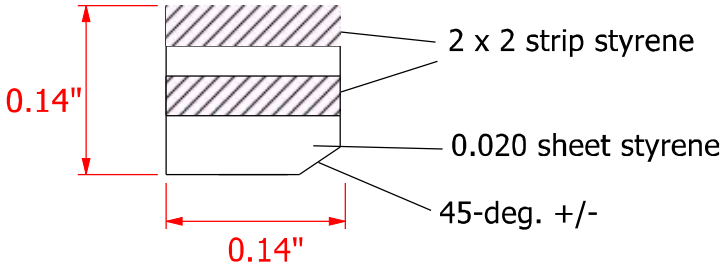
Door Rail Support (make 7)



Door Stop (Upper, Make 2)

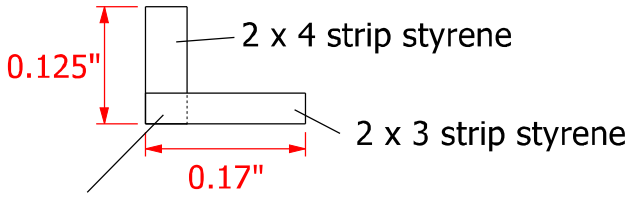


Door Stop (Lower, Make 1)



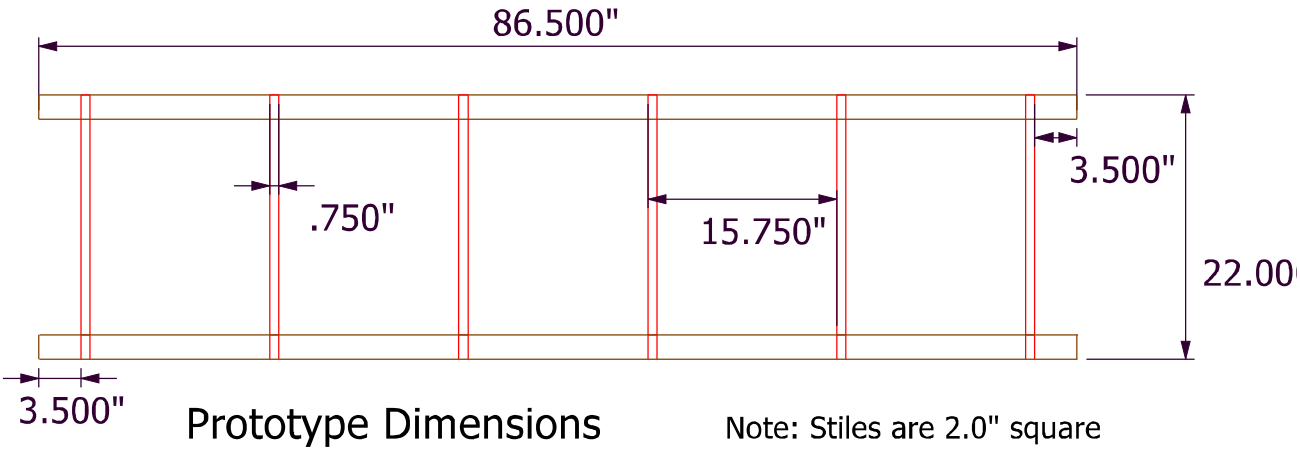
Door Stuff (Cont.)

Door Latch



Two pieces of 2x3 strip styrene stacked under latch arm in order to raise arm up to clear door frame

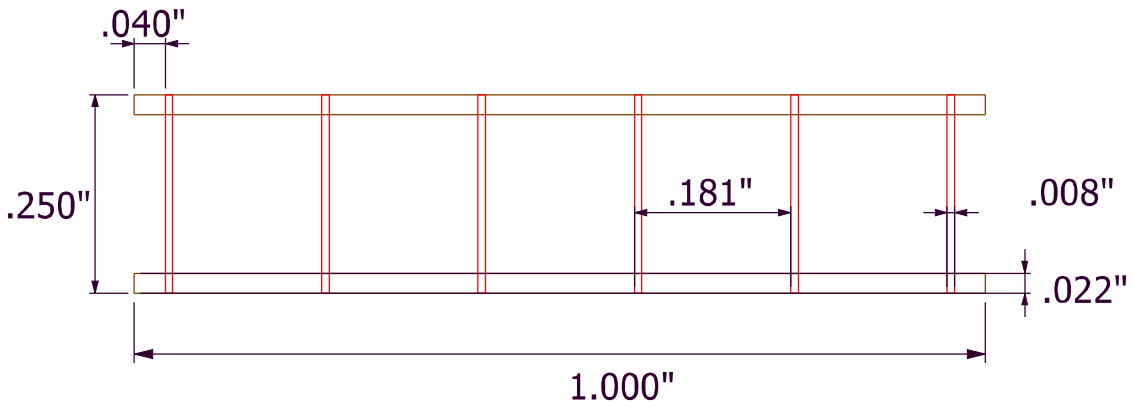
Ladder - sides and ends 4 total



Prototype Dimensions

Note: Stiles are 2.0" square

HO-scale, and build to dimensions (not to scale)



Stiles - Use Evergreen Styrene strips 2" x 2" #8202 (.022" x .022")

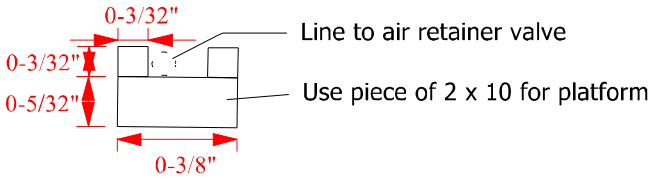
Rung - Use Tichy Train Group 0.008" phorporus bronze wire

Use small dad of Gorilla Super Glue (CA) to secure rung to stile
Consider putting small slot in exch stile and glue rung into this slot

Miscellaneous Parts for Steel Box Car 135499

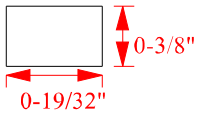
Brake Wheel Platform

(Image 2x, dimensions are accurate)



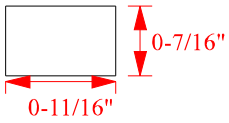
Tack Boards

B-end



Tack board base is piece of 0.020" sheet styrene covered wth 1"x6" scale lumber

Doors (make 2)

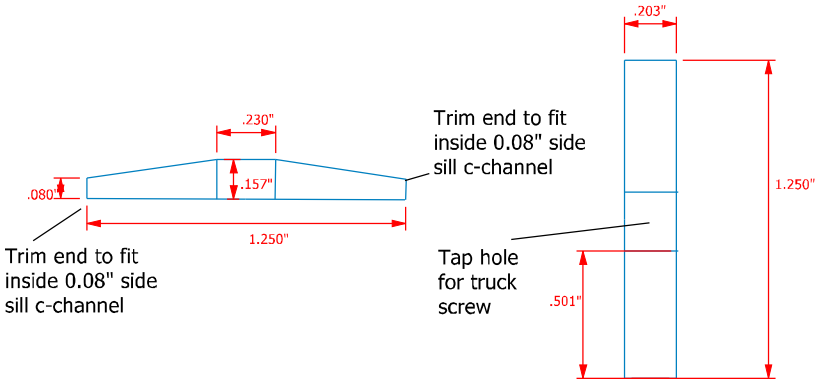


Underframe for PRR 135499 Steel Box Car.

Dimensions are from annotated Trainshed Cyclopedia #3 drawings on pages 114 and 115, or from measurements made with dial caliper and scaled from page specific scale factors.

Bolster (Image 1.5 X)

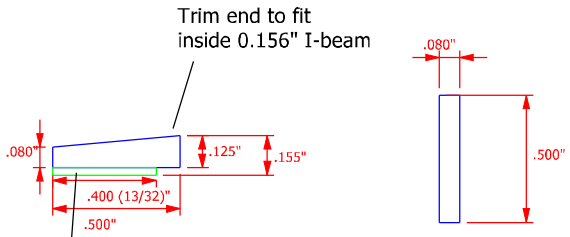
(Make 2)



Glue two pieces of 0.100" x 0.156" Evergreen Styrene to make each Bolster and shape to diagram above.

Cross Bearer (Image 1.5 x)

(Make 8)



Glue two pieces of 0.04" x 0.125" Evergreen Styrene to make each Cross Bearer and shape to diagram above.

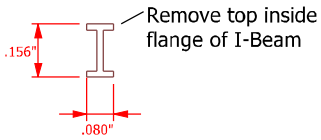
Attach 0.03" x 0.08" x 13/32" shoe under Cross Bearer to create notch so that the bottom edge of the Cross bearer fits perfectly over the metal plate and the bottom flange of the Center Sill I-Beam

Underframe for PRR 135499 Steel Box Car. (Cont.)

Center Sill (Image 2 x)

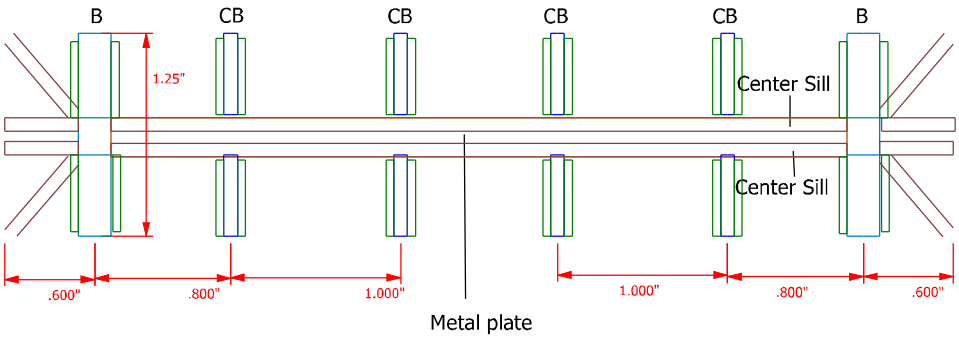
(Make 2)

Evergreen Styrene 262 5/16" I-Beam



Underframe Structural Assembly Drawing and Instructions

B - Bolster
CB - Cross bearer



Install Plastruct 3/64" angle ▭ on each flat edge of Bolster and Cross bearer as the means to attach Bolster and Cross bearer to car floor

Mount the two Center Sill pieces on the 1/4" thick by 20" wide Metal plate that goes between Bolsters

Install diagonal pieces of Center Sill I-Beam material in the 4 corners of the underframe after installing underframe to under side of the floor.

PRR 135499

Manufacturer	Part #	Part Name	Scratch built Part Count	Commercial Non-exempt Part Count	Purpose / use
Northeastern Scale Lumber	3012	2 x 4	13		Roof walkway supports
	3004	1" x 6"	12		Roof walkway
			12		Roof platform
			6		Tack bvoard boards
	3014	2 x 8	6		Floor boards
	3013	2 x 6	58		Floor boards
Evergreen Strip Styrene	8106	1 x 6	1		Fill in gap
	8208	2 x 8	2		Lower door stops
			12		Center sill spacers
	8203	2 x 3	8		Part of door latch
	291	.060" Angle	40		Roof car lines
			1		Upper brake shaft support
	8104	1 x 4	1		Gap below door
			1		Fill in gap
	8404	4 x 4	4		Door part
	8102	1 x 2	1		Gap below door
			14		Support for bottom rail
			16		Vertical ribs
	8202	2 x 2	2		Rail at bottom of door
			4		Upper 2 door stops
			2		Brake platform vertical standoff
			2		Lower door stops
			2		Diagonal platform supports
			4		Roof platform supports
	8210	2 x 10	1		Brake platform
	8204	2 x 4	8		Door edges
			2		Header across top of side
			4		Hanger at top of door
			2		Part of door latch
			2		Header across top of end
			2		Piece across mid of end
			4		End ladder stiles (SB 2 x 2)
	104	.010 x .080	8		Caps on Cross Bearers

	177	.100 x .156	4		Bolster Pieces
	132	.03 x .04	2		End extender
	8108	1 x 8	4		Roof corner trim

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Manufacturer	Part #	Part Name	Scratch built Part Count	Commercial Non-exempt Part Count	Purpose / use
	8202	2 x 2	8		Ladder Stiles
	121	.02" x .03"	2		End extender
	122	.02 x .04	2		Fascia
			4		Gable trim
	146	.04 x .125	16		Cross Bearer Pieces
	142	.04x.04	8		Fascia support blocks
	134	.03 x .08	8		Shoe Under Cross Bearers
	164	.08" x .08"	2		Spacers between bolster and coupler
	211	.040 rod	2		Main air hose coupling
	218	.02 rod	4		Door handle
	281	0.06 H-column	4		Brake Cylinder and AB Valve Supports
			4		Diagonals in corner of underframe
	223	3/32" tube	4		Poling Pockets
	275	.156 I-Beam	2		Center Sills
	282	.080" H-column	4		Center sill spacers
	294	1/8" angle	4		Corner pieces
			4		Corner inside reinforcement
	296	3/16" angle	4		Internal cross brace supports
	264	.125" C-channel	2		Glue block on end of center sill
Evergreen Styrene	262	.08" C-Channel	2		Side Sills
	9030	.03" thick sheet	2		Car sides
			2		Car ends
			2		Internal cross supports
			2		Internal cross braces
	9020	.02" thick sheet	2		Door base
			14		Support for bottom rail
			4		Upper door stops
	9010	.01" sheet	4		Steel side panels
			1		Center sill base plate
			2		Bolster shim

	9040	.04" sheet	2		Gable ends
			3		Internal roof trusses

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Manufacturer	Part #	Part Name	Scratch built Part Count	Commercial Non-exempt Part Count	Purpose / use
Detail Associates	2506	0.019" brass wire	1		Main air line
	2504	0.012" brass wire	12		End ladder rungs (SB .008")
			4		Stirrups
			12		Grab irons
			1		Brake shaft
			2		Coupler release lever
Tichy Tain Group					
	1100	.008 Phosphor Bronze	24		Ladder Rungs
	3037	Eyebolt	6		Roof platform railing supports
			4		Coupler release lever supports
	8142	Nut, Bolt, Washer	2		Attach brake lever to center sill
			4		Reservoir mounting to center beam
Plastruct	90501	3/64" Angle	30		Door part
			2		Rail for top of door
			4		Rib on both sides of door
			36		Ladder standoffs
			12		End ladder standofffs
			16		Bracket to attach cross bearer to floor
			8		Bracket to attach bolster to car floor
A-Line Chain	29219	40-link per inch		2	Brakeshaft
Kadee	276	Air hose		2	End of car air hose
Cal Scale		AB Brake Set		1	Reservoir, AB Control Valve, Brake cylinder, etc.
			---	---	
			577	5	
		Percentage	99.14%	0.86%	
Northeastern Scale Lumber pieces		107			
Evergreen Strip Styrene pieces		248			

Evergreen Styrene	42
Detail Associates Brass Wire pieces	32
Tichy Train Group pieces	40
Plastruct	108
Miscellaneous	5

	582