MasterClass
Mini - Coach Class 2006

Build a Classic
Carter Brothers Passenger Coach & Combine
Another Adventure in 1:20.3

Project Coordinated By
David Fletcher
With
Craig Hoefer, Ross Buchanan, Kevin Strong, Rick Raively, Doug Bronson & Harald Brosch

Hosted By

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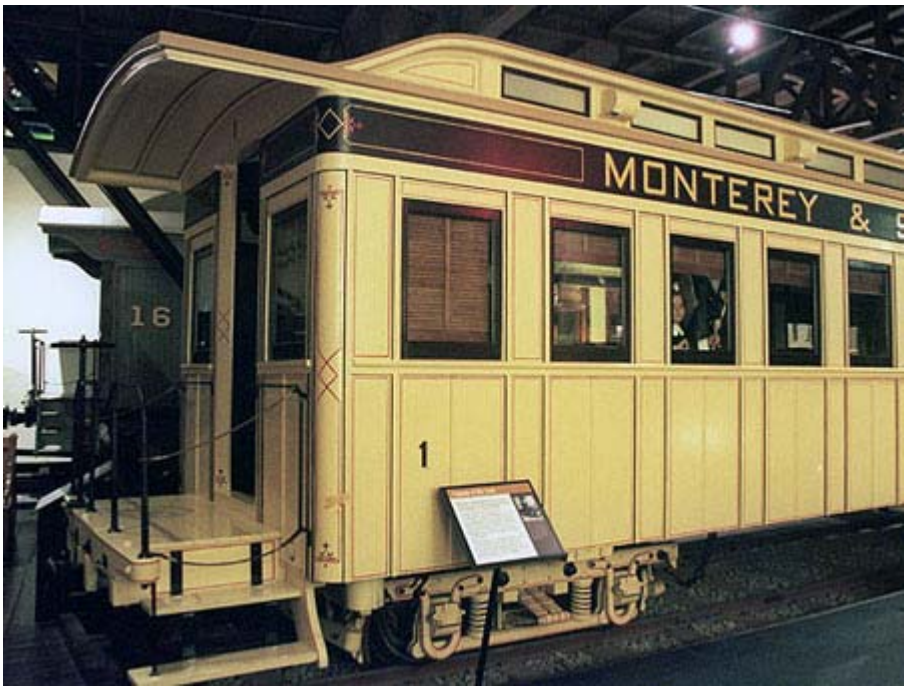
Mini - Coach-Class 2006



A Classic Carter Bros Coach & Combine

Chapter 1

A little about Carter Bros.

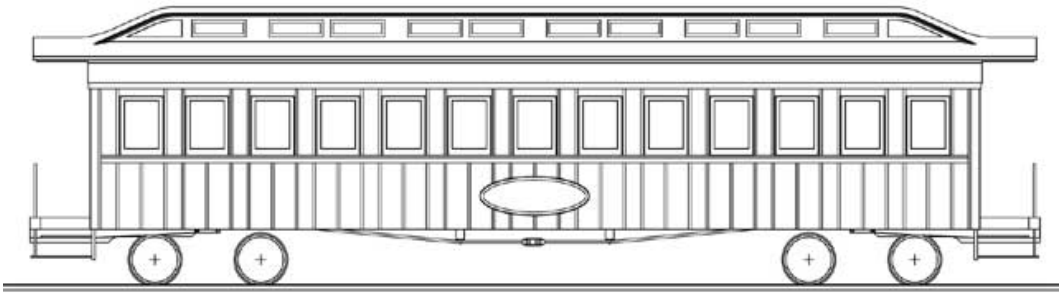
I need to begin by stating that none of this would have begun without the terrific reference material provided to us by Bruce Macgregor, especially his most recent book, "The Birth of Californian Narrow Gauge". In addition we are especially thankful to Michael Collins for his superb drawing set of the M&SV Combine in 'as built' style, also provided in Bruce's book. These were the drawings from which this model was based.

Chaps, we're starting a new project. While most of our projects have been about early US locomotives, there has been something missing from our rosters and I felt it was about time we fixed the problem. Having learned a great deal during the CP Huntington Miniclass about the possibilities of laser cutting, with the very professional and superior laser work by Rick Raively, I realised that the very thing I had wanted for so long was finally within our grasp. I'll be right up frank about it. I firmly believe the building of a Passenger car is about the hardest model anyone can undertake. There are issues of size, keeping very large parts straight, plumb and in line, issues of tough cutting, to cut ALL THOSE WINDOWS, and then there is ... THE ROOF. Why were US passenger cars so complicated? Building a model locomotive is child's play compared to the US passenger car! With laser cutting, everything changes and the impossible becomes just a matter of 'when will I assemble it?' For me, the cars I've loved the most are the 1870s duckbill-roof styled cars. There is something so graceful and elegant about this style. Additionally, these cars would see upgrades over the years, with the basic design sometimes remaining in service through to the 1920s and 30s. The designs would move from the smooth sided 'board & batten' design to the more modern 'matchboard' or planked sided cars. Our class will enable the construction of both types.

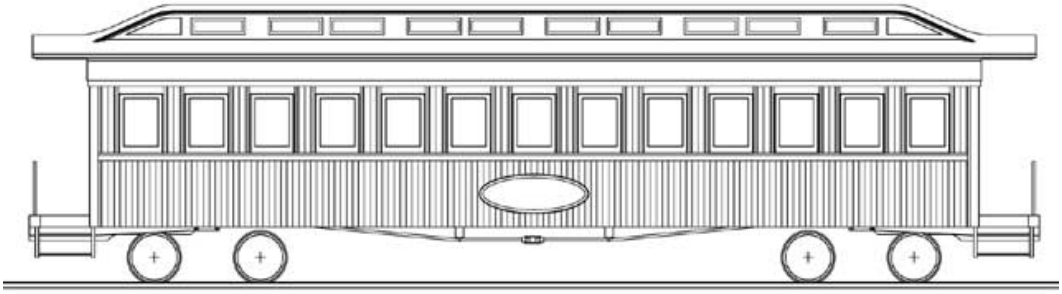
While there were many respected car manufacturers from the east during the 1870s, and possible car prototypes could have come from Eastern roads, Colorado or even the south, the cars that I liked the most came from the fledgling builder in the west: Carter Bros of California. I'm no expert on cars per se, but with good drawings and documentation, this is not a problem, and with the assistance of people knowledgeable about the prototype, we can put together a very nice set of cars appropriate for narrow gauge operations from the mid-1870s through to the 1930s.

Specifically, the cars we're modeling are based on the Monterey & Salinas Valley Combine, one of the earliest cars to come from Carters in 1874. As you will learn, there were design and detail errors in these early cars that Carters would later rectify in designs that followed, but despite that, the visual style of the Carters car remains reasonably consistent. The car body runs at 36' to the body ends, and is a little over 40' to the end beams. The prototype today resides in beautifully restored condition, at the California State Railroad Museum, Sacramento. In late December 2005, I was able to visit the car, take a lot of photos and examine it, bringing this project one step closer to reality.

The prototype is specifically the car shown above, but this car would undergo changes through it's life, and full passenger car versions, of similar styling and length would also be built by Carters. For this class we'll be running 4 basic car types as shown below, as well as an SPC 'Caboose' version, which is the standard combine but with the Baggage Door moved to a central position in the Baggage area. Here are the two coach versions:

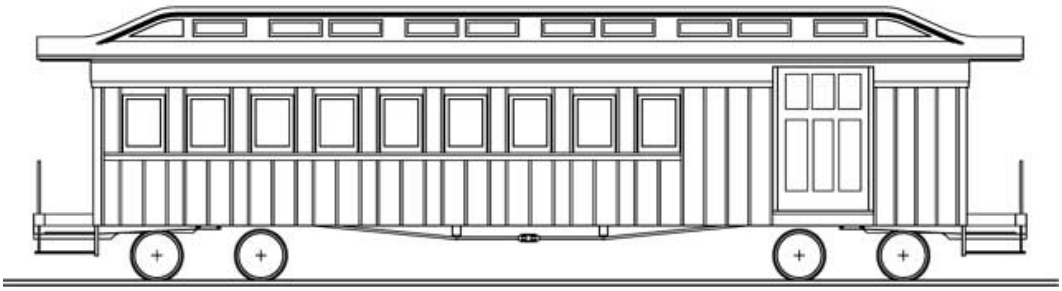


1870s COACH – BOARD & BATTEN SIDES

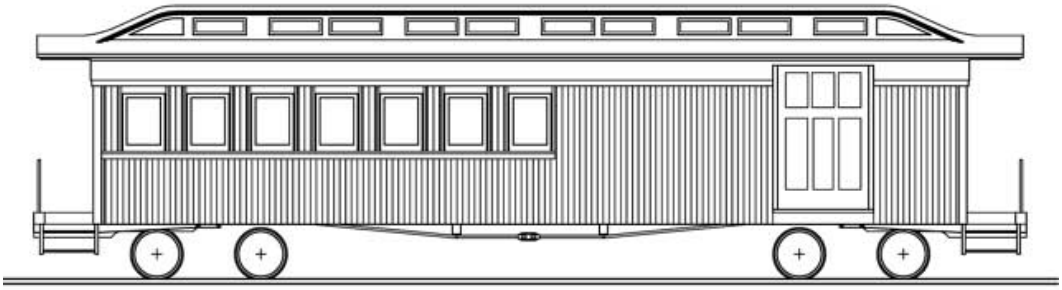


1880s COACH – 'MATCHBOARD' OR PLANKED SIDES

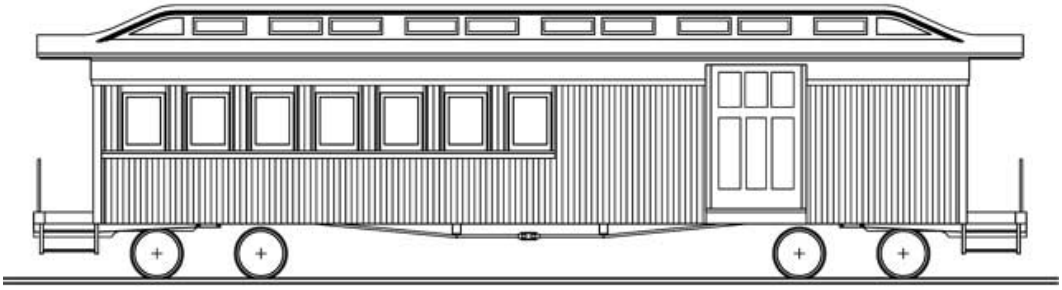
Here are the combine versions, note the bottom image of the SPC caboose is a laser kit option being provided by Doug Bronson.



1870s COMBINE – BOARD & BATTEN SIDES



1880s COMBINE – 'MATCHBOARD' OR PLANKED SIDES



1880s COMBINE – 'MATCHBOARD' SIDES – SPC CABOOSE

Like all of our MasterClasses, this class will contain the instructions on how build your own model as well as outline some of the historical background to the cars, their builder, where they ran, and we'll also indicate the locations where cars of similar styling ran, even if not built by Carters.

1870s Board & Batten Combine - Styrene model assembled.

This Chapter contains the following sections:

- **Background** - Ross Buchanan outlines the history of Carter Bros as manufacturers of passenger equipment, as well as a short history of the Monterey & Salinas Valley line, and the first combines built by Carter Bros.
- **Similar Cars** - Carters built cars which were consistent with the 'style' of the day. Through collaboration with the respected eastern builders, the cars that Carters built were visually similar to many cars running on other roads around the country. Kevin Strong will outline some of the cars which were similar to our prototypes, while not actually built by Carter Bros.

  The Prototype Pictures - A pictorial reference section showing the Monterey & Salinas Valley Combine as she looks today in the Museum.
- **Monterey & Salinas Valley Combine - Timeline and Colour Schedule (PDF Download) -** Craig Hoefer presents a timeline outlining the historical changes to the combines over time. Also presented are the colour schemes for the combines at various dates.
- **Construction** - Build the car of your choice following the step-by-step instructions and drawings.

More Information:

For more information about Carter Bros and the South Pacific Coast RR (owner of a large number of Carter Bros Passenger Cars), take the time to visit the following web sites:

- A really good summary of the Carter Bros history, presented by Hayes Hendricks at the Ironhorse web site:
  Wooden rollingstock generally:
  http://www.ironhorse129.com/rollingstock/index.htm
- Checkout the Builder's dictionary in the above link too.
  Carter Bros History:
  http://www.ironhorse129.com/rollingstock/builders/carterbros.htm
- Carter Bros equipment list, as prepared by Randy Hees:
  http://pw1.netcom.com/~hees/CarterList.html
- The South Pacific Coast RR
  http://www.spcrr.org/

The Laser Cut Kits.

The secret to the ease in building cars like this is the availability of most of the parts, laser cut as a kit for us. There are some additional parts you'll need to purchase to complete the cars, but 99% of what is required is in the kit, including all the hardest parts.

Regardless, like all MasterClasses, you don't have to purchase any laser cut kit if you don't want to. It is possible to spend more hours and cut all the parts yourself using our PDF templates as a guide. The PDFs templates for the cars are linked off the first page of the construction section.

Finally, I shall also place the DXF files for the 4 cars on-line for all to use. These DXFs will enable folks with their own computer controlled milling machines, or access to laser cutting, to cut their own kit in their own way. I only ask that should you do this that you let me know if you intend to sell the kits. My intention is to allow you to cut your own kit for yourself and your friends, not build up a kit business with it, unless discussed with me. Its only a courtesy, as I won't and can't stop you, nor is it my intention to prevent the spread of these cars via any means. The hobby desperately needs access to good 1:20.3 coaches!

For this Masterclass, the coach kits will be available from three sources. Pricing is set up to make these affordable as possible, with minimum profits or add-ons. Please be patient, especially in the early days of this class, as interest in the car kits has been huge, and it will take time to fill the orders. As such, we'll aim to get one kit to all in turn, and then provide the 2nd kit and so on. This will enable all to start building something while awaiting the 2nd and 3rd cars to arrive.

The three kit suppliers are as follows:

Rick Raively -US - Rick is our first and original laser cutter for the MasterClasses. Rick's kits are cut entirely from styrene. I have the highest recommendation of these kits as the smooth nature of the styrene best mimics the grain-less smooth sides of the original 1870s 'as built' designs. The matchboard versions of the kit come complete with all the planking scribed into the sides. Rick's kits will come complete with Hartland trucks, without wheels. Hartland's coach trucks are easily the closest RTR truck available suitable for these cars.

The Price for these Kits is $170 US including shipping within the US. Shipping outside the US is additional. The kits will be cut for the period of the Masterclass, or as long, as interest remains high, but will not be a long term kit offering.

Payment Options:

1. Money order to
   Rick Raively
   106 Hannold Blvd
   Deptford, NJ 08096
2. Paypal - email **rtrains@verizon.net**

No personal cheques please.

Doug Bronson -US - Doug is offering laser cut kits in wood of the 1880s style matchboard sided Coach, Combine/SPC Caboose #3. The wood grain evident in using real wood for these kits is completely appropriate for the planked sided cars, especially for the appearance of these cars after some years of operation. Doug's kits will include the wooden parts required for the door and car corners.. They will also come complete with end railing castings, brake wheels and other detail castings needed, along with all glazing precut. These kits will also include the Hartland trucks, less wheels. The chassis on Doug's kit is a fully framed system based on the prototype, and has a higher level of detail. It is no more difficult to build than the other kit options. While the price is higher than the other two kit options, the added detail parts, and wood components as a 'complete' kit will easily equate to the added parts you will use to finish the other kit options. Doug's kits comprise laser cut wood parts to 95% of the kit, plus laser cut styrene seats and brake beams.

Doug is offering these kits for the Masterclass at near cost prices, for the period of the Masterclass only. After that time, the cars will remain in the Bronson-Tate catalogue along with their other kits for the longer term and will be sold at commercial rates.

The Masterclass Price for Doug's kit, inclusive of the trucks (less wheels), castings and added timber trims is $195US. This Price will be offered through to August 1, 2006. After that time, prices will go up.

Doug will accept money orders or personal checks. All personal cheques will be held for one week to clear. This will be explained in an E-Mail that will be sent to each buyer.

Doug can be contacted:
carterkit@bronson-tate.com

Harald Brosch - Germany - Harald is the prime laser cutter for a group of kit builders/makers in Germany called 'The laser Gang'. They will be offering all 4 versions of the car in laser cut wood, including their own innovations in enabling ply to be bent more easily! Harald's kits will be available world-wide. Harald will also offer a 'Budget' version of the cars, that do not include any interior seats. Harald's kits will not contain any detail parts or trucks. The following prices are indicative - to be confirmed with Harald.

- Harald's full kits, inclusive of seats, $165US / Euro 125 + shipping.
- Harald's Budget cars, without seats are $106US / Euro 83 + shipping.

Harald will also sell seat sets separately for anyone interested - here are the details for just the seat kits-

- Set of 6 seats with armrests on both sides single sets - $ 12,55 / Euro 9,80 per set.
- If you buy 5 sets or more $ 11,00 / Euro 8,60 per set.

Check with Harald over the shipping costs and options.
Harald's Web sites and Contact:

Harald Brosch
Lüneburger Strasse 43 - 21423 Winsen
Mobil: 0179-2121559 - Fax: 04131-64247
www.williwinsen.de Modellbahn HP
www.eisenbahn-modulbau.de Shop
www.lasergang.de Waggonbausätze in 1:22,5

Additional Parts

Needed For Rick's and Harald's Kits only.

The additional parts listed below are needed to complete Rick's and Harald's. Doug's kit will include wood/metal equivalents of the elements listed below and are costed into his kit price.

There are a number of 'quarter round' elements and thin strips that are required to complete the model. It would be pointless and costly to laser cut these strips. Instead we'll recommend some Plastruct and Evergreen product. The list below is specifically for the styrene kits, however all styrene elements listed below can be substituted for wood when building Harald's wood kits. Wood parts can be found in model shops that stock wooden ship building parts etc.

Here are the essential parts for the styrene cars:

Additional Plastic Parts For Coach/Combine Kits					
Evergreen					
Item No.	**Description**	**Size**			**Qty. / Pkg**
		Inch	**mm**	**Fract**	
123	Dimensional Strip 14" (35 cm) Long	0.020 x 0.060	0.50 x 1.5	N/A	10
	Notes: Used for the battens on the car sides and ends (see Construction Step 10). For the 1870 Board & Batten design 2 packages per car are required. For the 1880 Planked Side (Matchboard) design some battens are still used around the windows, 1 package per car is required. *(Originally I used 1.0 x 1.5 mm battens, which were too thick from now on 0.50 mm thick battens will be used)*.				
196	Dimensional Strip 14" (35 cm) Long	0.188 x 0.188	4.8 x 4.8	N/A	4
	Notes: These 4.8 mm square strips are used to make the quarter rounds (quads) that are applied to the four outside corners of the coach/combine outer walls (see Construction Step 18). 1 package per car is required. *(If you can find 4.8 mm quarter rounds (quads) then use that.)*.				
222	Round Rod 14" (35 cm) Long	0.062	1.6	N/A	8
	Notes: This is what I refer to as my "Rivet Rod", we'll be using this to create rivet and bolt heads by cutting thin slices from the rod and gluing them in various places around the car. (See Construction Step 27)				
230	Round Tubing 14" (35 cm) Long	0.312	7.9	5/16"	3
	Notes: This tubing is used to make the "Drum Type" air vents found on the Clerestory (see Construction Step 24), and the upper car corners where the Letter boards wrap around from the car side to the car ends (see Construction Step 18). Also may be used in making the exterior stove chimney (smoke-jack) (see Construction Step 31). *(One piece of tubing is all that is required to build a single car, so if you can buy it by the piece it will be less expensive.)*.				
241	Half Round 14" (35 cm) Long	0.060	1.5	N/A	5
	Notes: These pieces are used on the windowsills (see Construction Step 18). *(1 Package per car is required.)*				
250	Quarter Round 14" (35 cm) Long	0.100	2.5	N/A	3
	Notes: These pieces are used in the rounded door reveals on the Coach end doors, Baggage end doors, and the sliding baggage doors in the car sides (see Construction Steps 4, 8 (Combine Only), 9 (Coach & Combine)). *(1 Package per car is required.)*				
254	Square Tubing 14" (35 cm) Long	0.250 x 0.250	6.3 x 6.3	N/A	2
	Notes: These pieces of square tubing (i.e. SHS = Square Hollow Section) are used in the four interior corners of the car to cement the car ends and sidewalls to each other. Additionally it's recommended that in the case of the combine two additional pieces be cemented to the baggage compartment side of the wall that separates the coach and baggage sections of the car, thus providing a total of six points of attachment tying the car chassis to the car body (see Construction Steps 11 & 32). *(1 Package per car is required.)*				
266	Channels 14" (cm) Long	0.188	4.8	N/A	3
	Notes: These pieces are only required if you are building the combine, they are used to create the channels (i.e. both upper and lower) that the baggage door in the car sidewalls slide in (see Construction Step 25). *(Only one length of channel per car is required, so if you can buy it by the piece it will be less expensive.)*				
9020	Opaque White Styrene Sheet (9"x12")	0.020	0.50	N/A	3
	Notes: This 0.5 mm sheet is used in various places within the car's construction. Cut into 11 mm wide strips and used as the outer most letter-board / fascia that wraps around from the car side to the car ends (see Construction Step 18). Used to close one end of the "Drum Vents" on the Clerestory (see Construction Step 24). Used in making the platform step straps (see Construction Step 28). Used in the external stove chimney (smoke jack) construction (see Construction Step 31).				

Plastruct						
Catalog Code	UPC Pkg Code	Description	Size			Qty. / Pkg
			Inch	**mm**	**Fract.**	
ST-4	**90201**	ABS Square Tubing 1/8”	0.125	3.2	1/8	7
	Notes: These pieces are used to make the new spreader bar between the truck side frames that the brake and brake beam assemblies are hung from (see Construction Step 27) *(Only one length of this item per car is required, so if you can buy it by the piece it will be cheaper.)*					
ST-6	**90202**	ABS Square Tubing 3/16”	0.1875	4.8	3/16”	6
	Notes: These pieces are used to create the central core in the Evergreen 6.5 mm square tubes cemented in the interior corners of the car and are what actually provide the material that the bolts holding the chassis to the car body thread into. (See Construction Steps 11, & 32). *(Only one length of this item is required per car, so if you can buy it by the piece it will be less expensive.)*					

K & S Engineering / Special Shapes Co.					
Item No.	Description	Size			Qty. / Pkg
		Inch	mm	Fract	
	Brass Rod Solid - Round 12” (30 cm) Long	0.040	1.0	N/A	
	Notes: This item is used for car end handrails (see Construction Step 30) and platform step support (see Construction Step 30). *(4 Lengths of this item is required per car.)*				
	Brass Rod Solid - Round 12” (30 cm) Long	0.060	1.5	N/A	
	Notes: This item is used for making the truss rods for the under carriage (see Construction Steps 13, & 23). *(x Lengths of this item are required per car.)* I personally purchase and use full-length brass brazing rod from a welding supply house for approximately $0.40 per length. If you can find it, it may be less expensive that way.				
	Brass Tube – Round 12” (30 cm) Long	0.080	2.0	N/A	
	Notes: This item is used to make the platform end rails (see Construction Step 30). K&S makes two types of this size tubing one has a wall thickness of 0.135” and the other with a thickness of 0.175”, either type is acceptable. *(2 Lengths of this item are required per car.)*				

Detail Part Options					
Note: The detail parts included vary from one kit supplier to another, so check the documentation regarding the specific kit you are purchasing to determine exactly what you may or may not need to acquire on your own.					
Brake Wheel, Ratchet & Pawl					
Notes: Based on the Michael Collins drawing of the M&SV combine, the brake wheel diameter is not that large, it measures about 16.5 mm in 1:20.3 scale.					
Item No.	Description		Supplier		
0019			Ozark Miniatures		
			Hartford Products		
			Hartland Locomotive Works		
Turnbuckle – Truss Rod					
Notes: We have no castings for sale here in Auz, and it takes time to get stuff sent. Also half the time I don't know the sizes of items I want, and end up buying a casting of the correct item, but 70% too small!! So I hand make a lot of my stuff. Bolt and washer details, turnbuckles etc, I just don't bother with castings, even though they are better (and costlier!). So I'll leave those to you. Take a look at it when you get to that part of the construction.					
			Ozark Miniatures		

Trucks					
Notes: The Raively styrene kits and Doug's kits will come ***complete*** with Hartland 4' coach trucks, less the wheels. Harald's kits do not come with trucks, unless organised with the supplier of the kits (discuss with Harald). You can also purchase the Hartland trucks from Hartland Parts, $7 a pair. ***Contact Phil Jensen at Hartland Parts Dept*** ***Tues and Thurs, 8am-1pm Central.*** ***Ph: 402 571 2933.*** You can also use LGB, Bachmann or Aristocraft Sierra car trucks on these cars, but take care that alterations to the end beams of the car will be necessary to avoid clashes on the curves.					
Wheels					
Notes: 30mm, or prototype 24" wheels. Bachmann larger metal wheels are fine, but you can use many of the fine wheels out there.					
Couplers - (Needed for all kits)					
Notes: Couplers are your choice. The model comes detailed with wooden beams (draw timbers) on the ends that held the original link coupler. However you can adapt or delete those beams to install KDs, Accucraft, or even Ozark couplers. I'll be using the coupler pocket on the Hartland truck, with a Delton coupler fitted (Aristo Classics), which will ride below the actual link pocket.					

Inspiration.

There are always former models of our favourite prototypes that really do inspire us. For the Mason Bogie and CP Huntington models it was the mid 1980s models made by Delton that set the bar for me, and towards what I was wanting to achieve with my models of the same.

In the late 1990s, Accucraft Trains ran a really beautiful set of Californian and Colorado Baldwin 4-4-0s and 2-6-0s, nominally to 1:24 scale. To accompany these locomotives, Accucraft made a coach set, comprising a coach, combine and baggage car. The combine was based on the Monterey & Salinas Valley combines, 1880 rebuilds. The coach was a Carters Bros 13 window arched window version and the Baggage a two door SPC 35' car. The cars were lettered for D&RG as well, and as you'll see in the background section by Kevin Strong, the Jackson & Sharp cars of the 1880s were very close to the Carters prototype Accucraft had chosen.

Here is a view of the Accucraft Carter Bros coach. A special thanks to Rich Schiffman for providing us with this car.

To give you an idea of size difference, here is a view of the Accucraft car with our new 1:20.3 Carter Bros car behind it.

Monterey & Salinas Valley Railroad

The Mouse that Roared

By Ross Buchannan, UK.

Background

Droughts and floods plagued the Salinas Valley grain farmers during the 1870s and 1880s. When conditions were bad it was difficult to break even, and when conditions were good prices dropped. Even worse, the Southern Pacific Railroad, with no competition, charged unbearably *high rates* to transport grain to market.

In 1874 a group led by *Carlisle S. Abbott* began work on an 18.5 mile narrow gauge railroad, the Monterey & Salinas Valley Railroad, between Salinas and the deep water port at Monterey thereby breaking the monopolistic hold on the Salinas Valley, hitherto enjoyed by the Southern Pacific (S.P.)

Inception

The Monterey and Salinas Valley Railroad was chartered by members of the *Patrons of Husbandry*, also known as the Grangers, on February 26th, 1874 among whom such local worthies as David Jacks, C.S. Abbott, Alfred Gonzales, and many more. Altogether there were 73 stockholders.

David Jacks, owner of considerable acreage between Monterey and Salinas was the principal financier for the effort, but Abbott also made a major investment

In March, John F. Kidder was retained as the Chief Engineer and Superintendent of Construction already having done surveys for a stillborn railroad proposal. He estimated that constructing and equipping the line should cost little more that $240,000.

Savings on the shipment of freight were estimated to be as much as $200, 000 per year over what the S.P. was charging the citizens of Monterey County. The S.P. immediately countered by lowering their rates and threatening a line from Castroville to Monterey.

Articles of incorporation were drawn up with Abbott as president and Jacks as treasurer. Groundbreaking was held on April 20th, 1874 with no ceremonies by C.S. Abbott, and later that day construction began led by Kidder using 140 workers, half Caucasian and half Chinese. The chosen route was broadly level or gently rolling over sandy soil, and presented no significant engineering difficulties except for bridging the Salinas River.

Construction and Operation

Local farmers contracted their graders and labour to the construction, taking reduced freight charges in lieu of payment, confirming the original intention of a co-operative effort. The lines first locomotive, the modestly titled "C.S.ABBOTT" arrived by schooner on September 9th 1874.

Bridging the Salinas River was a major problem, but the five spans of 80' each and 300 feet of trestlework were completed by late August. By the end of September the line was nearly completed, with the Salinas terminal located at what is now the intersection of Pajaro and Willow streets. Approximately 25,000 sacks of wheat had been stored at Salinas in anticipation of the opening and on September 25th, this locomotive began handling the first revenue shipments on the road. Track gangs reached Salinas on October 9th with only a few items yet to be completed. Kidder left on the 10th to survey a proposed narrow gauge railroad out of Hollister, California. Regular service to Salinas commenced on October 26th and the Monterey & Salinas Valley Railroad became the first narrow gauge to be operated in California. The line and equipment were so fully occupied in handling wheat that the inaugural excursion did not take place until November 16th.

The line had ultimately cost about $360,000, 50% more than Kidder's original forecast, largely due to the difficulties of the Salinas bridge , but by the end of the year over 6,000 tons of grain had been transported to Monterey; the combined rail and steamship rates were averaging two dollars a ton less than those charged by the Southern Pacific. Business for the new railroad was very good, and the fledgling concern was widely publicized on account of its pioneering quality and apparent consistency with the doctrine of the narrow-gauge proponents as an excellent source of cut-price transportation. On January 11, 1875 directors were elected confirming Carl S. Abbott as president, David Jacks as Treasurer, and Joseph W. Nesbit was confirmed as Superintendent of the railroad. By the 16th of January, John F. Kidder and his assistant C.P. Loughridge had left for Grass Valley, California having finished the survey for the Hollister and San Juan railroad project.

The Shape of Things To Come

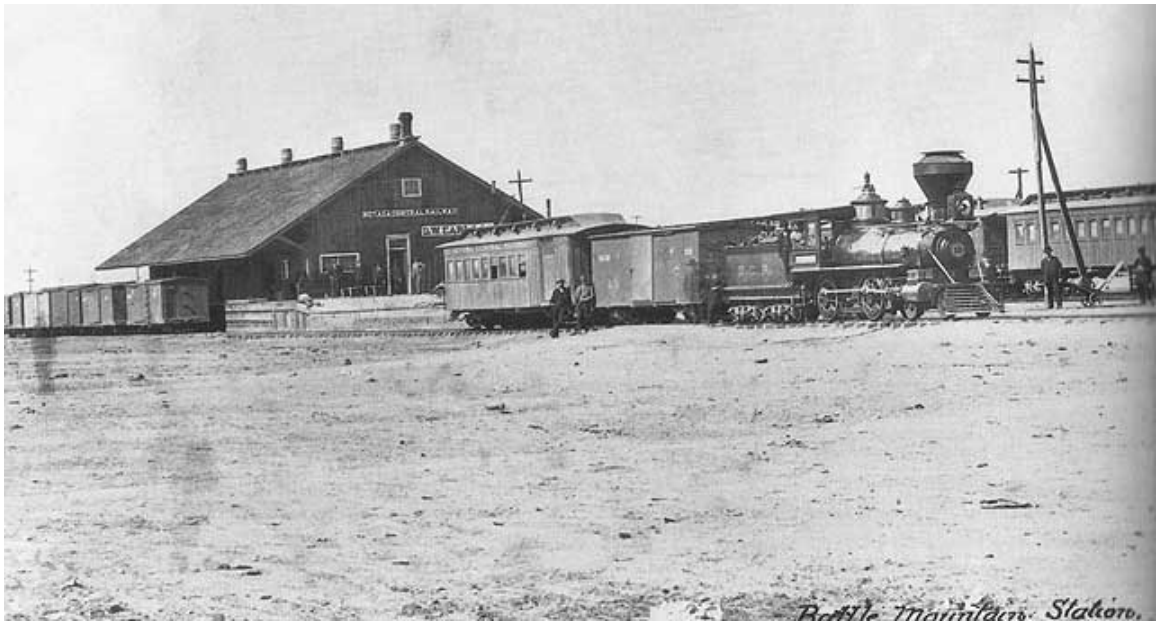
On January 19th, 1875 a 'Northern' struck the Monterey Peninsula a mighty blow, and by the 26th the approach trestle to the bridge was but a memory and it was two months before it was reinstated. . Mr. Nesbit resigned from his position to accept the position of Superintendent on the Santa Cruz and Watsonville Railroad in February of 1875. Alfred Gonzales took over as Superintendent. David Jacks would leave in June having perpetrated a short lived attempt at shifting control of the railroad. The optimism continued undiminished in spite of this, and in February 1875 a second locomotive, a 4-4-0 named the "MONTEREY" arrived at Salinas.

In January of 1876 the bridge washed out again, and this time it took six months to replace, and would be washed out once more during the life of the railroad. Another misfortune came: 1876-1877 was an extremely dry year, with less than five inches of rainfall, and the valley's crops failed. The engine house burned down on September 1, 1877 damaging both locomotives and a passenger car. The following year was extremely wet and crops were abundant, but an unseasonably late June rain destroyed most of the grain. Carlisle Abbott, who had 6,000 acres planted in grain, could not ship a single sack. Seeing their opening, the Southern Pacific lowered their rates below those of the Monterey & Salinas Valley, and the line fell deeper into debt. Two work cars were removed from the roster of the M. & S. V. railroad in 1877 possibly going over to the Santa Cruz railroad.

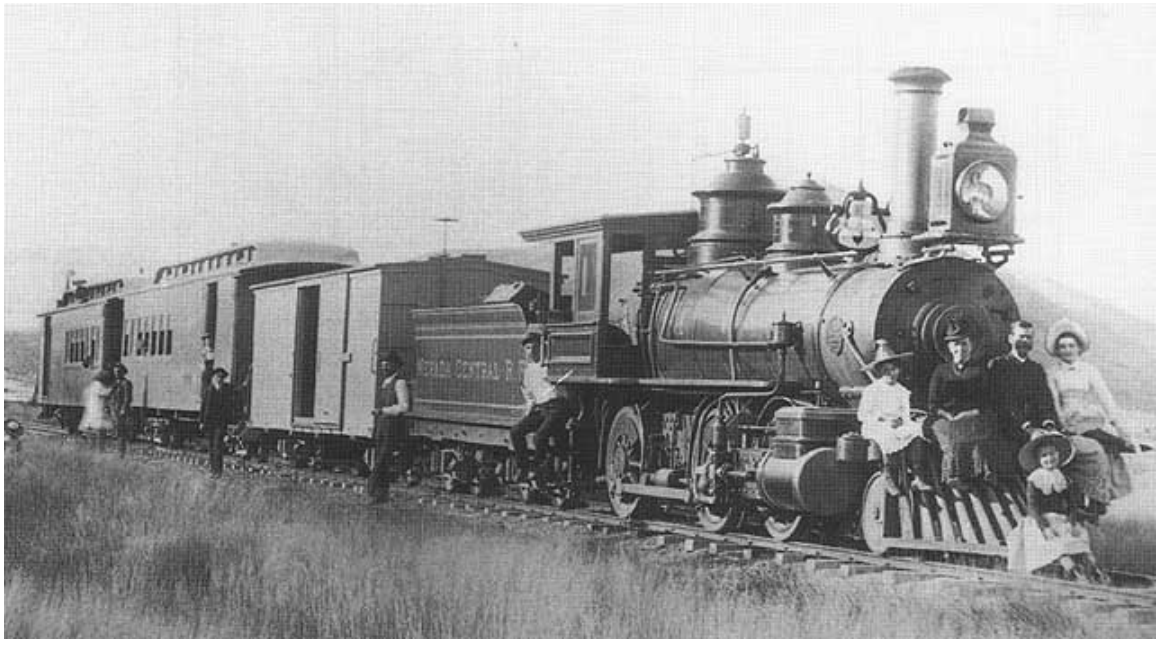
The Final Fate

The farmers who had founded the railroad had not done so in order to charge themselves excessive freight rates. The railroad became unprofitable towards the end of the decade and on December 22nd 1879 it was sold at a sheriff's sale for $128,558 to the Pacific Improvement Co. a Southern Pacific subsidiary, and the office was transferred from Salinas to San Francisco. The Pacific Improvement Co. was charged with the construction of the hotel Del Monte in Monterey.

Work was immediately begun on ripping up the track with all the narrow gauge equipment, rolling stock, rails, etc. going to the Nevada Central at Battle Mountain, Nevada-far enough away so it could not be a competitor. The Southern Pacific favoured a new standard gauge entry into Monterey from Castroville Junction, shortening the San Francisco-Monterey mileage to 125 from 136.5 miles. They built a new bridge over the Salinas River, but it was washed away in April of 1880. They managed to replace it in time to support rail traffic to the Monterey Peninsula for the grand opening of the Del Monte Hotel in June.



Early View of some of the M&SV equipment on the Nevada Central RR. Note the Carter Bros Combine, and the 4-4-0, 'Sonoma' originally from the North Pacific Coast RR. Both the combine and locomotive are preserved together at the CSRM.

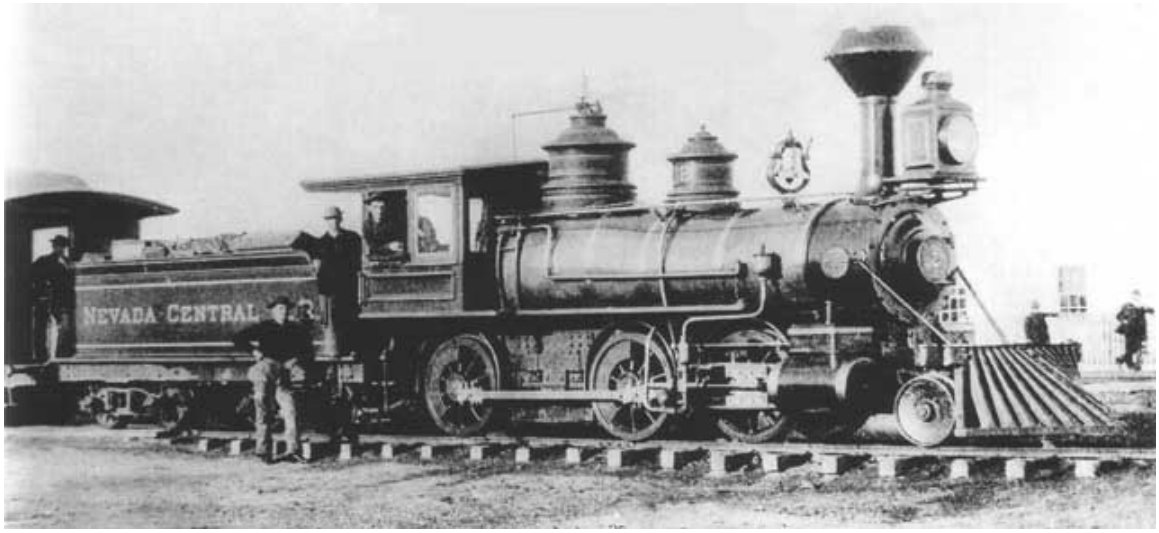


An excursion of the Nevada Central. Two of the M&SV Combine cars can be seen in tow.

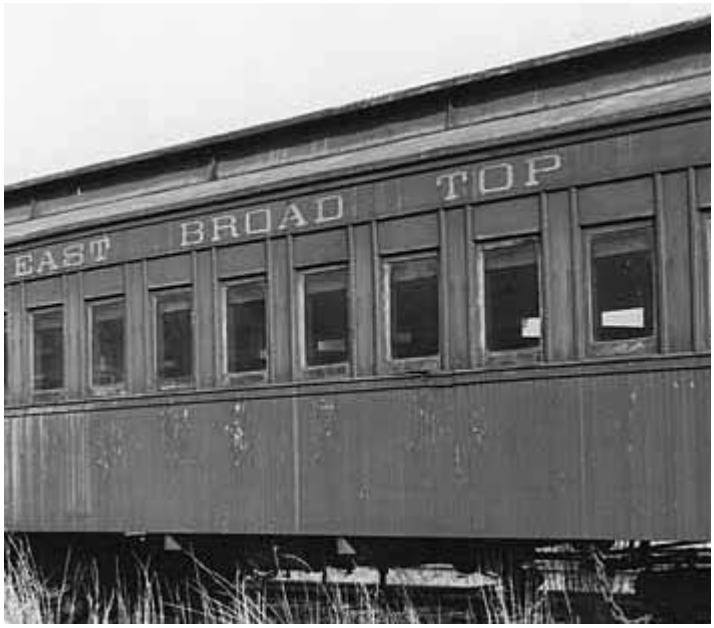
The Nevada Central, and its stock of Carter Bros equipment would remain in service through to the late 1930s. Ward Kimball would purchase this old Mogul (NC#2) and restore her to the well know 'Emma Nevada'.

The Last Word

Carlisle Abbott was unable to recover from the financial disaster of his narrow gauge line. He subsequently sold the Abbott House to David Jacks and moved to Arizona. This was a loss for the town, as Abbott had represented Salinas as a member of the California Assembly from 1876-1879. After many adventures in the southwest, Abbott retired and moved back to Salinas. The Southern Pacific route into Monterey remained in use until 1979 when it was cut back to Seaside. The cities of Monterey and Seaside took title to the abandoned line and far as Camino del Estero in Monterey and have retained the rails in situ.



Nevada Central #2 in 'as built' condition. This Baldwin Mogul, would be purchased by Ward Kimball in the late 1930s, and rebuilt into Emma Nevada.



Variations on a Theme

By Kevin Strong
Centennial, CO

"Imitation is the sincerest form of flattery."

Evidently, there was a lot of flattery going on between passenger car builders in the latter part of the 19th century. Even railroads were know to copy designs—almost board for board—of such builders as Billmeyer & Small, Jackson & Sharp, and others. When you look at the Carter Brothers passenger car kit in that light, you begin to see that it's not so much a specific car, but the embodiment of many different manufacturers' works.

Scholars of early passenger car design—especially narrow gauge passenger cars—often run into difficulty when presented with a photograph and given the task to identify the builder. There are no truly identifiable aspects of any one car builder, and the amount of overlap in design was truly amazing, often to the point of befuddlement.

This is good news for the modeler. Instead of a model of a very specific, unique passenger car, we have a model that's 100% accurate for a specific car, but likely 80% accurate for possibly a quarter of all narrow gauge passenger equipment built prior to 1900. There weren't many narrow gauge railroads in the US that built or ordered new passenger equipment after 1900, so whether you're modeling a specific railroad or doing a freelance line, these kits will offer something that would be quite plausible on your rails.

To start, let's look at the construction of the car, and how it compares to cars of other builders. First, let's look at the physical dimension of the car (not including the platforms.) At 36' long, it's right in the ballpark of many 13-window coaches. I've seen lengths for these cars ranging from 34' to 37'. The width of 8' 3" is—again—right in the ballpark for narrow gauge cars with 2-abreast seating on both sides of the aisle, which became the standard practice around 1880. (Prior to that, cars had 2-abreast seating on one side of the aisle, and single seats on the other. This arrangement switched sides in the middle, which is typically where the stove was located, too.)

Next, there's the finish—either board-and-batten or tongue-in-grove siding. Both styles were common. The board-and-batten siding was the older style, used by virtually all builders. The tongue-in-grove, or "matchboard" siding became popular from around 1885

forward, give or take a few years. Many cars had tongue-in-grove siding below the belt rail, but retained the board-and-batten siding around the windows. All of these variations are attainable with the various versions of the kit available.

The roof is the wildcard. There were many styles of roofs, the duck-bill roof modelled on this kit being but one of them. More common was the "bullnose" roof, though that had many different forms as well. Early on, a simple arched roof was just as likely to be built as a roof with a clerestory. Many of these cars would later have clerestories cut into the roofs. By 1915, a simple arched-roof car would most likely be a third-class coach or relegated to work service. Changing the roof supplied with this kit to either a bull-nose end or a simple arched roof shouldn't be terribly difficult, and would definitely give your car a unique look.

How close you want to make your kit to your particular favorite prototype is limited only by your modeling skills. Most likely, concessions on the length and width will have to be made, but it will very likely not be off by more than a scale foot. Most of us will be happy to live with that. The end platforms may vary, as will the style of steps. These are fairly simple items to scratch-build, so if you have a strong desire to change them, it's certainly doable.

For my coach, I'm going to build a model of the East Broad Top RR's business car, the "Orbisonia." This car was originally built as a 13-window board-and-batten coach by Billmeyer and Smalls. The coach was rebuilt to its business-car configuration by the Bradford, Big Level, & Kinzua railroad before being sold to the EBT in 1907. I thought it would be an interesting project to take a 13-window coach kit and turn it into a business car, mirroring the prototype's history. The EBT had other 13-window coaches for which this kit would be quite close, but none had a duck-bill roof, and the challenge of building a business car (complete with interior) is just too great to pass up. Perhaps for a second kit, I'll do a standard coach.

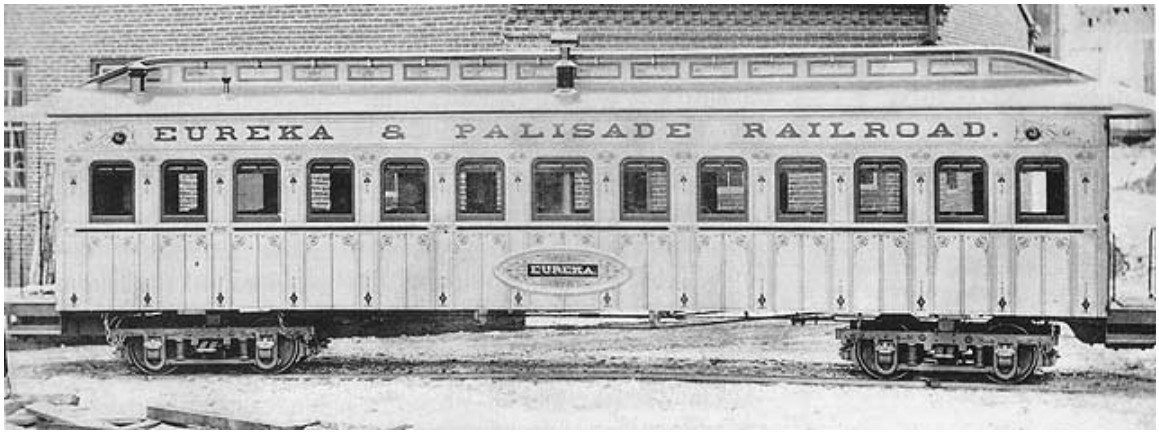
Some Examples:

The car on the left of the photo below is a 13-window car, with a simple arched roof. The builder is unknown, but believed to be Billmeyer and Smalls. The car on the right, known as the "Brownie" is typical of 3rd class cars built by B&S, J&S and other builders of the era.

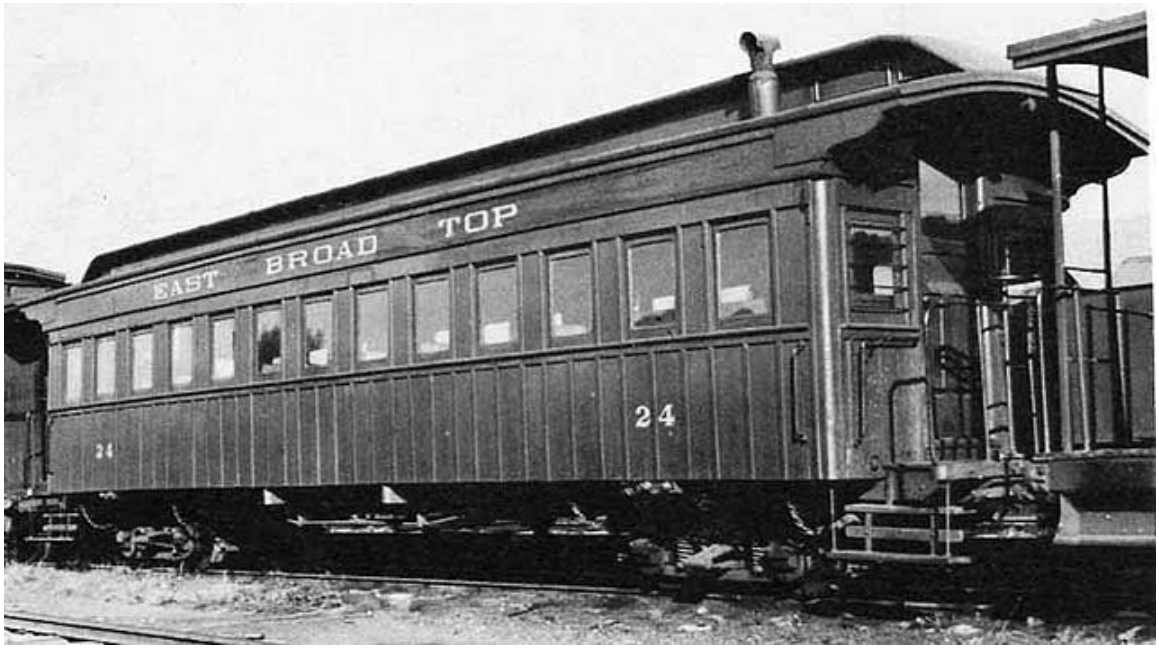
From the B&S catalogue, this etching shows a typical 13-window coach with board and batten siding. Note that in this example, the centre window is longer than the other 12. Based on the location of the smokestack, that is because the stove was located in the centre of the car. Such cars were typically available with 3-across seating and 4-across seating.

Narrow Gauge Passenger Car.
BUILT BY BILLMEYER & SMALLS,
YORK, PENN'A.

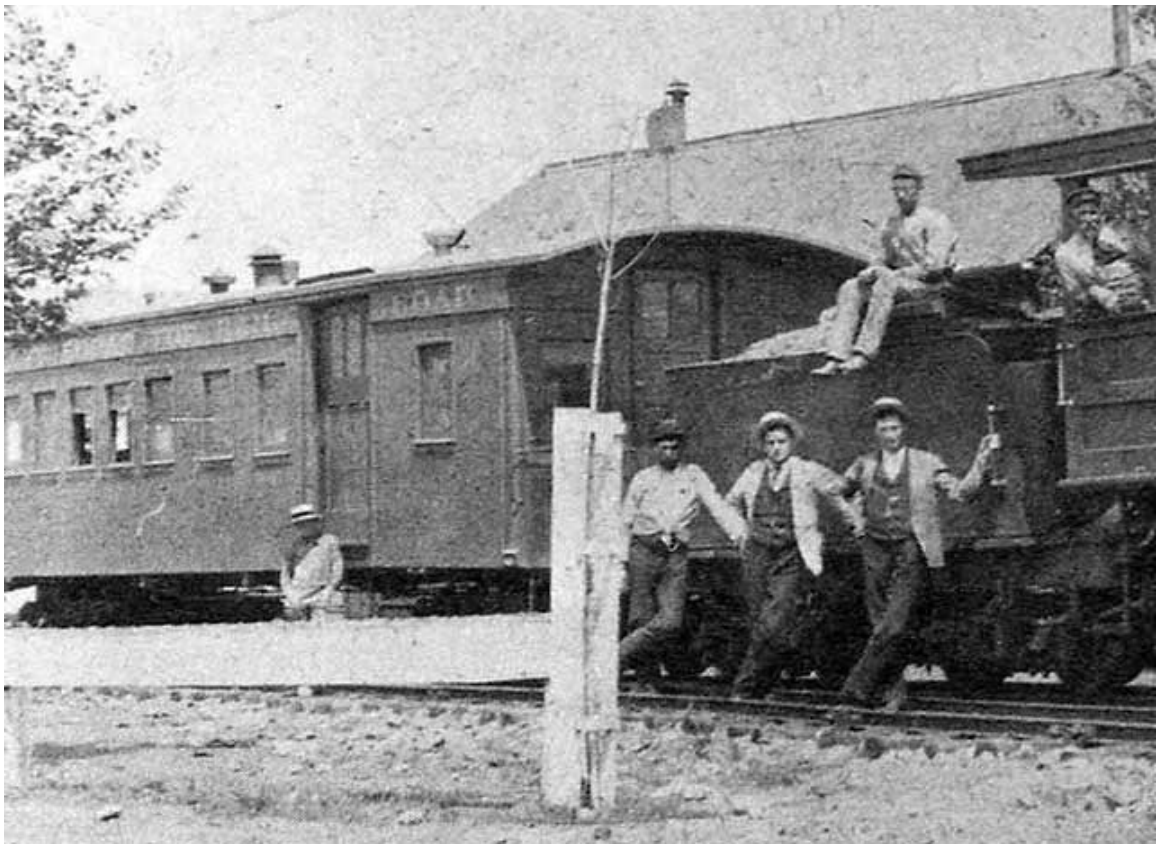
The following is the actual builder's photo of the same car.



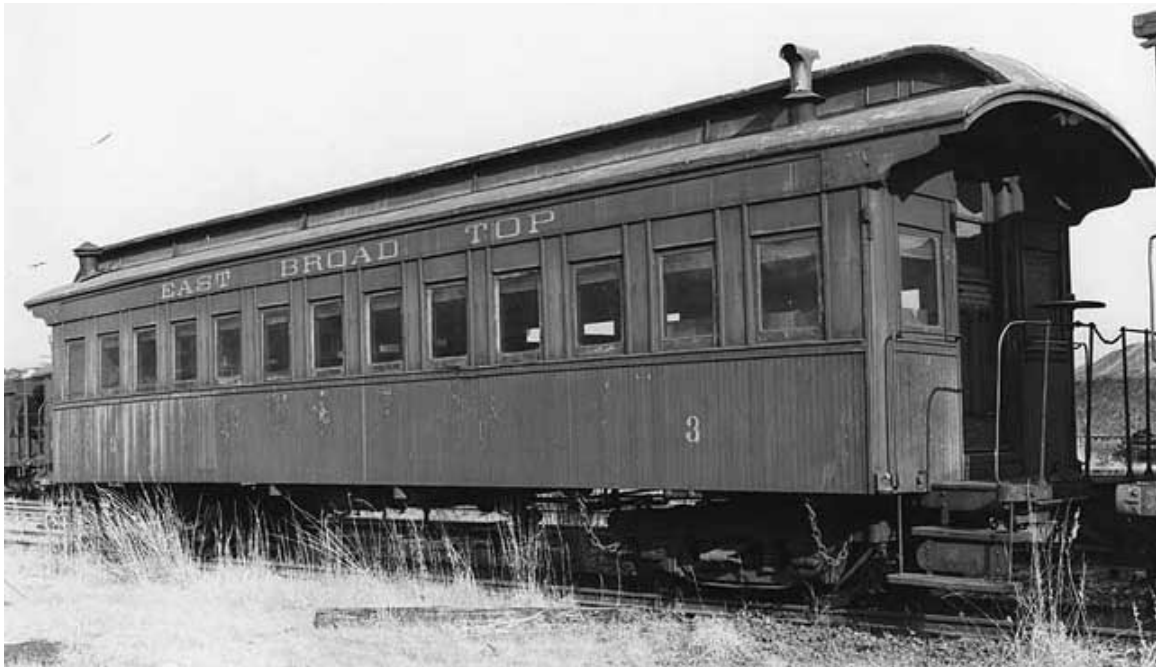
The image of the car above and below is possibly the same car shown above in the uppermost photo, having been rebuilt by the railroad with a clerestory roof. The ends of the clerestory are identical to those known to have been built by the EBT shops on other cars. Length - 35' 6", width 8' 1"



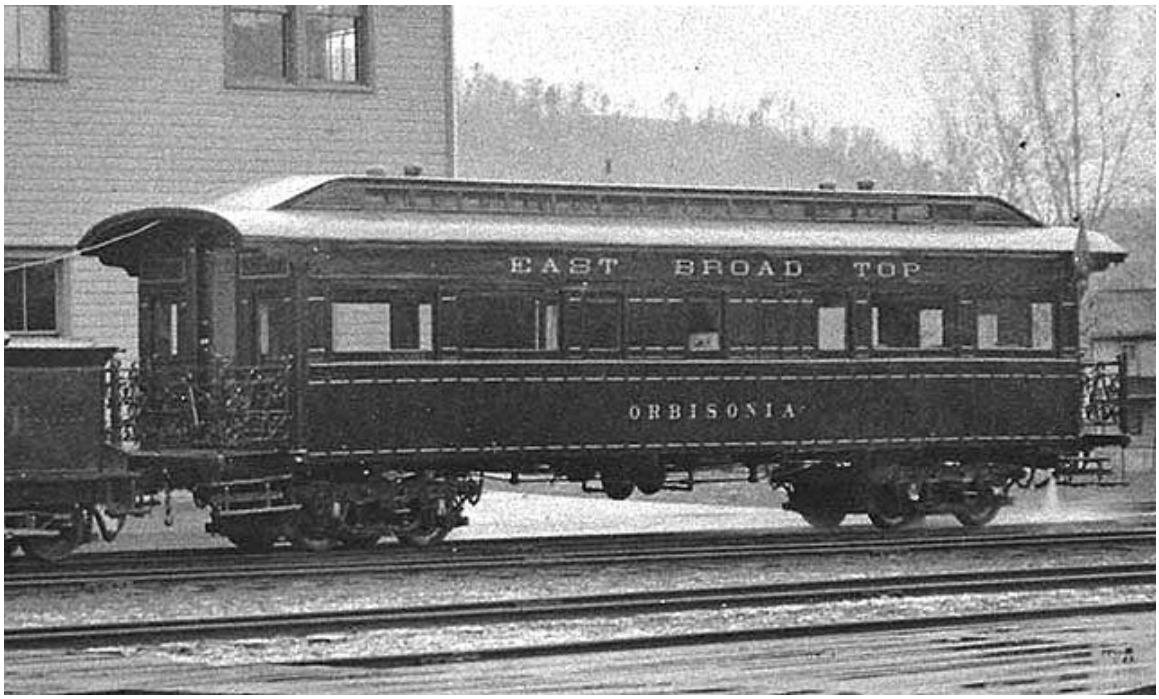
East Broad Top combine #18 is another example of a B&S car, built in 1885 for the EBT's Shade Gap branch. This car has a simple arched roof that would later be modified to a clerestory roof. Note also the absence of a full belt-rail. Length - 35' 2", width 8' 2"



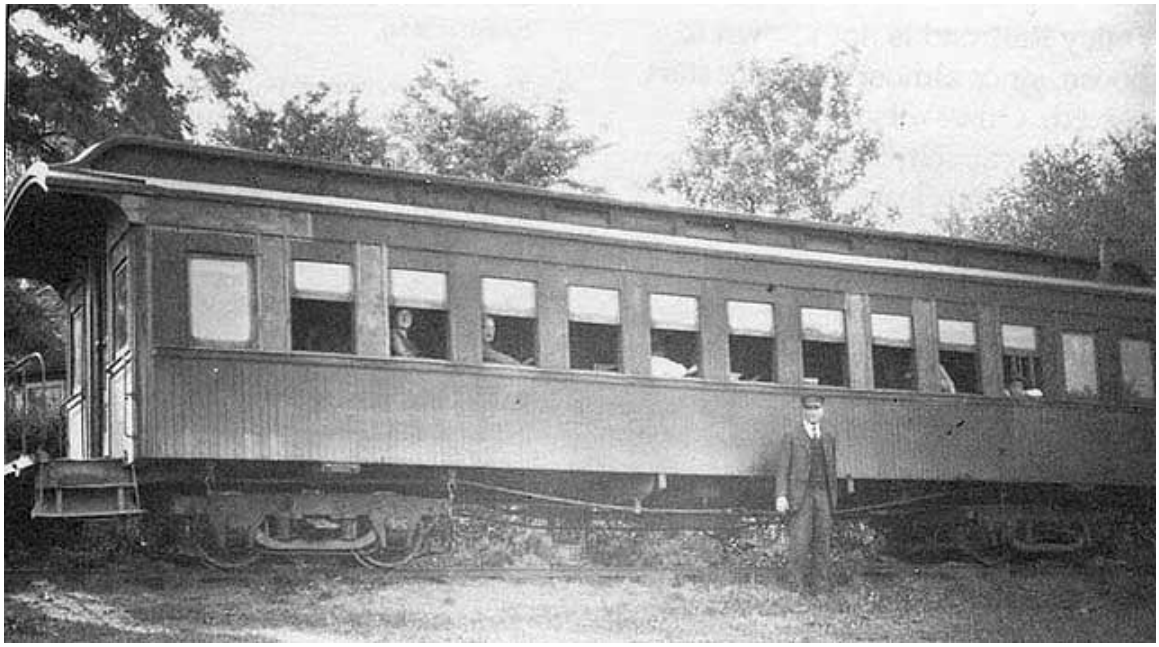
This coach, purchased from B&S at the same time as combine 18, but shown after the EBT modified its roof to a clerestory. (Note the similarities in the end between this and EBT #24) This car has the board and batten siding above the belt rail, but planked siding below. Length 35' 2", width 8' 2"



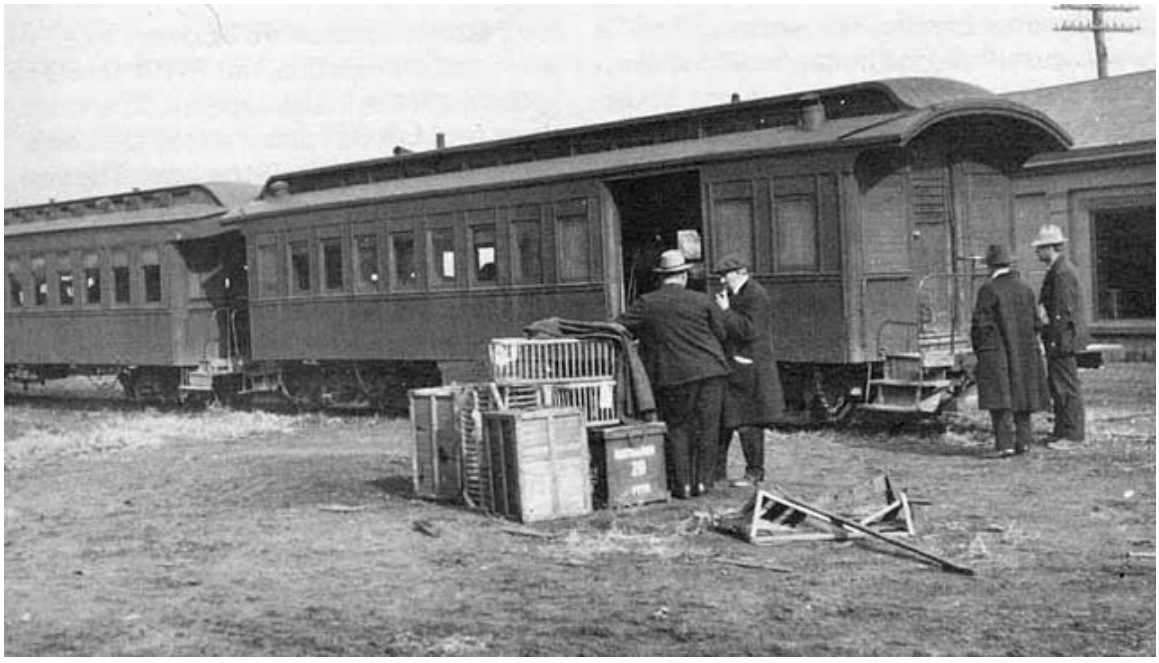
This car was built by Billmeyer & Smalls as a 13-window coach (likely identical to EBT #3). Its overall size is equal to that of EBT coach #3 and combine #18. The car's original owner, the Bradford, Bordel, & Kinzua, rebuilt the car to the business car configuration shown in this photograph, taken on the EBT almost immediately after they acquired it. The clerestory roof is original to the car, not added by the EBT. Length 35', width 8' 2"



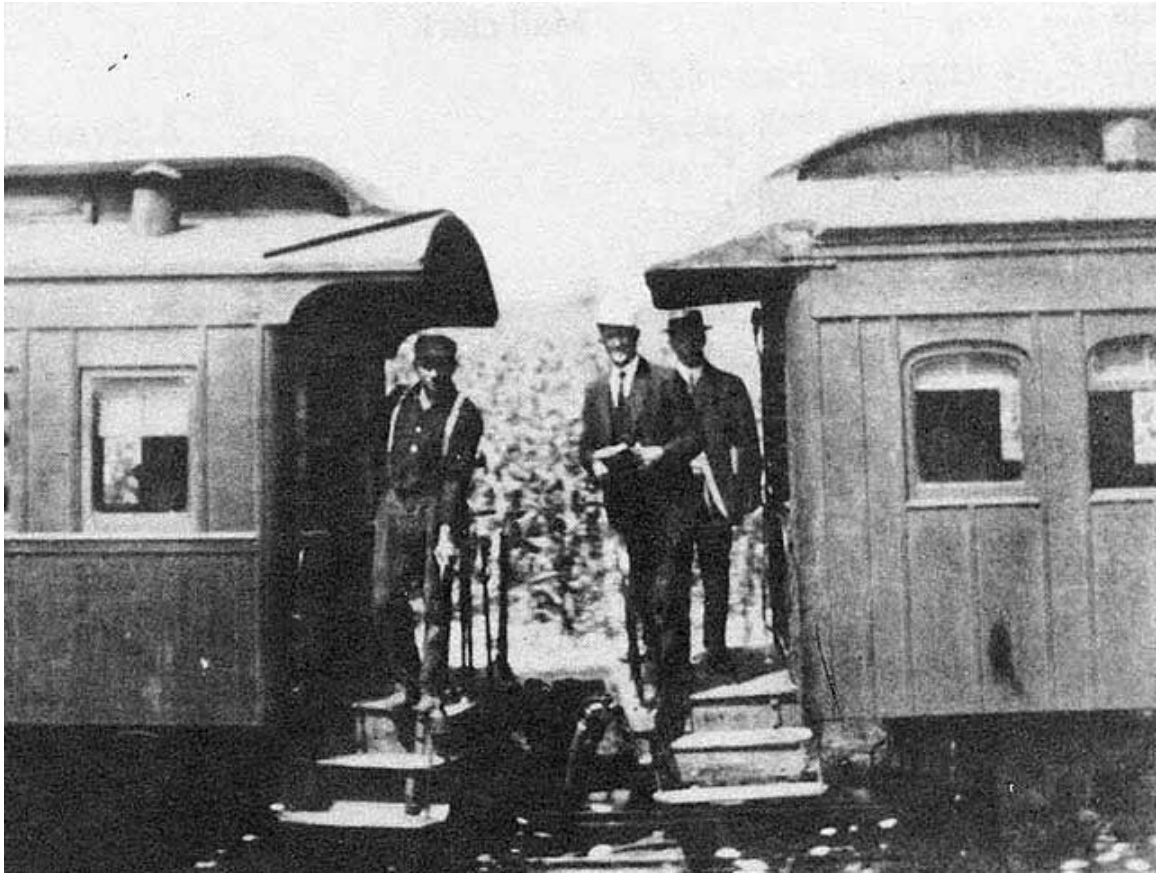
The Tuscarora Valley Railroad operated some Billmeyer & Smalls 13-window coaches as well. Note the difference in the duckbill roof between this car and EBT #20. Length 34' 8", width undocumented.



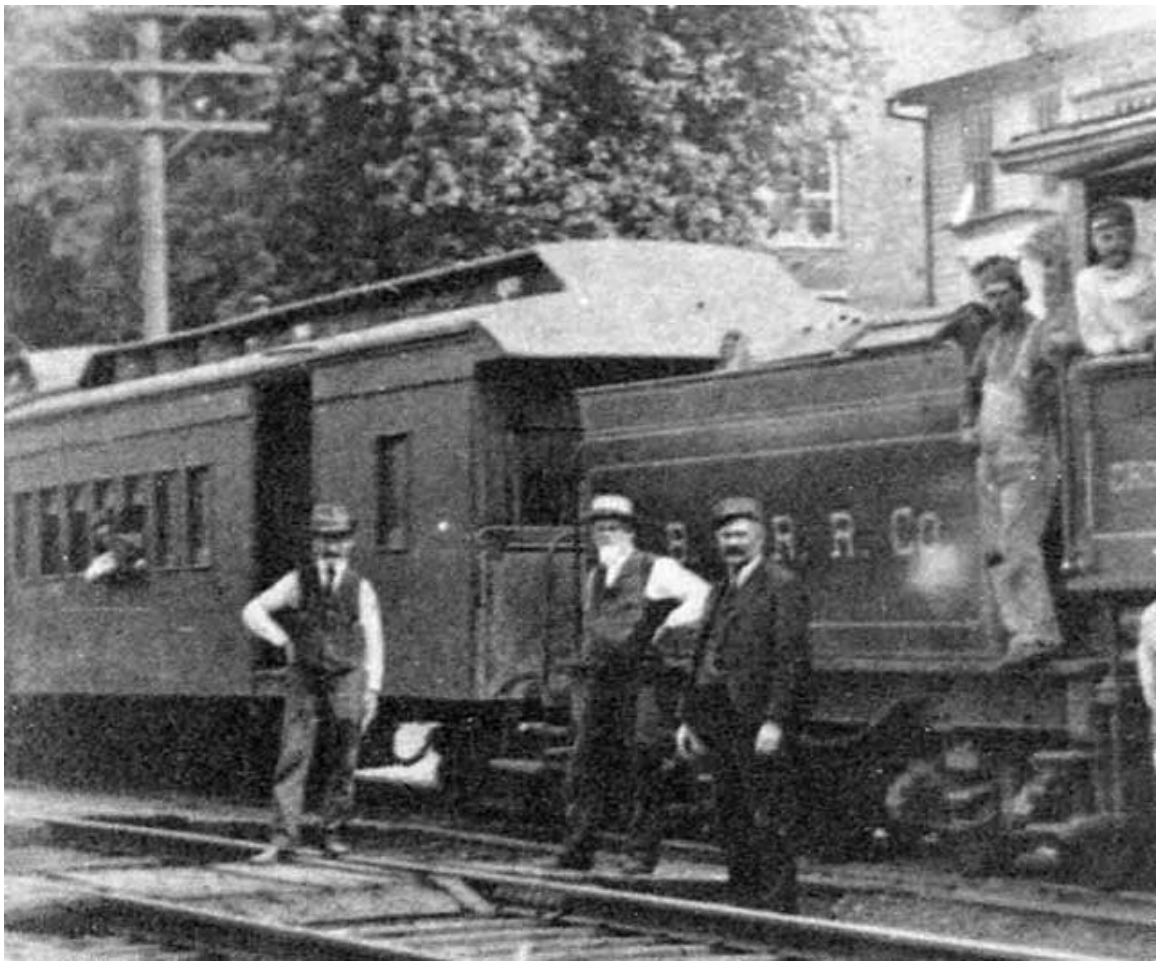
This car is believed to be the same car as the TVRR coach shown above after the TVRR modified it to a combine.



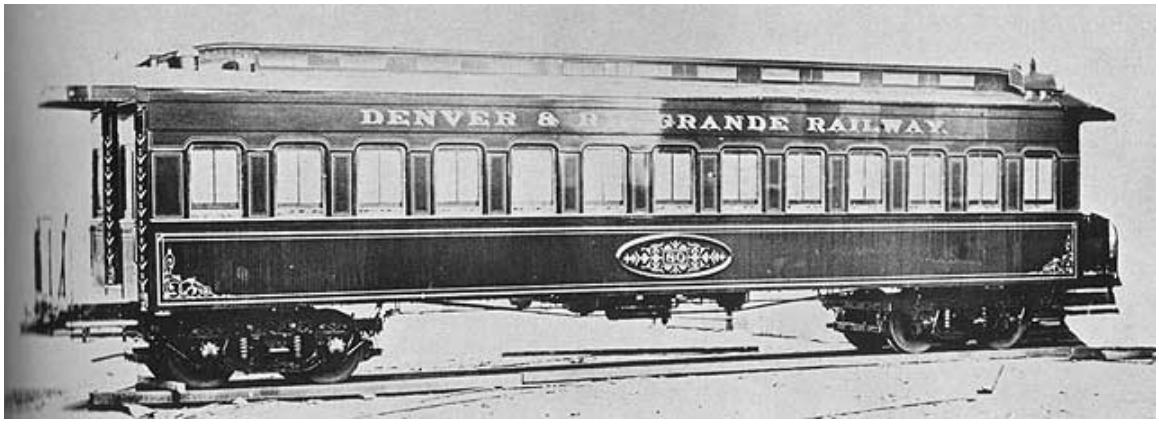
A comparison of a duckbill end and an obviously homebuilt roof end, apparently made by the TVRR shops from sheet metal.



An early experiment by the EBT at building a roof end. Thankfully this was later replaced by one a bit more aesthetically pleasing.



In Colorado

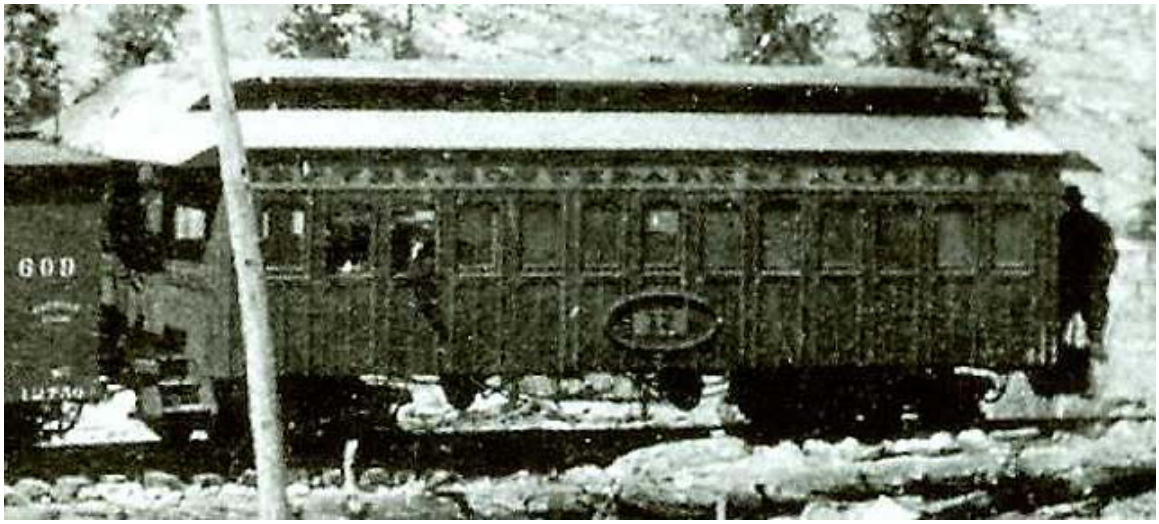


The D&RG acquired their early coaches from a range of the classic manufacturers, including Jackson & Sharp, Billmeyer & Small, and Barney & Smith. Here is D&RG coach 80, as delivered to the D&RG in 1881. This was the D&RG's series 7 car, 64 units delivered between 1880 and 1882. (numbered #33 - #97, renumbered #259 - 321 after 1885). The coach is again a 13-window type, 38' 4" to the end sills, 44' 4" total length, and a width of 8' 5". A car like this could be adapted from our matchboard coach kit, via a new eaves molding and letter board pasted atop our kit's parts.

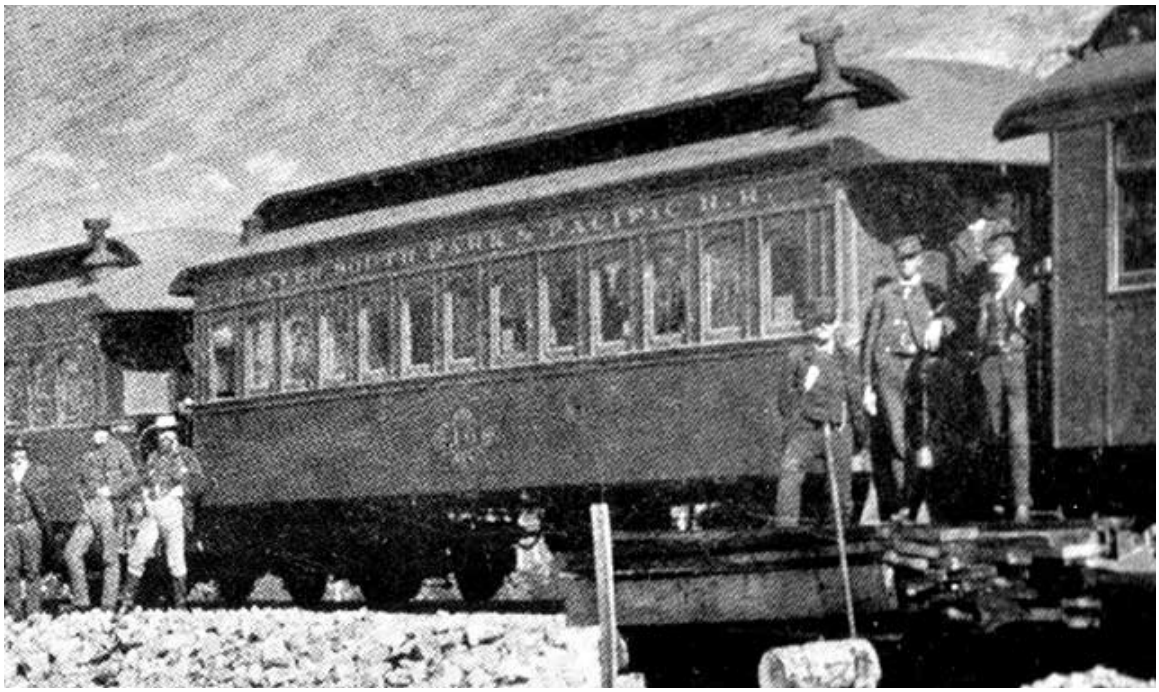
Here is the same type of coach many years down the track.

Other Colorado roads included the Colorado Central and Denver South Park & Pacific RR, which later were to combine into the Colorado & Southern RR.

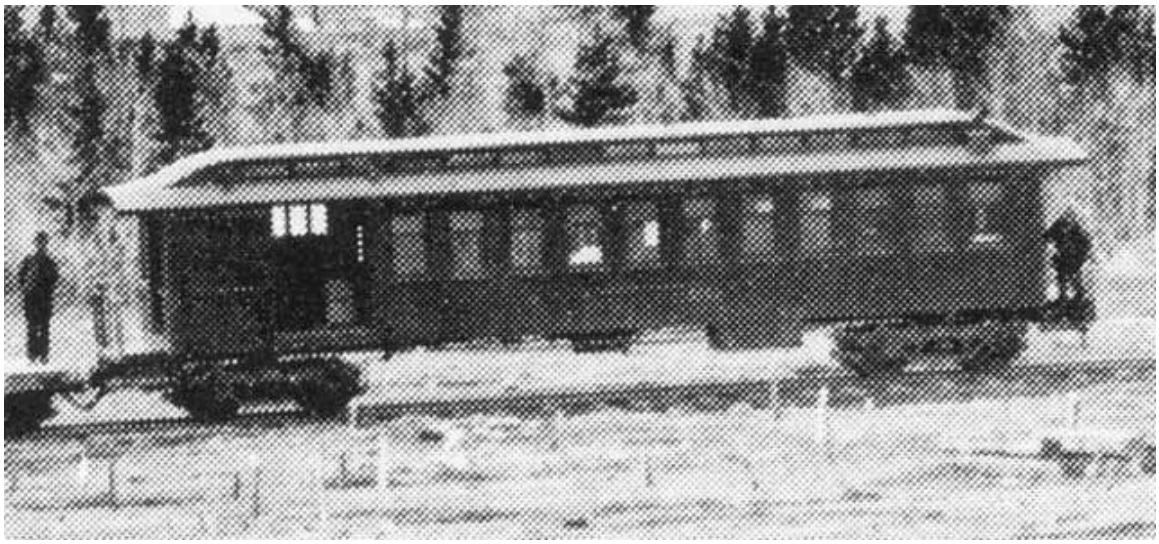
Here is DSP car #17, built by Bowers, Dure & Co, 35' long to the end sills (car body length).



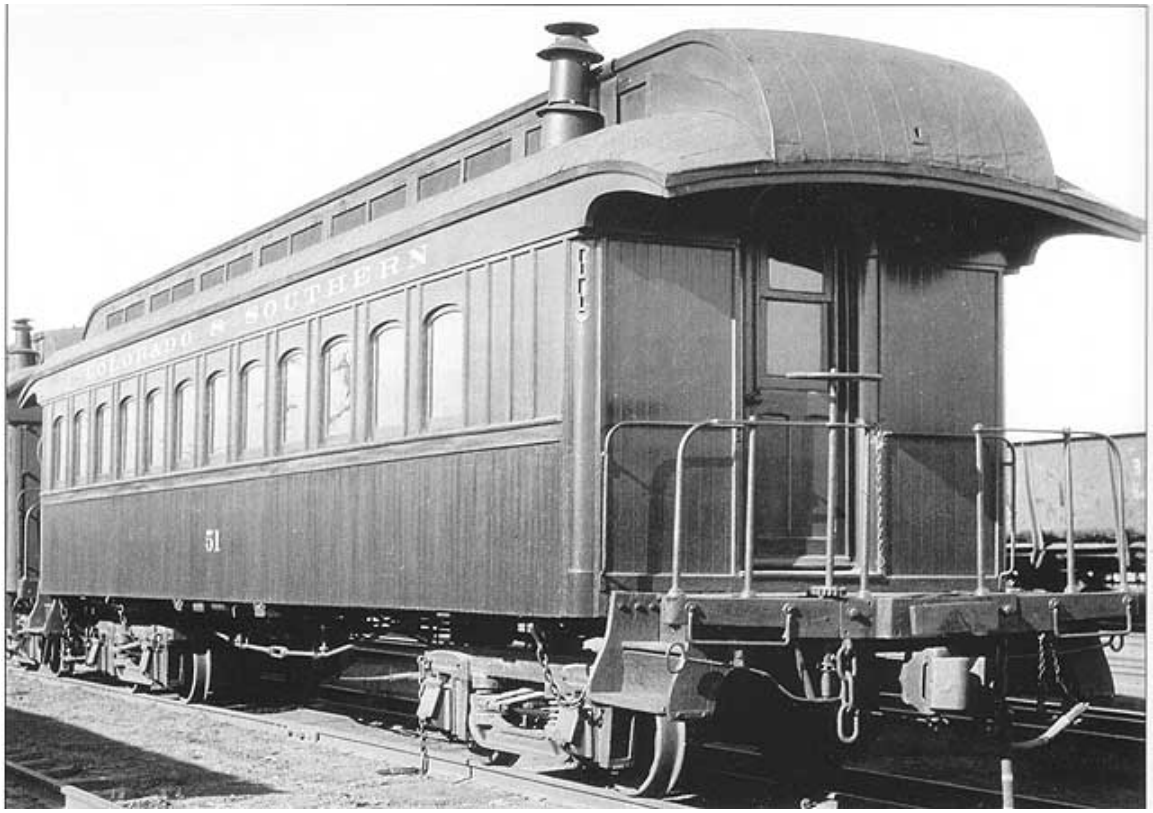
DSP #16 also by Bowers, Dure & Co, 35' to the end sills:



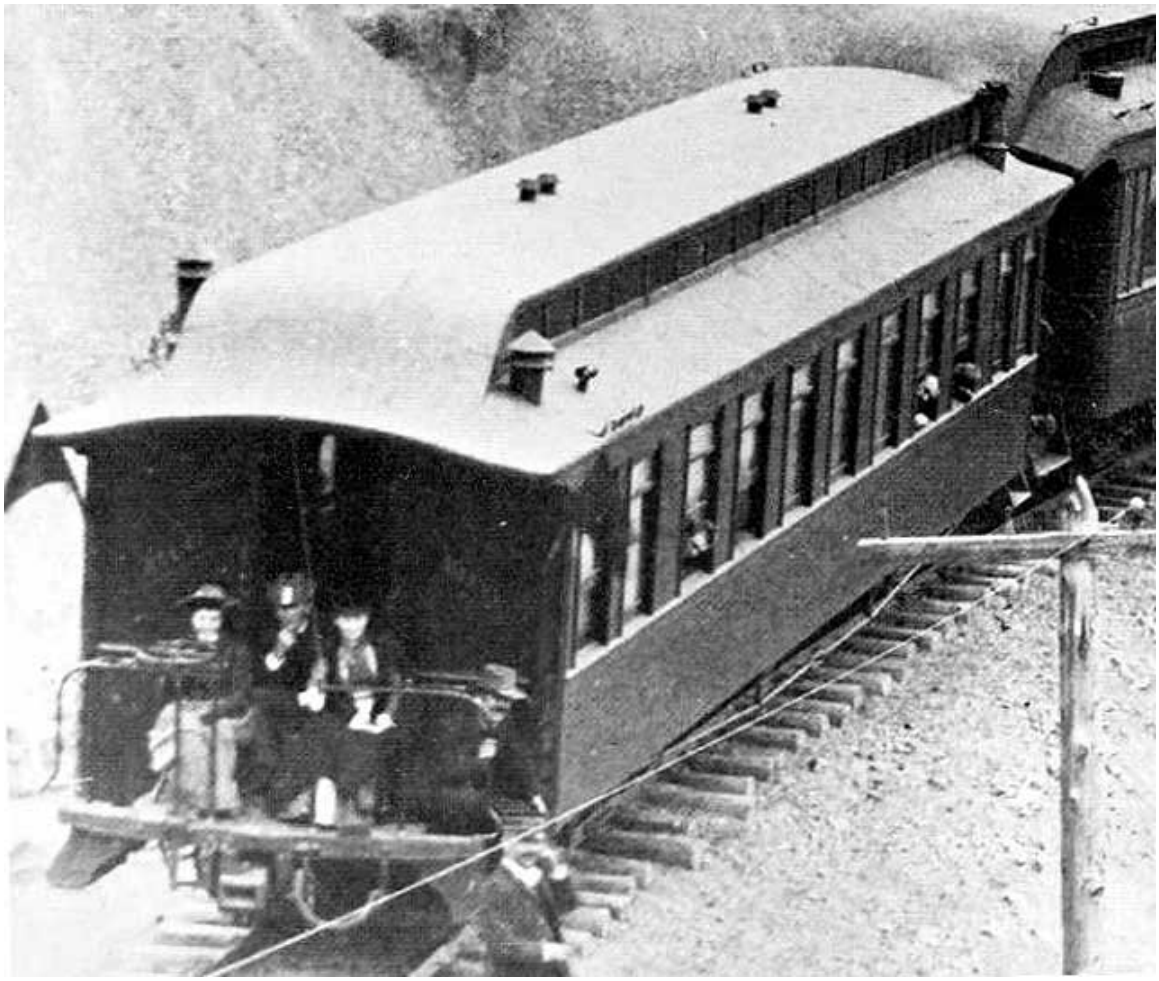
and a DSP combine:



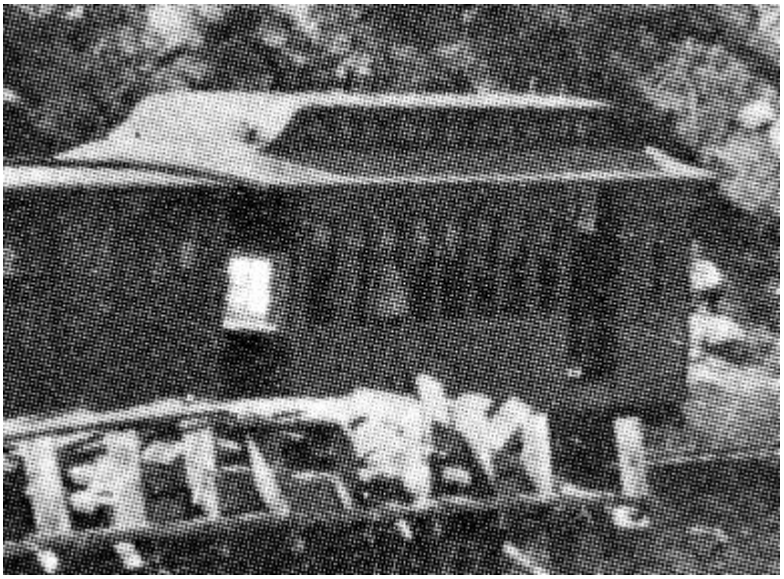
Another DSP Bowers Dure & Co coach, acquired 2nd hand from the Sante Fe in 1880, also 35' long over the end sills



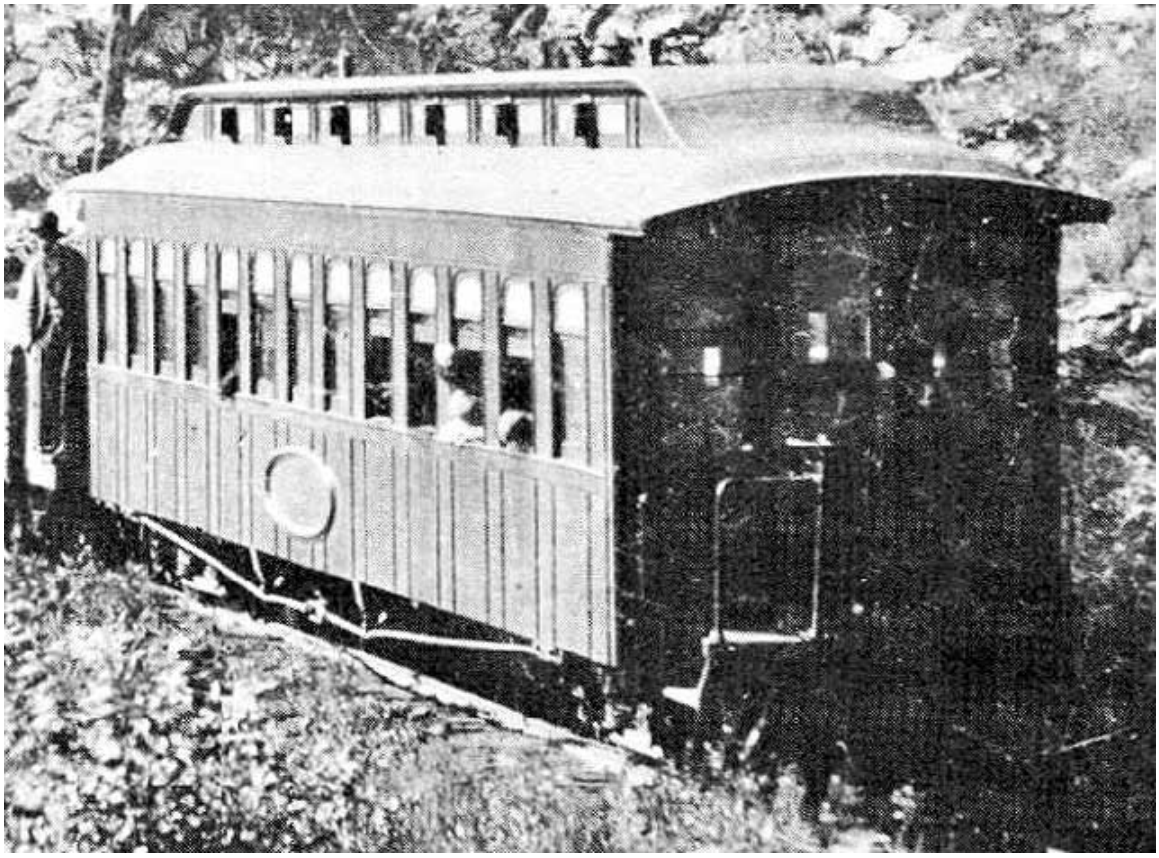
The Colorado Central line also had some 13-window duckbill cars. Car 11:



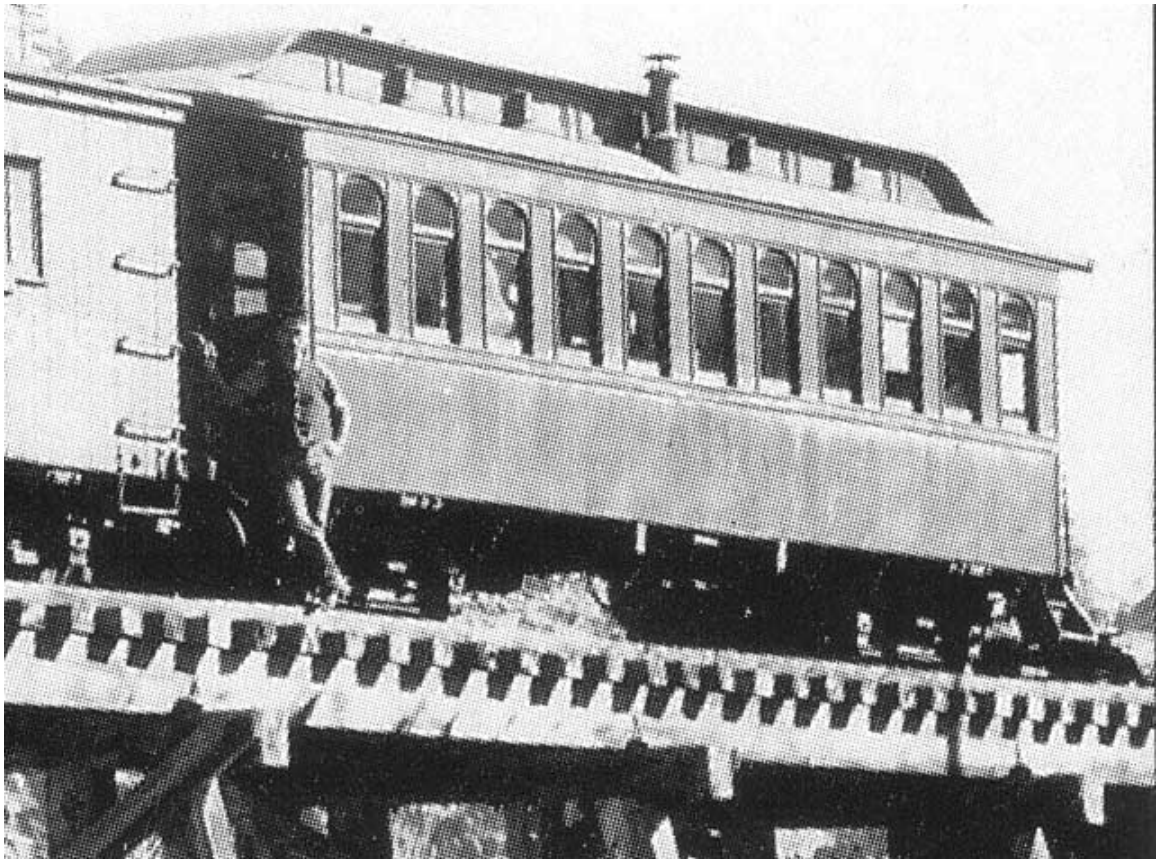
Combine #5:



Another Coach or 'Chair car' on the early Colorado Central:



and a really neat 30' 11 window (probably 30' or so over the sills) Colorado Central car, used on the DSP

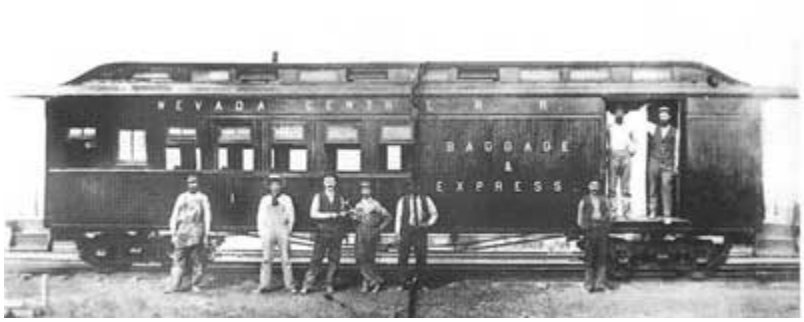


Restored Cars on the Durango & Silverton.

A 13 window, Duckbill roof styles car was restored by the D&SNG 1983-1986 as their car #257. Originally built in 1880 by Jackson & Sharp, as D&RG #43, she looked exactly like the D&RG J&S cars pictured earlier in this article. She was rebuilt many times, even with bull nose roof ends. In 1891 to 1931 she served on the Rio Grande Southern as their #257 before becoming a farm shed near Montrose. In 1983 she was moved back to Durango for restoration. #257 is the D&SNG's oldest J&S car. Here is a fabulous view of the restored J&S Duck Bill car, photographed by Carla Breitner and brought to us by Gary Woolard:

Here are views inside the car that Carla took. As Gary pointed out in the forums, these NG cars are small, and the two seat benches either side of the isle are a tight squeeze for two people today! This will definitely come up when installing the seats in your 1:20.3 scale cars, people will still be a tight squeeze to fit into our laser cut seats!

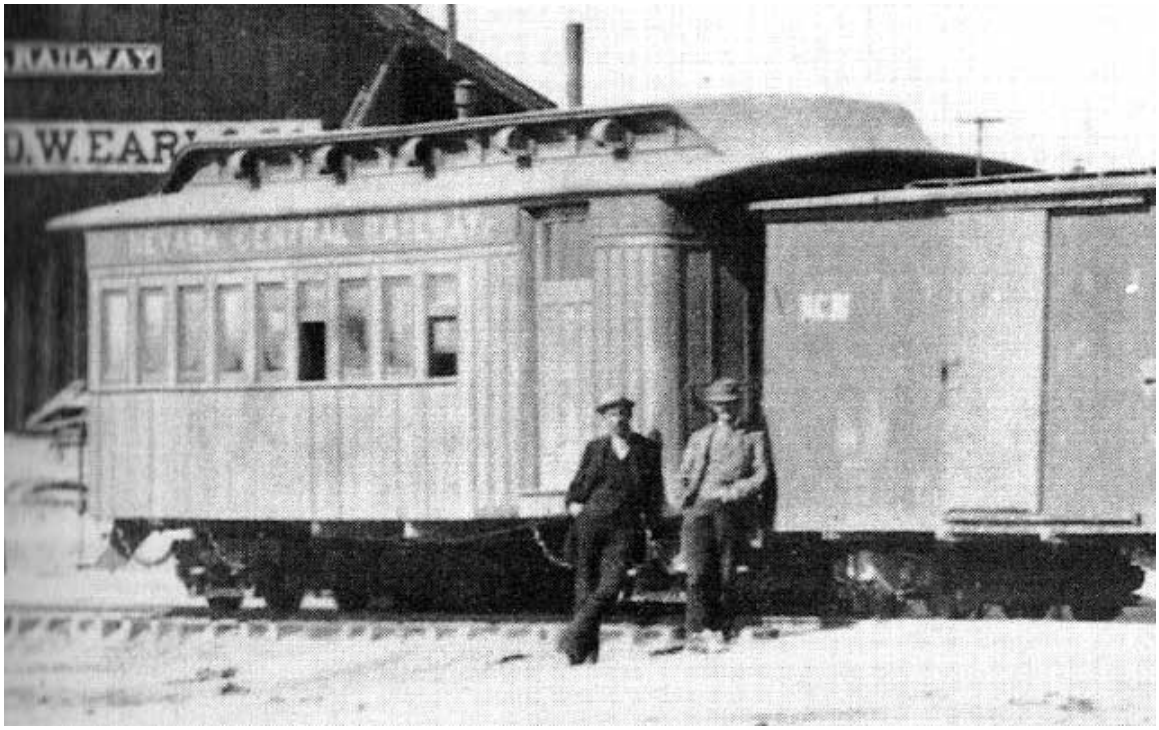

DURANGO & SILVERTON



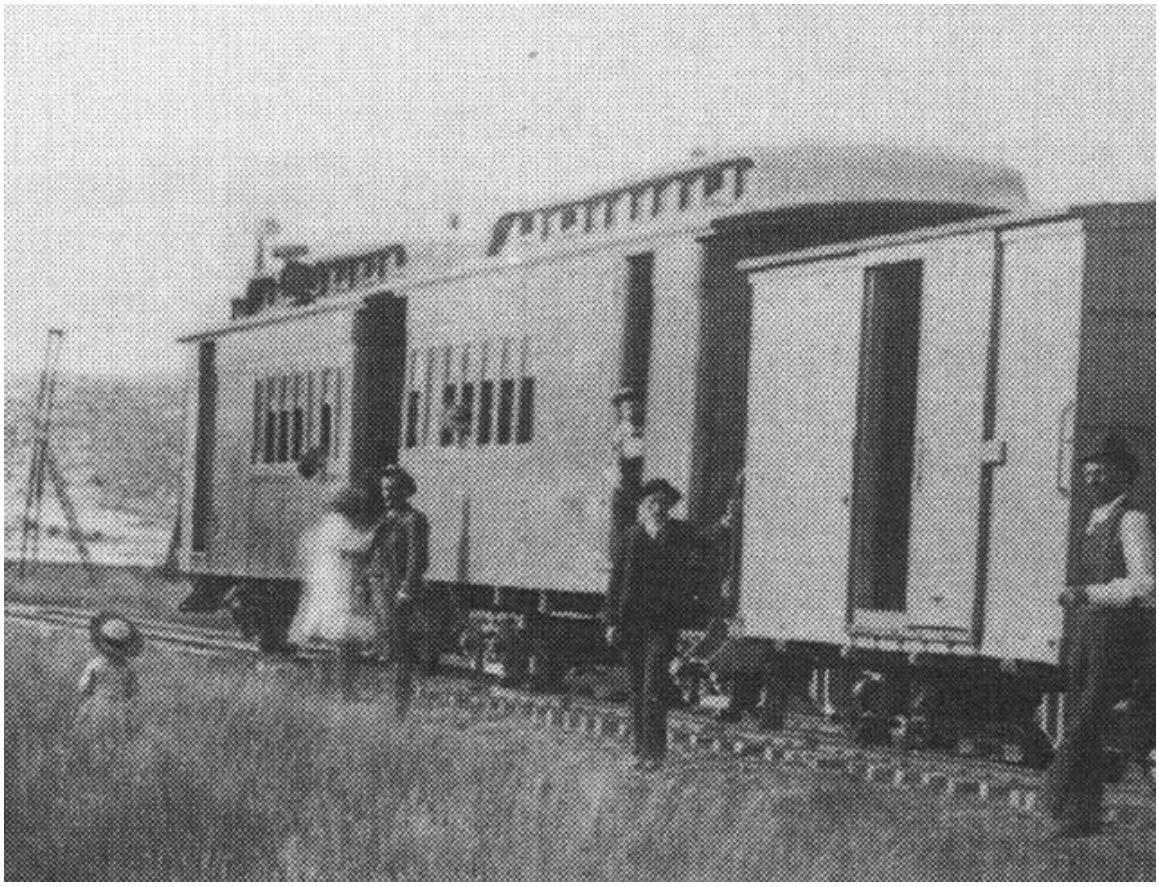
Monterey & Salinas Valley Combine #1

Colour Photos by David Fletcher

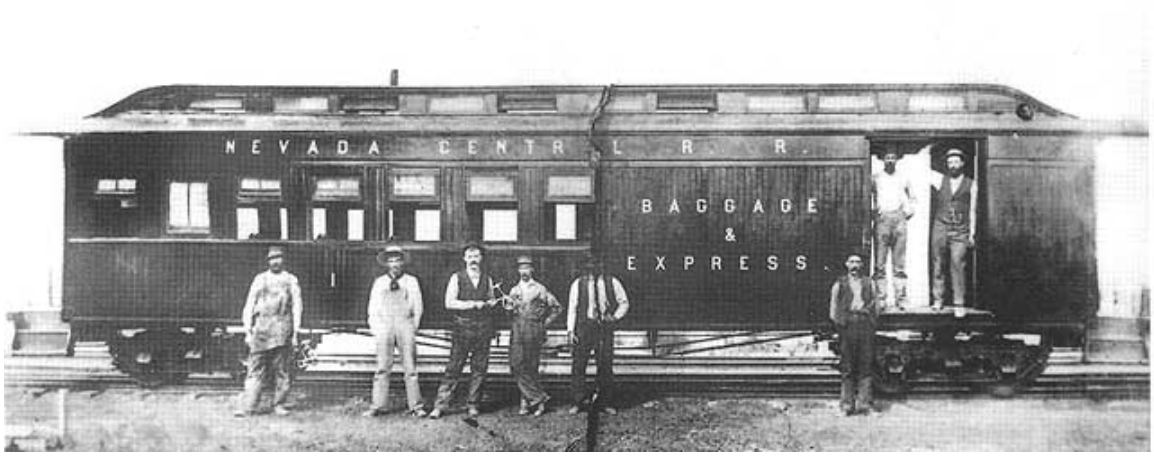
The following is a collection of photos of the Monterey & Salinas Valley Combine, as photographed in December 2005. This is the prototype for the car we're building in this miniclass. We've also provided a few photos of the same car during her life, as provided to us by Bruce Macgregor. You will note the move from board & Batten styling to match board sides along with other detail changes. As built, the combine was 36' long to the end sills. We'll start with some of the earliest photos of the car:



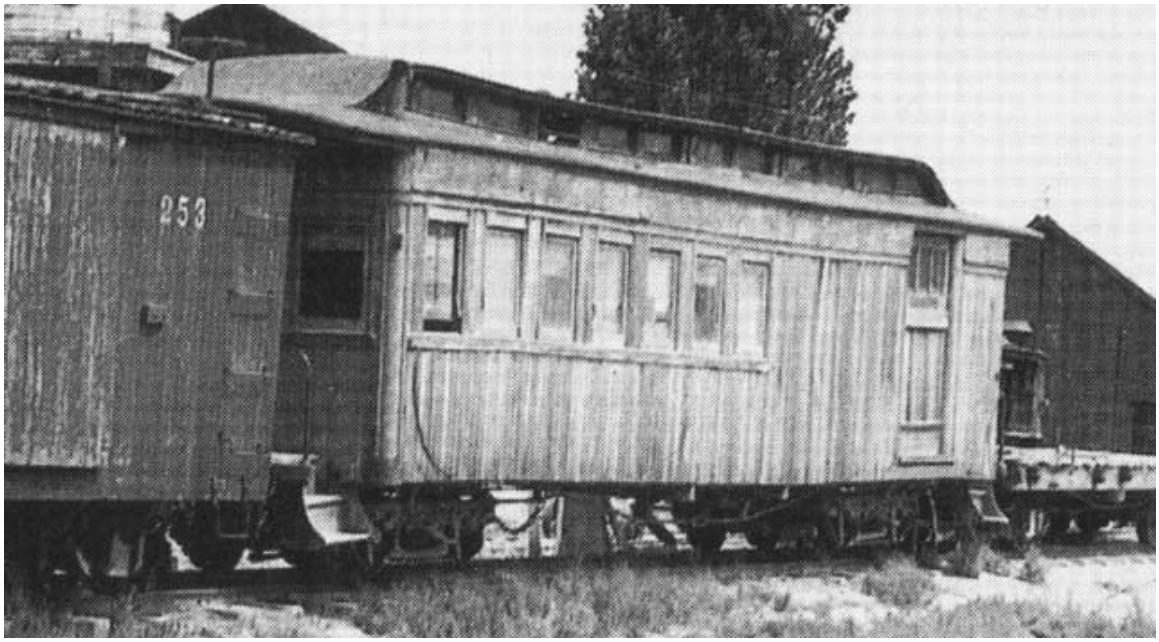
Taken on the Nevada Central RR, this photo shows the car pretty much in 'as built' style, prior to 1880.



Two of the original M&SV Combines on this excursion train on the Nevada Central in 1887.

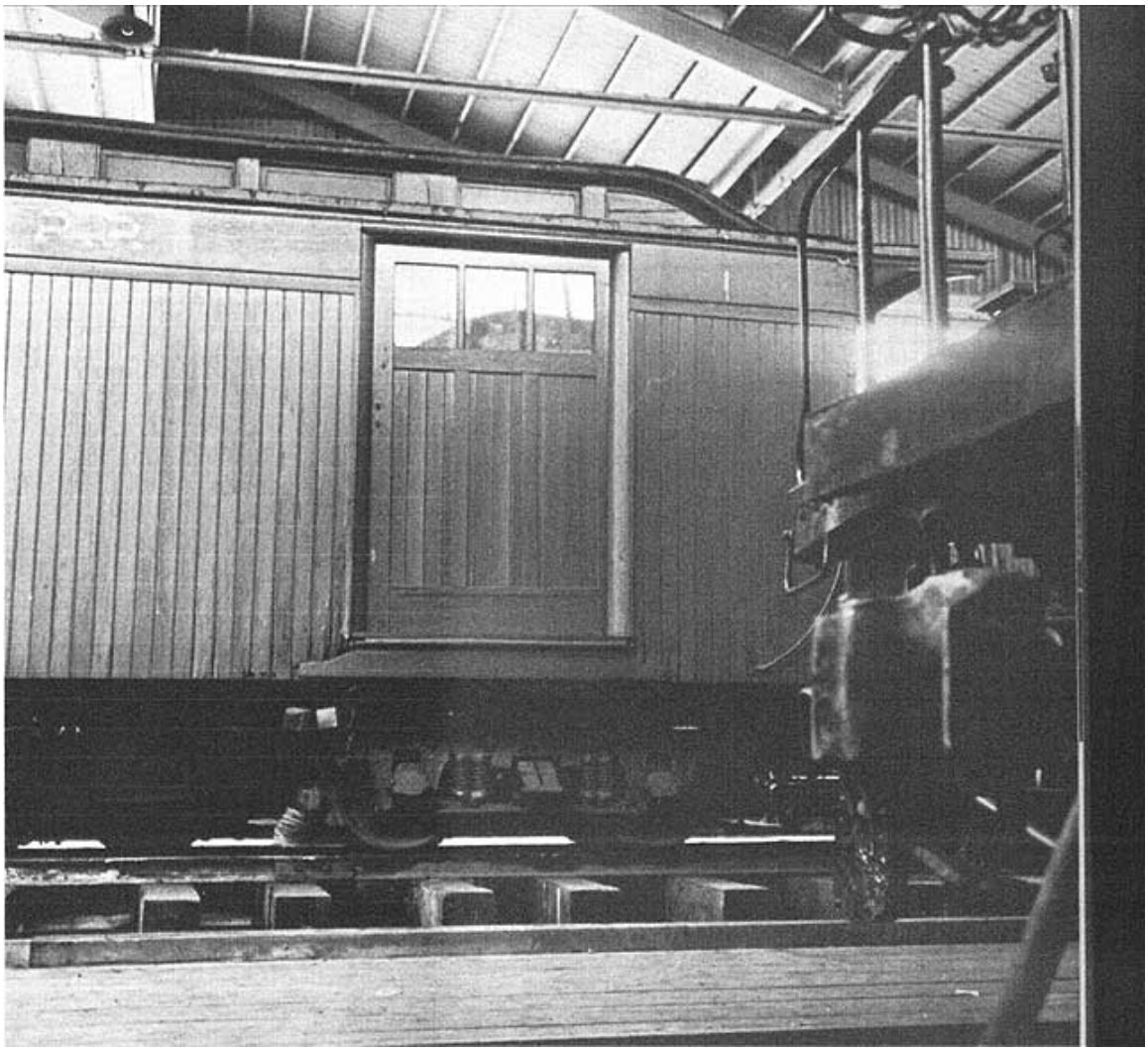


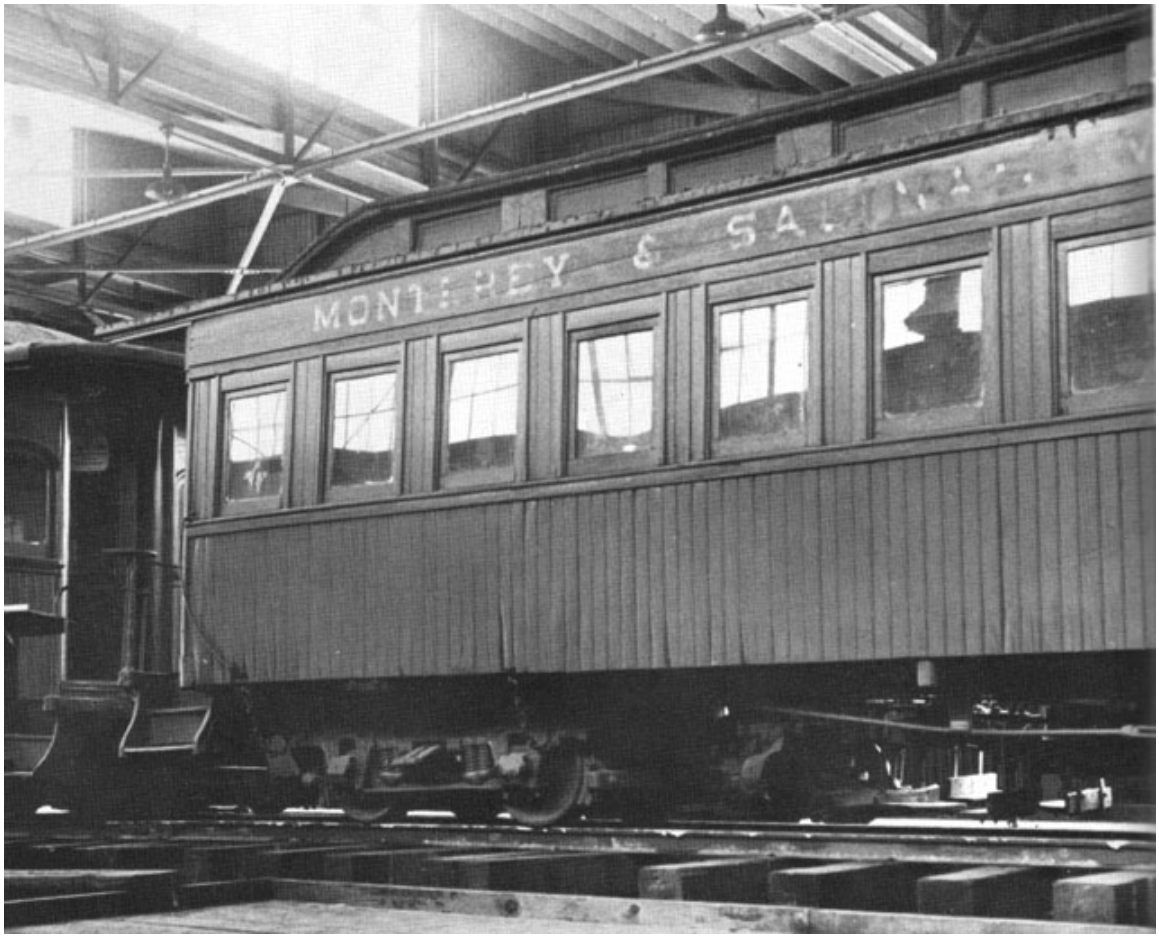
A fantastic view of the M&SV Combine #1, on the Nevada Central, rebuild with matchboard siding and Carters 4' trucks, circa 1897. Note the addition of the iron Queen Posts under the Needle Beams.

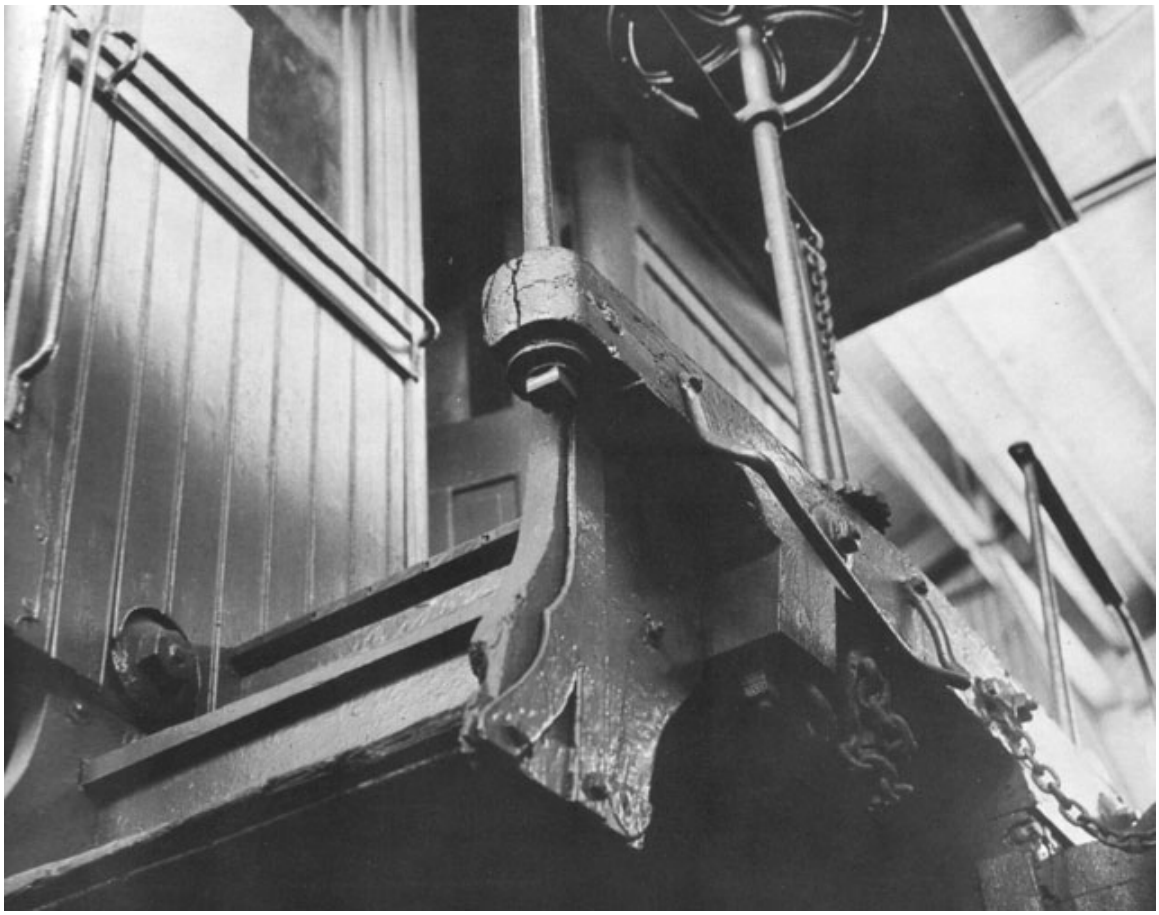


Looking neglected in the Battle Mountain yards, here is the M&SV Combine in 1938.

Below as the car is moved into the protection of the Museum environment.

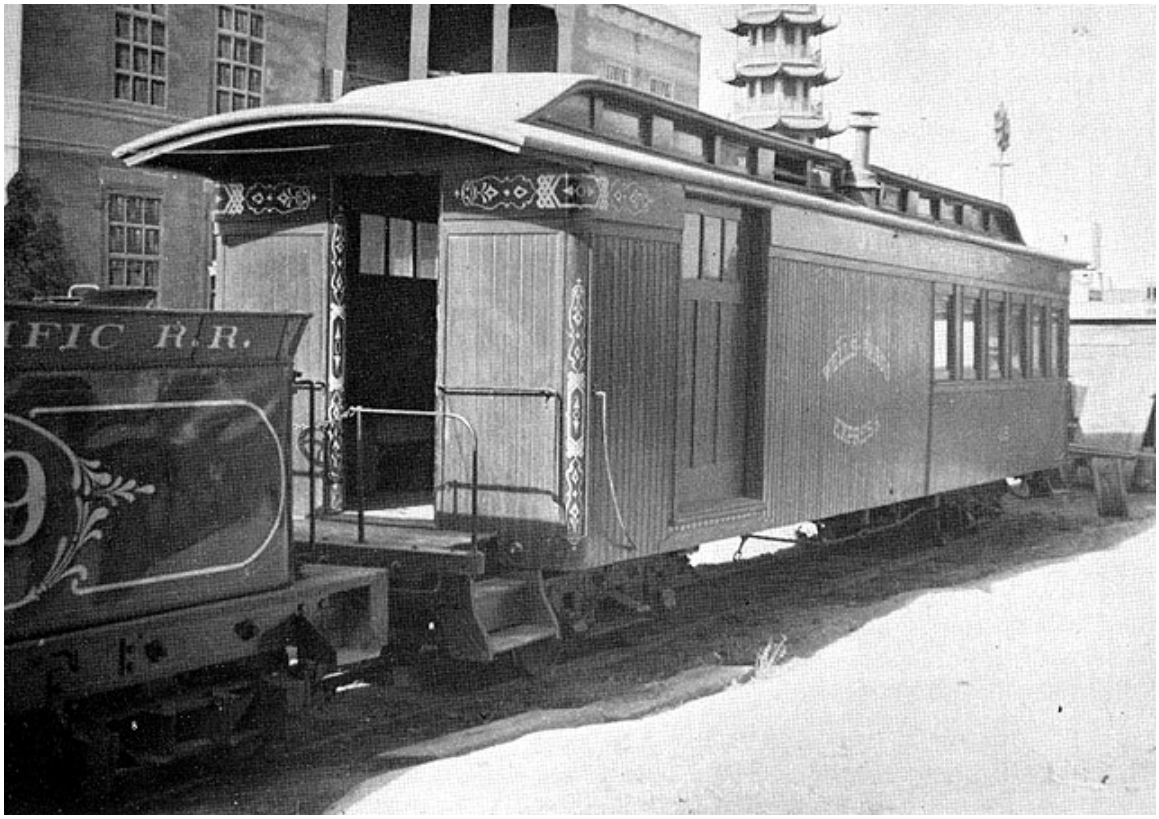






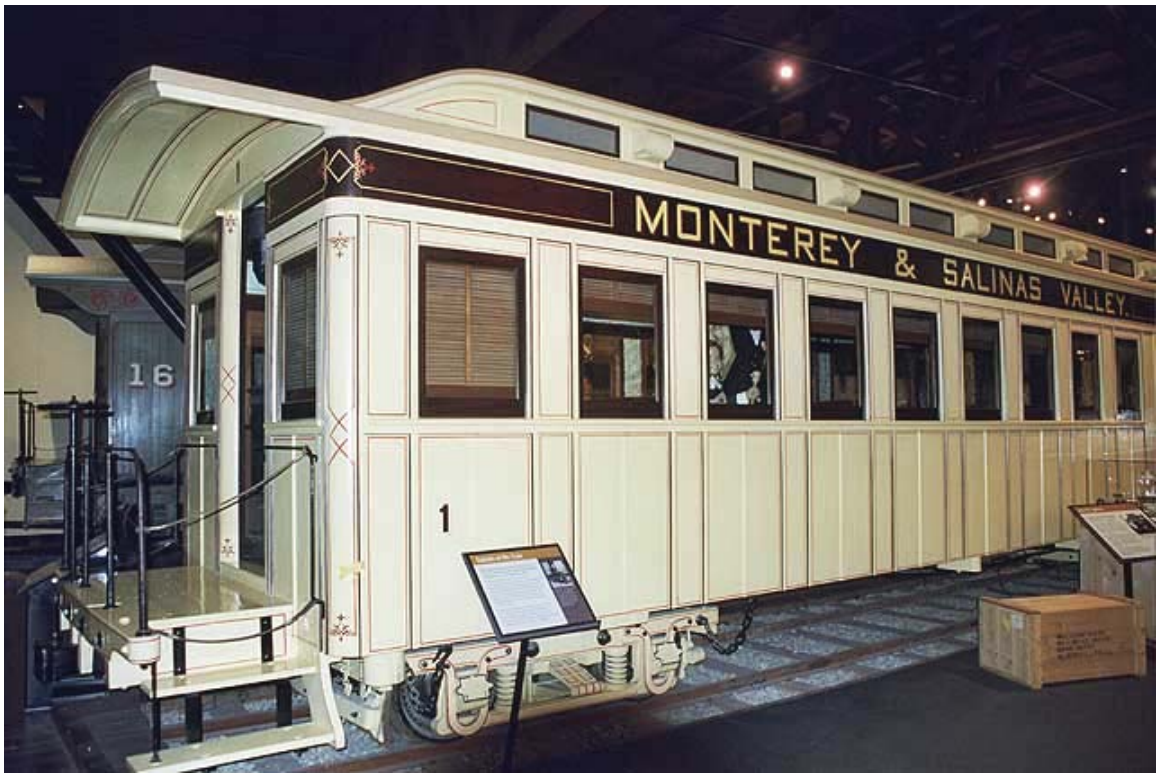
A detail of the end beams, M&SV combine.

The M&SV combine all dolled up in 1939/40 for the roll of consist behind re-lettered Loco #119 for the Golden Spike re-enactment in the 'Cavalcade of the Golden West' exposition, San Francisco.



The next series are of the car as seen today in the California State RR Museum. Please use these photos to add details to your model.


MONTEREY & SALINAS VALLEY.


MONTEREY & SALINAS VALLEY.
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VALLEY.
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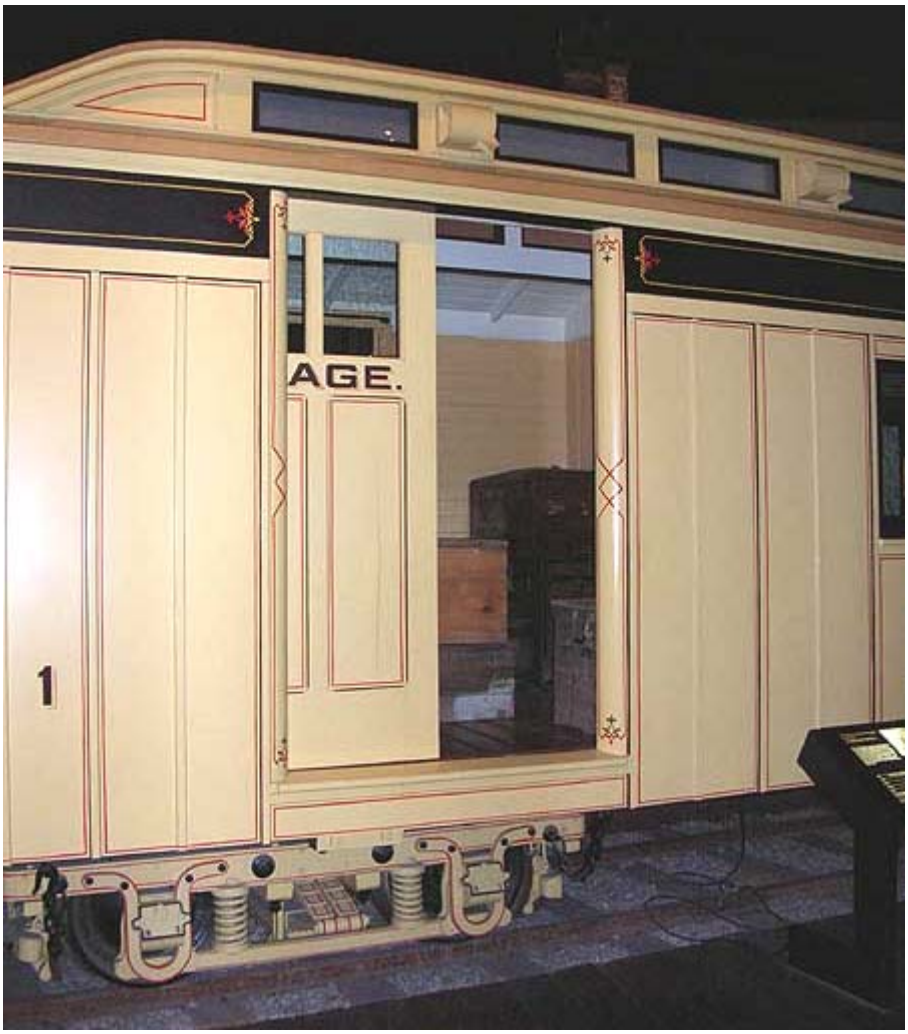
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MONTEREY & SALINAS VALLEY.

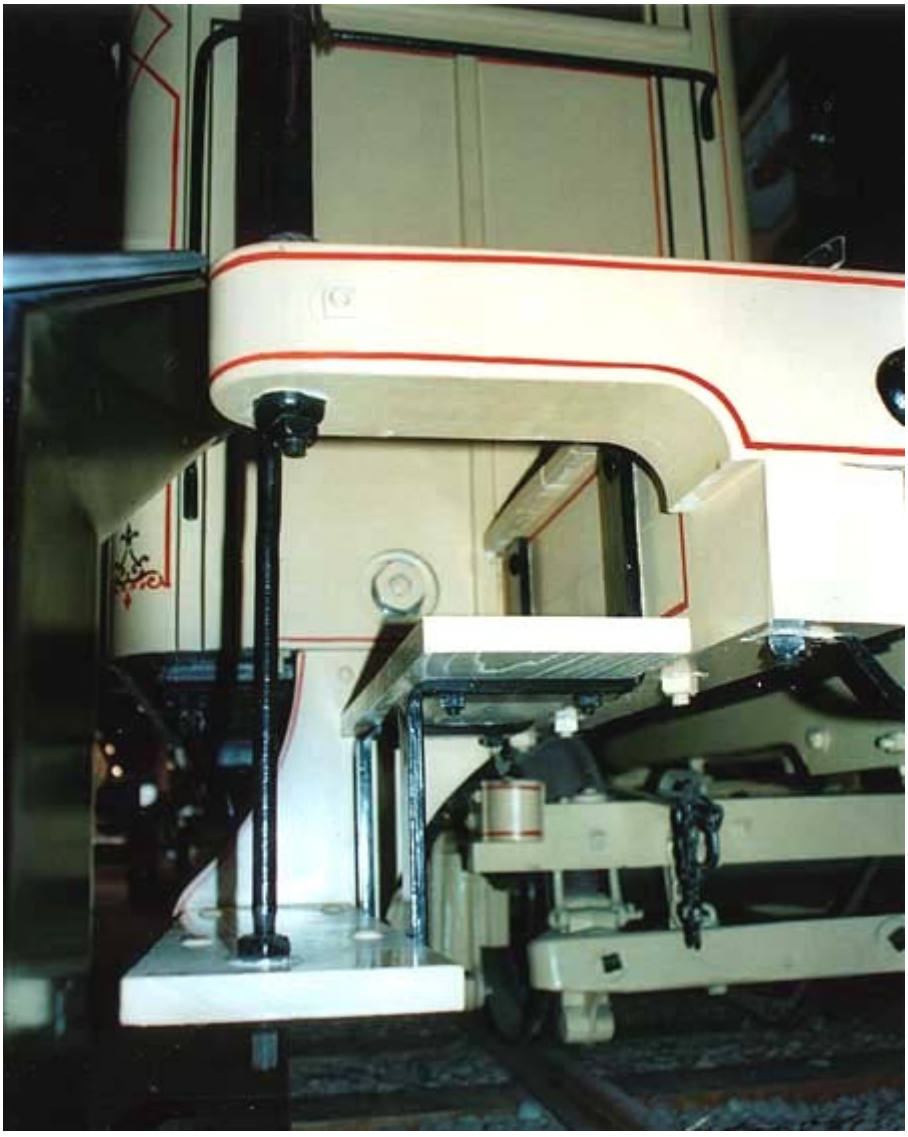

MONTEREY & SALINAS VALLEY

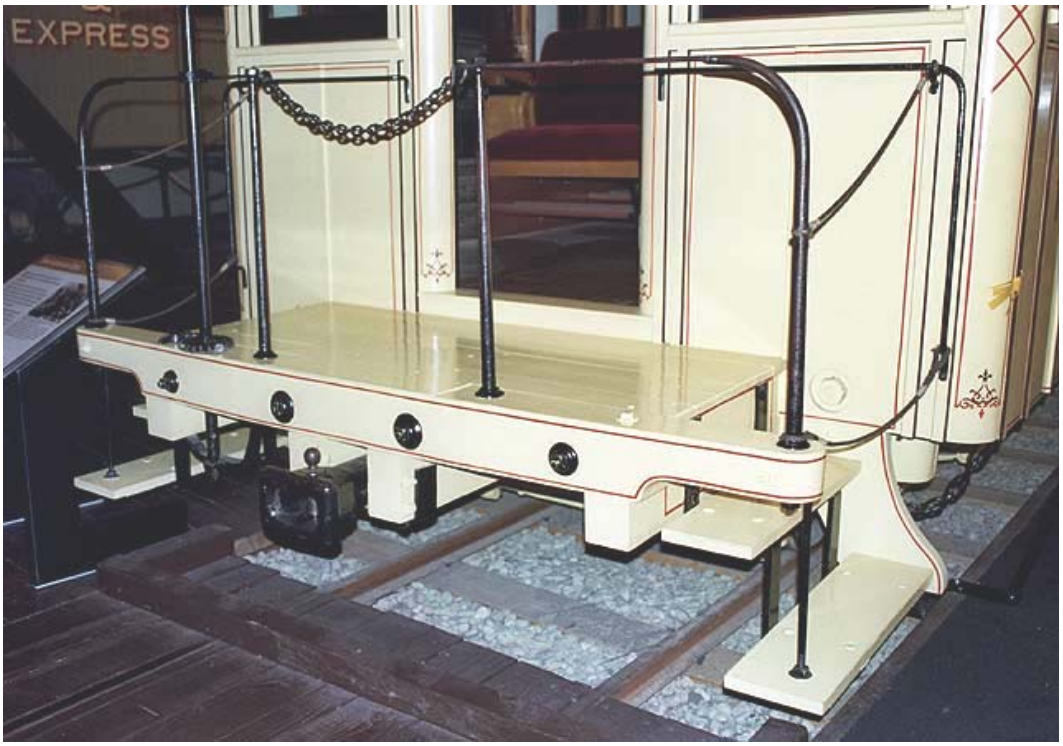
Here are some views inside the baggage compartment.

A view down the isle of the passenger compartment:

The End Platforms, stairs and beams:


1

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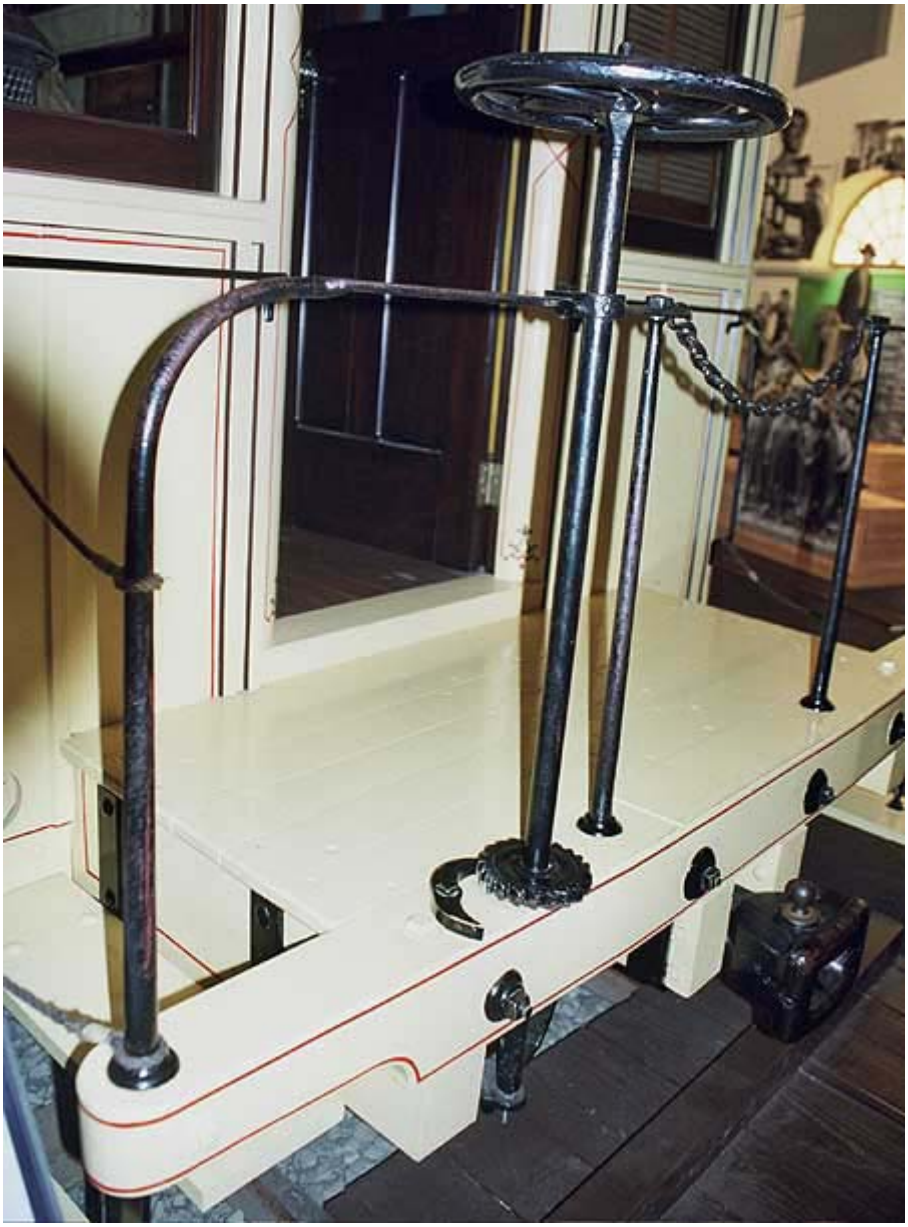

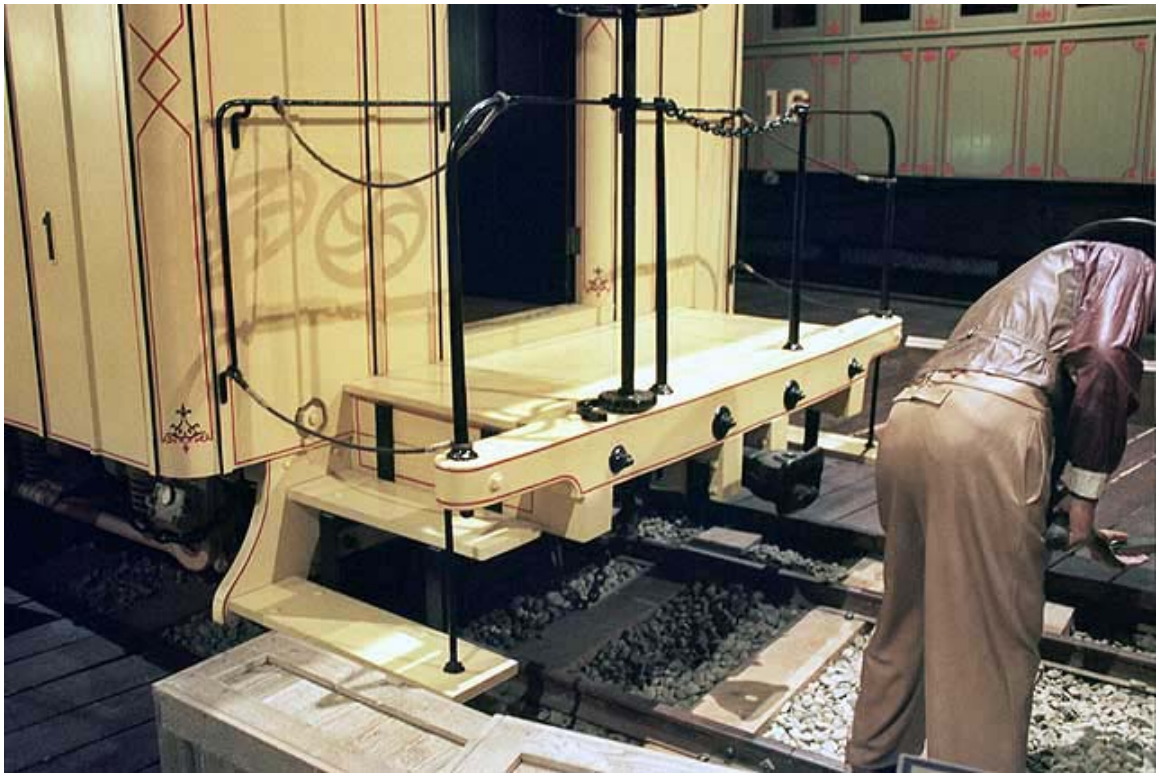
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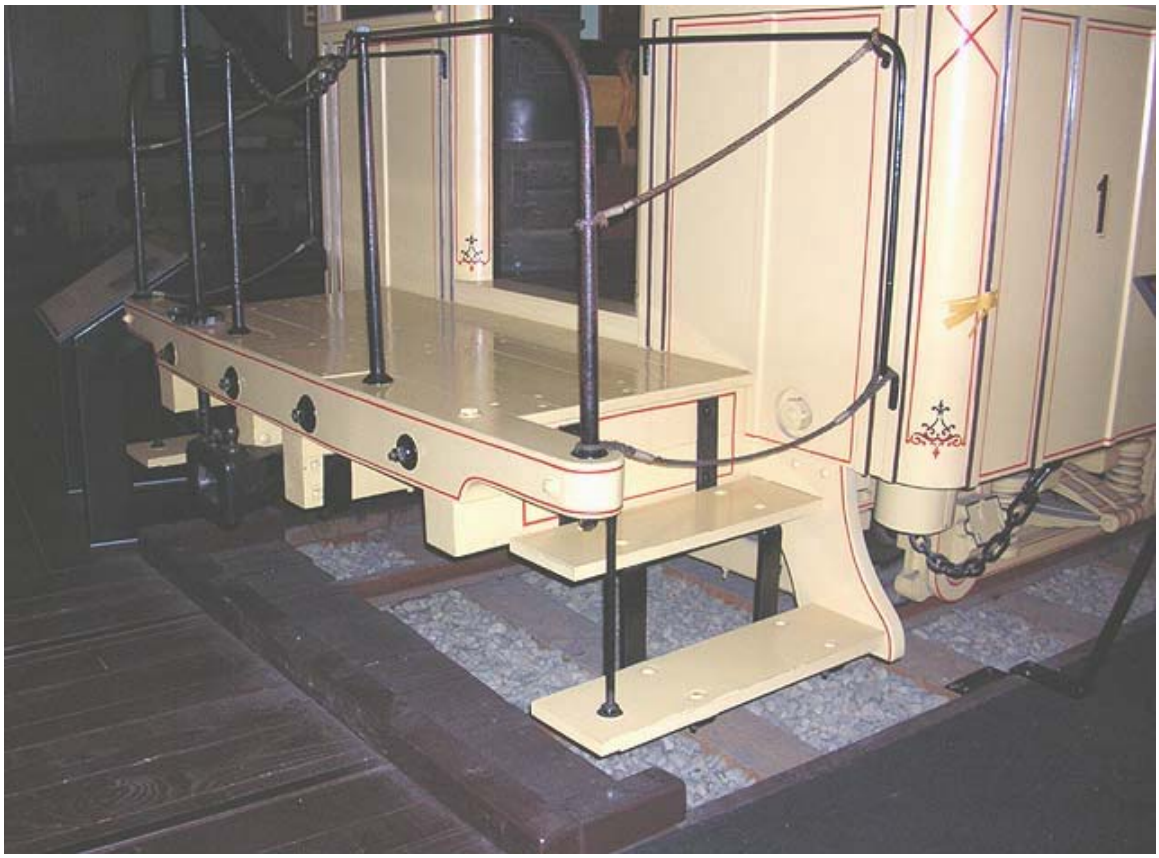
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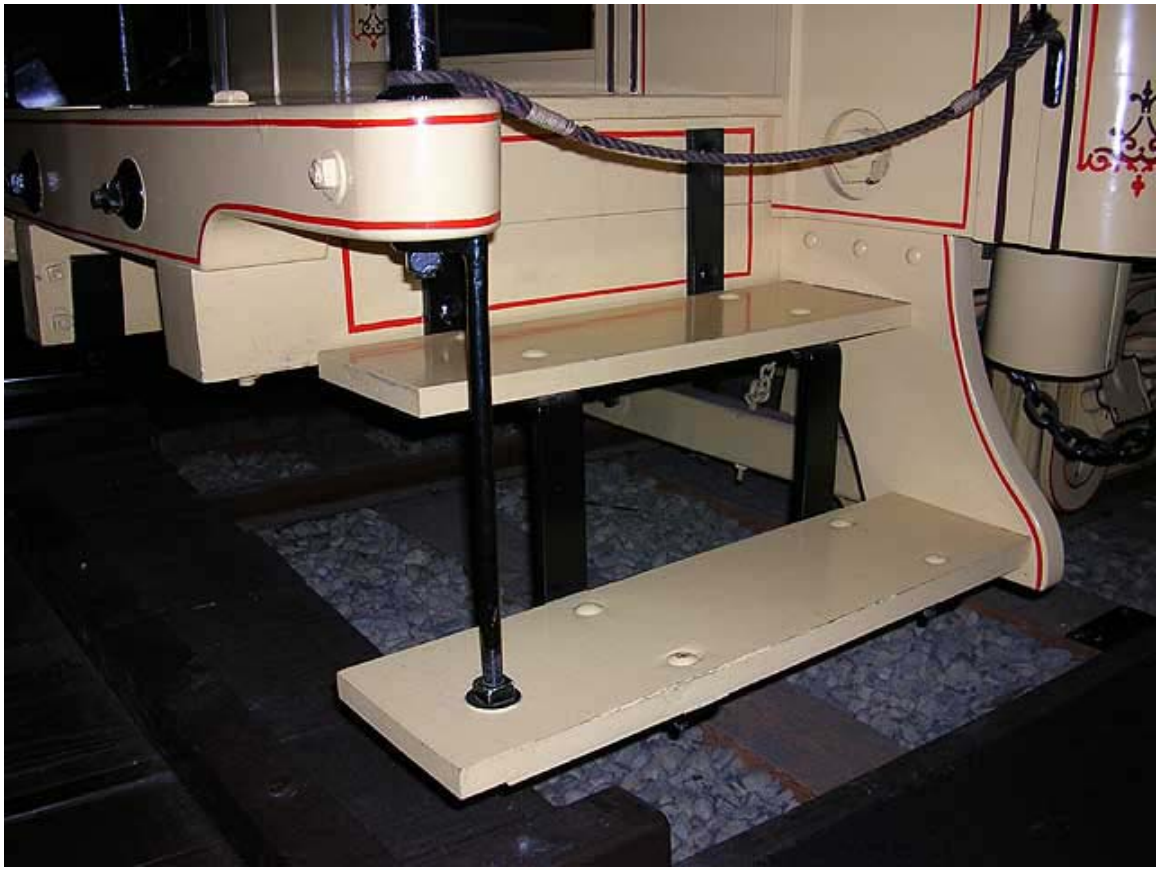


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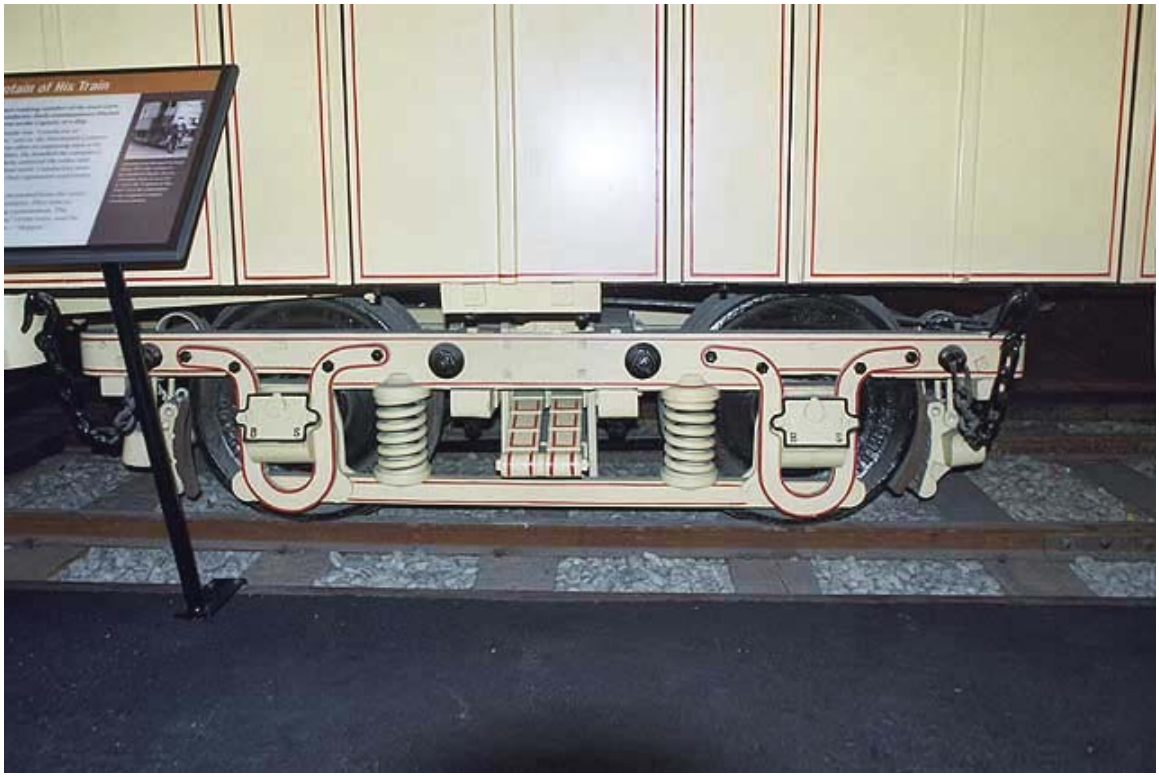
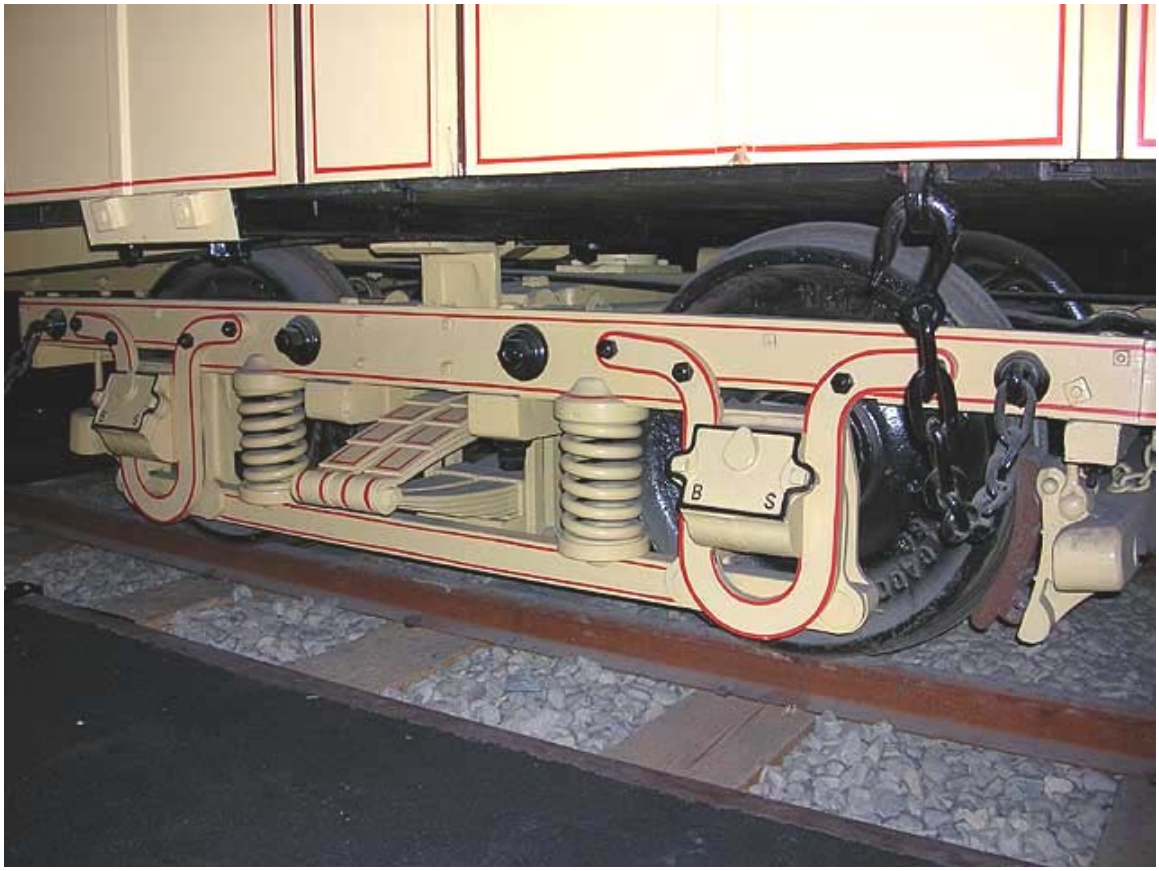
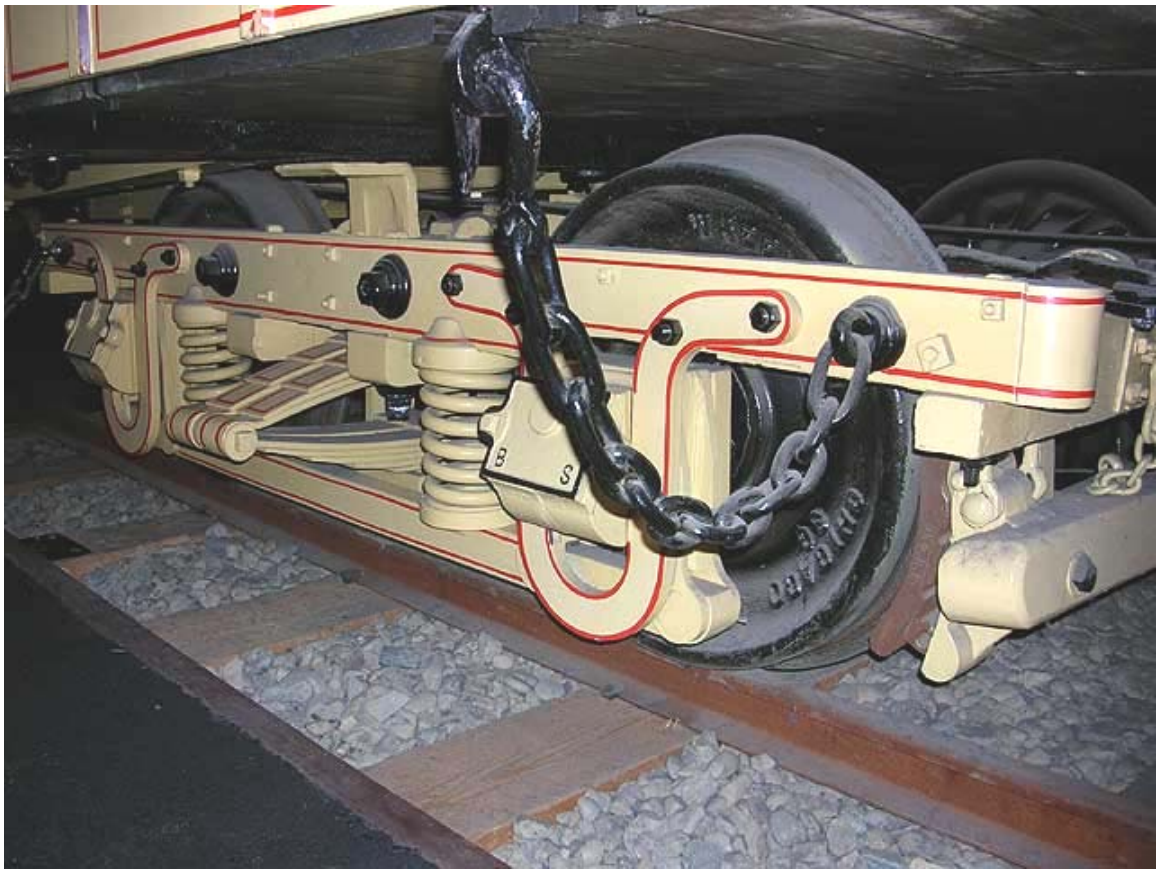
The Trucks:







The Roof - Note the tin panels applied to the roof.

Car Body Details: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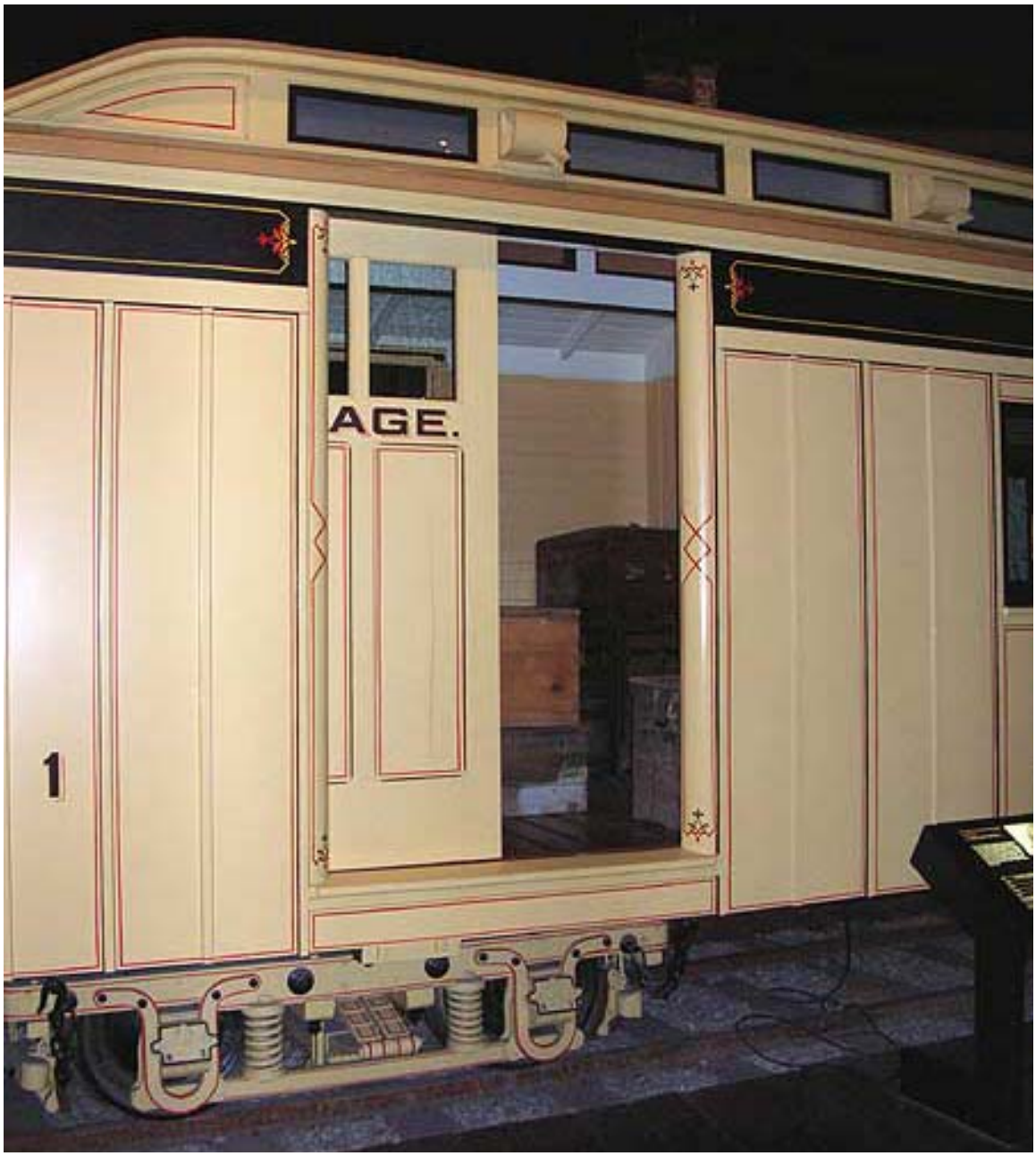
AGE.


AGE.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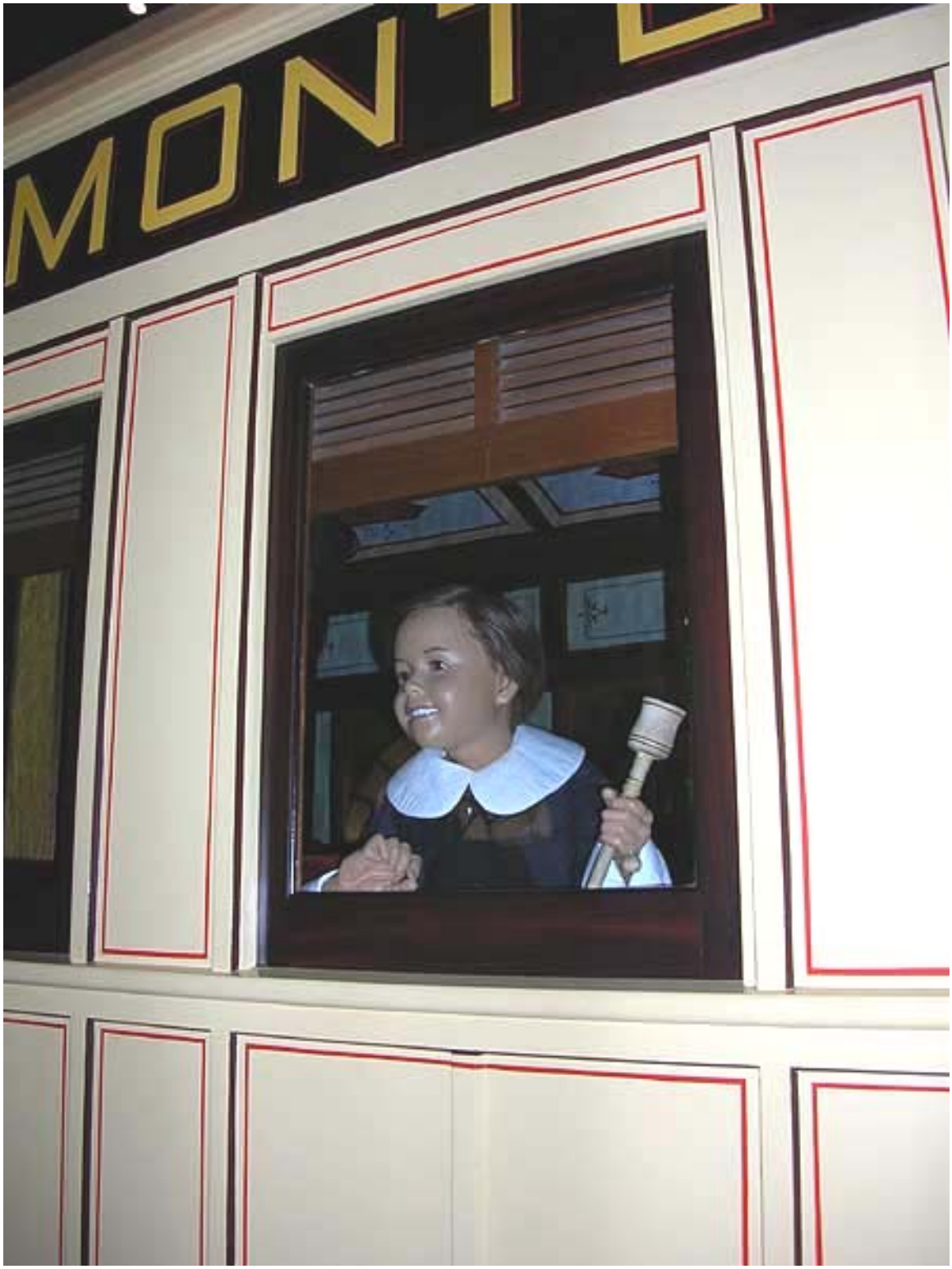
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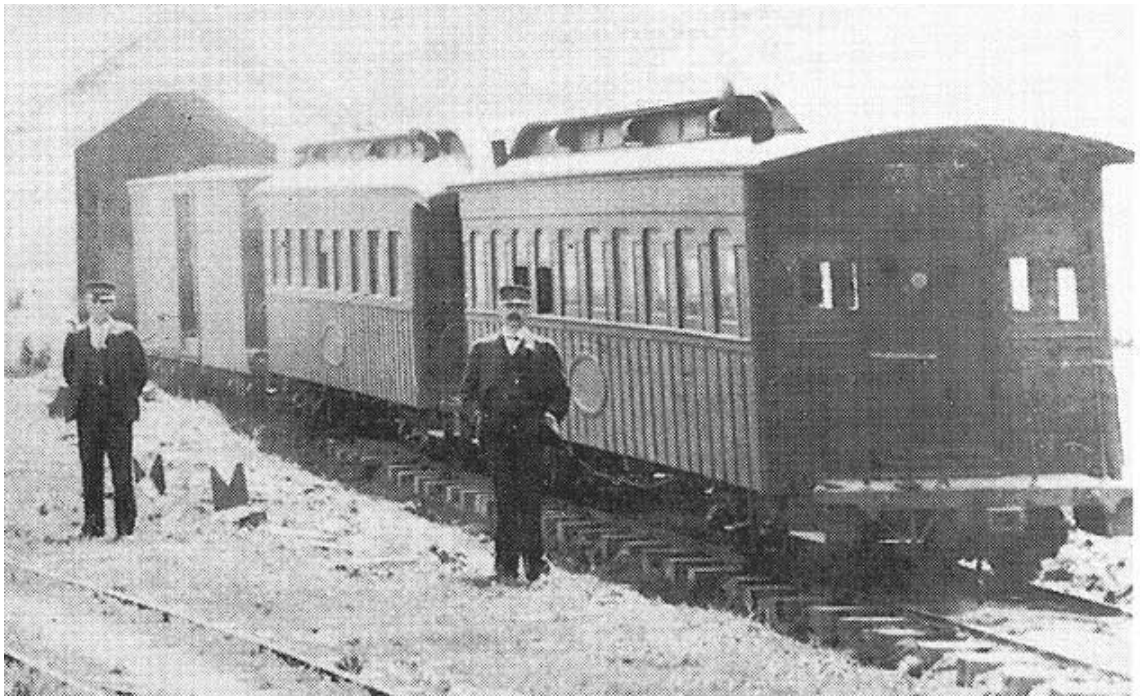
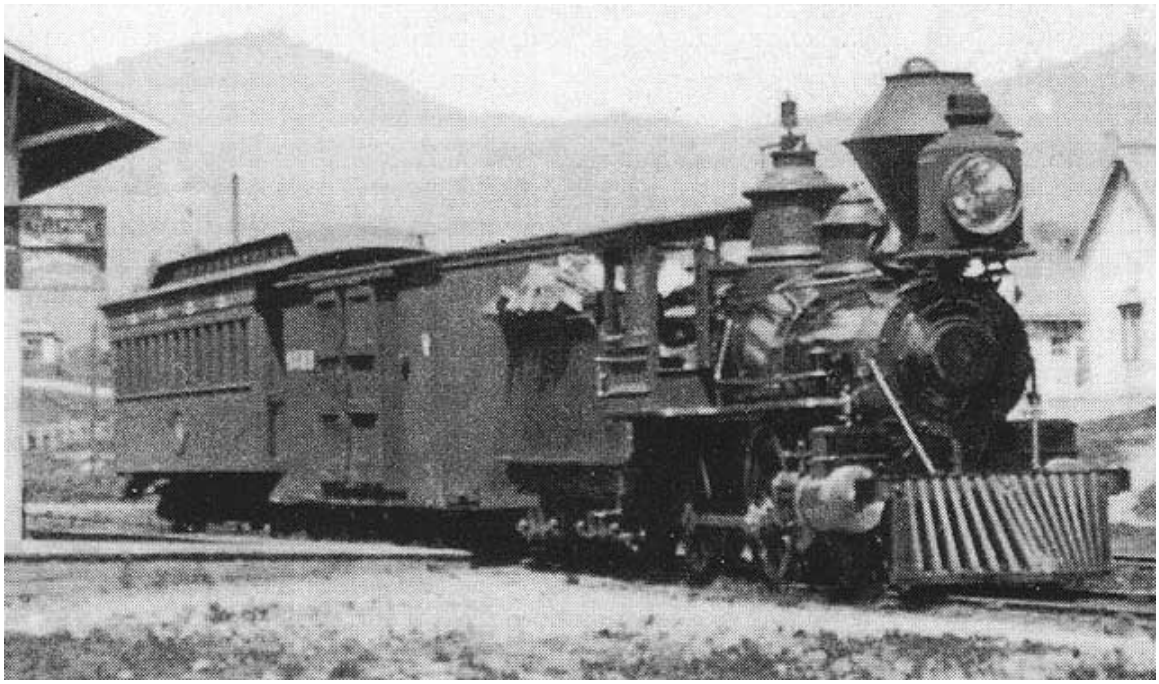
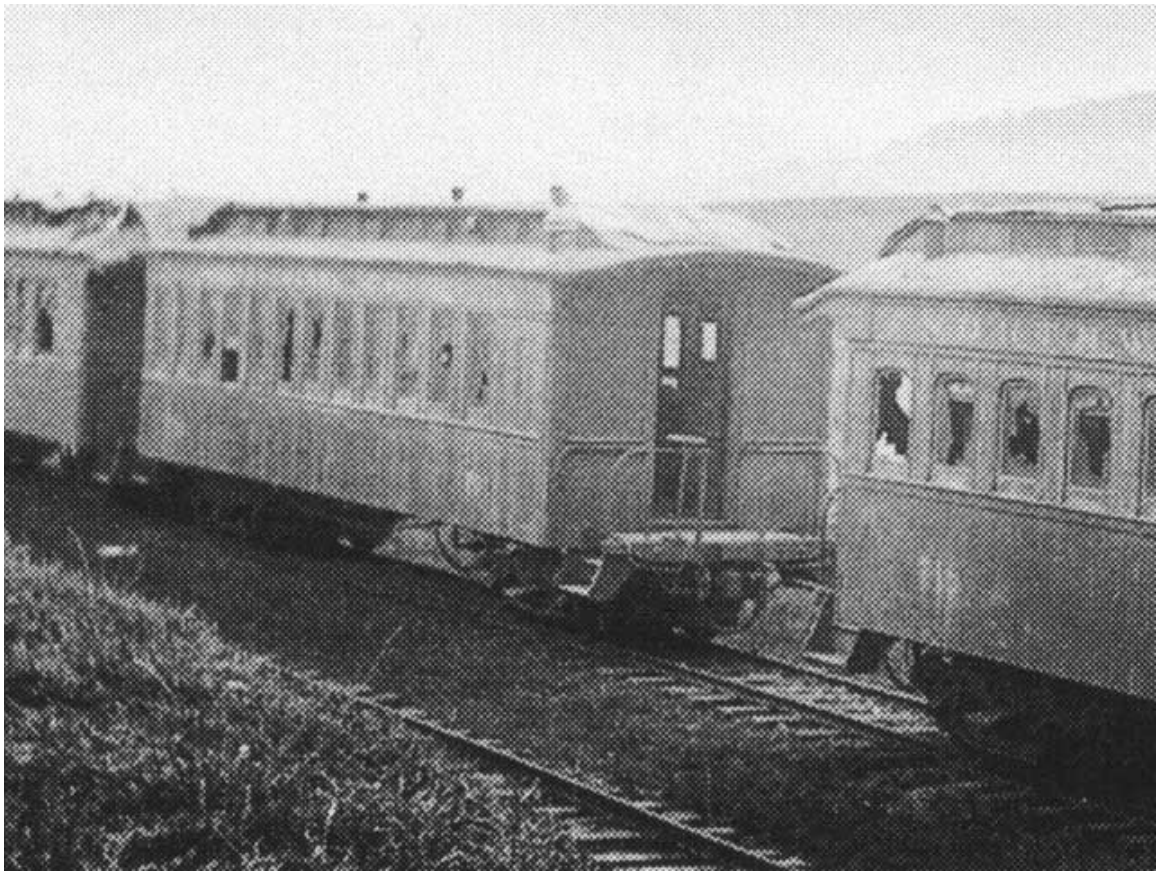
Carter Bros Cars, of Similar design, running on Californian Railroads:



2nd Hand Carters Pass cars on the Arcata & Mad River RR in the 1880s.

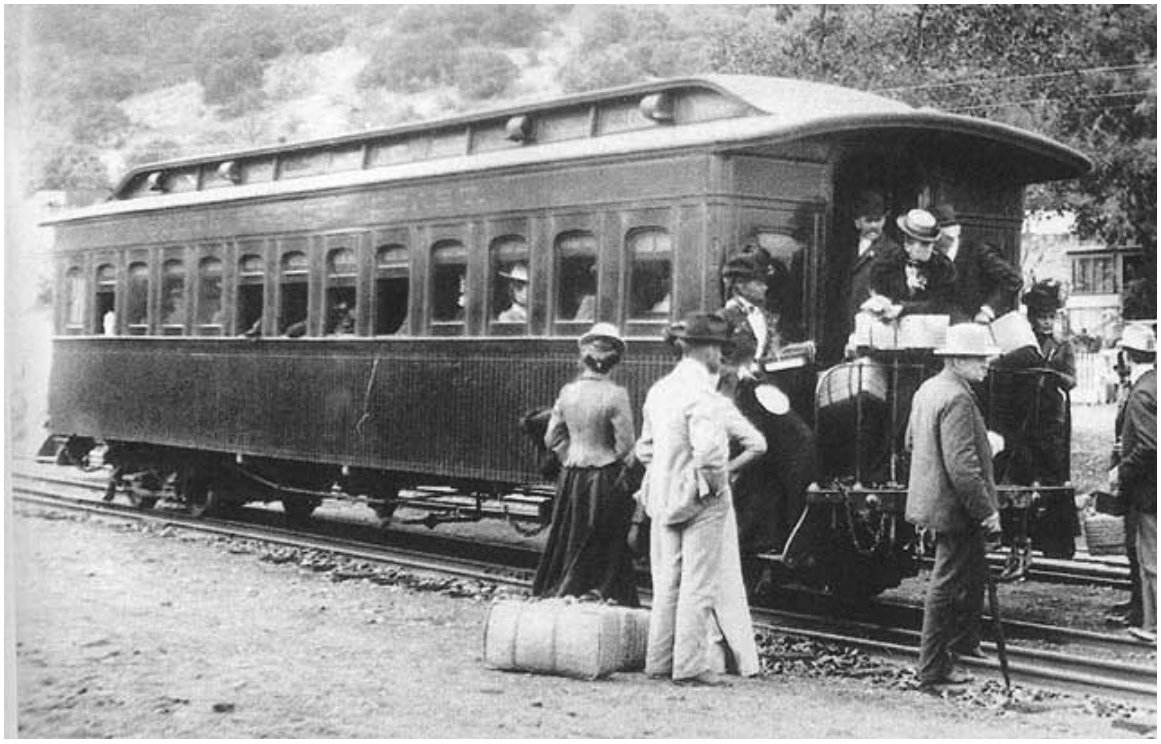


A Carters Pass car on the Sonoma Valley RR in the early 1880s.



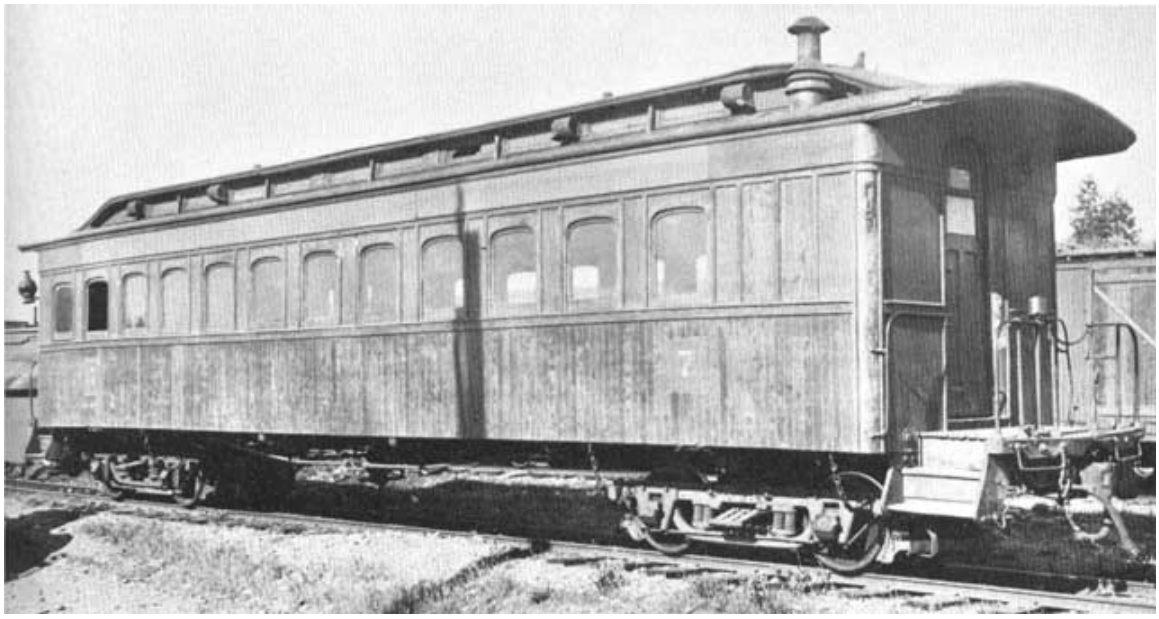
South Pacific Coast Car #5, at the end of days, built 1878, Length 36' 4" to the sills.

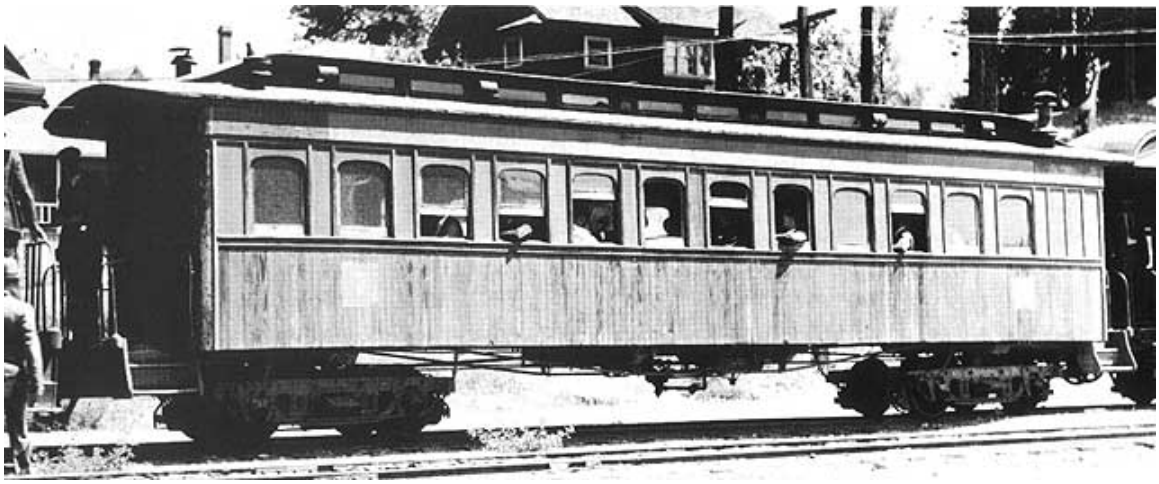
A Similar car running on the SPC, note the extended window height on these cars:

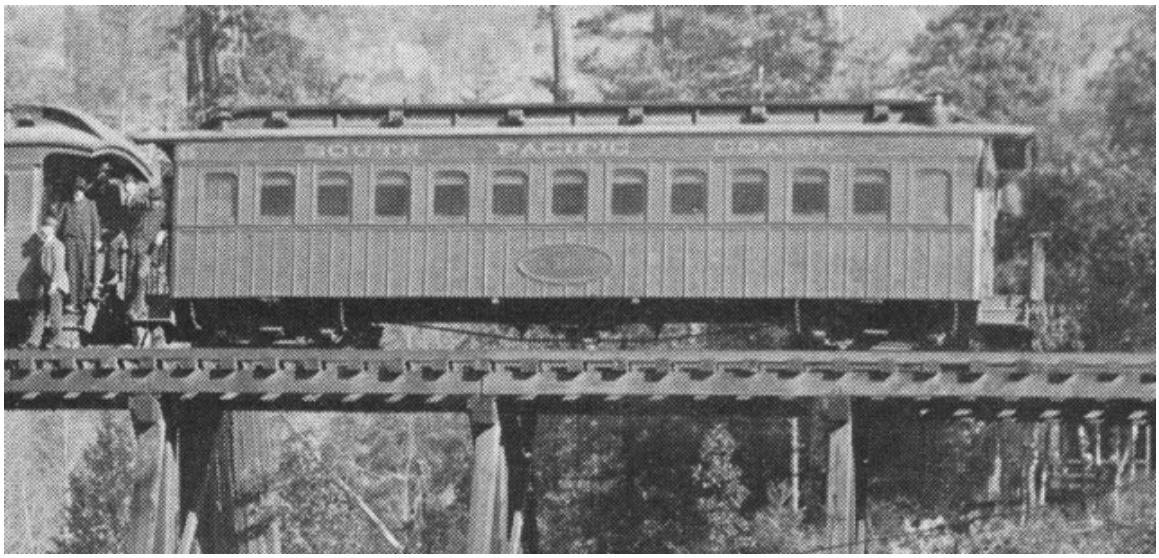


Above is South Pacific Coast #22, a Carter Bros Pass car of 1879, length to the sills, 36' 7". Note the 13-window style, arched windows. Later sold to the Southern Pacific NG as their #13, and finally in 1934 to the Nevada County Narrow Gauge, as their #7.

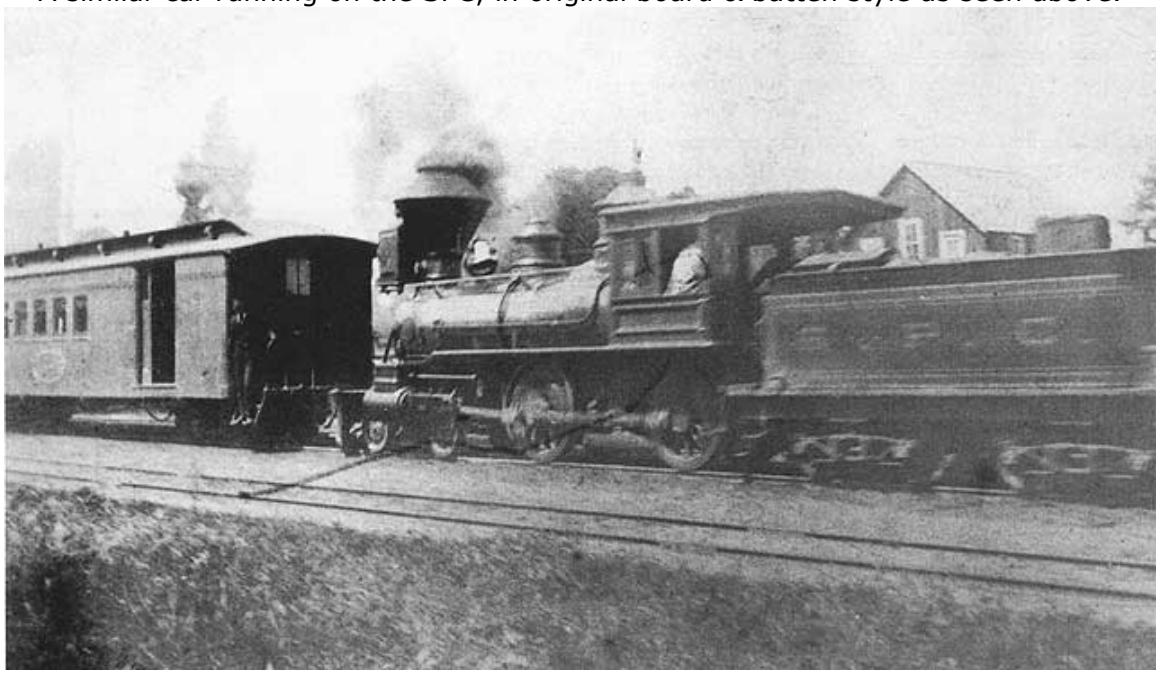
Here are a couple of views of #7 on the NCNG. This was the prototype for the Accucraft Passenger cars of 1998.





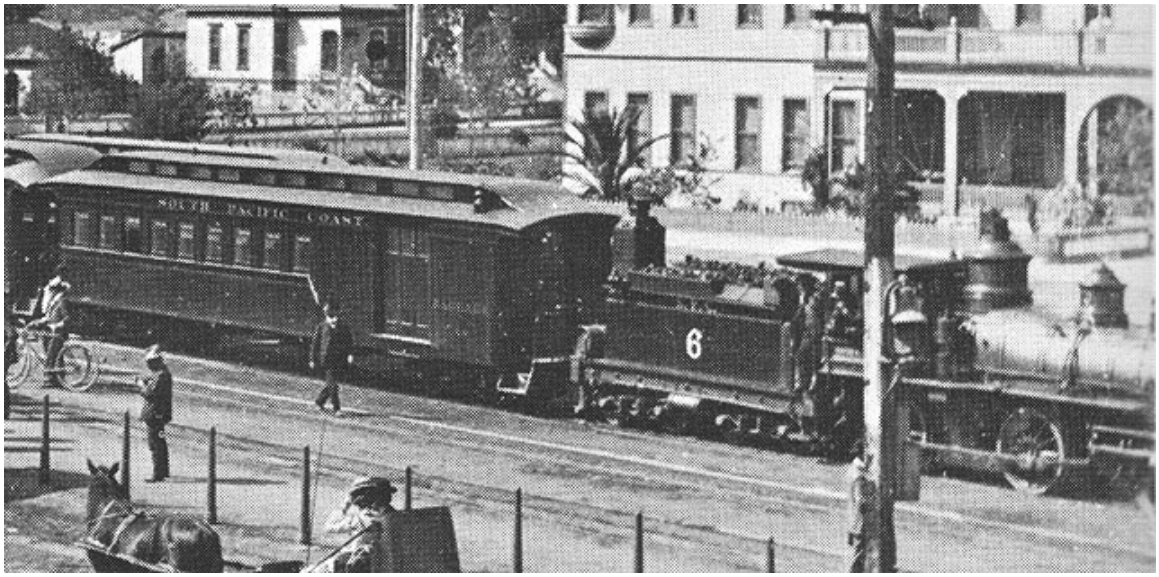


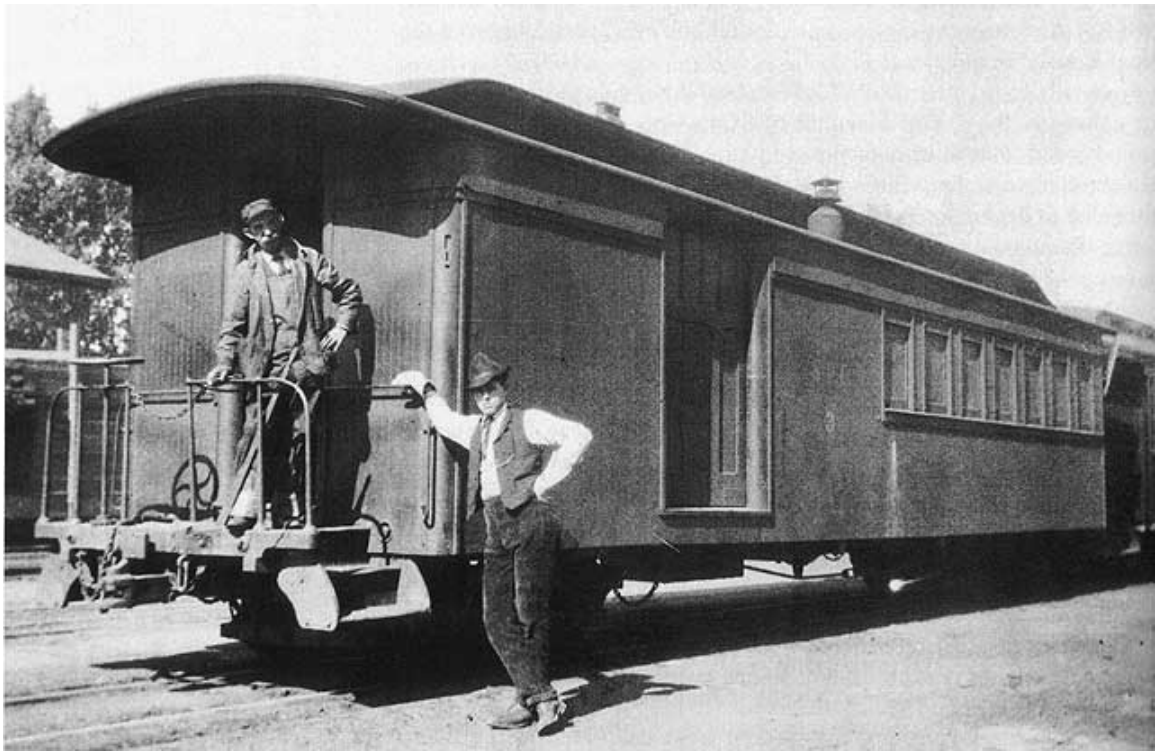
A similar car running on the SPC, in original board & batten style as seen above.



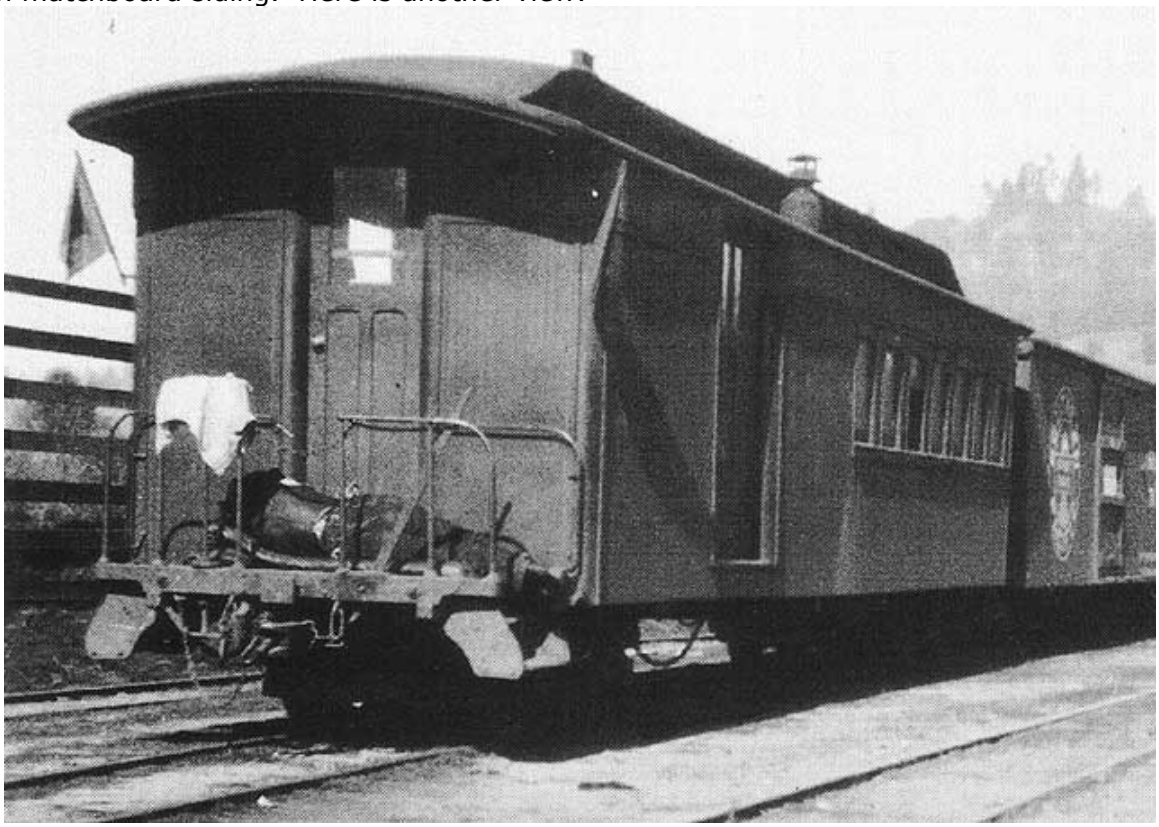
A Carters Combine on transit service on the South Pacific Coast RR in 1883. Note the Baldwin 4-4-0, much like the same made by Bachmann.

The SPC also ran 9 window combines as seen in the two photos below:

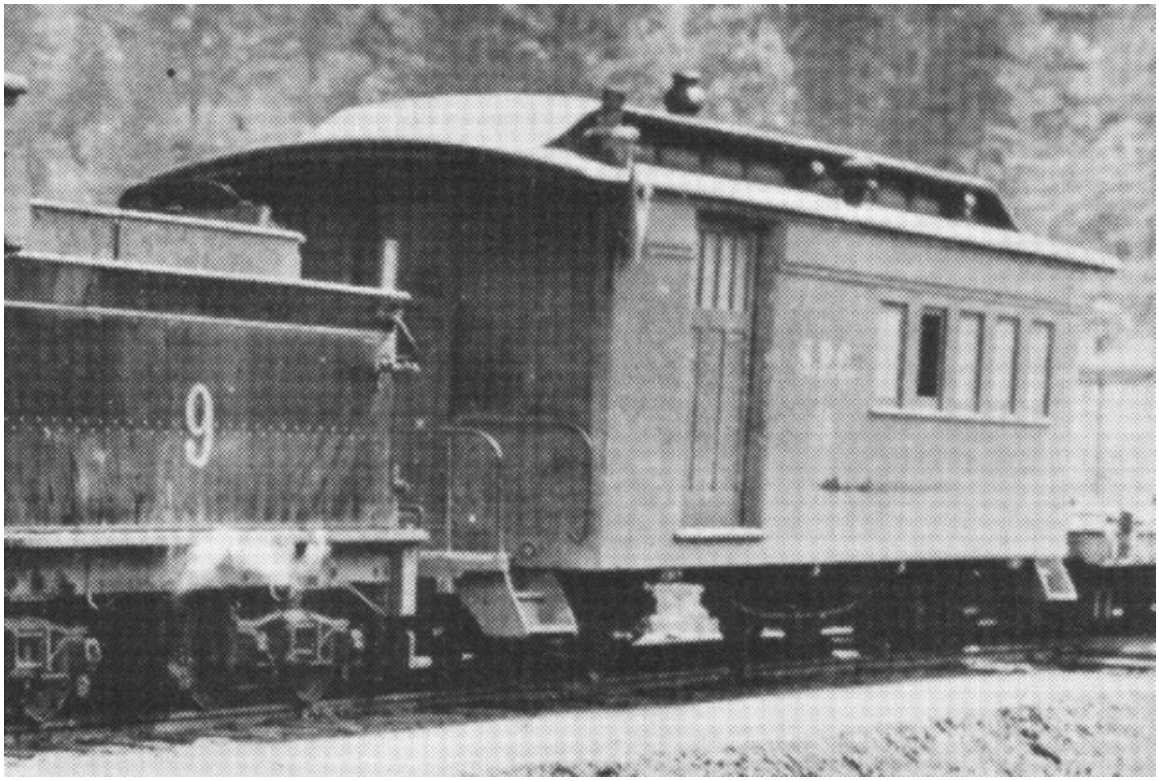




Caboose #3, A Carters 36' 8" Carters Combine (used as a Caboose) on the SPC, built 1880 with matchboard siding. Here is another view:



One of the Short 30' long Duck Bill combines of the SPC was Caboose #47. This could be bashed from our kit:



Construction

Assembling the kit.

This construction section will cover the assembly of the kit to a fully running completed model, less painting. For all of you who just want to build the model, paint it for your own road and get running, you need nothing more than this chapter. Chapter 2 of this class will cover the finer points of the Carters cars, internal works, accurate painting styles and decal options. All of this however will be applied to a fully assembled kit as covered in this chapter. For those interested in applying an accurate paint job to this specific prototype, I would suggest holding off any painting until chapter 2 is on-line.

The Templates.

The following 4 PDF sets are for the 4 car styles we're building. Anyone building the laser cut kits will not have to download and print these drawings, but I would recommend it anyway, so that you can place your laser cut parts on top of the drawings and know what part belogs where! Scratch builders who are not buying a laser cut kit will need to print out the PDFs. Please ensure the PDFs are printed at 100% for US letter, and check the scale bar on each page to ensure you are printing to full size - 1:20.3 scale. Please note that the PDFs are set up the same as used by the laser cutters, including all the slots and tabs to help assembly. As scratch builders cutting your own parts, most of these tabs and slots are not required and only make cutting the templates harder! I would simply review this construction section for how the various parts are used, and make up your own mind as to what you 'must' cut and what can be simplified in your own way.

Download the PDFs Now:

Combine - 1870s Board & Batten sides
Coach - 1870s Board & Batten sides
Combine - 1880s Planked Sides
Coach - 1870s Planked Sides

If downloading all the PDFs for the 4 car types, then MAKE SURE you keep the 4 sets separate. They contain very similar parts, and mixing the PDFs up would be...bad!

DXF Files for Laser Cutters and Computer Driven Milling Machines/CNC.

The following 4 downloadable DXF files cover the CAD templates for running computer driven cutting devices. You will need to upload the DXF files into the computer and convert to the appropriate driver used by the cutting machine. Also you will need to arrange the parts close together to maximize the number of parts onto each sheet.

Download the DXF files here!

Combine - 1870s Board & Batten sides
Coach - 1870s Board & Batten sides
Combine - 1880s Planked Sides
Coach - 1870s Planked Sides

Info to all Builders.

Regardless of how your parts are obtained, you'll note that there are no 'numbered' parts. Please do the following organization of parts:

- Place all the larger 2mm thick parts together in one pile.
- Place all the larger 1mm thick parts together in one pile.
- Place all the small 2mm thick parts into a shoebox-sized box.
- Place all the small 1mm thick parts into a shoebox-sized box.
  (This is to reduce the searching for parts somewhat.)

For all building the styrene laser cut kits, please note that there is a paper film applied to one side of every part, this is important in the laser cutting process. Spend an evening sitting by the TV and peel the paper film from the face of all the parts in your kit. You don't want the paper on your parts, and it would probably prevent the car being welded together properly anyway!

Adhesives

Styrene Kits - There are only two types of adhesives needed for the styrene kits:

- Humbrol or Revell liquid polystyrene cement. The Humbrol's product is called "Precision Poly", while the Revell product is called "Contacta Professional". In the US, Testors make both liquid and a gel type cements (when buying the gel type in a squeeze tube, don't get the "non-toxic" type, which bonds slowly and weakly. Stick with the "real thing" and use good ventilation). The liquid types are identical and are a solvent based styrene cement. They come in a small bottle with a long stainless steel needle like stem. This gives very good glue control and the solvent does not evaporate too quickly, which is central to welding large sheets of styrene together. This is the most used adhesive for these kits. The welds are very strong. Here is a view of the Revell product:

- The 2nd type of glue needed is our regular MEK based solvent welder, used to weld parts together using capillary action. This welder will be used on most of the smaller parts. I prefer the Testors Welder, but you can also buy MEK in larger containers (and much cheaper!) at hardware stores. Again, ventilation is essential.
- Other glues such as 'Super Glue' as required, for hand rail ends etc, and possibly some epoxy type glue if desired. I didn't need any other glue for the coach assembly beyond the two welder type glues above. Here's a view of my preferred Testors Welder at the top of the image, with the epoxy and super glue lower down:

For people building the wood kits, use an aliphatic resin glue (also called PVA or "yellow carpenter's glue"). This sets up fairly quickly (8-10 minutes) and makes for an extremely strong joint. Old-fashioned casein white glue ("Elmer's" and the like) will work, but it dries much more slowly and its higher moisture content tends to warp the wood more readily than yellow glue.

Lets Get Building....

Step 1 - The chairs!

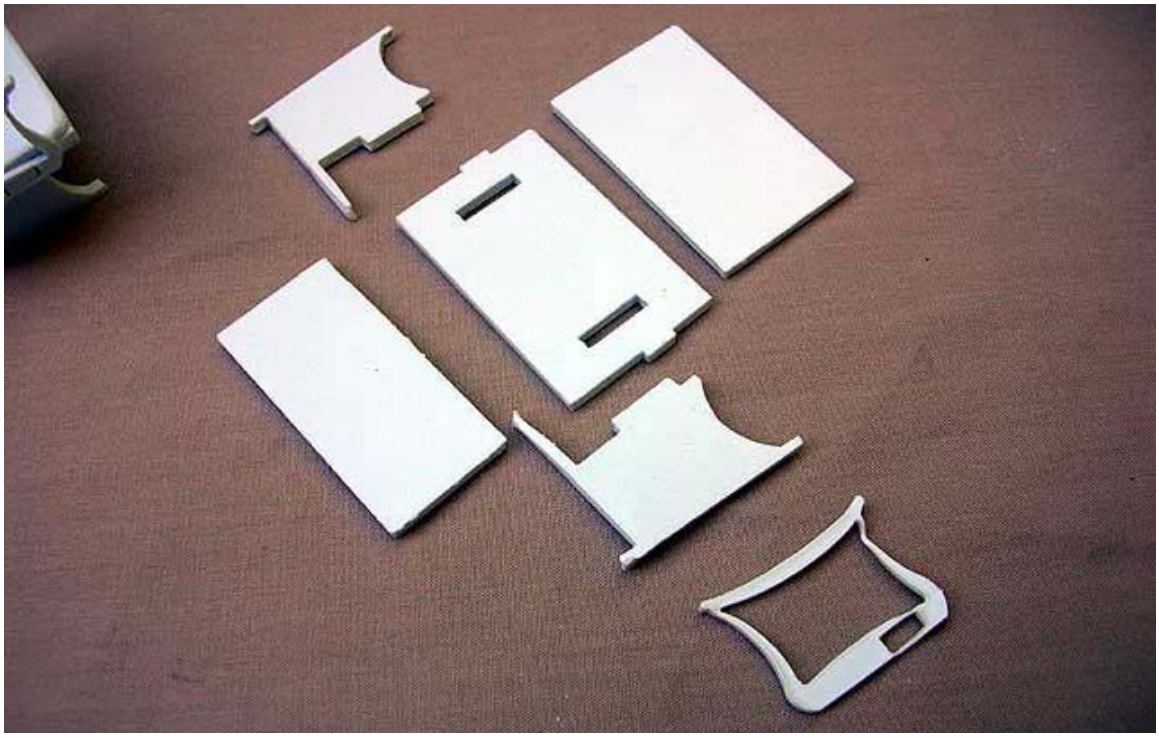
Refer to the PDF entitled "Chairs"

Lets get started with something easy, and something that will enable you to get used to assembling laser cut material. We'll start with the chairs!

Pull together the parts required for the chairs. >From the small parts - 2mm box, a seat base with two slots in it, two 2mm thick cushion parts and two leg elements. From the 1mm thick parts box, take out those ornate arm rest details. In the 9 combines we've allowed for 17 chairs, 13 chairs in the 7 window combines and in the coach, we've allowed for 25 chairs. In both cases, the chair space to one end of the car will be taken up by a pot belly heater. As such the combine has 9 chairs on one side, and 8 on the other, while the coach has 13 chairs on one side and 12 on the other. Also, folks building Doug's Combine as 'SPC #3' Caboose, may want to fit out the interior like a caboose, with long seats along the sides of the car, facing to the central aisle.
Note also that the chair design here is a simplified version of a chair style to look like the chairs in the M&SV combine today. They are made to look 'the part', and are not detailed scaled models of the actual chairs. The actual chairs in the car today have backs that can swap sides, allowing the chairs to face forward in both directions. Ours are set in one direction, and made up like a fixed seat.

The excellent Michael Collins 'as built' drawing I based the car setouts on, only showed one armrest, but we've since changed it to two armrests, which is what the car has today. Here is a Photo of what the chairs look like today, you may want to add your own padding to the chairs! This photo brought to us by Craig Hoefer:

Here is the collection of parts for one chair, note that 2 armrests are needed for the full chair.

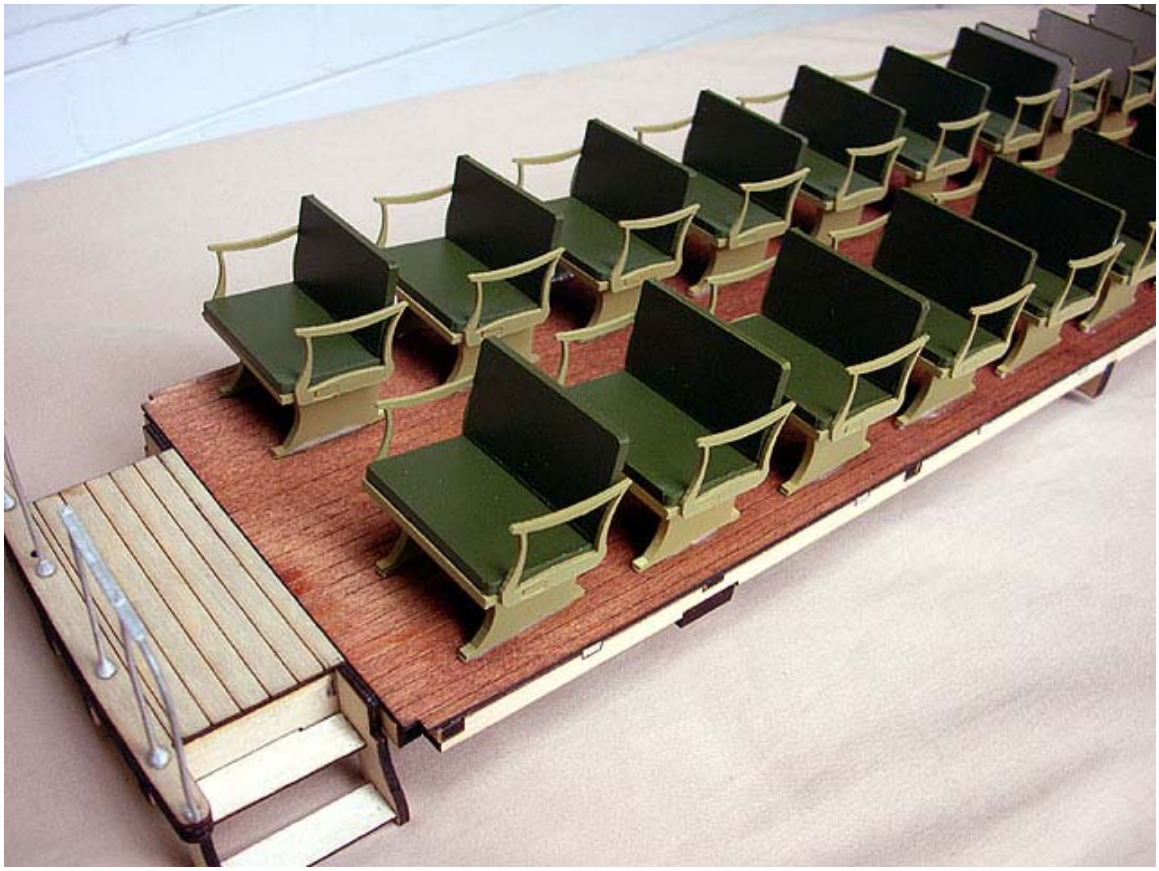


Note the tabs on the sides of the seat base are used to hold the arm rests to the side of the chair. The two cushion parts should be rounded off around the edges using fine sand paper. Weld the legs to the bottom of the seat base, with the edge tabs toward the front end of the seat.

Assembled the seats looks like this, with one arm rest applied:

Repeat this to make all 17 chairs for the combine and 25 chairs for the coach, add arm rests to both sides of each chair.

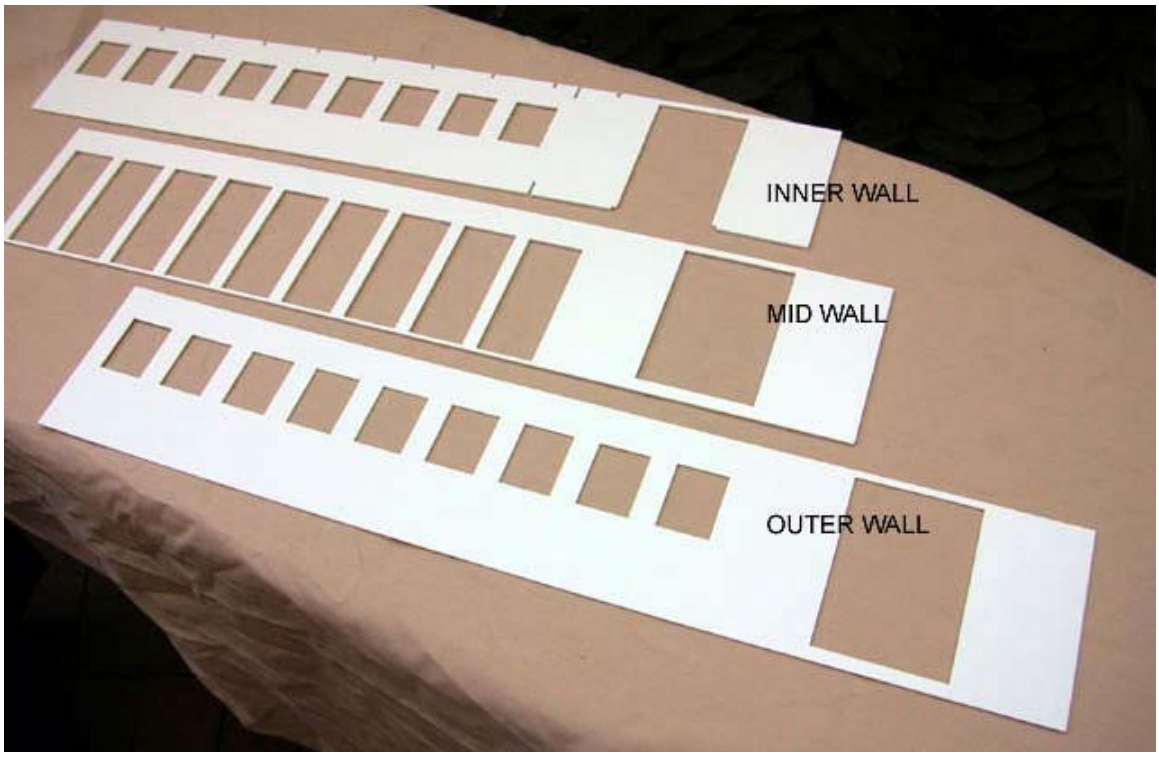
After the floor/chassis is assembled, you can choose to install your seats. Different layouts are possible, and as such, the chairs can be arranged as you like. When attaching the chairs to the floor, make sure to allow the 2mm clearance along the floor edge, where the car body overlaps the floor. Also I found it useful to rest the car body next to the floor, using the window layout to setout the seats on the floor. Here is a view of the seats attached to the chassis floor as demonstrated in Doug's kit:



Step 2 - The car sides.

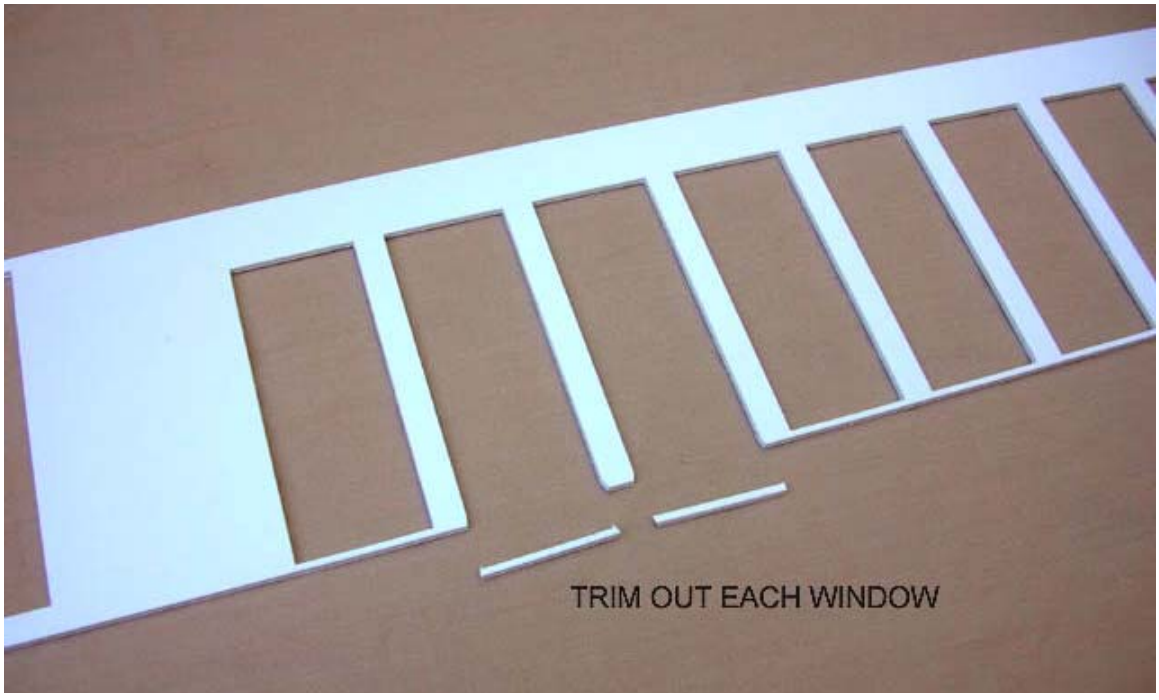
Refer to the **PDF set entitled "Car sides- Inner layer - a, b, c", "Car sides- Mid layer - a, b, c" and "Car sides- Outer layer - a, b, c"**. It will take 3 letter sized PDFs to make up a whole car side for each layer! This car is large! Nate the need to repeat the templates for both sides of the car.

The car sides are all made from 3 layers of styrene. The innermost 2mm thick layer of the wall is the most complete, strong layer upon which the outer layers are applied. The middle layer is also 2mm thick, but has large lots cut out of it for the window frame assemblies to slide in. The outermost layer is only 1mm thick and is the dress layer to our walls. On the planked sided version, the outside face of this layer is scribed with planking lines. On the Board & batten versions, look hard, because the outside face of the 1mm wall is scribed with the location lines for the battens. Use these scribed lines as a guide for the location of the battens. The battens are not evenly spaced so the scribed lines will help a great deal. The 3 layers of styrene making up a typical side wall look like this:



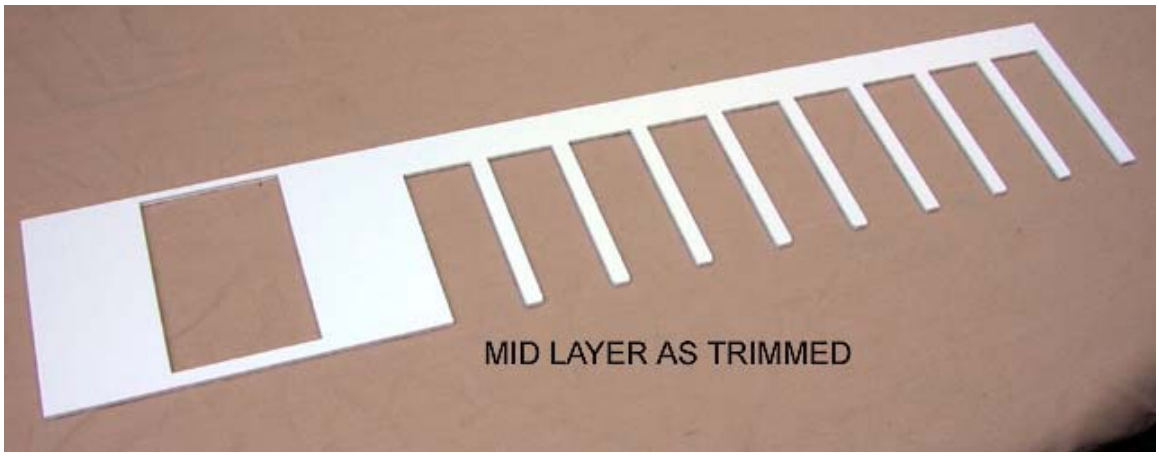
Set out the layers like I have above, but do it for both sides of the car. For the combine, it is essential to remember that the baggage door opening is to the left-hand side of one side of the car as seen above but is on the *right-hand side* for the other side of the car. This will mean the finished car has the baggage compartment on one end of the car. If you make up both sides with the baggage door to the LHS, then you'll have a baggage door on one side of the car facing into the Passenger compartment. Don;t come crying to me, man, if you weld up all your walls with both sides the same! THEY MUST BE SET UP AS A MIRROR IMAGES OF EACH OTHER!!

Next take just the 2mm 'mid wall' layer. See the thin 3mm thick rails along the bottom of each large window opening? Trim them out like this:



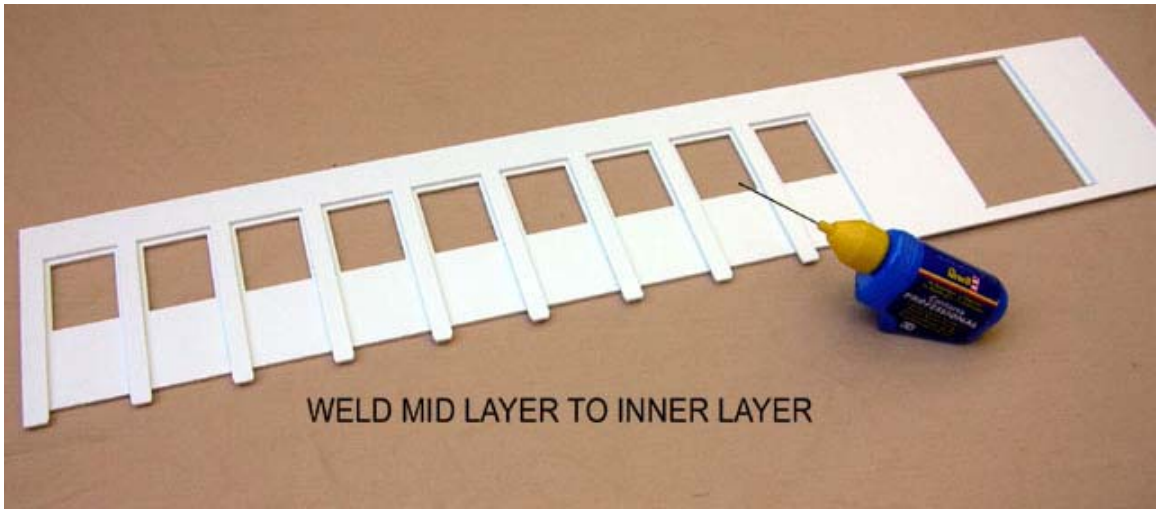
IT IS ABSOLUTELY ESSENTIAL THAT YOU TRIM OUT THESE BOTTOM RAILS NOW! If you forget to do this, and weld the walls together, you won't be able to insert the window frames after the coach in painted! Trim out all 9 windows in both sides of the combine, and trim all 13 windows for the coach sides.

The trimmed out middle layer will look like this:



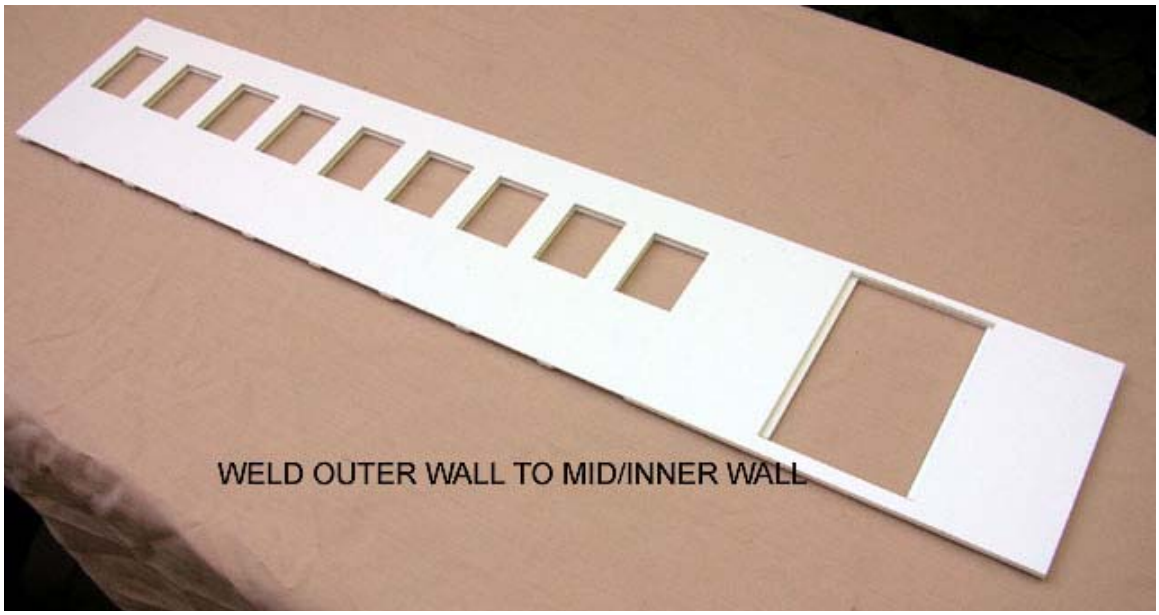
The reason for this was to keep the styrene wall 'square' during laser cutting, and also keeping the wall strong during transport. The wall is relatively weak as a single wall layer, but will become strong again when welded into the 3-layer-thick completed wall.

Next apply your polystyrene cement (Humbrol, Testors, etc.) to one side of the mid layer only. I applied the glue in large zig-zag formations across the back of the sheet, with each line separated by about 1/4". Drop the mid layer styrene wall components down into the inner most 2mm thick wall layer. Check the top and side edges for alignment. The top and side edges will match exactly. The middle layer however will be 7mm longer than the inner layer along the bottom edge...so don't match up the bottom edges! The middle layer welded to the inner layer will look like this:



You can see why we apply the glue only to the middle layer, and not to the inner layer! If you applied the glue to the inner layer face, you'd have glue right across the whole wall, and as you can see, no glue is needed below each window! This area must remain clean and glue free to allow our window frames to slide in later.

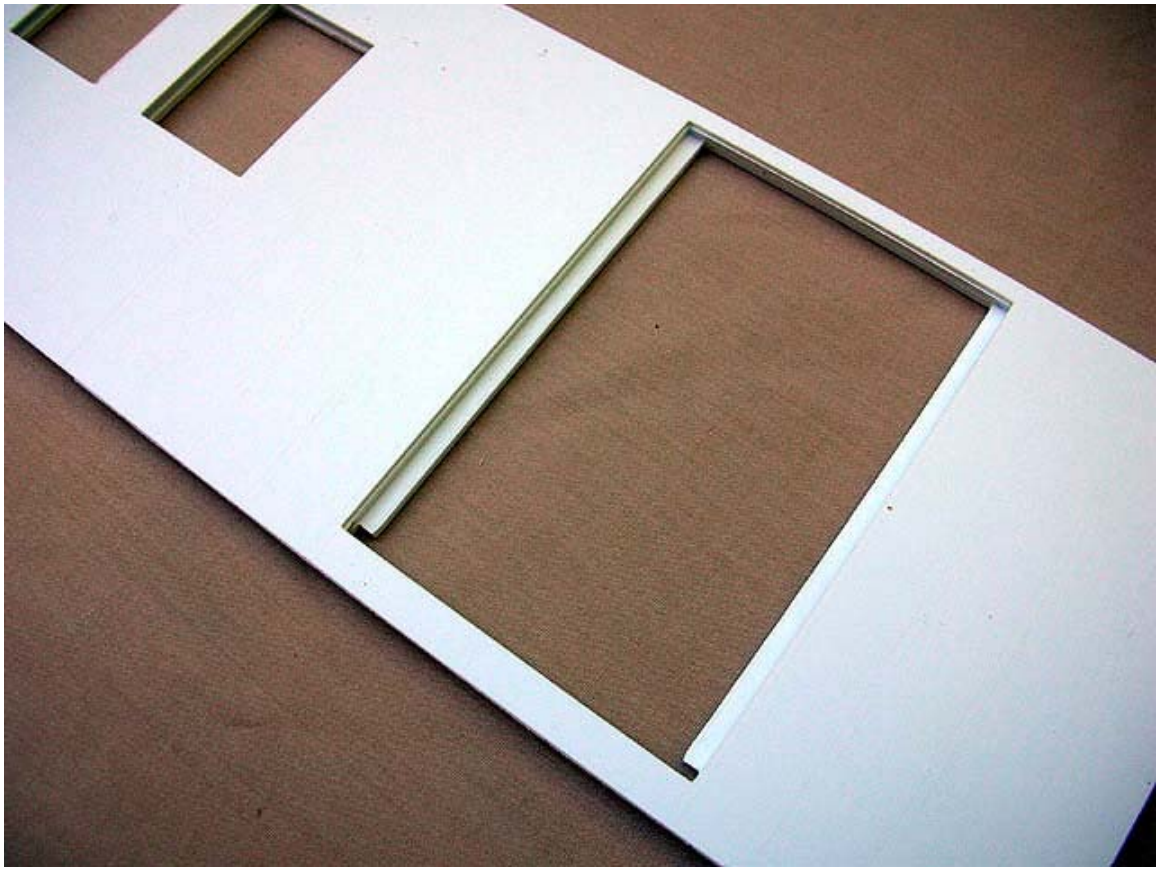
Next apply more polystyrene cement to the outer face of the middle 2mm layer and drop the 1mm thick outer layer down onto the wall assembly. **MAKE SURE YOUR SCRIBED LINES FOR PLANKING OR BATTENS ARE FACING OUTWARD!** Also, before dropping the outer face wall down onto middle/inner layers, check that you have the right part in hand. For the combine there is only one outer part to use, because you need to have the scribed lines facing outward and the baggage door aligning at one end. For the passenger car version, the parts are reversible, as there is no baggage door at one end of the car. All edges of the outer walls align perfectly with the edges of the middle layer. With the outer wall applied to the middle/inner layers, the car wall will look like this:



The wall to the opposite side of the car will be the exact mirror of the view above, with the baggage door to the LHS side!

Looking close up at one of the window areas in the wall, you can clearly see the 'slot' created for the window frames to slide into after the car is painted:

You'll also note that the innermost layer of the wall has a baggage door area that is narrower than the middle and outer layers. This is where we apply a quarter-round beading to create the prototypically rounded door reveals. We'll do that later.



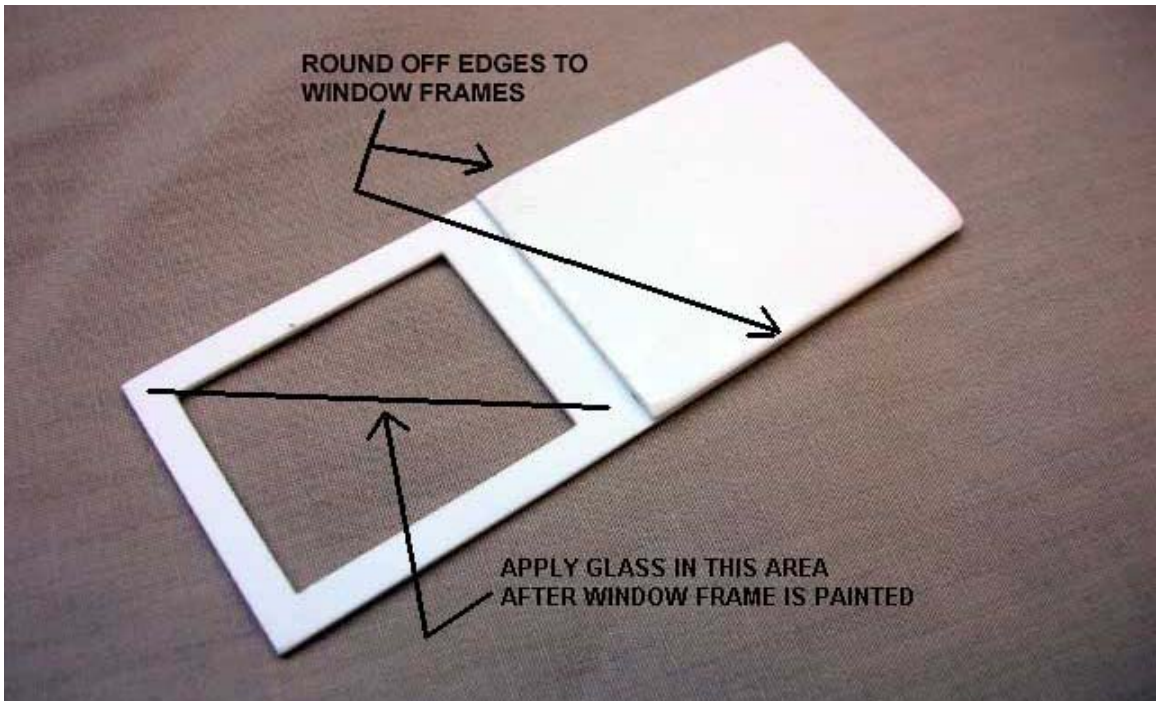
Step 3 - Making the Window Frames.

Take a look at the **PDF entitled "Window Frames"** These are all cut from 1mm thick styrene. Note the numbers of frames needed for the various car type:

- For the 1870s combine there will be 18 of these window frames to assemble,
- For both 1870s and 1880s coaches there are 26 windows to be made
- For 1880s Combines there are 14 window frames to be made.

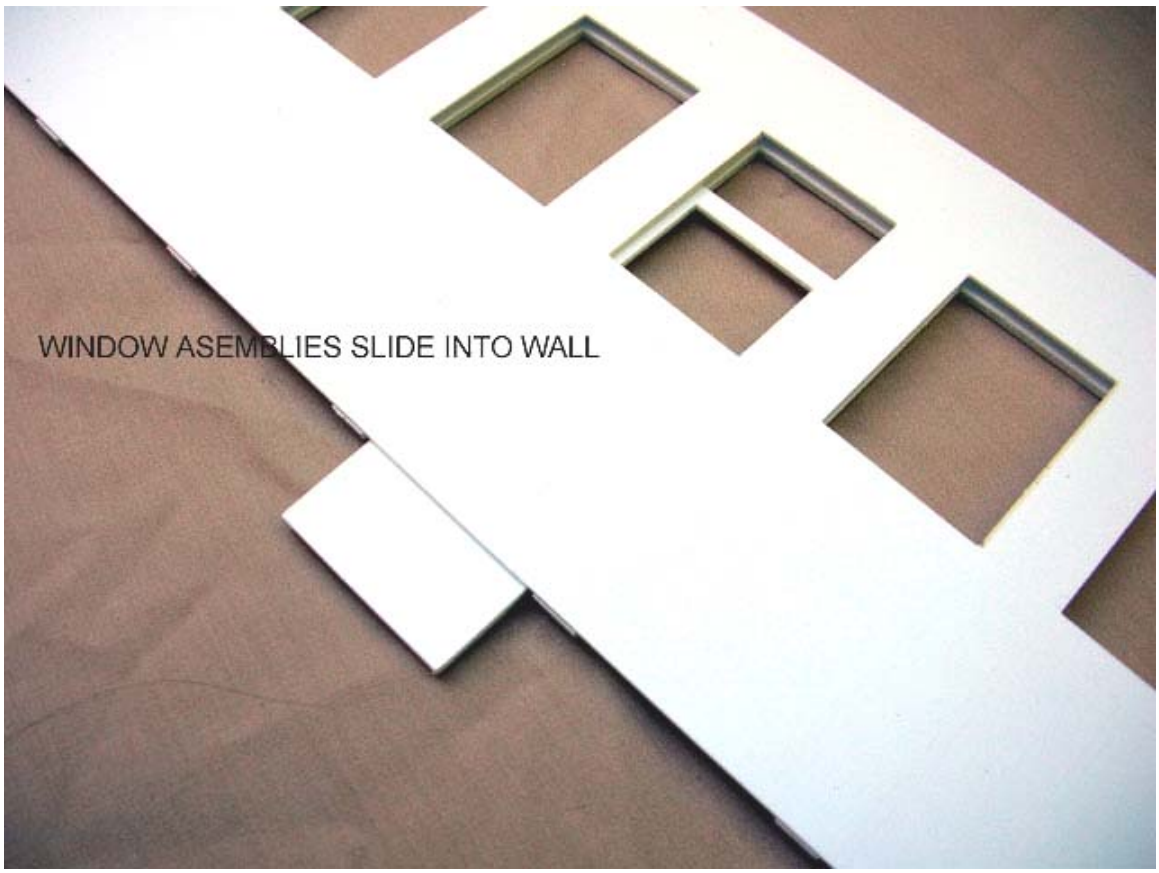
The numbers required are also noted on the PDFs.

Each window frame is made up of a long plate with the window cut in one half. A 2nd layer of 1mm styrene is to be welded to the lower parts of the window plate, making the lower portion 2mm thick in total. After the lower plates are welded to the window frame plate, carefully sand the edges round. This will make the windows easier to slide into the car wall slots later on. A completed window frame assembly looks like this - now make the rest of them, and store them away safely.



As you can see above, after the window frames are painted later on, you apply the glazing to the upper rear half of the window, making a fully 2mm thick plate across the whole length of the assembly. But for now, with no glass applied, the 2mm thickness is only in the lower half.

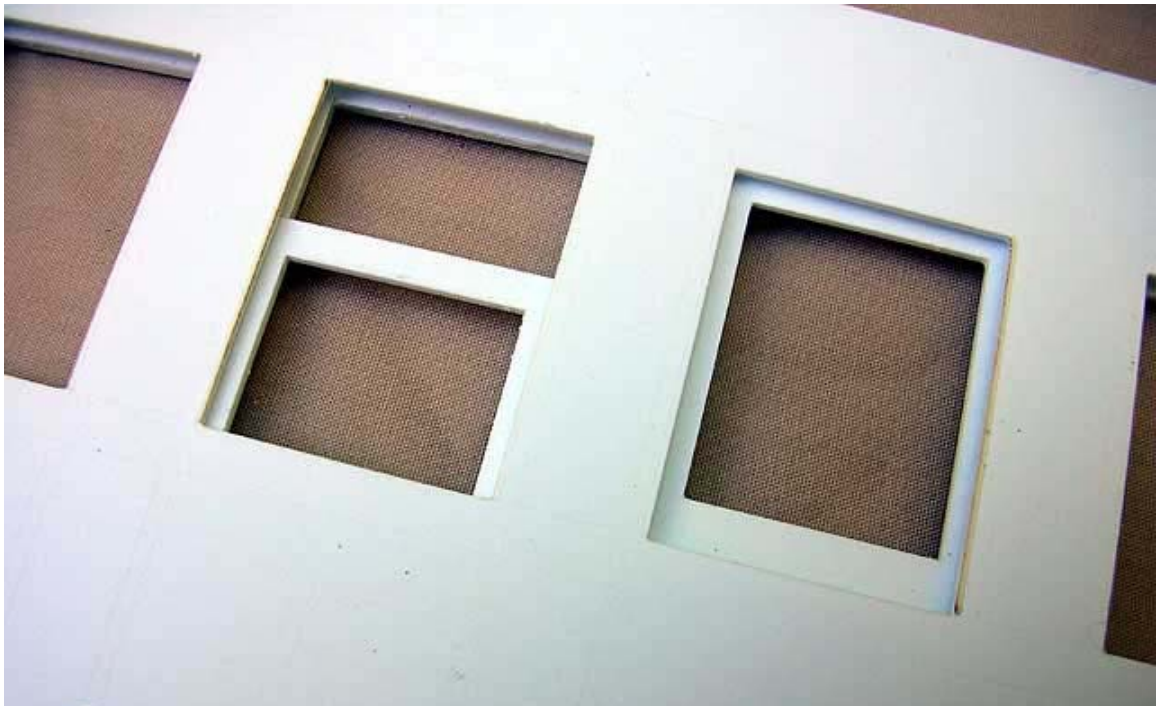
If you'd like to, you can do a test fitting of the windows into the side walls. The window assembly slides in from the bottom of the car. The full window frame side will face to the outside, the glazed side facing to the inside of the car.



DO NOT GLUE WINDOW FRAMES IN YET. WE WILL SLIDE THEM IN LATER, WHEN THE CAR IS PAINTED. The system allows us to paint the car and the window frames separately, no masking required! This system also allows the car walls to be fully glazed with no glue needed!

You'll note that these slide in window frames kinda 'look' like sliding windows in a real coach. I must point out that the whole intention of this slide-in window design was to enable you to paint the frame separately. The Carters cars had the window frames slide UPWARD not downward in reality. But since we need to weld the roof onto the car to hold it all together, we cannot slide the windows in from the top. The coach kit is designed to have the windows painted and fixed in their closed position. Some of you however are building these cars to represent cars from Colorado and the east, built by other coach firms. Some of these cars might have had slide down windows, with leather straps to support the sashes at different open positions. If you wish to show your car with some windows slid down, I dont mind. Just trim off the excess at the bottom of the car.

Here's a view of window panels inserted in fully closed and partially 'slid in' position.



Notes about the window designs for Harald's and Doug's wood kits:

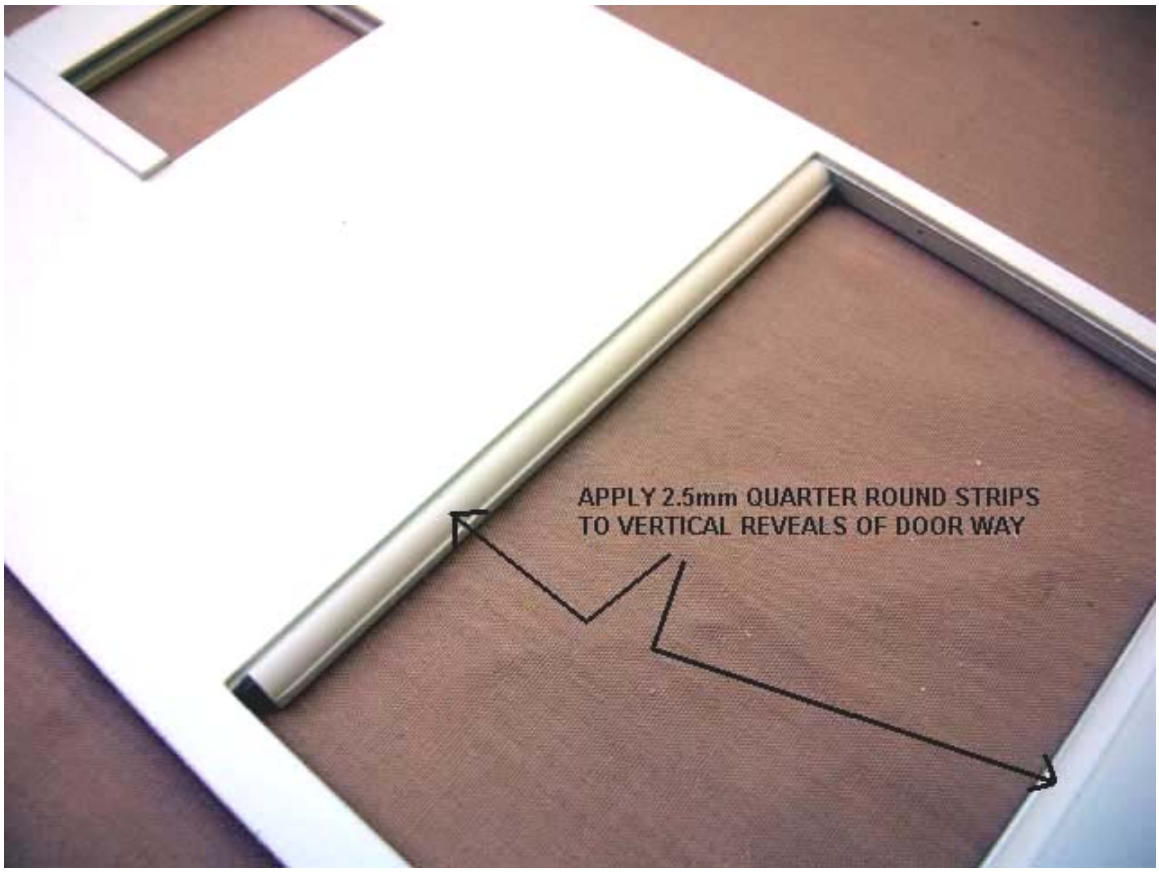
Harald's kit - In Harald's kit, the window panels are the same as shown above, however the wood thickness vary a lot more than the styrene equivalents. For this reason, the inner 1mm backing panels when applied to the window panels may total a wood thickness in excess of 2mm..and thus will not slide into the space in the wall. Please test your window panel fitting first before gluing the 1mm backing to the window panels. In my case, I had to delete the backing panels, and applied 0.75mm thick clear plastic glazing to the whole of the window panel rear.

Doug's Kit. - Doug's kit is the most refined of them all for windows. His comprise two layers of timber window frame with clear glazing between. The total thickness of the 3 layers is under 2mm, and will slide neatly into the walls. Also his windows are not full car body height, allowing the windows to slide up and down if you like - remember on the prototype Carter cars, the windows slid upward, not down, but this is such a cool opportunity, and many folks will build these cars with an eye for freelancing that we thought the windows can slide down if you want them to.

Step 4 - The rounded Door Reveals.

The beautiful styling of these cars has the corners to the car wonderfully rounded, and the reveals to the end doors and sliding baggage door nicely rounded too. Now that the car sides are made, we'll add the rounded reveals to the side baggage door.

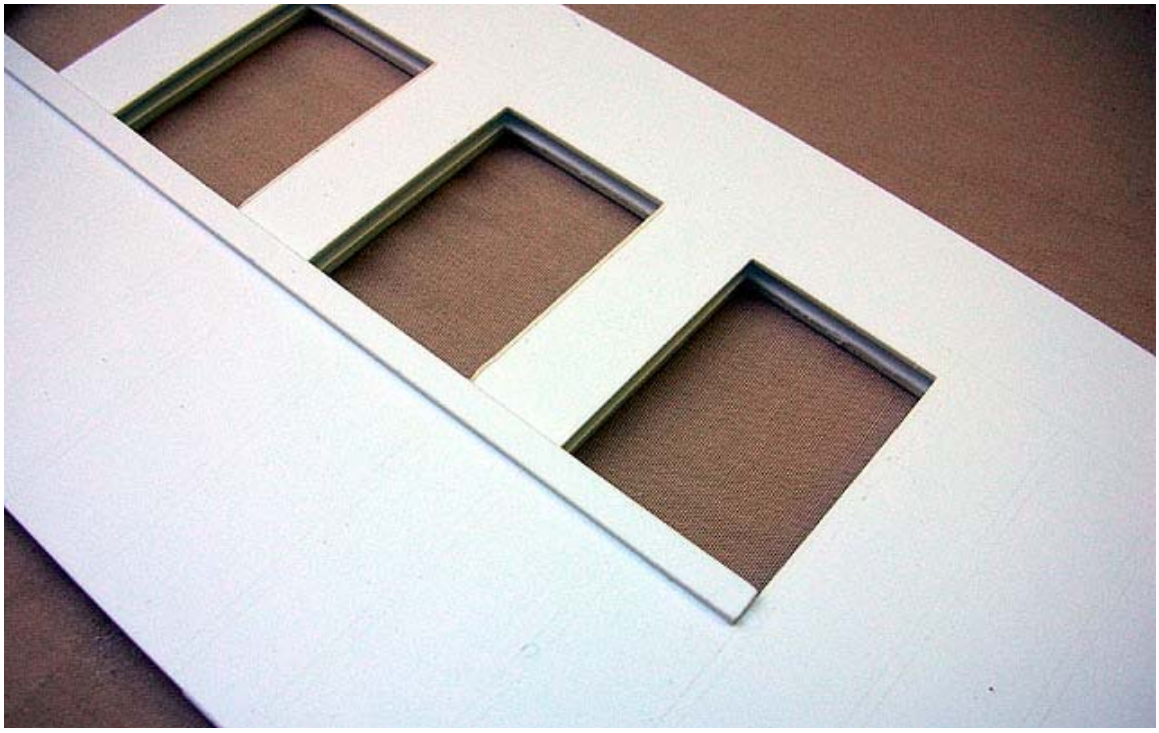
Take your Evergreen 2.5mm radius 'Quarter Round' strips. Measure the door reveal height from the upper sill down to the lil slots near the base of the door. These slots are to hold the door sill in place later, so we don't want to cover that over with these quarter rounds! Cut and weld the quarter rounds down to the exposed inner wall layer like this:



Next using fine sand paper or a fine metal file, sand the edge of the 2mm inner layer so it's flush with the curve of the 2.5mm quarter round, forming a complete, 4.5mm thick rounded reveal.

Step 5 - The window Sills.

This bit is pretty simple. The window sill provided was included on the **PDF entitled "Car Sides - Outer layer a, b, c".** We now need to add a sill panel to the entire length of the window areas of the coach/combine, whether planked or B&B. In the laser cut kit, you'll find a long 5mm wide strip of styrene. Simply weld the strip directly to the bottom edge of the windows. The strip will end approx 1.5mm shy of the very end edge of the wall. This is to allow the batten at the car corners to run full height. On the combine versions, the sill will end in line with the last window opening as shown in the photo below. In place, the sill panel will look like this:



Some prototype info - in order to keep the kit costs down, we've miraculously laser cut virtually everything from only 1mm and 2mm thick sheets! The window sill can certainly be used as a 1mm thick part as shown above. Prototypically however, for the 1870s Board & Batten Version, according to the original sectional drawing of the car, the sill thickness should match the batten thickness, at only 0.5mm thick. You may want to use your 1mm thick laser-cut strip as the pattern to cut your own strip from 0.5mm thick sheet.

Step 6 - The dividing wall

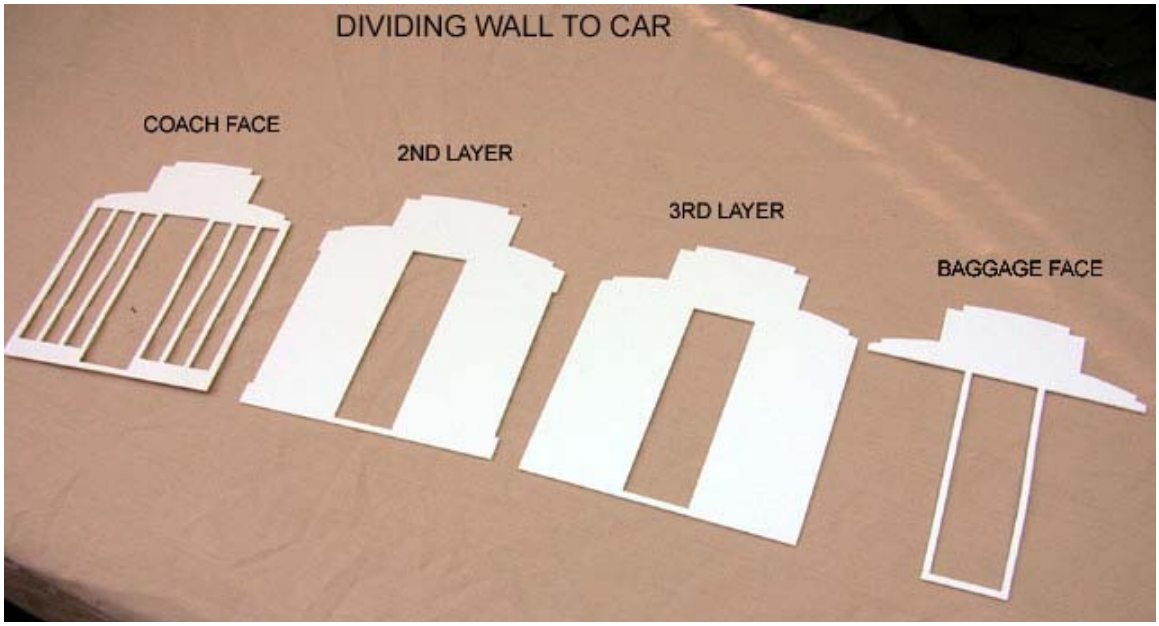
Refer to the PDFs entitled "Dividing wall, a, b" for the Combines.

Refer to the PDFs entitled "Dividing wall" for the Coaches.

There is an internal wall inside the combine which divides the baggage compartment from the seating area. This wall plays a pretty major role in making our 2 ft long car stronger too. For this reason I've also provided a more decorative dividing wall for the Pass car versions too, which can divide the car into two compartments. The dividing wall in the passenger cars is a good idea if you're after a really robust car. If you're more interested in getting interiors correct, then is it OK to delete the dividing wall from the passenger car version if you like, and just secure the dividing wall area to the chassis for more support.

The combine has 4 layers of 1mm thick styrene to make up the dividing wall. The side facing toward the passenger section is paneled per prototype; the side facing the baggage section is just plain vertical boards. In the full coach version, the dividing wall is only 3 layers thick, with the paneled finish to both sides.

Here is a line up of the 4 layers to the Combine wall:

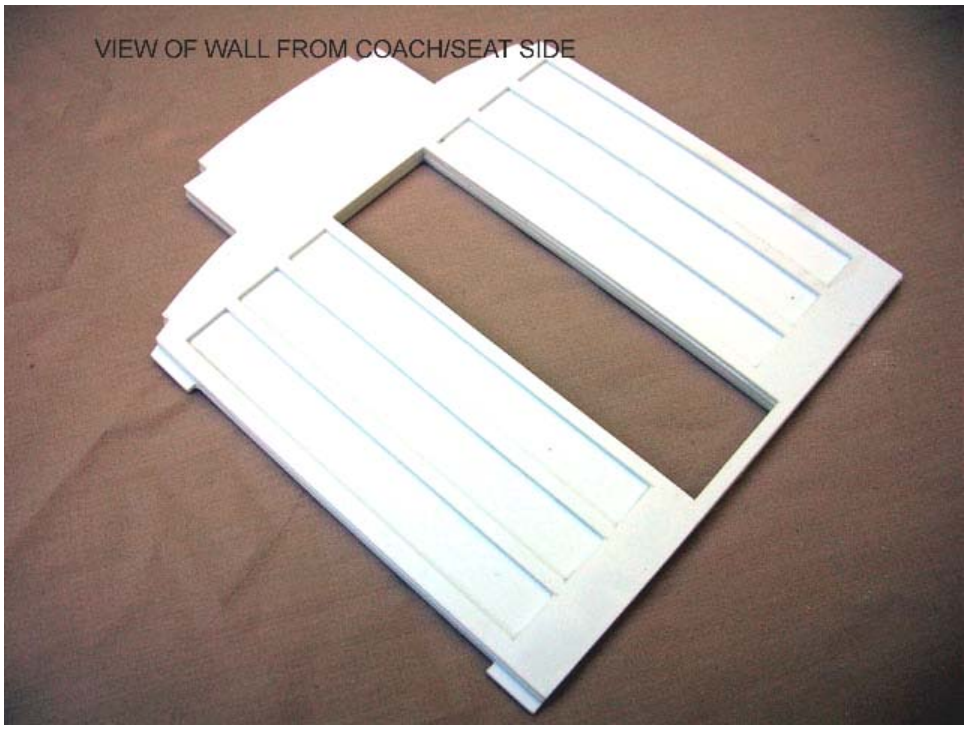


The coach version only has two 'Coach Face' layers and the 2nd layer.

Weld the layers together (4 layers for the combine and 3 only for the coach). Apply the welder to the outer faces first so that you only apply glue to where it is needed.

Here is a view of the completed dividing wall as seen from the baggage side of the car:

The same wall as viewed from the passenger side will look like this:



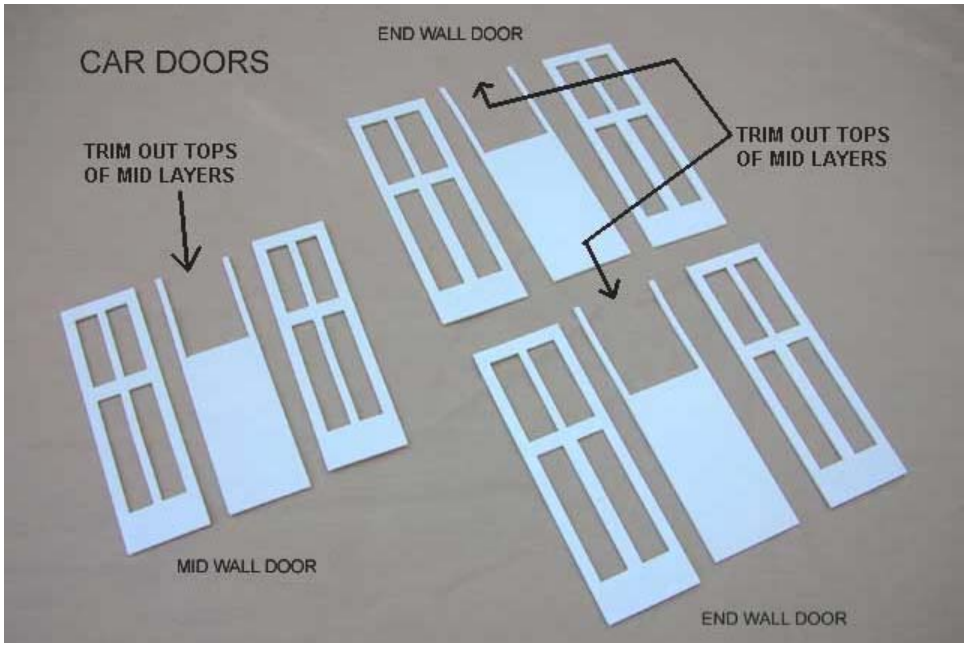
This is also the view to both sides of the wall for the 'coach' versions.

Step 7 - The Doors.

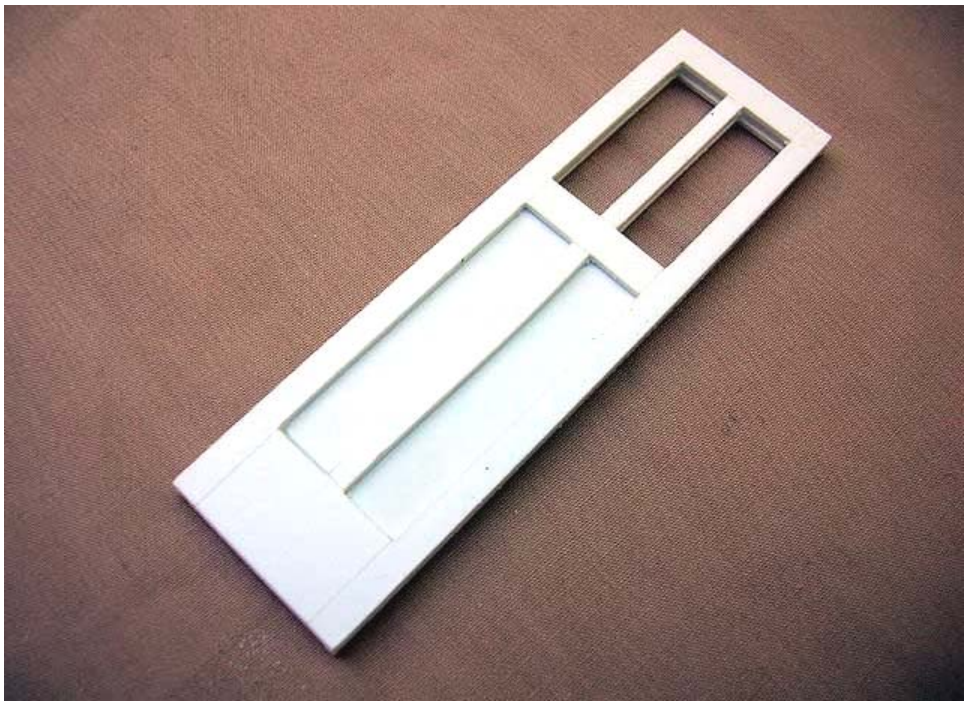
Please refer to the PDF entitled "Doors"

Both the coach and combine will have 3 doors (not including the combine's side baggage doors). There is a door to each end of the car, and a door to the dividing wall of the car. Each door is made from 3 layers of 1mm thick styrene. The two end doors are wider than the mid door.

Note that the mid layer of 1mm styrene has a window area cut into it. Just as on the sidewalls, you should trim out the tops of the window openings in these mid layers to look like this:

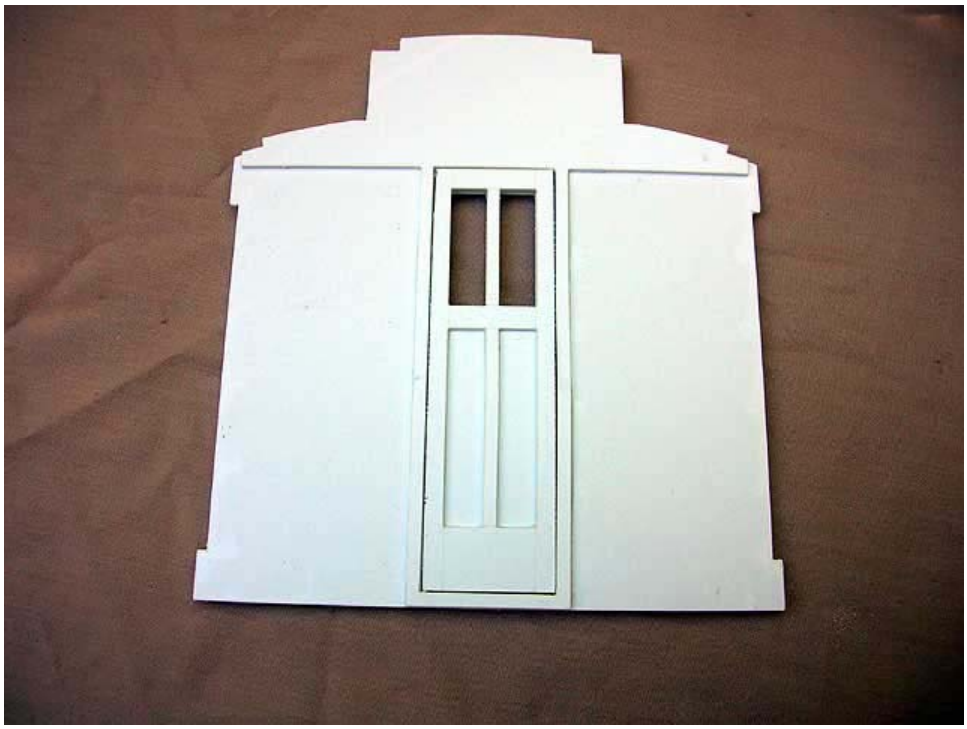


Lay out the parts as shown above. Check the outer layers; on one side they have some joint lines scribed in, always have the scribed lines facing outward here. Next weld the outer layers to the mid layer from both sides. Only sparingly apply welder to the members of the outer layers. In the upper window area, apply welder only to the vertical edges, and not the vertical mullion, or upper mullion (as they do not attach to anything but air in the mid layer!). Once each door is welded together, you'll have a neat door, panelled on both sides, with a slot in the top edges of the door. The idea is to the paint the doors prior to being installed in the car. When the paint is dry, drop a glazing rectangle into the top of the door and slide it into place. The doors welded together, without glass yet applied, will look like this:



With the narrow mid wall door dropped loose into the Mid wall, the door/wall assembly looks like this:

Seated side shown above.



Baggage side shown in above picture.

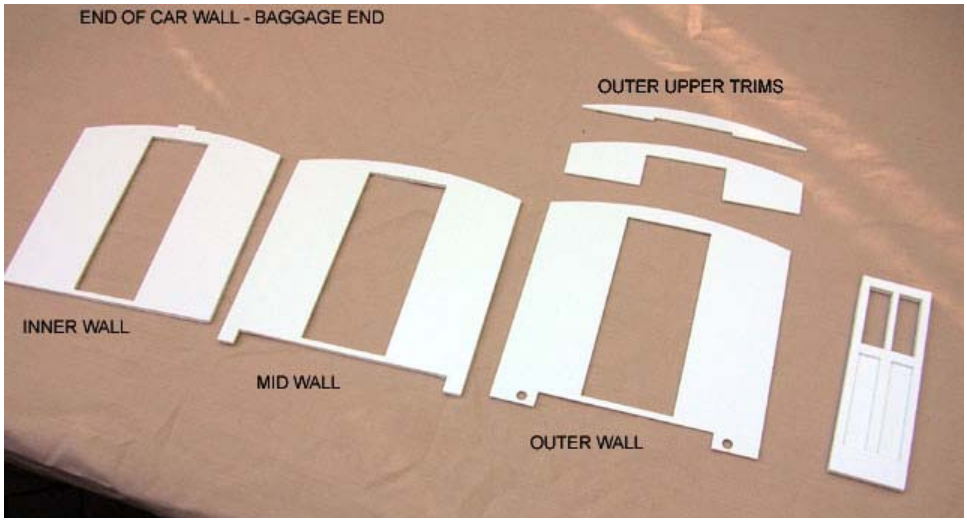
You can either weld the doors in place, closed after the car is painted, or you can attach the door using doll house hinges, or mini-brass hinges used on jewellery boxes, or just use a strip of fabric tape as the hinge. Above all, do not glue the doors, or attach them in any way, until after the car body is painted, and the doors painted separately, with the glass slid in place.

Step 8 - The Baggage end Wall (Combine Only).

This is for the construction of the car end wall on the baggage end, which has no windows. This wall is only used on the Combine, not the coach.

Refer to **PDFs entitled "Baggage end wall, a, b."** These cover the 6 layers that make up this end wall.

Lay out the parts like this:

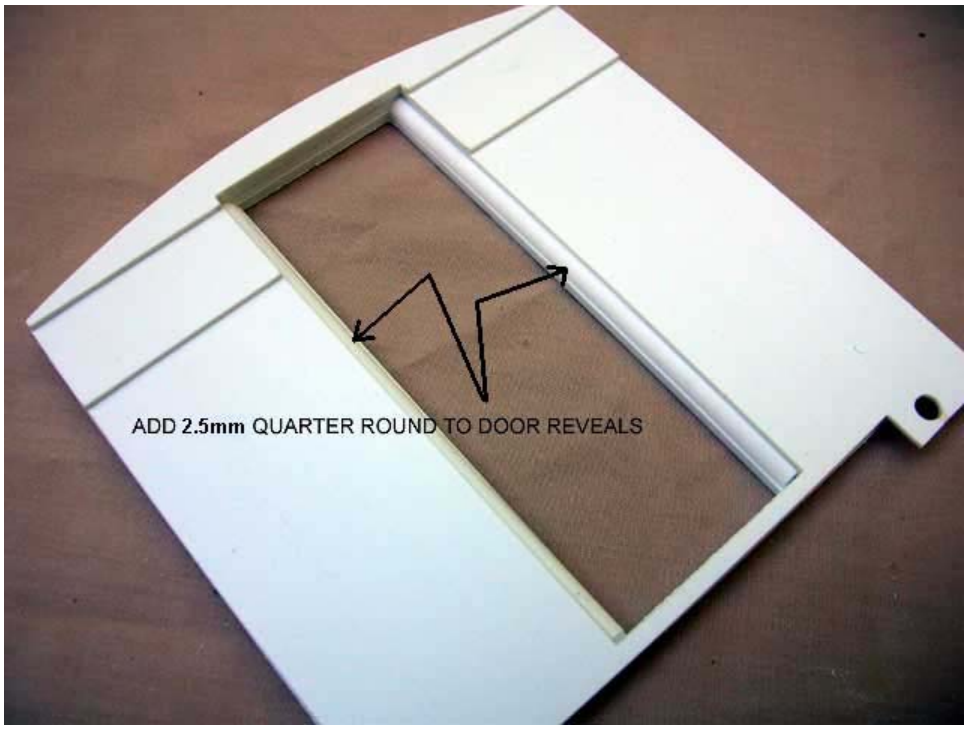


The wall is made exactly like the car's side walls, with an inner 2mm layer, mid 2mm layer and an outer 1mm layer with scribed detail. To the upper area of the outermost layer, there are some upper trims as seen above. Also, not shown in the above layout is a 1mm thick door frame that is to be welded to the inside face of the inner layer, aligning with the doorway outline. The above photo also shows the completed end door itself, done in the last step.

Weld the layers together in order and all is peachy. The side edges and top edges will all perfectly align. The welded up end wall will look like this:

Note again the innermost door opening is narrower than the outer doorway. This is to allow for the 'quarter round' styrene to be applied to round off the door reveals, just as on the baggage door.

Take your Evergreen 2.5mm quarter round and weld matching lengths into the door reveals like this:



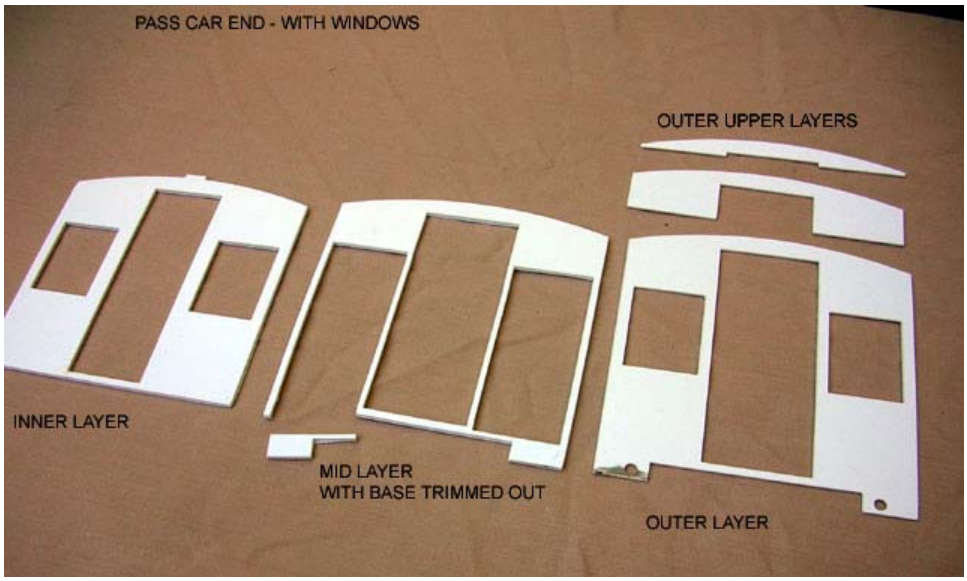
Finally, using sand paper or a fine metal file, file the edges of the 2mm inner wall layer to blend into the 2.5mm quarter round elements, creating a smooth 4.5mm curved reveal.

Step 9 - The Coach End Walls.

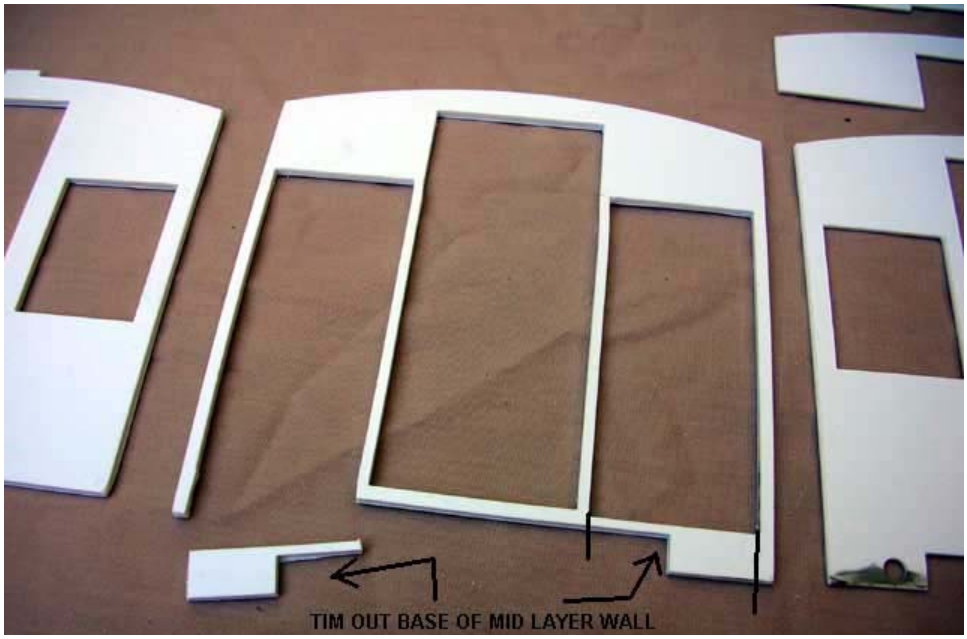
This end wall design, complete with windows, is used on the coach end of the combine, as well as both ends of the full coach. People making the coaches will need to make 2 of these walls, while folks doing the combine will only make one wall like this.
Refer to **PDFs entitled "End wall, a, b"** from the set of Coach PDFs

Refer to **PDFs entitled "Pass End wall, a, b"** from the set of Combine PDFs

Lay out the parts like this:



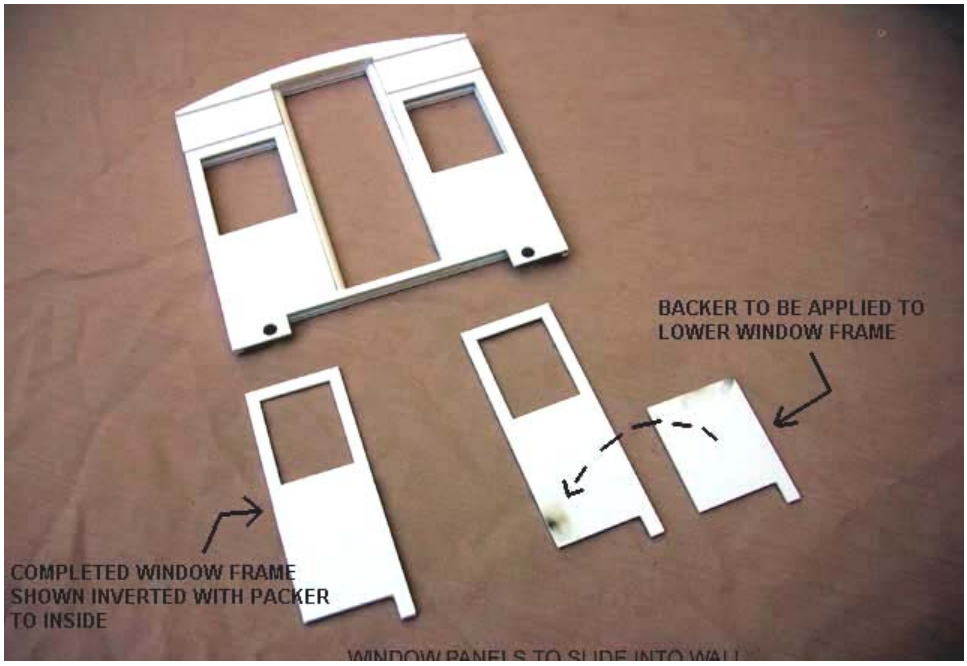
Again, like the side walls for the car, we need to trim out the bottom edge of the mid 2mm thick layer. This will allow our window frames to slide in from the bottom of the car. Trim out the bottom of the mid wall layer exactly like this to both windows.



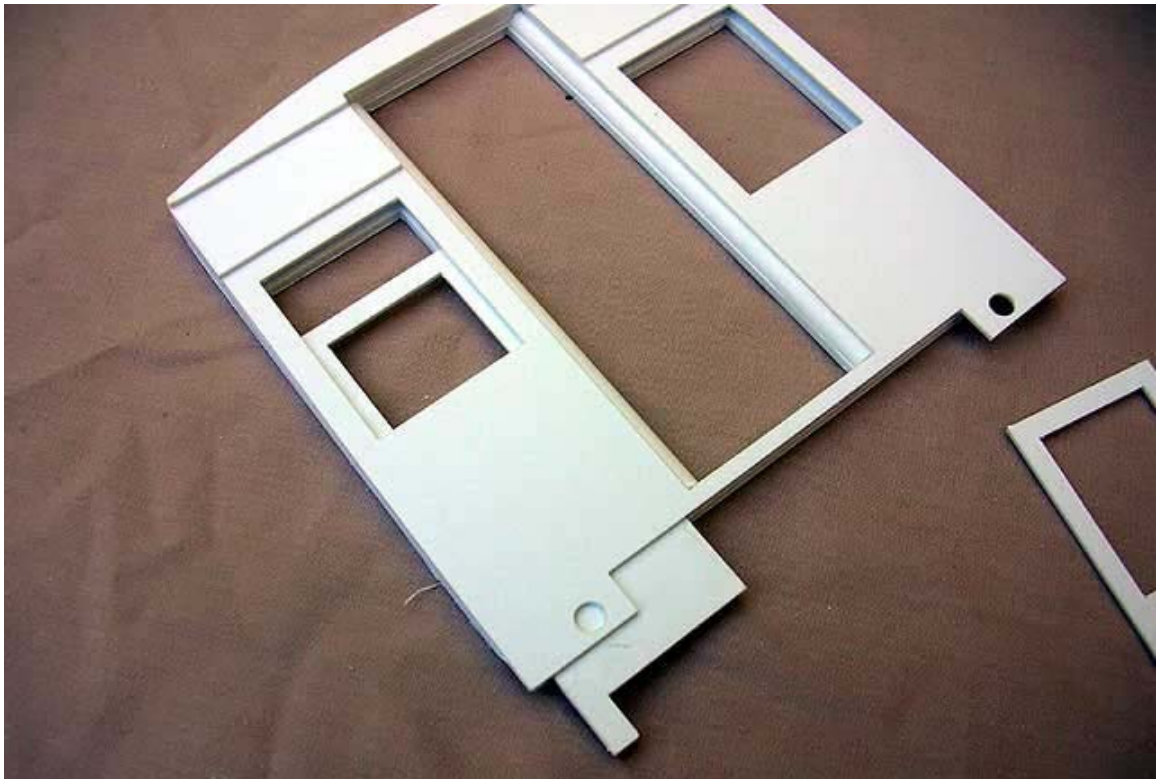
Apply the polystyrene cement to the mid layer elements only, welding this mid layer to the inner layer first. Then apply the glue to the outer face of the mid layer and drop the outer wall layer down onto the mid layer. The side edges and top edges will all perfectly align. Weld the upper trims in place onto the upper outer layer. The completed end wall will look like this:

Again, apply the 2.5mm quarter round trims to the side edges of the door reveals, file and sand the edge of the inner most 2mm layer to integrate with the quarter round strips, making a 4.5mm deep rounded reveal as seen above.

Next we need to make the window frames for the end walls. These are made exactly like the window frames we did for the side walls. There is a long outer window frame layer of 1mm thick styrene, and a lower 1mm thick packer to be applied to the lower half the inner face of the window frame. The set up can be seen in this view:



Go ahead and test the window frame elements sliding into the wall from below. Please don't glue the frames into the wall yet. You want to paint the entire car body and window frame separately first before sliding the windows into place. Here's a view of the test fitting of the window frames into the end wall:



To the inside of the door reveals in all the kits is a door frame surround as seen applied to the inside of this wood kit:

Step 10 - Batten Time.

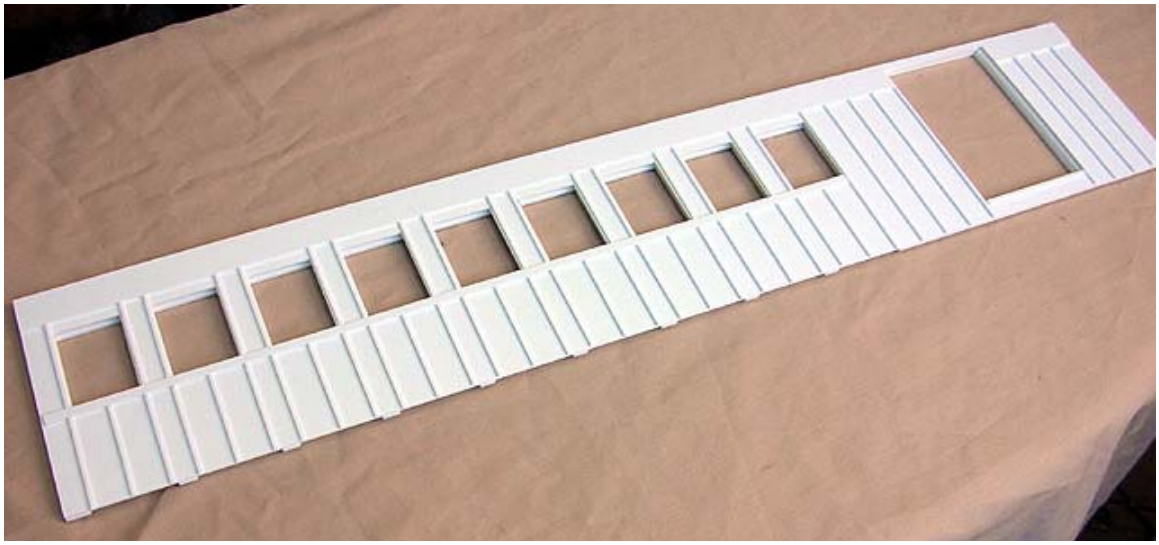
Its almost time to assembled the walls into a 3D body. Before we do that, we want to install all the battens to the walls, and apply the upper letter boards to the top of the car walls.

Board & Batten Cars

Using your Evergreen 0.5mm thick, 1.5mm wide strips, weld the strips onto the car walls. Follow the scribing on the wall sides to align the batten vertical/parallel, and also to space the battens correctly. The battens are not evenly spaced, especially around the baggage door of the combine, but that is exactly how the prototype was done!

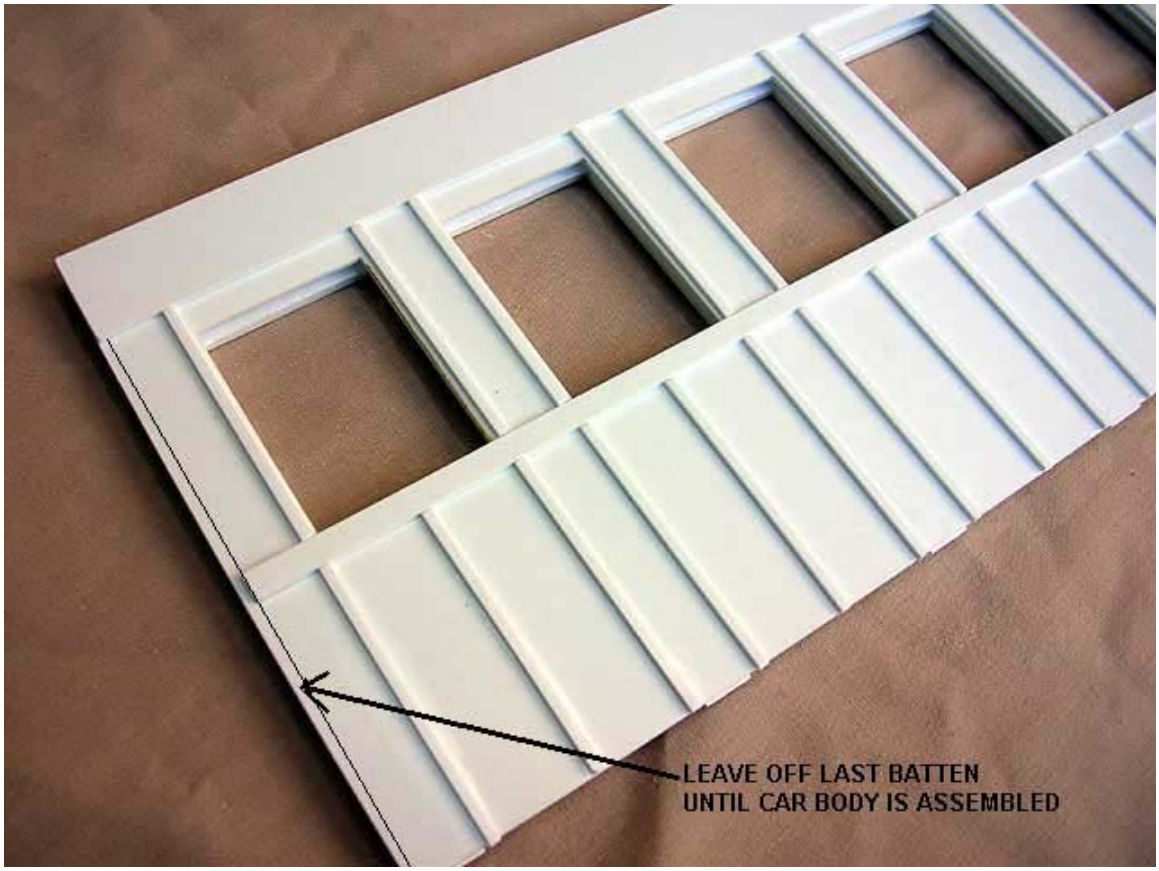
You'll also find a 1mm thick, 16mm wide strip in your laser cut kit that runs the full length of the car and is to be welded to the upper wall, with the top and side edges aligning with the car wall. This is the 'Letter Board' of our car.

With the Letter Board welded in place, and the 1.5mm wide battens welded in place, the outer wall looks like this:

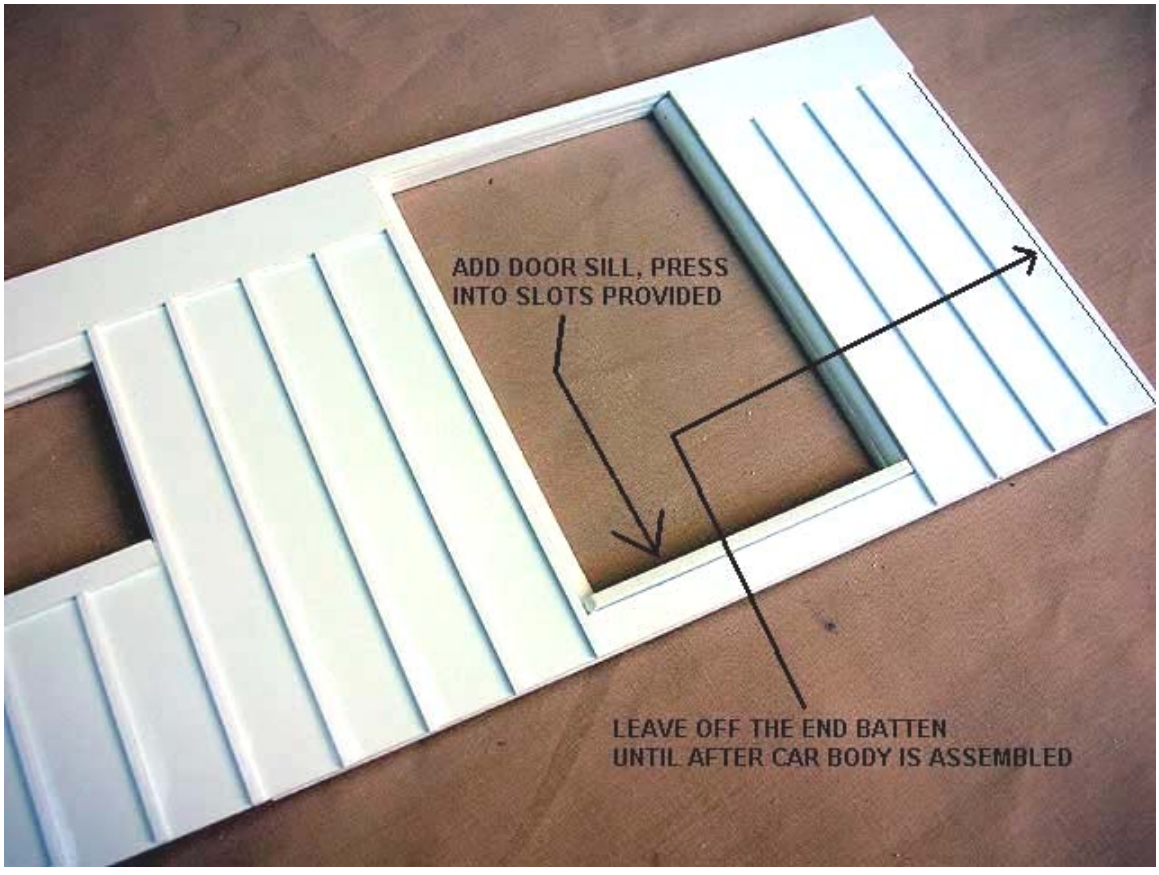


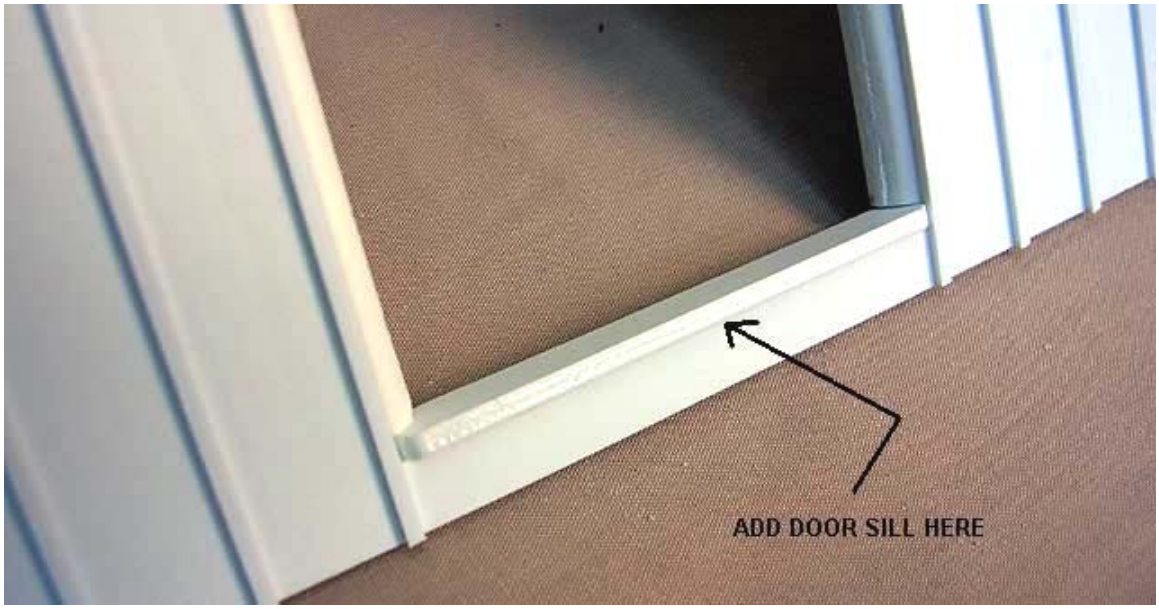
Note the batten locations seen above - battens run from the base of the wall up to the window sill. Battens also run from the window sill up to the Letter Board. One batten each side of each window. Battens run full height at either side of the baggage door. There is also a full height batten to be applied to the very end edge of the wall, but please do not apply that outer edge batten yet. We shall only apply those outer battens after the car is assembled with the corner quarter round elements applied and sanded.

Here is a close up of the window area of the cars, typical on both B&B combine and coach.



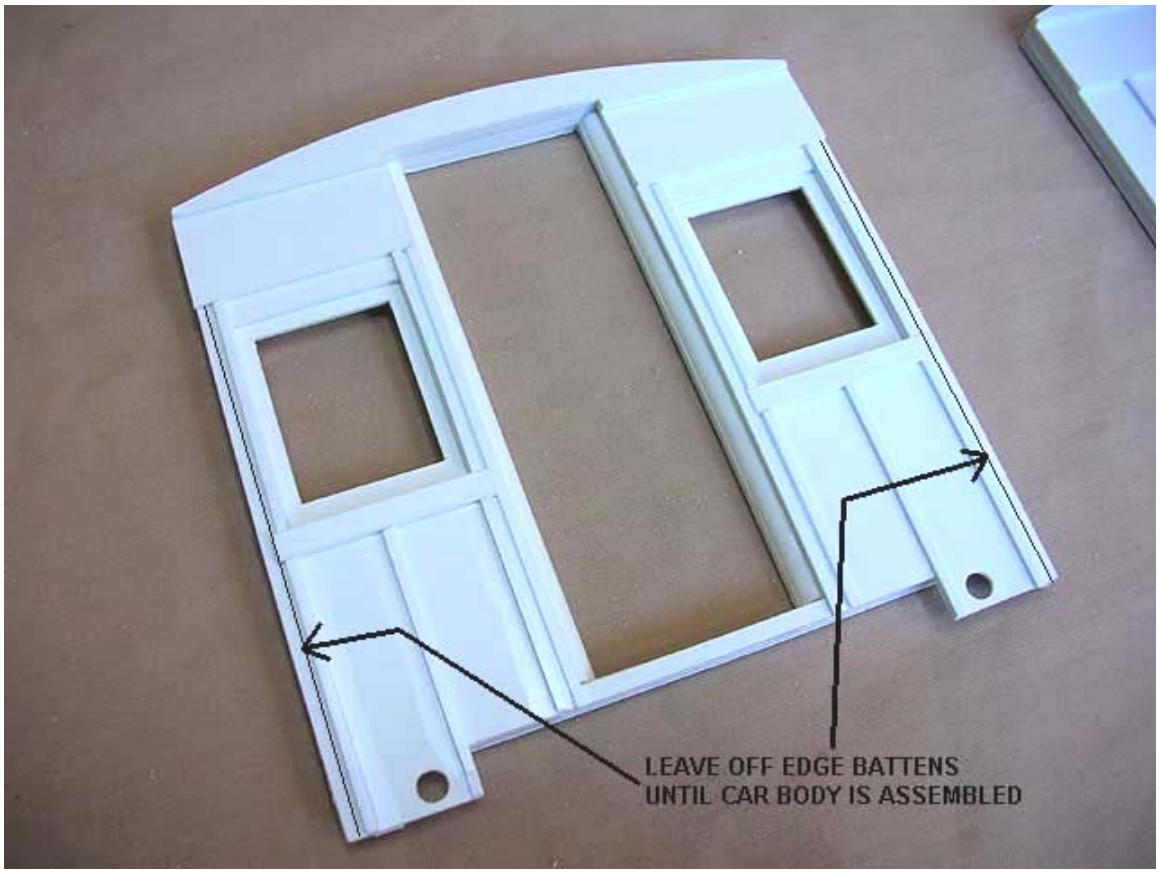
Here is a close up of the battens around the baggage door. Also at this time add the door sills to the baggage door area as shown here: The sill profiles can be found on the **PDF entitled "Car Chassis -Upper Layer - C"**





Battens to end walls:

Battens applied to baggage end wall of combine only.

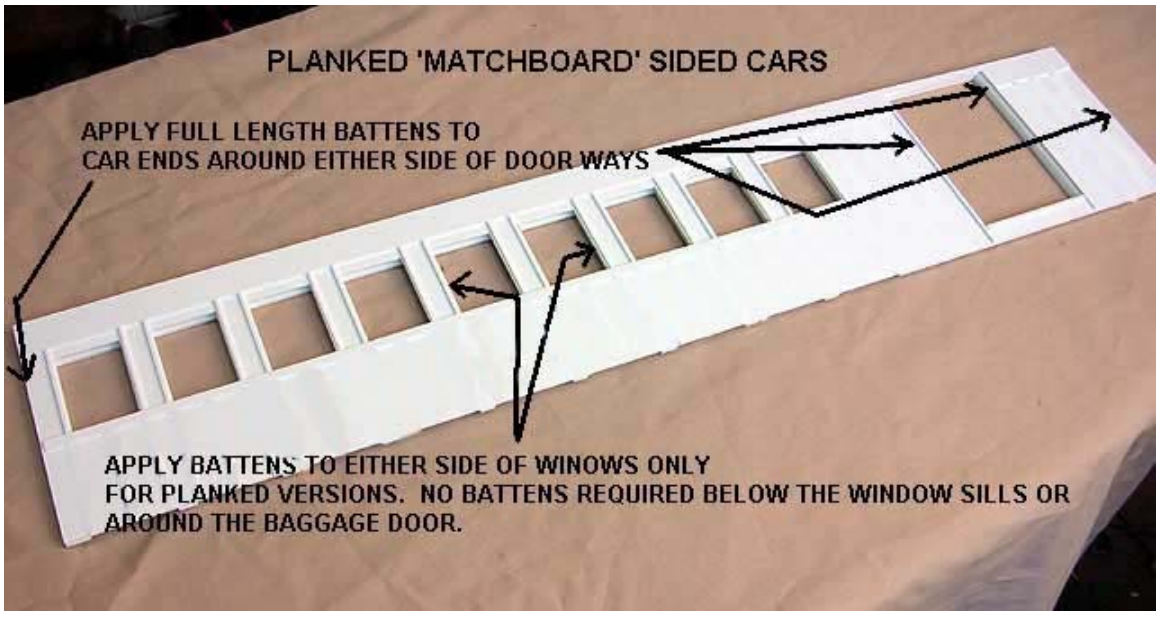


Battens applied to coach end walls.

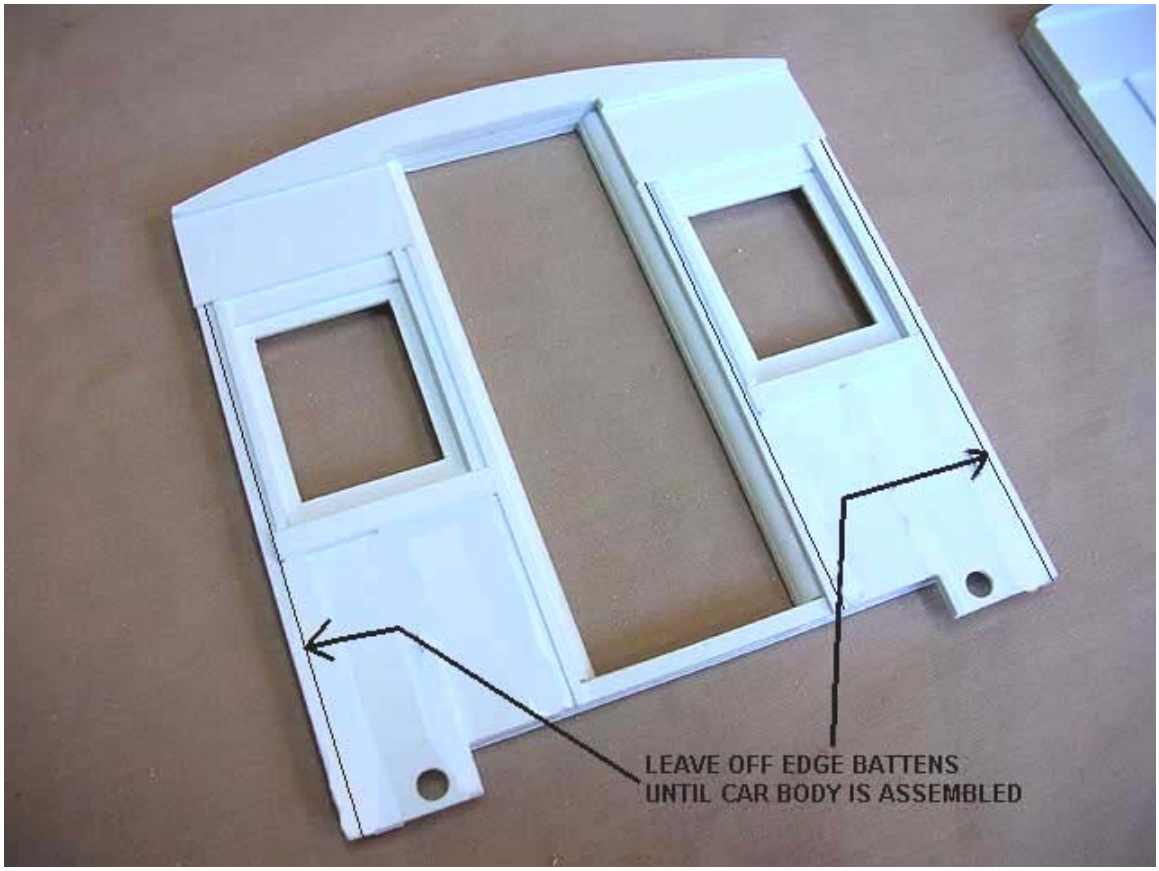
Matchboard - Plank Sided Coach & Combines.

As you'll see in the background photos, there were different styles of matchboard cars. Some were completely flat-planked sides with only the windowsills projecting. Others were planked sides, but with battens around the windows only and full length battens to the corners of the car.

Here is a demo of the battens required on the plank-sided cars - use the same intent on the end walls: battens only around the windows and full height to wall edges and either side of doorways.



Here is a demo of the battens required on the end walls of the matchboard/planked sided cars:



Here are some views of the matchboard sided coach showing the battens as required:

Step 11 - Assembling the Car Body.

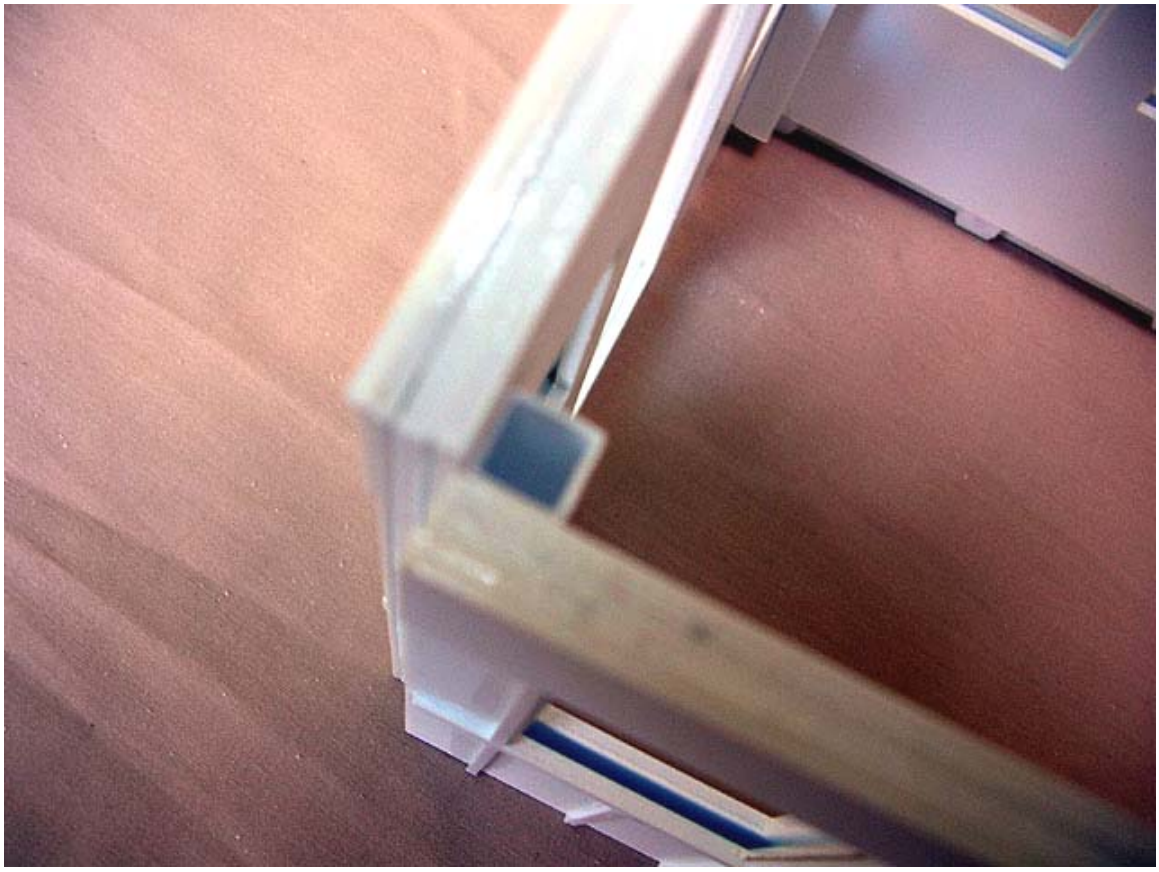
Ok, it's time to put the walls together to form the 3D car body.

First thing to do is get hold of your Evergreen SHS (styrene Square Hollow Section). I used the Evergreen 6.5 x 6.5mm styrene SHS. We use this SHS inside the corners of the 4 walls to actually hold the car body together. Inside these SHS, we slip some Plastruct 4.6 x 4.6mm grey ABS SHS. The ABS inner is used as a means to bolt the car body down to the chassis, with no exposed bolts to the outside walls of the car.

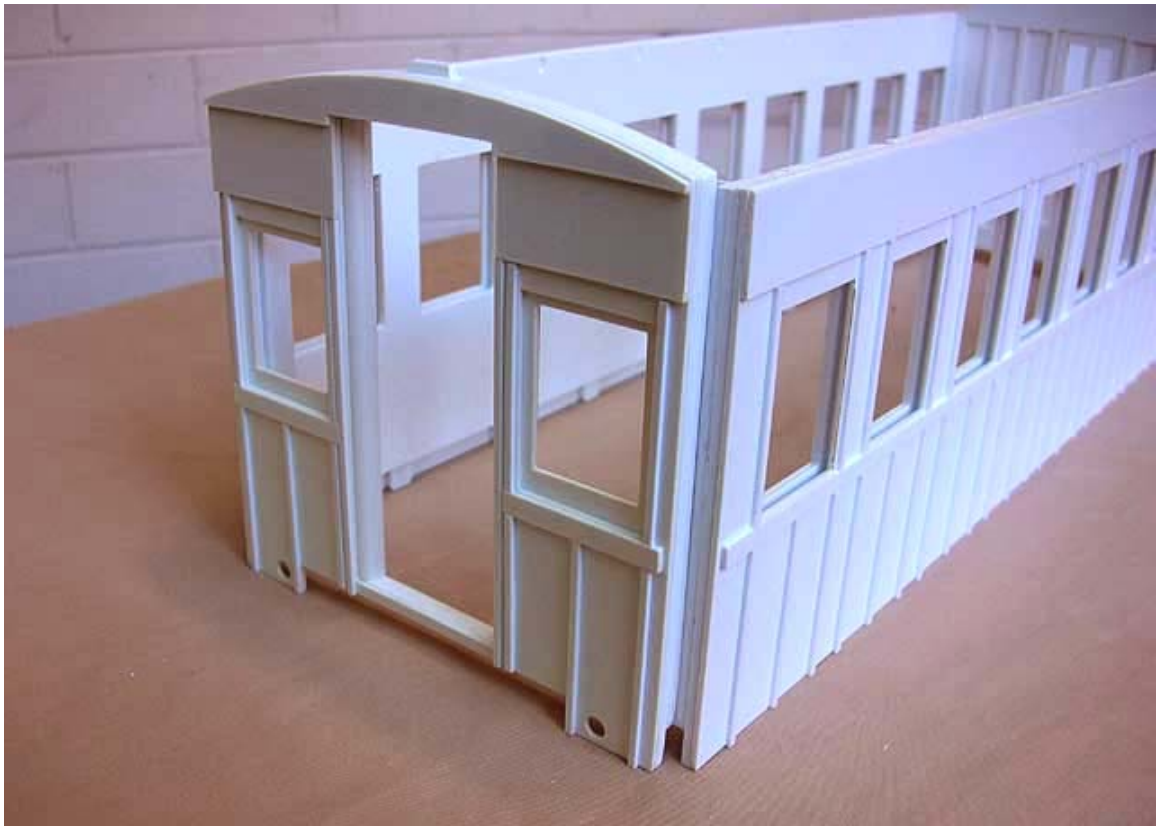
Take your two end walls and run the 6.5mm SHS up the vertical edges of these walls. Take great care to align the outer face of the SHS exactly with the side edges of the end walls. Weld the SHS into place like this:

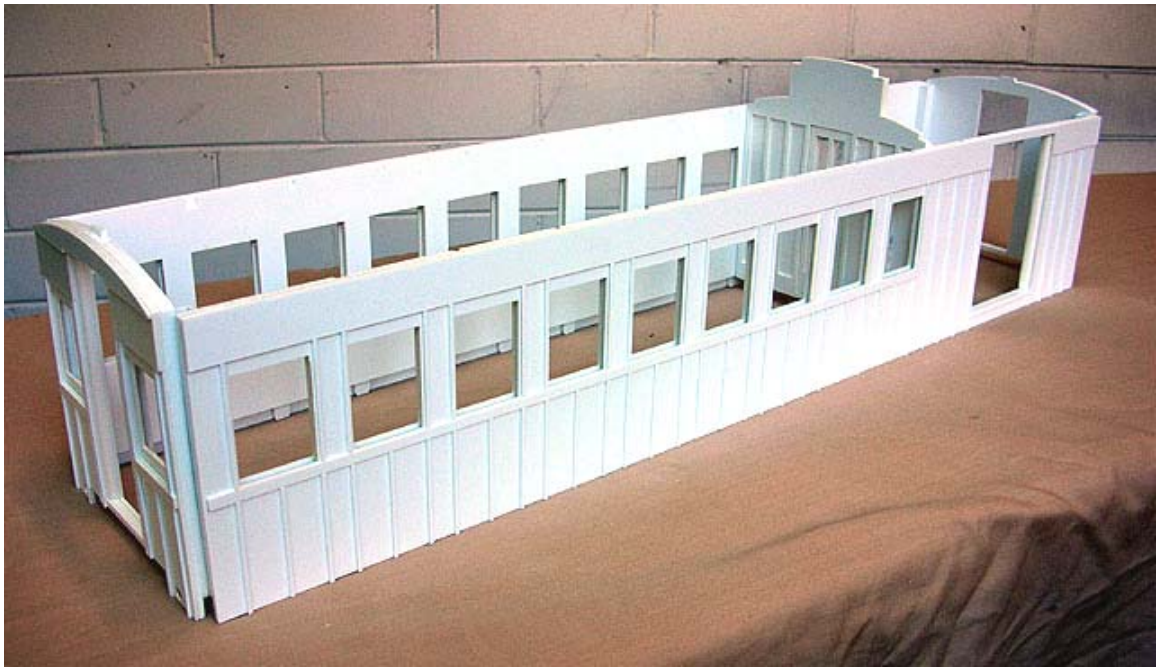
Next stand up one of these end walls. Make sure you're using a good flat bench top to set up these walls. The base lines of all 4 walls are all on the same level, so set up the 4 walls standing hard on the bench top. Weld the side wall to the end wall, by applying the side wall hard against the side of the corner SHS. Again, make sure the edge of the side wall does not run past the edge of the SHS.

The corner joint will look like this:



Apply the other end wall to the side wall in the same manner, and then apply the 2nd side wall. All 4 walls are now standing up. Check the edges of the SHS relative to the edges of the car walls in every case, as this will insure your walls are vertical and set out right relative to each other. Most importantly, do not let the side walls run any further past the end face of the SHS - the side walls do not actually touch the end wall layers at all. What you'll have is a neat vertical 5x5mm recess in each of the 4 corners of the car like this:

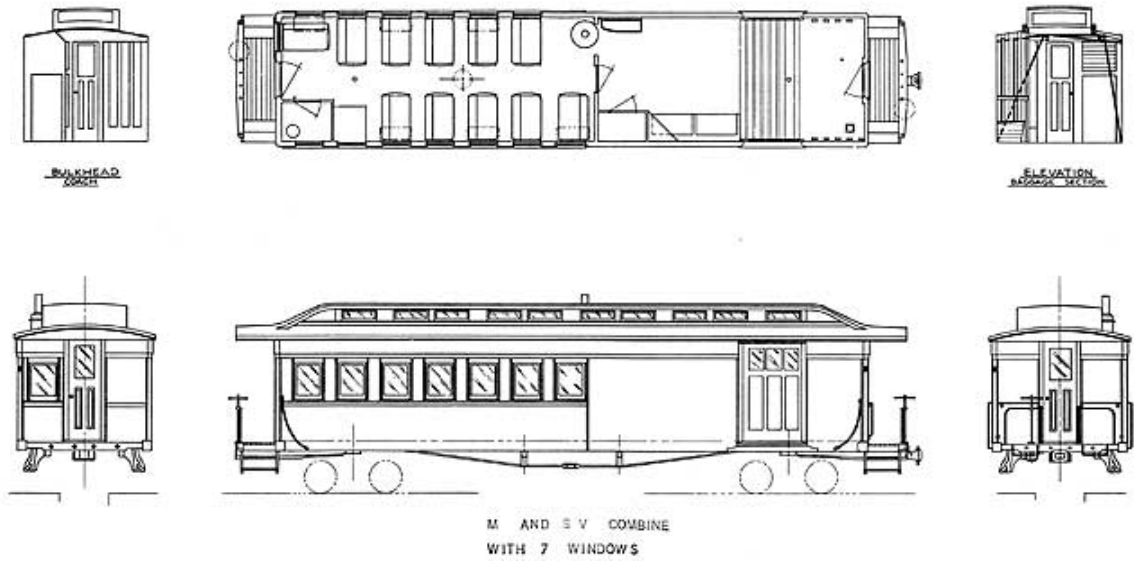




Next, as part of the strengthening of the car, lets had that dividing wall. You can see it set in place in the above photo.

Apply the dividing wall to the combine such that the paneled side faces the seating area and the planked side faces the baggage section. You will find some slots on the inside walls which will enable you to slip the dividing wall into place. The bottom of the dividing wall will align with the bottom edge of the inner wall layers, which is 7mm higher up than the bottom edge of the full car walls. Again, I would recommend a couple of lengths of the 6.5mm SHS along the baggage side wall interfaces for greater strength, and also to provide a mid-length chassis fixing point.

Since we're running 3 styles of combine, 1870s versions with 9 windows to the sides, and 1880s versions with only 7 windows to the sides, the baggage space in the different versions varies. Here is a nice drawing of the 7 window, rebuilt M&SV combine that our 1880s Matchboard version is based on. Note the location of the dividing wall in this design:



You might also like to set out the seats to the patten seen above, add the toilet and inward facing seat at the end. Also note how the wood heater is now central in the car, with part of it running through the dividing wall to heat the baggage section. The stove pipe is central to the car.

For the full coach versions, it is not mandatory that you use the mid wall, but it will add much strength to the car and provide a good way to fix the car chassis around the mid point of the car. You'll find the slots around the middle of the car on the inside wall to which you slide the dividing wall into place. Here's the dividing wall as applied to the combine:

Doug's Kit - Doug's kit has some additional internal finishes to be applied to the internal car sides - to the internal walls please install the window frames, which trim out the window openings as seen from the inside. The following view shows the frames, in stained wood, applied to the windows:

Step 12 - The Car Chassis.

Refer to the PDFs entitled:

"Car Chassis Upper Layer a, b, c"

"Car Chassis 2nd Layer a, b, c"

"Car Chassis 3rd Layer a, b, c"

"Car Chassis bottom layer a, b, c"

and

"Car Chassis Under Planking a, b, c"

The car chassis is made up of 4 layers of styrene, making a sum total of a 7mm thick 'block' for the whole bottom of the car. This thickness corresponds to the prototype's framing depth, but as a solid block of plastic/wood, is much simplified. There is method in my madness and departure from prototype accuracy:

1. I want this car kit to be as simple to build as possible, with minimal tools and effort, producing a finished car that looks right and is scaled correctly.
2. By setting up the chassis the way we do, you automatically have a car that is 'squared up' you require no jigs or angles to keep the frame square.
3. The prototype cars had no visible underfloor framing, because the bottom of the framing was clad over by 3/4" boards. The undercladding of the car allowed the builders to install sound proofing in the floor, in the form of sawdust filling the space around the frame members, between floor boards and underside boards. I can't however suggest that the insulation or underboards remained on all cars through to the 30s! It is, however, a convenient detail which enables us to simplify the floor chassis a great deal.

For folks wanting the 'framed' look, and no under-board cladding, I have set up the bottom 2mm layer to be trimmed in a frame-like manner, which gives the impression of a framed chassis, via the creation of shadows etc. This will enable people to look up at the cars at eye level and see framing under the car, even if not full depth.

Folks who have purchased the wood 1880s car kits from Doug Bronson have a fully framed chassis laser cut in the kit. The chassis is fully framed and will not follow the chassis instructions below.

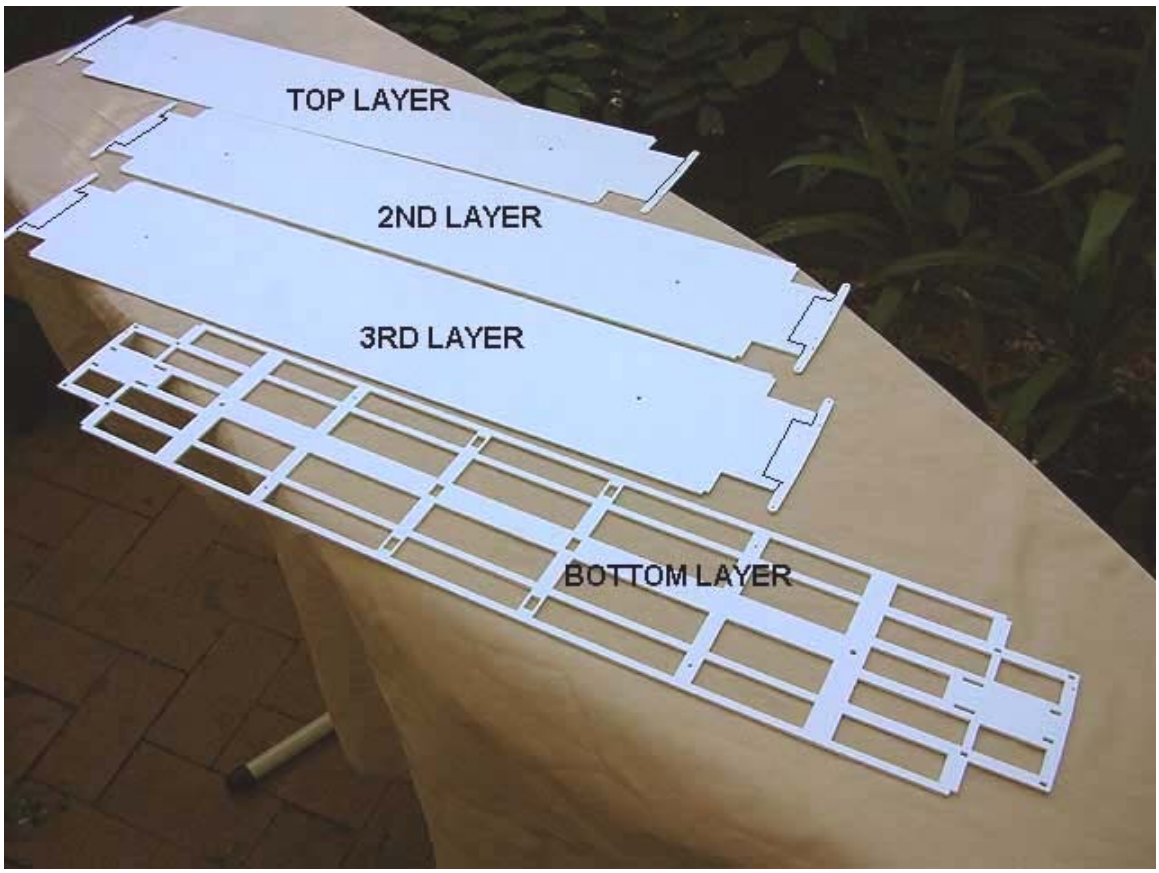
Finally, if the simplified framing as provided is not what you're after, you can use the laser cut parts as a template and make up your own frame using timber beams/rods from the craft shop.

OK, take your 4 layers that make up the chassis, the layers are ordered like this:
Upper layer - 1mm thick, with scribed lines for floor boards and end platform boards.

- 2nd layer down, 2mm thick styrene, no detail applied.
- 3rd layer down, 2mm thick styrene, same as 2nd layer.
- Bottom layer- bottom layer with frame pattern cut in.

There are also a number of planked scribed 1mm thick rectangle parts that are to be the underside cladding in the insulated version of the car.

Here is a view of the 4 layers for the car chassis:



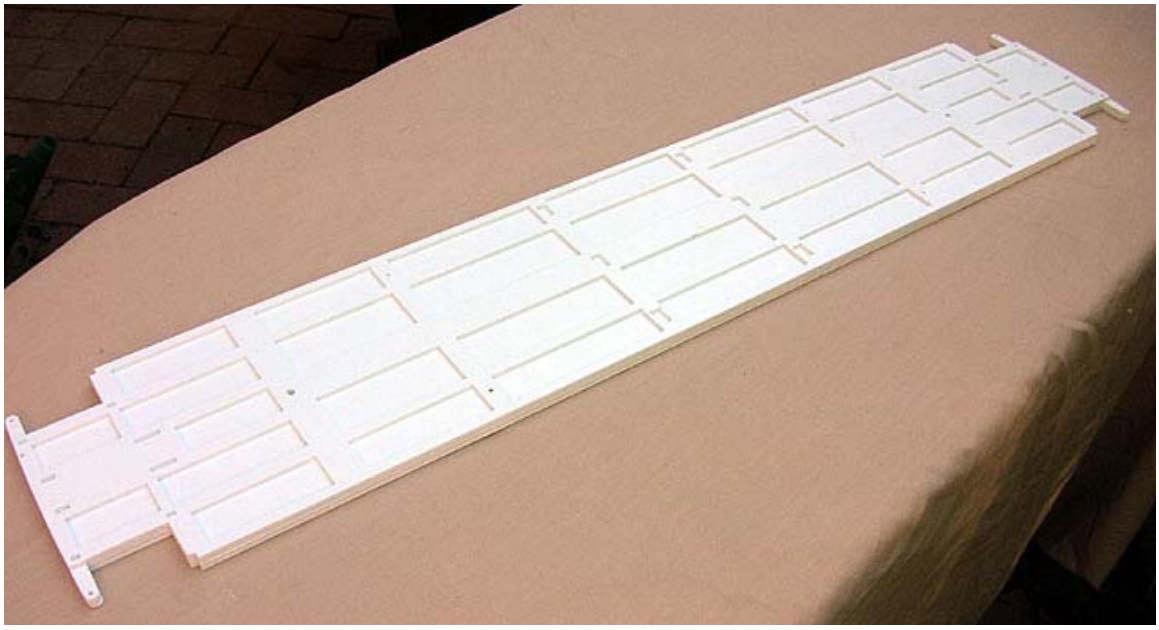
The End Beams.

Note in the above photo that the end beams to the chassis are shown attached to each chassis layer. Due to problems in getting the full chassis length to fit into the styrene laser cutter, we removed the end beams from the chassis parts in the 'production' version. The above photo shows the end beam profiles attached to each chassis layer, you can either glue them to the chassis to form the above view, or assemble the chassis first, weld the 4 layers of the end beams together in themselves and the slide them into place into the chassis at the end. I would probably do the end beams and chassis separately and weld them together after the chassis is assembled.

The end beams have a shallow curve to the exposed face and are layered as follows:

- 1mm thick top layer, with 5 holes across its length. 4 of the holes are for the end railings, the 5th hole is for the brake wheel staff. The brake wheel hole is the 2nd hole down from one end only. Make a note from the photos which side the brake wheel goes so that you weld the end beams together with the brake wheel hole in the correct place! Looking at the end of the car, the brake wheel is always on the left side.
- 2nd layer is of 2mm styrene, and is wider than the top layer, allowing for a tab to slide into the chassis to attach the finished beam firmly to the chassis. This 2nd layer also has 5 holes in it. Align the 5 holes with the top layer.
- 3rd layer is 2mm thick, same profile as the 2nd layer, but has only 3 holes in it for the outer end rail stanchion and the brake wheel staff. Again, align the holes with the 1st and 2nd layers.
- The bottom layer is shorter than the other 3 layers, with the curved outer edge aligned with the upper layers. The brake wheel holes must align with the holes above.

I'd use the styrene cement for the assembly of the chassis. Spread across the floor elements in a zigzag motion, 1/4" between passes. Looking from the bottom, with the 4 chassis layers welded together and the end beams attached, the assembly looks like this:



Harald's Kit - Harald's chassis is assembled exactly as above, but the end beams come attached to the chassis layers as seen in the above photos. They are not separate elements.

Doug's Kit - With the availability of a laser cutter being able to cut very thick sections of wood, Doug's kit comprises a fully detailed fully framed under floor framing per prototype, and is not layered up as seen above. Please refer to the instructions in Doug's kit to assemble the chassis.

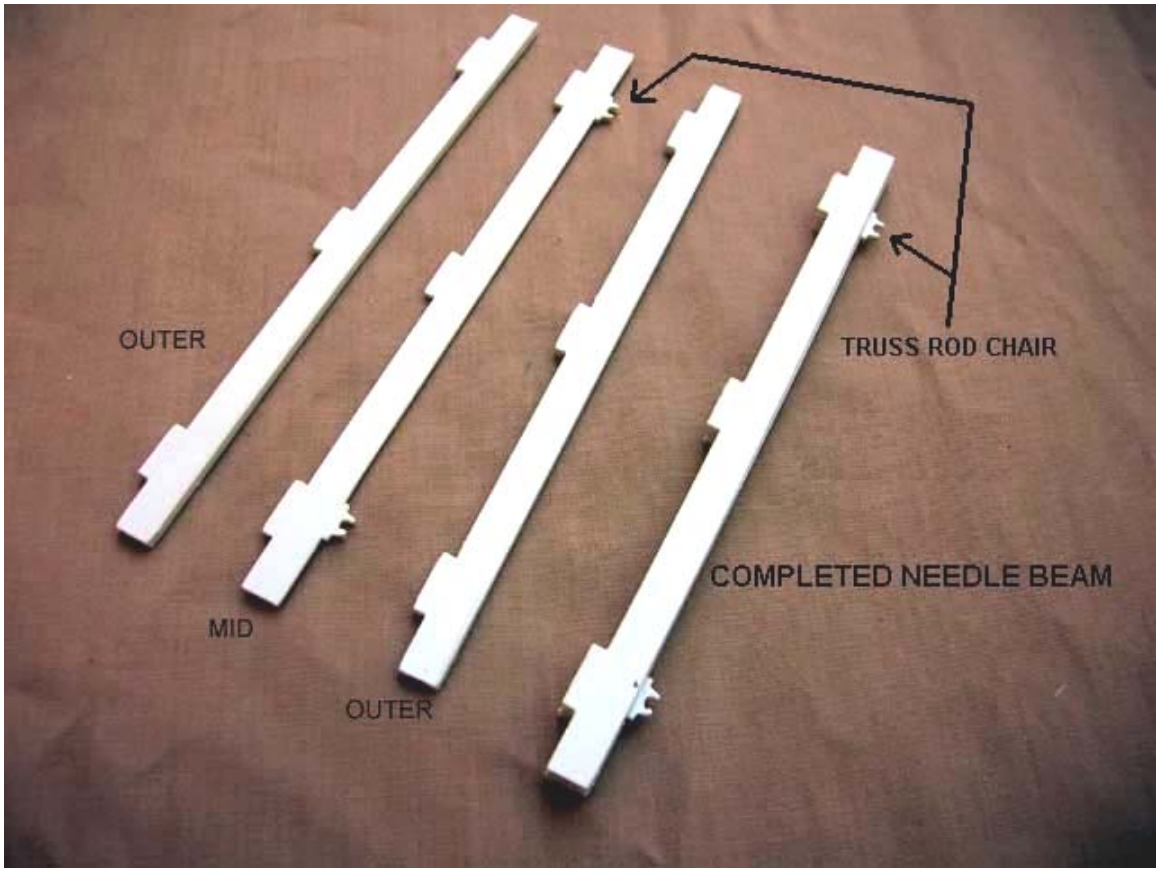
Step 13 - The Needle Beams.

These are the two timber beams that traverse the car across the middle and upon which the truss rods bear. As built, the truss rods rested firm against the bottom of the needle beams, with a metal chair where the truss rods passed over the beams. In this form, the truss rods formed shallow angles relative to the car base, with the turnbuckles close to the underside of the car. As the cars aged and sagged, the owners installed iron legs below the needle beams (called queenposts) to set the truss rods further away from the floor, making for greater angles and better structural support. I'll be demonstrating the 'as built' style, which is provided in the kit.

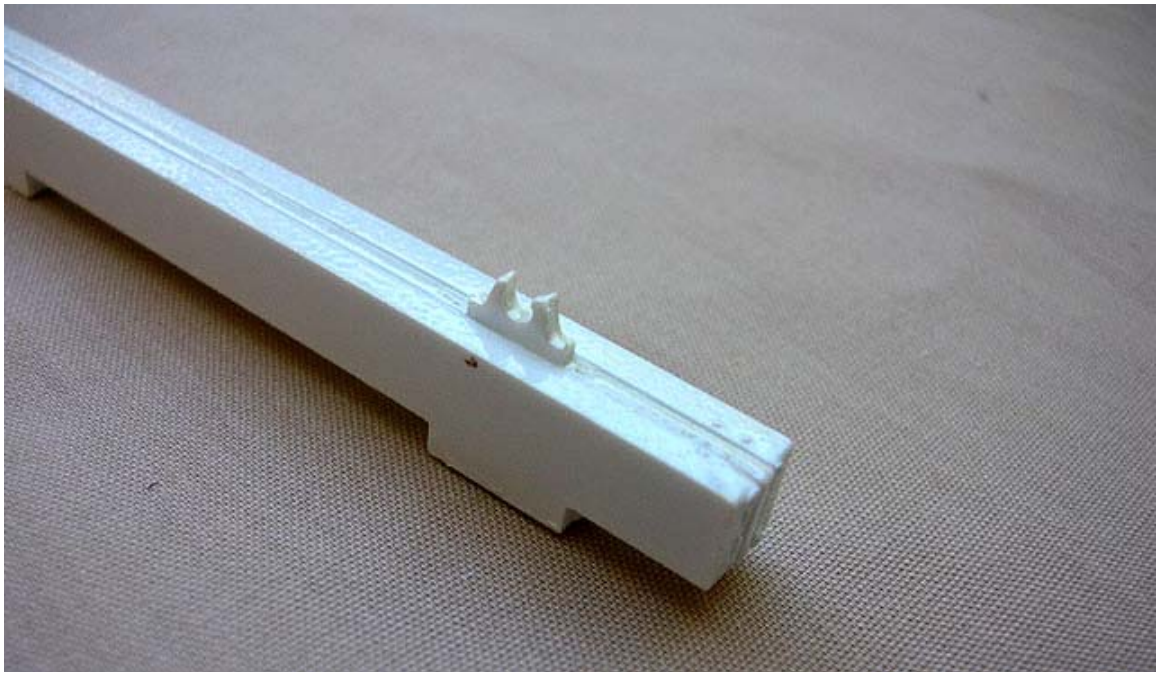
If you wish to add queenposts to the underside of the needle beams, I would recommend the Ozark Miniatures castings, part no. 1007. You'll need 4 queen posts of this type, 8 of them come in the pack from Ozark.

OK, let's make the needle beams. **Refer to PDF Entitled "Car Chassis Details"'**

There are two needle beams to assemble, each is made from 2 layers of 2mm styrene, and 1 mid layer of 1mm styrene, with the support chairs for the truss rods formed into this mid layer. Basically sandwich the 1mm layer between the two 2mm layers and you're done! Here is a view of a completed needle beam on the right side, and the 3 layers of the unassembled beam to the left side:



Here is a welded up needle beam with exposed truss rod chair. If you're intending to use iron queen posts below this beam, grind off this styrene chair and apply the Ozark queen posts in its place.



Once the 3 layers are welded together, the very ends of the beams may still be a little rough, with the 3 layers quite evident. You want those 3 layers to look like a solid block of wood, with nice rounded off vertical edges. When the needle beams are dry, lightly sand the exposed ends to a nice rounded surface and use filler if needed to help hide the layer joints.

Next look at the central area of the underside of your chassis, where you'll find 5mm wide holes cut into the bottom layer that correspond with the needle beam tabs - 3 tabs per needle beam. Simply press the needle beams into the chassis holes and drop in a little liquid styrene welder around the tabs.

Step 14 - The End Beams and Bolsters.

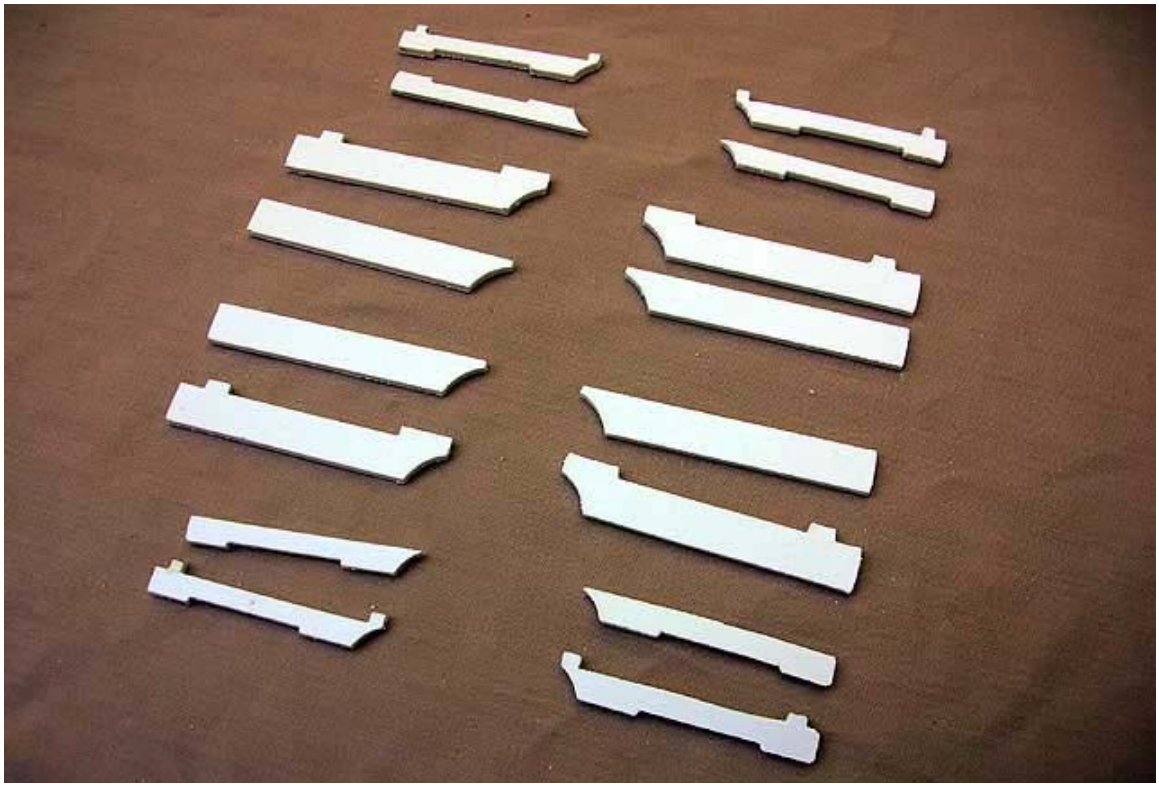
Refer again to the PDF entitled **'Car Chassis Details'**

At the ends of the car are four beams. Two beams toward the centerline of the car end, which ultimately house the coupling system, and two outer beams which support the end platforms of the prototype. The two middle beams are called 'Draw Timbers' and the two outer beams are called 'Platform Sills'.

In our kits these four beams are each made from two layers of 2mm styrene. Each beam has one of these two layers fitted with tabs that slot into the chassis, making the beam connection strong, and helping position the beams properly for you.

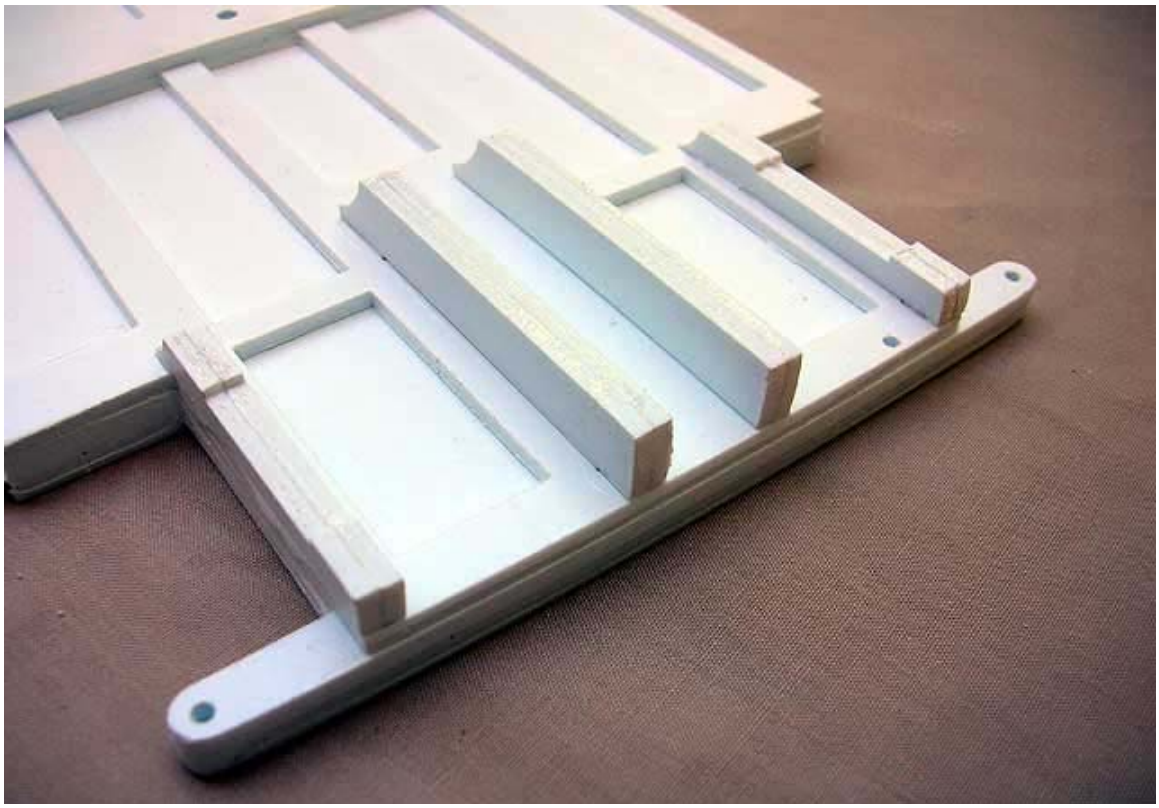
If building Doug Bronson's kit, these four end beams are cut as part of the chassis framing.

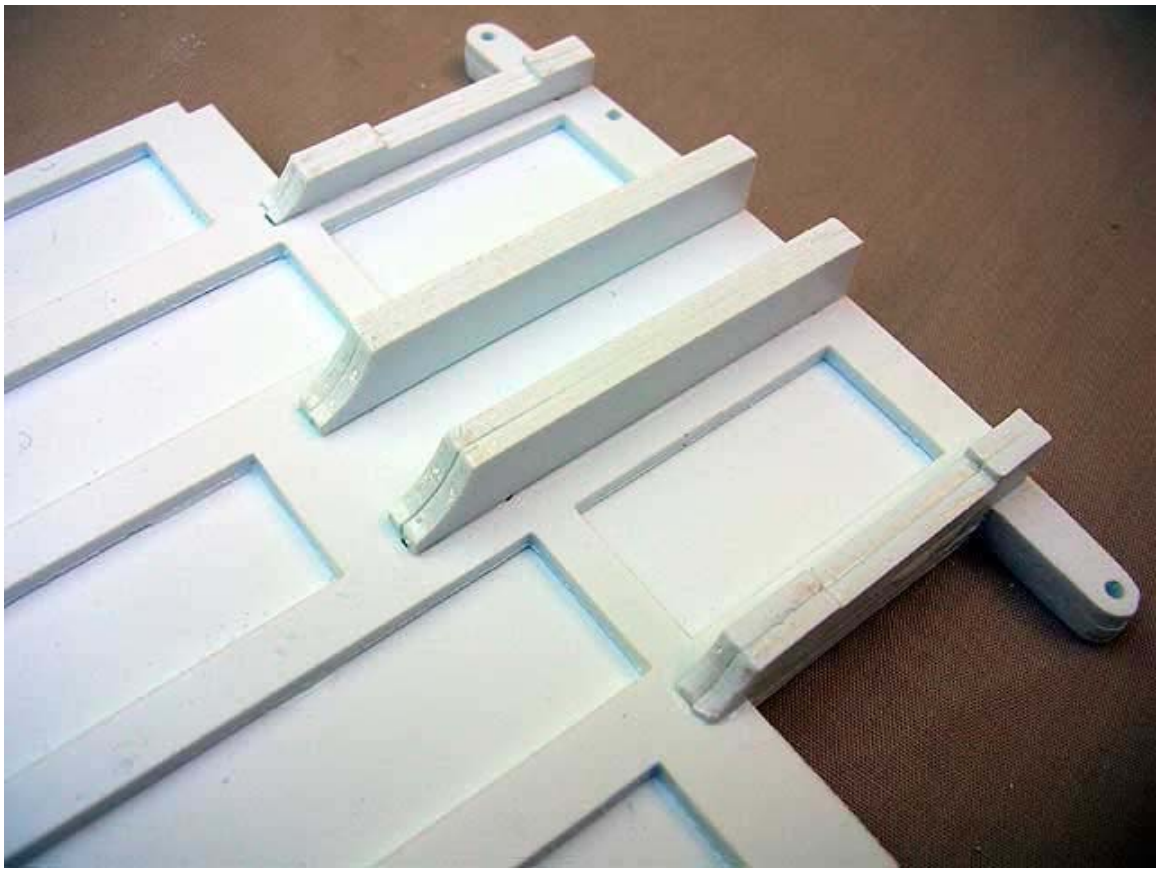
Lay out your beam parts, allowing a smooth and tab layer to each beam to sit next to each other. The laid out parts will look sorta like this, but note that your beams will be much longer, with tapered ends. Yours are prototypical, mine are short because I was concerned about the trucks pivoting freely without binding with these beams on tight curves. However, once my car was built, I discovered these beams would have little impact on the H-L-W trucks rotating, so I changed the design back to the way it should be! If using LGB trucks etc, then you probably will need to trim the beams back to look something like these shorter ones in my photo!



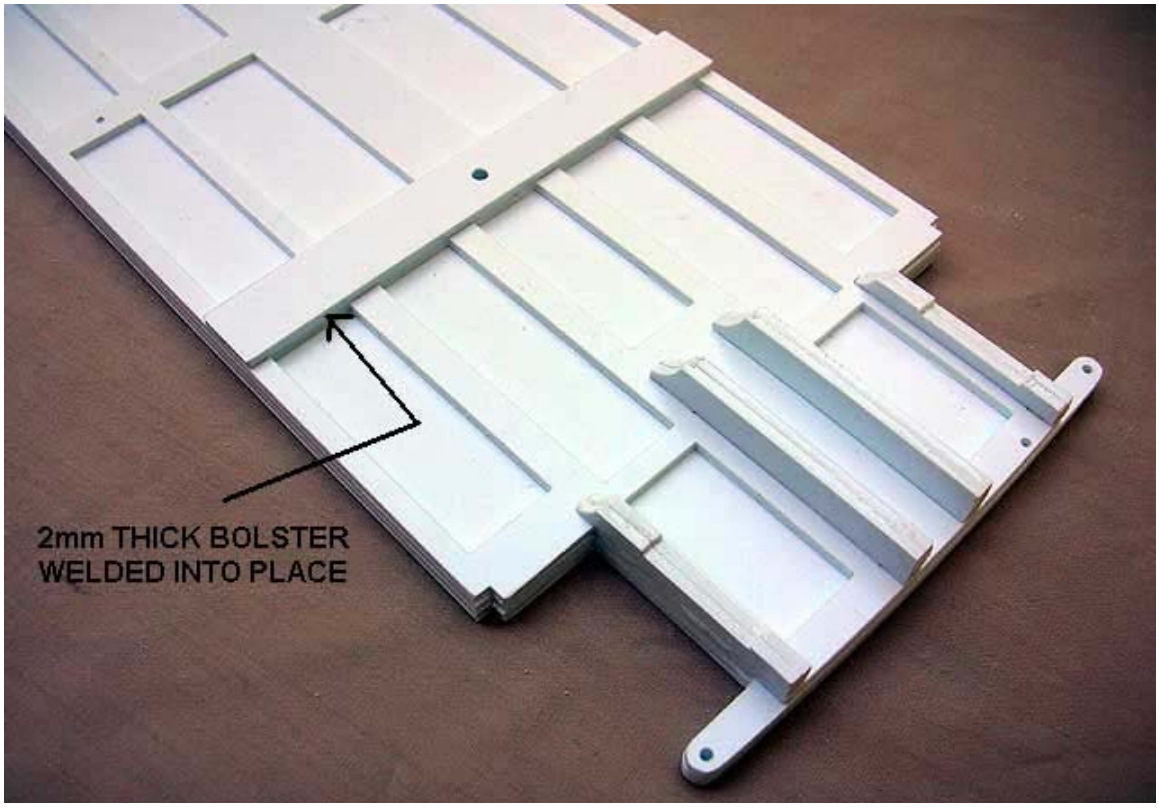
Next check over your chassis ends and look at where the tab holes are. For the platform sill beams, the outermost 2mm layer for the beams won't have tabs, but is supported by the inner layer with tabs. So, check the tab holes for positions of the beams and ensure you weld the two halves of each beam together properly so that you have left-hand and right-hand sides to all parts. The tabs on the central beams are to the outside of the beams.

With the beams welded together and inserted onto the chassis, the assembly looks like this:

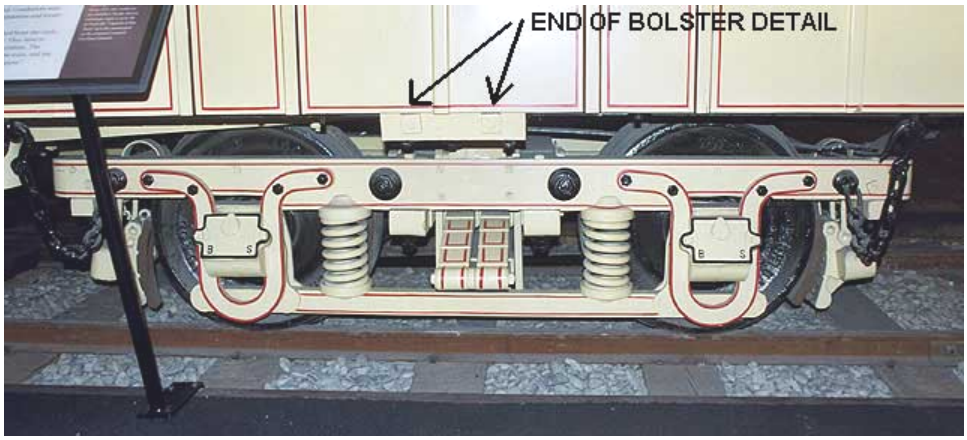




Now to install the **Bolsters**.
These are 2mm thick rectangles with a hole in the middle for the truck fixing bolt. Simply weld the bolster flat onto the car chassis, with the central hole for the trucks aligning. With the bolster welded into place, and the end beams shown, the assembly looks like this:



At the 2mm thick exposed ends of the bolsters, weld into place two slivers of either 1.6mm rivet rod, or two squares of 1mm thick styrene to indicate the ends of the tie rods running across the car width. You can also use square nut-bolt-washer castings for these if you like. Here is a view of the tie rod ends as seen on the prototype ends of the Bolsters:



At this point, drop your car body down over the chassis and see how it all slides into place. Do not fix or glue the chassis!

Step 15 - The Rafters.

Take a look down the top inside edge of your car body. You'll find a whole line of lil 2mm thick slots cut along the top edge. Note that the first, the end-most slot is 4mm wide, not 2mm. Also if you look along the combine wall, you'll see that there are no 2mm slots around the baggage door area. People building coaches and not combines will see the slots go the full car length, with the first and last slot at both ends being 4mm wide.

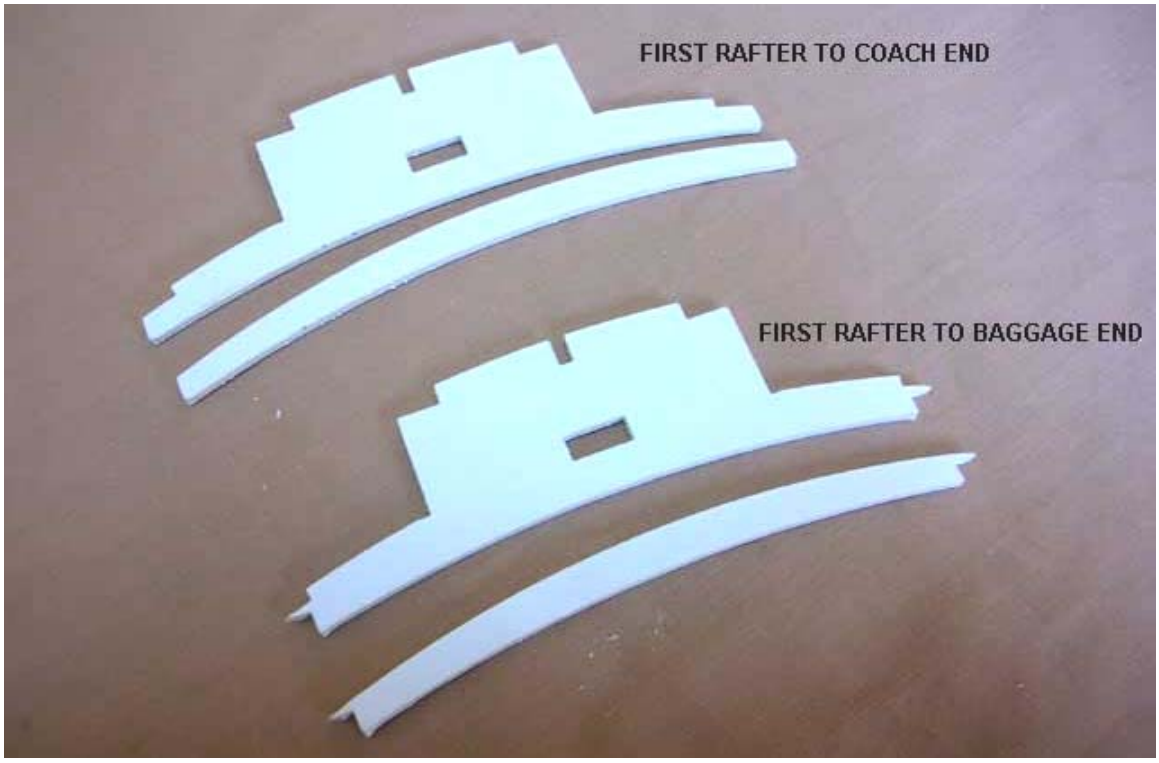
The 4mm wide slots are designed for the special double rafter that supports the Duck Bill area of the car roof.

Refer to the **PDF entitled "Rafters"**
There are two styles of first rafter - the coach first rafters and the combine first rafters. Both of these are the first rafters to be used, slotted into those 4mm slots.

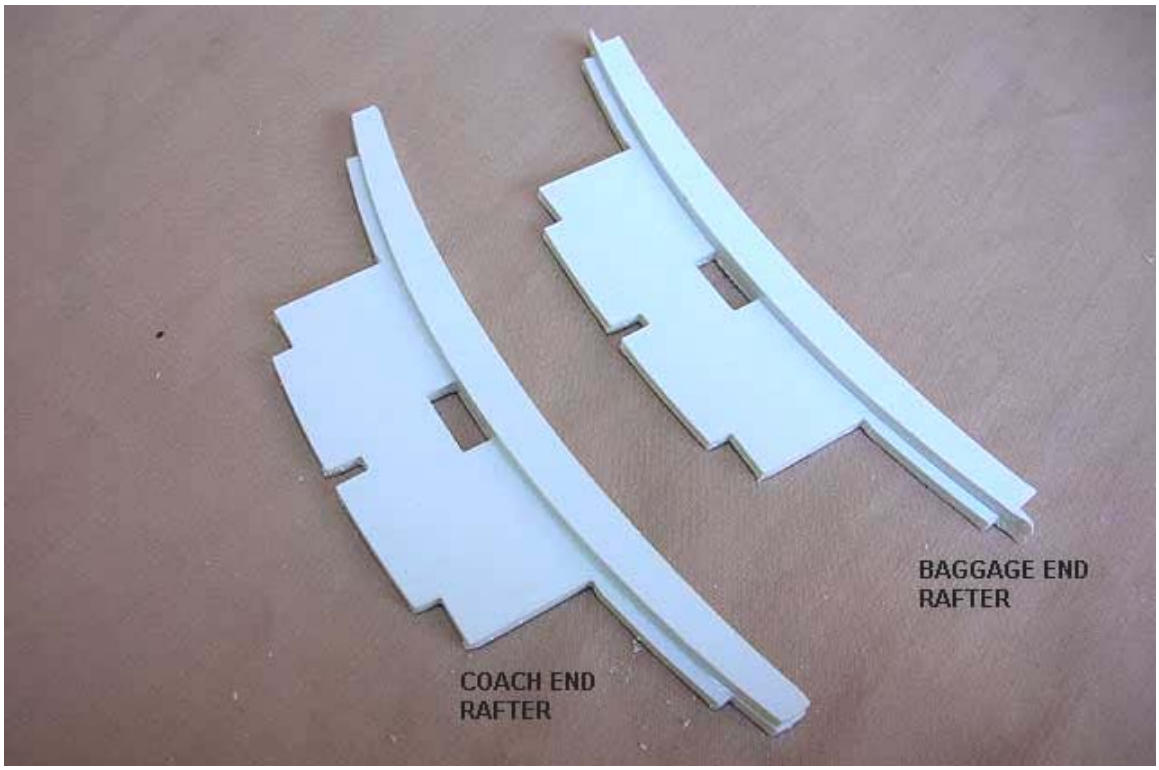
The coach requires two sets of the 'coach' rafters, and are used on both ends of the coach in an identical manner.

For the combine, you need one set each of the combine and coach rafters. The combine rafter being used above the baggage door in a special way we'll describe shortly.

The two rafter styles, prior to assembly look like this:

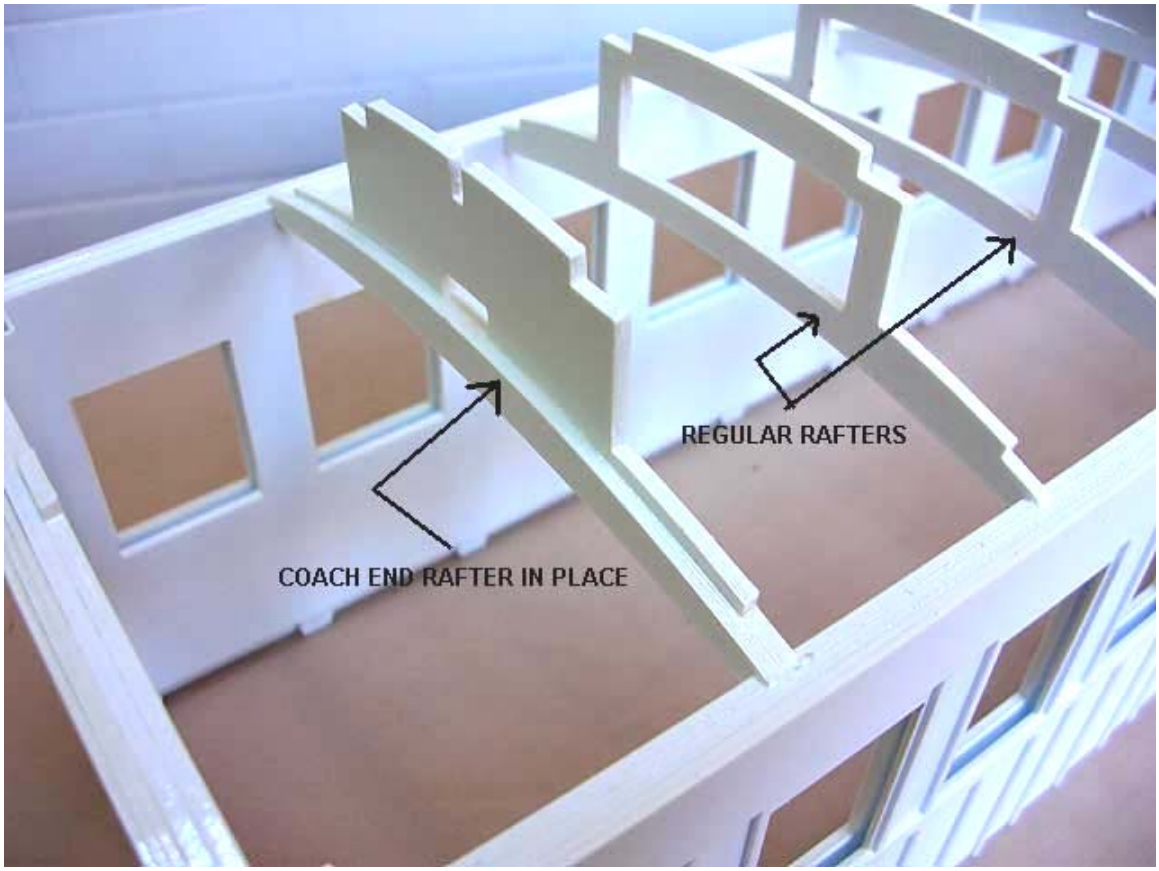


Next weld the two parts to each rafter together, forming the 4mm thick first rafters thus:



Next pull together all the rest of the regular 2mm thick rafters. In total there are 9 regular 2mm thick rafters. For people building the combine, there are only 8 regular rafters and a special rafter to go above the baggage door with a different end profile - keep that special rafter separate for now.

Take the coach 4mm thick end rafter and the 8 or 9 regular rafters and weld them into the car walls like this:

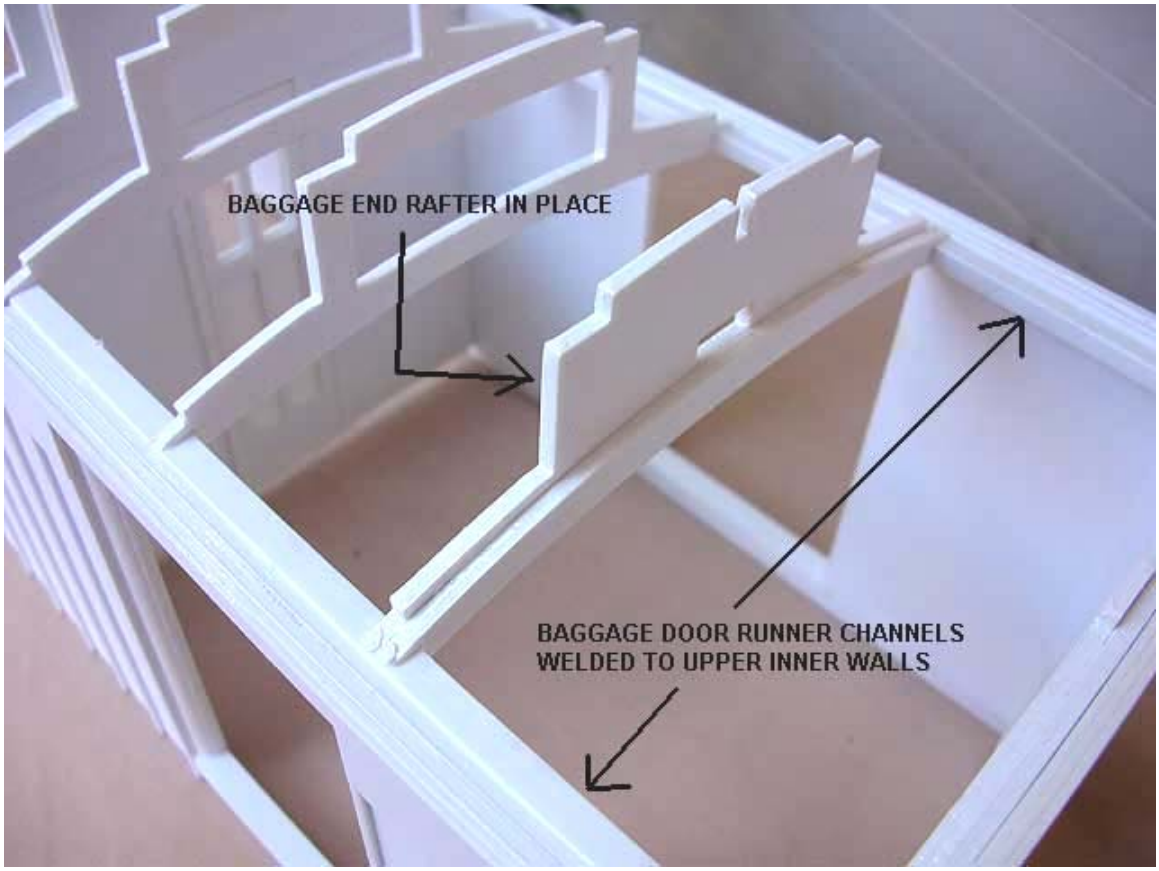


For folks building the coach only, repeat this look at both ends of the car, and your rafters are all done.

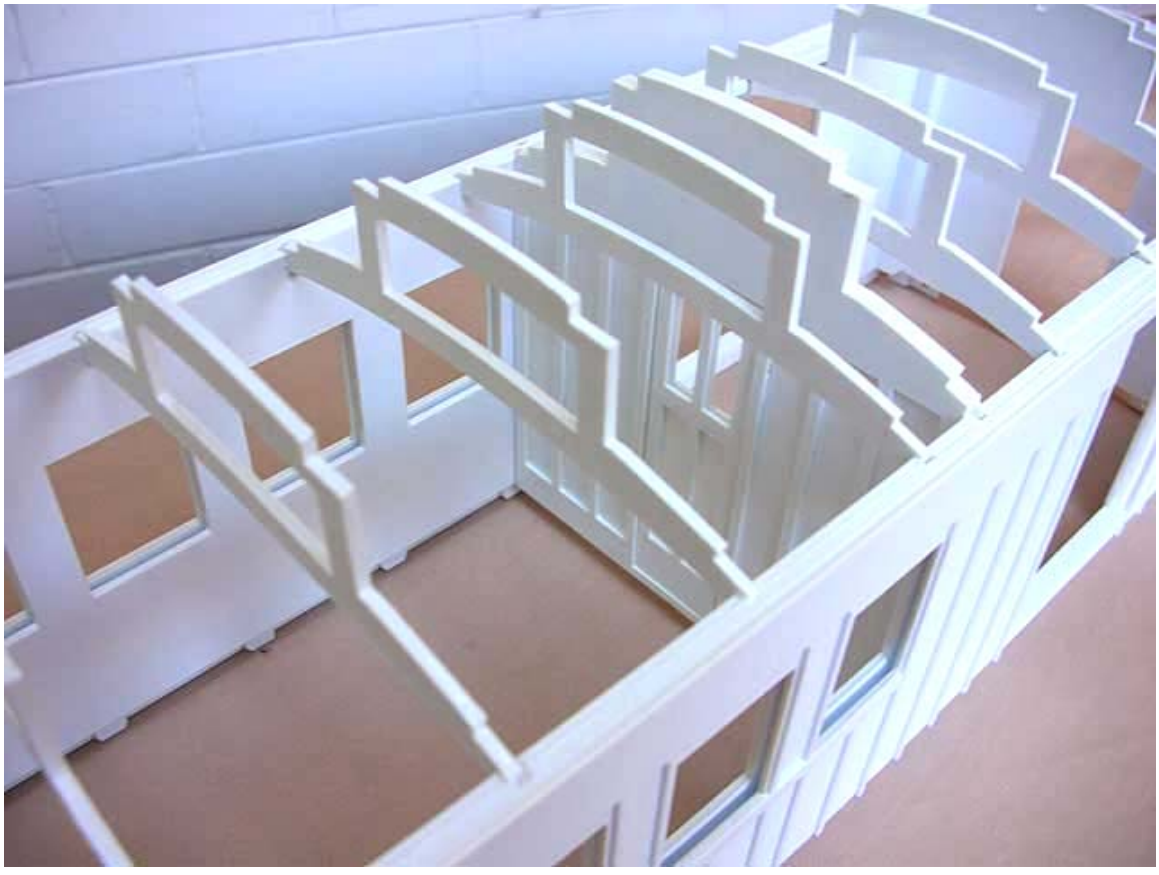
For people building the combine, we need to install the two rafters above the baggage door. Since the baggage door is almost the full height of the car side, and we're wanting to run the door in a track so that it can slide, there is no place left along the top edge of the wall to install any rafters! The method we use is simple. We attach the top track of the door slider and attach the rafters to the top of that track.

The track is made form two lengths of styrene Evergreen 4.8mm channel (listed in the parts list at the top). Cut the two lengths of this channel to run from the end of the car back to the 8th regular rafter, slotted in position near the baggage door. The baggage doors will slide toward the car end wall. Weld the tracks to the upper inside face of the walls, with the channel facing downward. The top edge of the channel shall be flush with the top edge of the walls. All we do then is weld the 9th regular rafter to the top of this channel, and then the final 4mm duck-bill rafter onto this channel as well. How do we space the rafters when we don't have any slots to set them out? Two ways - you can either measure the setout of the rafters from the completed coach end and weld to the same setout - or, as I did, just drop the 2mm thick clerestory window components into the rafters. The clerestory parts have 2mm slots long the bottom edge which align with each rafter. You can use the slots to set out the rafters over the baggage door channels. With the channels installed and the two special rafters welded into place.

The baggage end of the car will look like this:



Here's another view from the middle of the car, looking toward the baggage area:



and a view of the car with all the rafters in place:

Step 16 - The End Roofs.

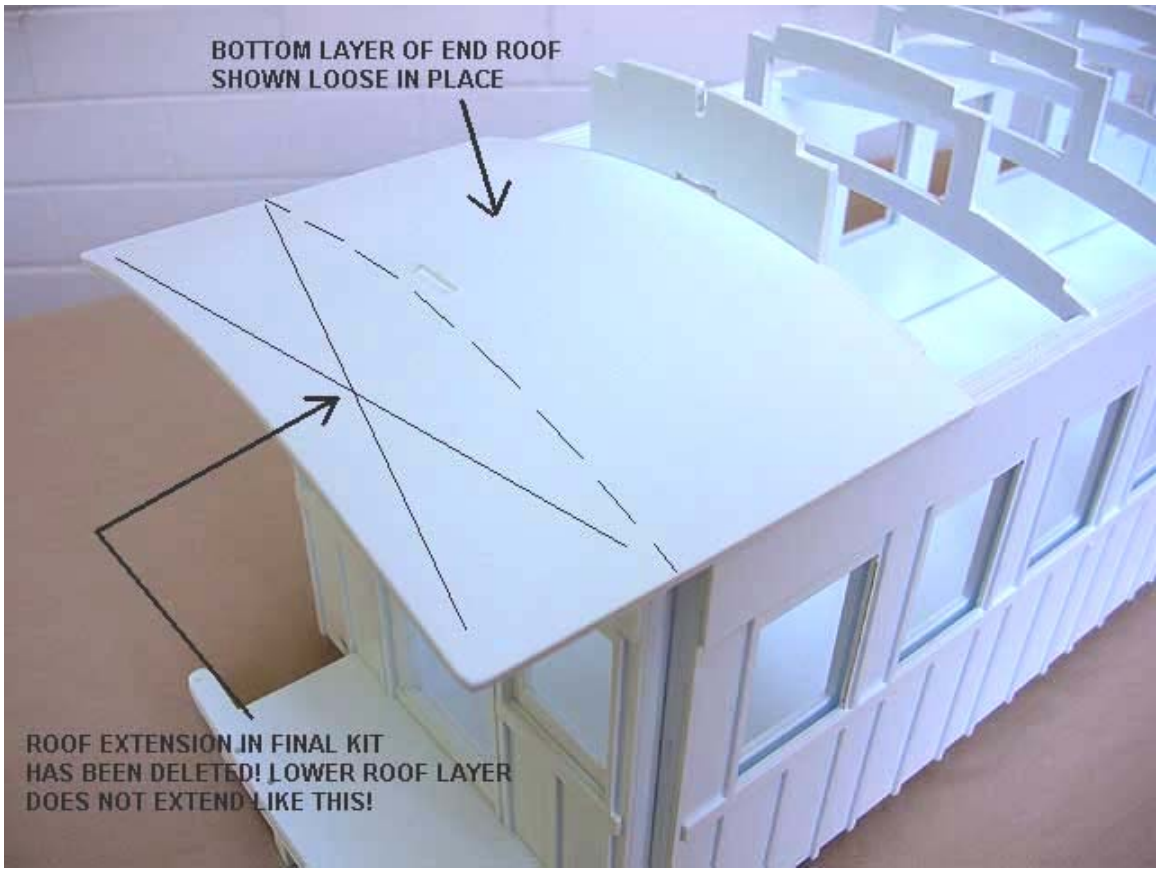
Refer to the PDF entitled "End Roof a, b"
The End Roofs are made from 2 layers of 2mm thick styrene, bent into a gentle curve. To the underside of the exposed eave above the car's end platforms, we add some exposed framing, cut from 1mm thick styrene.

First find the lower 2mm thick roof layer; we need to bend it. Note the tab cut into the panel end. This tab is used to slot the inner edge of this roof to the 1st rafter. Make a note of this tab, because you're about to bend the roof, and don't want to bend it the wrong way! I used a gas flame from the stove, holding the styrene sheet approx 6" above the flame, and gently moving it from side to side in 3-4 second bursts to slowly heat up the styrene, without charring it. You will instantly see the styrene bend away from the heat source, this is the curving you want to follow in bending the roof. Before going any further, take hold of a round rod of some sort, I used some PVC pipe of the 1" diameter size. Place the roof part onto some soft backing, such as a few newspapers piled up, or a 1 inch thick lump of foam rubber. Next roll the pipe over the roof, like a rolling pin on dough. The roof will begin to curve as you roll. Next heat again and repeat the rolling. If it helps to get some experience with heat bending styrene, use some 2mm off cut and heat and bend it. Go slowly, heat and bend a little at a time to evenly bend the roof element to the same curvature as the end rafter. Make a note that the styrene will start to straighten out as it cools, so it may take several passes in heating and bending, and you can perhaps just over-bend a little, so that when it springs back, it takes on the curve you want.

Do not apply too much pressure bending the parts while still cool as you will fracture the styrene. It is definitely best that you are bending the lower layer first. If this layer cracks, at least it won't be visible as it is covered over by the upper roof layer!

With the lower layer bent to shape, you can drop the roof element onto the car end to check the curvature. There is a small tab at the inner face of the roof, just slide it into the slot in the first rafter.

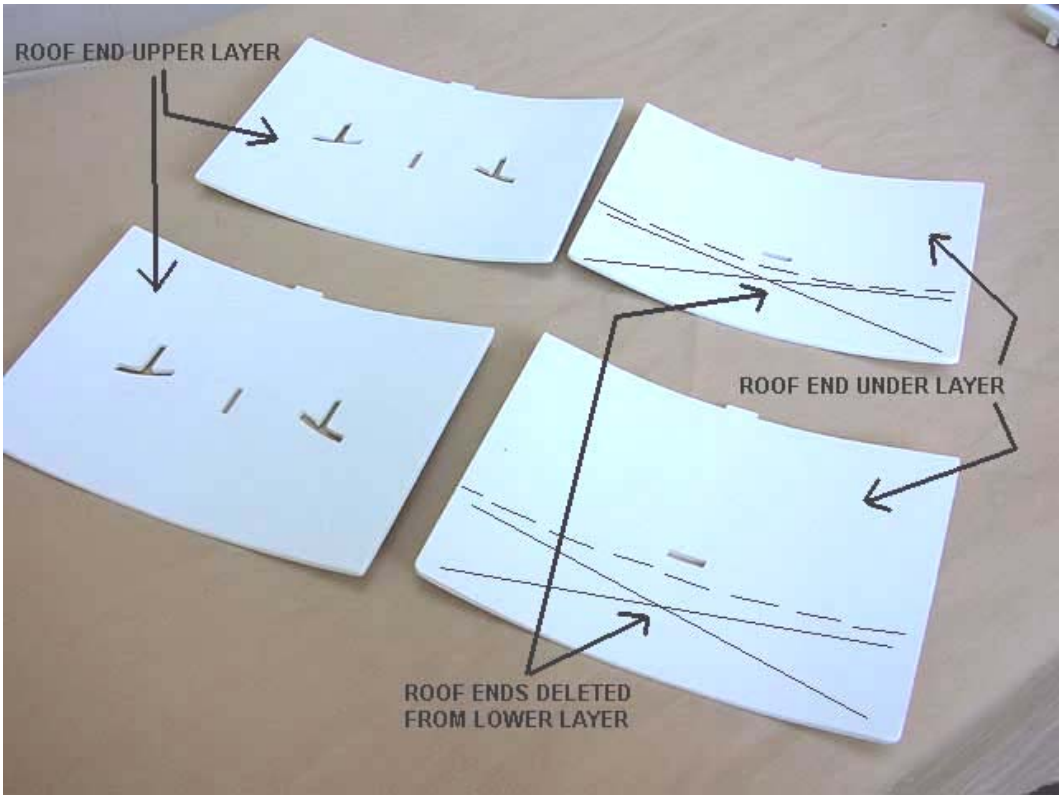
Drop the roof into place loose like this:



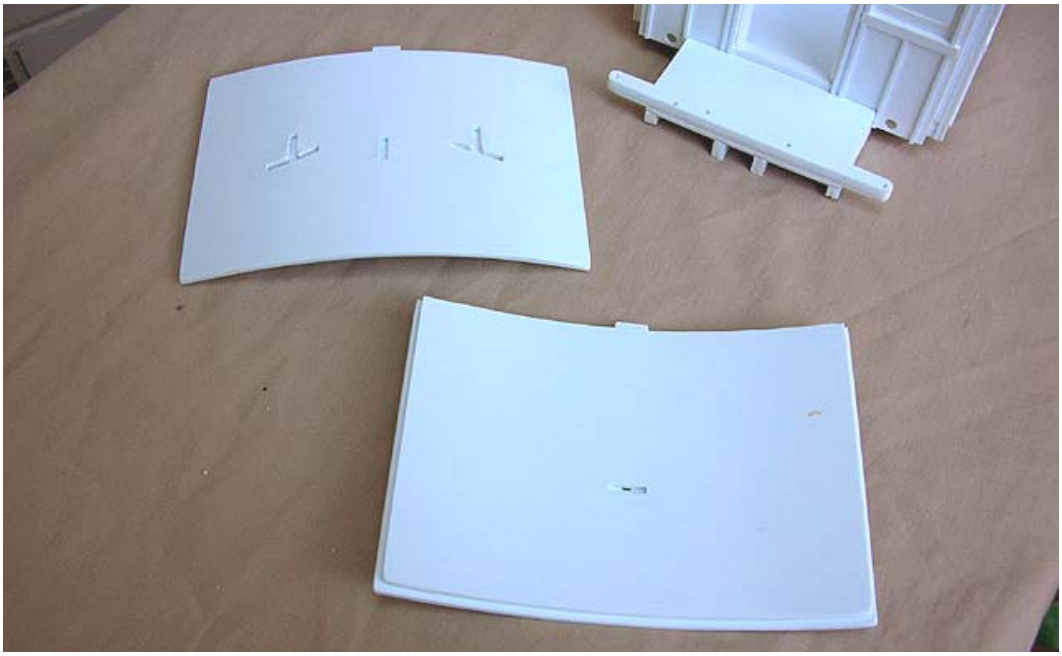
Note that I've altered the roof deign a little from the prototype car and this bottom 2mm roof layer does not extend past the car end walls - see above.

Another view of the loose fitment of the end roof's lower layer:

Next take the 2mm thick upper layers to the end roofs. The upper layer is laced with slots for the duck bill to slip in. Again, heat and bend the upper layer, slow and careful to avoid cracking, especially around the slots in the roof centre. The upper and lower roof layers are like this:



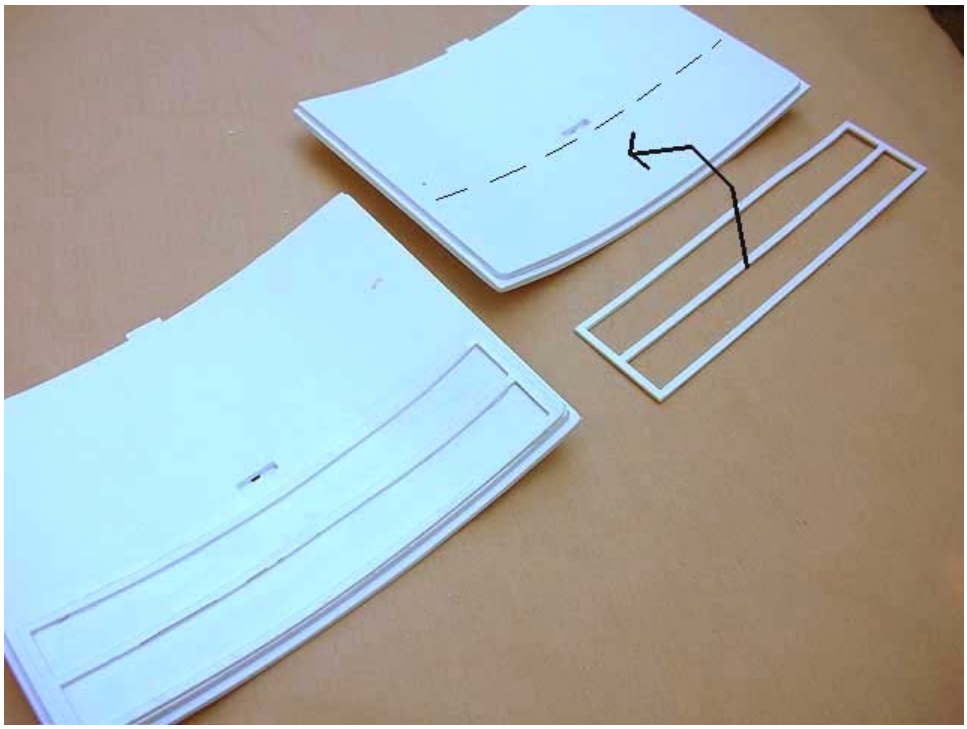
Once you've bent the roof layers to the curve to match the rafters, and they have cooled and are are not springing back to flat, weld the lower layer to the inside of the upper layer using the polystyrene cement. Match the tab ends of the roofs, where they meet that first rafter. The lower layer is slightly narrower than the upper layer, so the only edges that align are the edge with the central tab. Laminating the roof layers together in this way will also help to keep the styrene roof elements curved. The welded roof elements will look something like this:



Note again, that the bottom layer does not extend out as far as my photos above show.

Ok, again drop the end roof elements in place for a test fit, to ensure that your curves are holding. Do not apply glue yet!

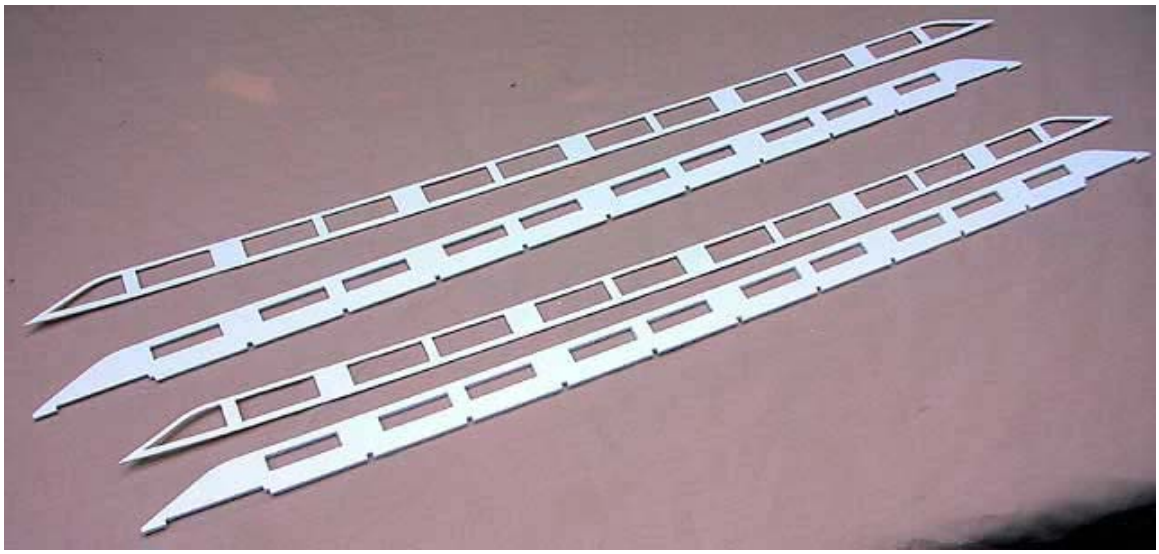
Remove the roof ends again and turn over. Now take that 1mm thick framework part and weld it up against the outer edge of the bottom 2mm layer. In my photos here, I show it welded to the face of the bottom layer, but my roof is too thick, which is why our bottom layer is now only half the length of the upper layer. Weld the 1mm thick frame part to the underside of the exposed upper layer. The finished end roof assemblies will look like this:



Weld the roof ends to the car body. Weld firmly in the joint between the rafter and roof end, as well as the edge of the car walls with the edges of the roof. I used the polystyrene cement for this. Use masking tape if needed to pull the roof edges down hard onto the car sides.

Step 17 - The Clerestory.

Use the **PDF entitled "Clerestory Roof a, b, c, d, e, f"**. Make the clerestory sides. There is a 1mm thick outer layer and a 2mm thick inner layer. Just weld the two layers together. The top edges will match, while the bottoms are different. The window sizes in the inner 2mm layer are smaller than the outer 1mm layer, creating a window frame effect. The 4 layers look like this before being assembled:



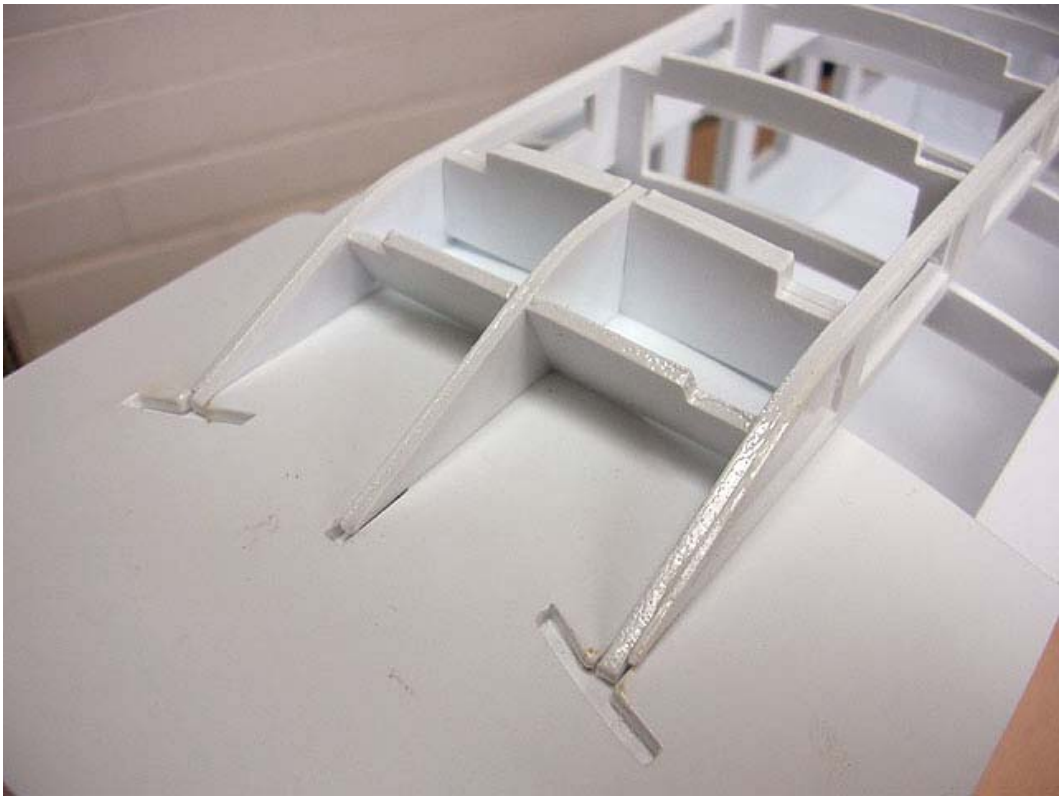
The notches along the bottom edge will slot over the rafter tops. The clerestory inner face will rest hard against the upper rafter vertical edges.

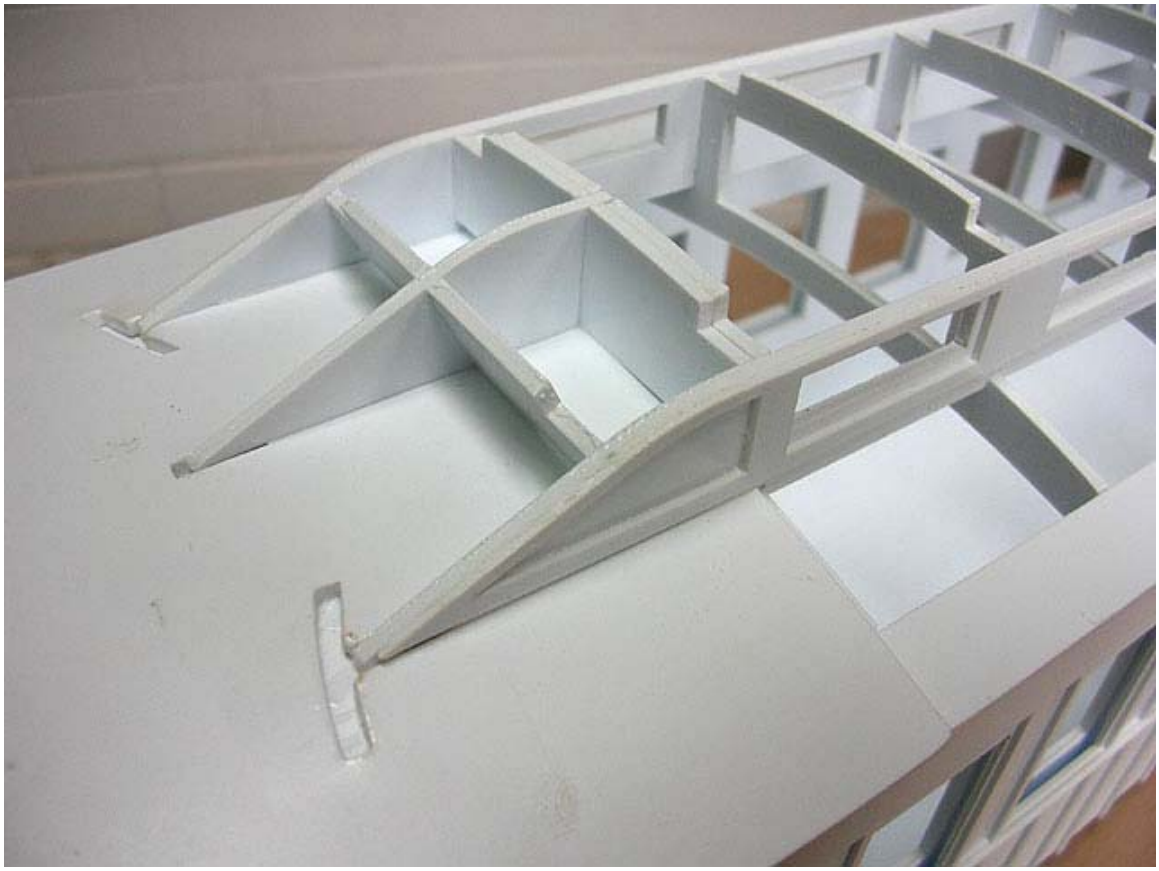
With the clerestory dropped into place and the end tabs slotting into our curved end roofs, the assembly looks like this:

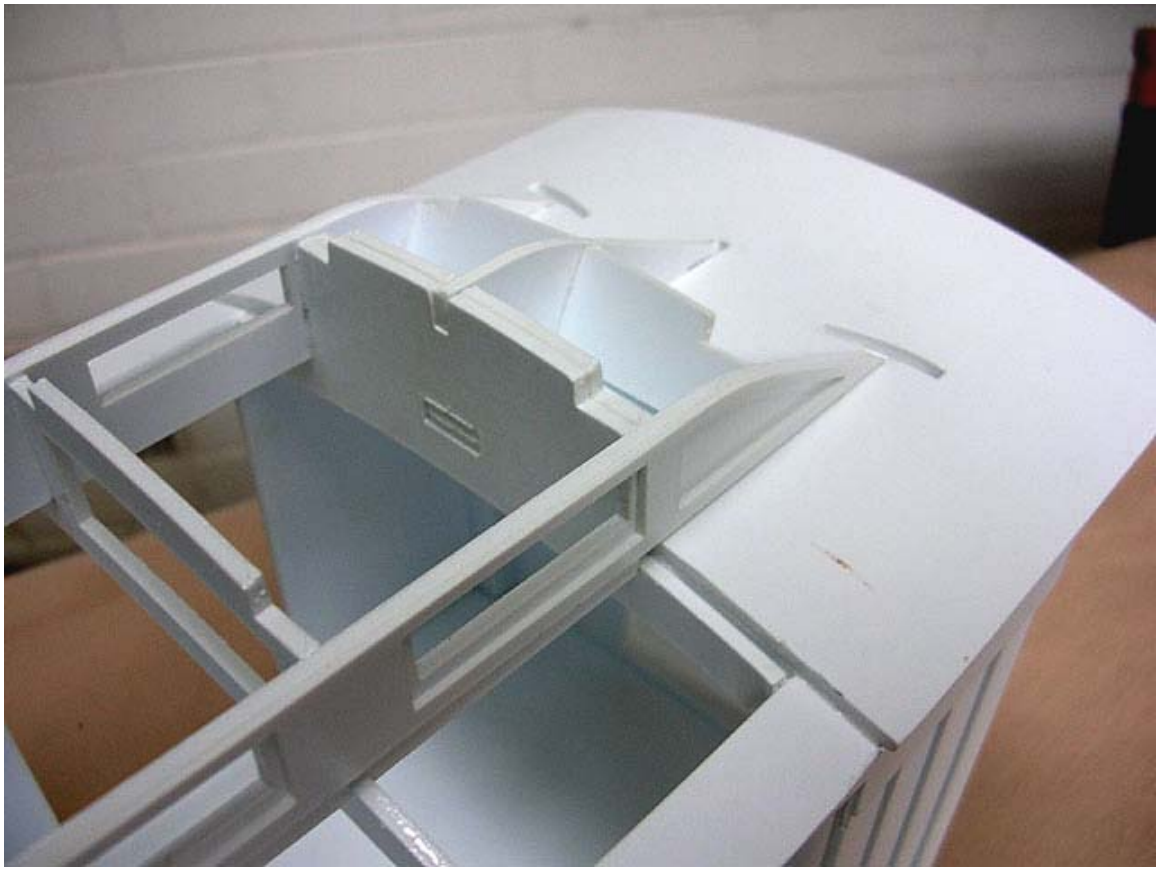
A close up of the duck-bill area of the clerestory:

The chassis in the above photo is sitting loose under the car, but helps to keep things 'square' while assembling the roof.

Next apply the duckbill framing members from the **PDF entitled "Rafters".**
There are 3 parts that all interlock and are welded to the duck-bill roof area like this:



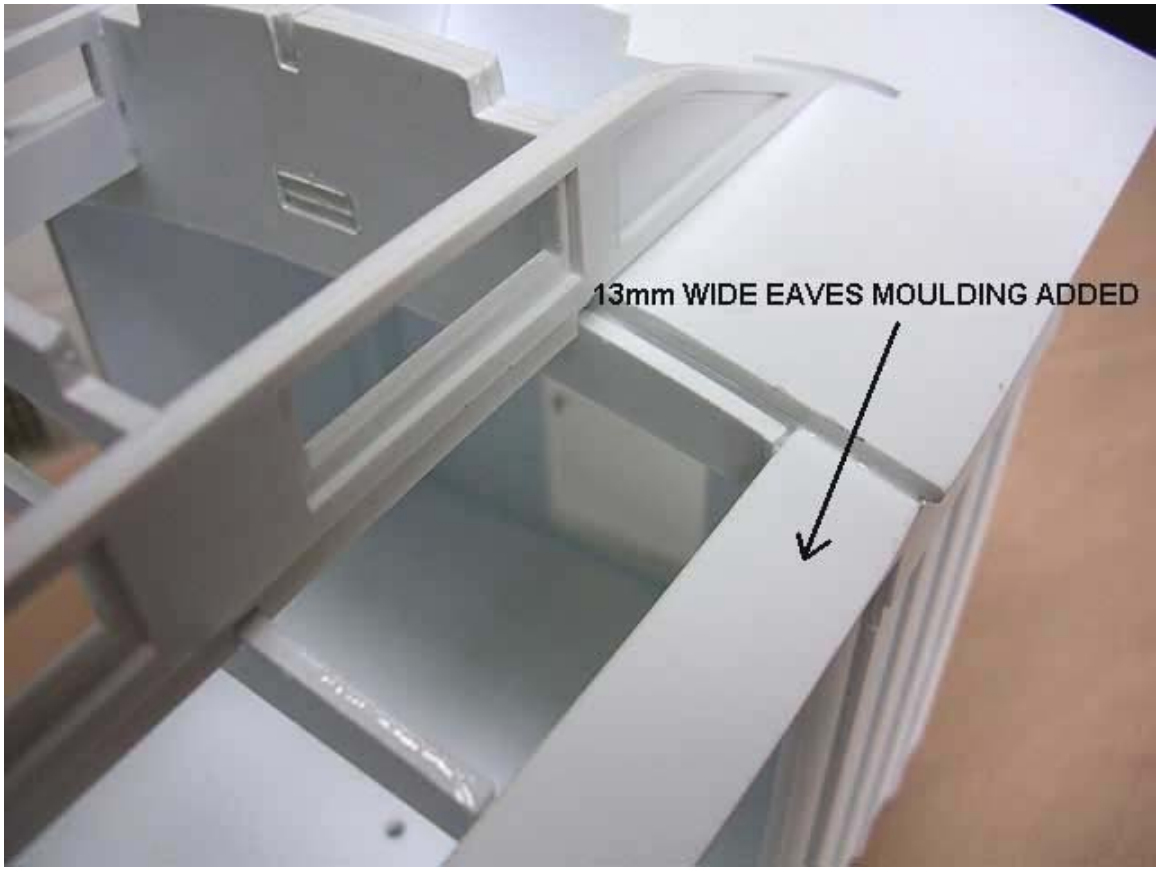




Repeat for both ends of the car.

As you can see at the bottom edge of the above photo, the edge of the main roof has also been installed. Each of these two pieces is a 13mm wide strip of 2mm styrene, nominally 422mm long, glued to the walls all along the car length, butting into the end roof elements. There is no PDF for this strip, because its simpler to describe the two styrene strips! Just cut two lengths of 2mm thick material, 13mm wide, 422mm long. (Laser kits naturally have these strips in the kit.) Weld them directly to the lower ends of the rafters, with the outer edge aligned with the outer edge of the roof ends, lower layer. This 2mm thick strip, which blends into the roof ends lower layer, forms the 'eaves moulding' to our roof and is a necessary external detail. In making the eaves moulding this way, we not only get a heck of a strong roof edge that simply can't peel off, but also we have formed the best mounting surface for the main roof to be applied! All this makes for a dead simple and really strong roof.

Here is the 13mm wide eaves moulding added to one side of the car. Add them to both sides.

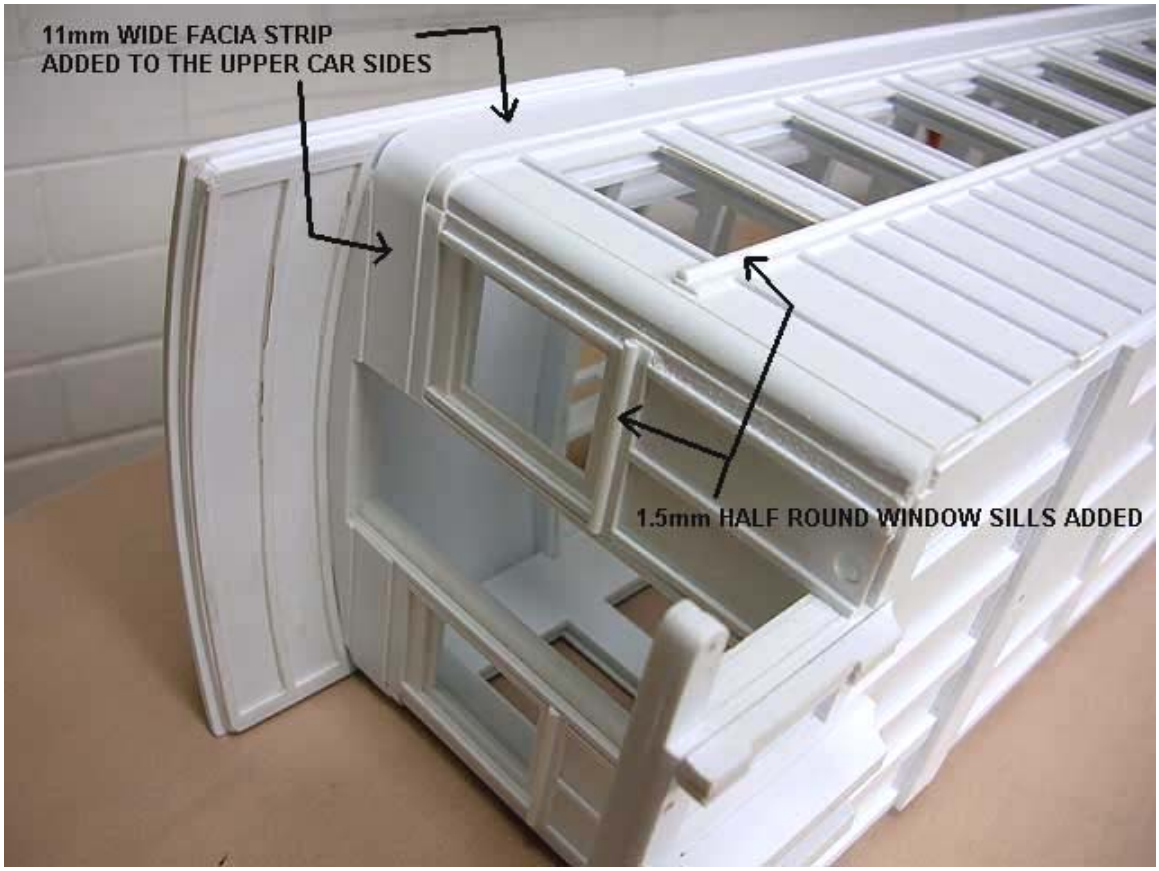


Step 18 - The Curved Car Corners.

Now that the end roofs are installed, and the clerestories added and everything is now nice strong and braced. we can turn out attention back to the car body, and those quarter round rods to be installed in the four corners of the car. You can either find a 4.6mm or 5mm radius quarter round in wood, styrene etc, or do as I did: use the Evergreen 4.6x4.6mm solid Square section, sanded to a quarter round shape in situ. Looking at the styrene manufacturers, I was not able to find anyone who made a styrene quarter round that large. However, tile people, applying tiles to bath rooms do use plastic quarter round sections of this size, around shower screen, etc., so go hunting if you don't want to do any square section sanding!

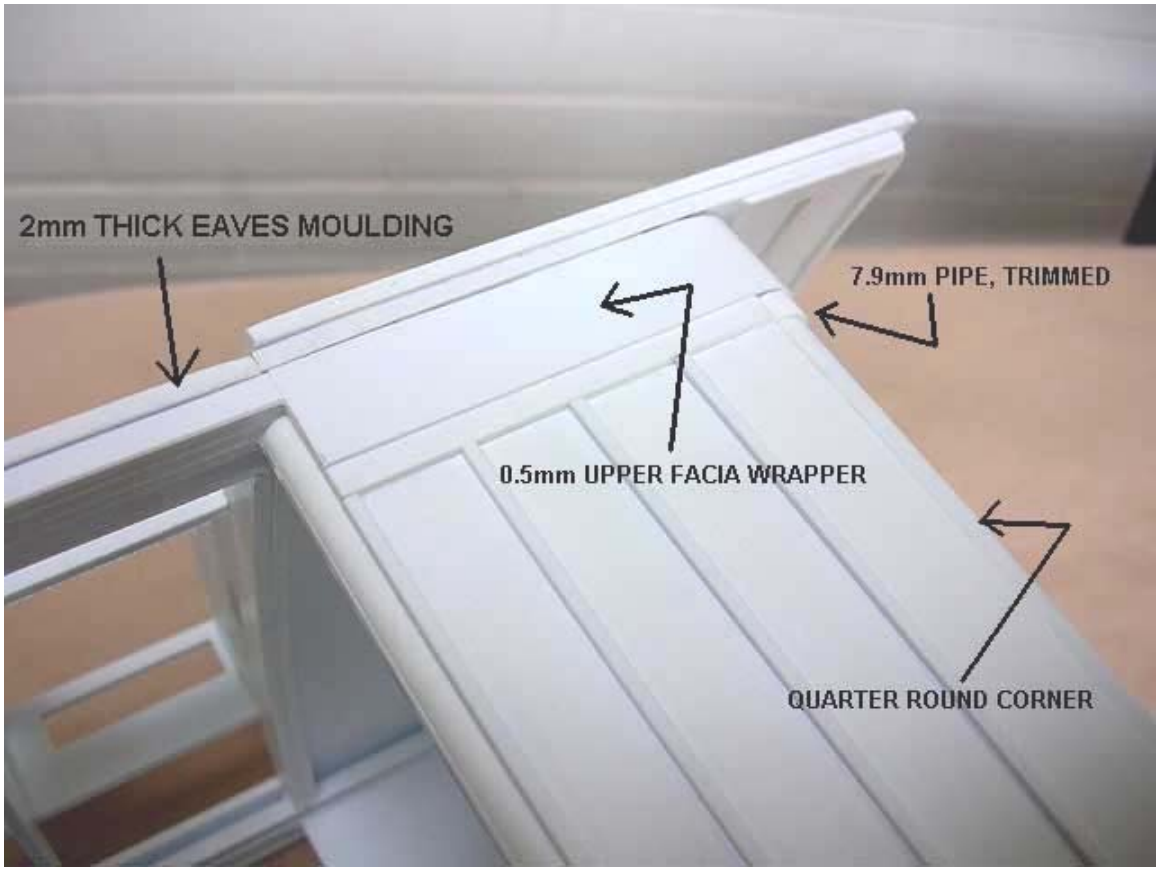
To sand my square section corners to quarter round shape, I first welded the square sections into the exposed corners of the car body. I trimmed the tops of the corner rods to meet the roof line angle (which is why we apply the corners after the roof ends are installed!). Once welded in place, I then sanded the corners to the quarter round profile in situ, using metal files and fine sandpaper. This is also why we didn't install the outermost battens to our car sides, we'll add them after the corners are sanded to shape. Once the quarter round sections are sanded to shape on the car, we need to add a 'thickening' to match the 1mm thick letter boards applied to the car walls. I used my Evergreen 7.9mm diameter styrene tube. I cut it to the length of the letter boards and trimmed the tube into half a pipe. Then trimmed it further to about 1/3 pipe, sanded and welded it to the upper corners of the car, welded hard onto the face of the quarter round corners.

Once the upper corners are done, it's time to wrap the upper fascia panel around the entire car sides. This is not in any of the kits, and in a way is kind of optional. But to match the Carters design, we need to add a 0.5mm thick fascia strip around the whole car. Use your 0.5mm thick styrene sheet, and cut 4 lengths of 11mm wide strip. Starting at the upper edge of the end wall doors, weld the strip to the end wall first and wait for the styrene to set. Then wrap the styrene strip around to the side of the car, curving nicely around our quarter round corners. A view of the finished quarter round corner with the upper 0.5mm styrene fascia added to the car end wall, wrapping around to the side wall looks like this:



Also, take this moment to add the half-round window sills to the car sides and end windows as shown above.

You will need to trim the 0.5mm upper fascia around the baggage door area, just use the opening as a guide to cut the right amount out, like this:



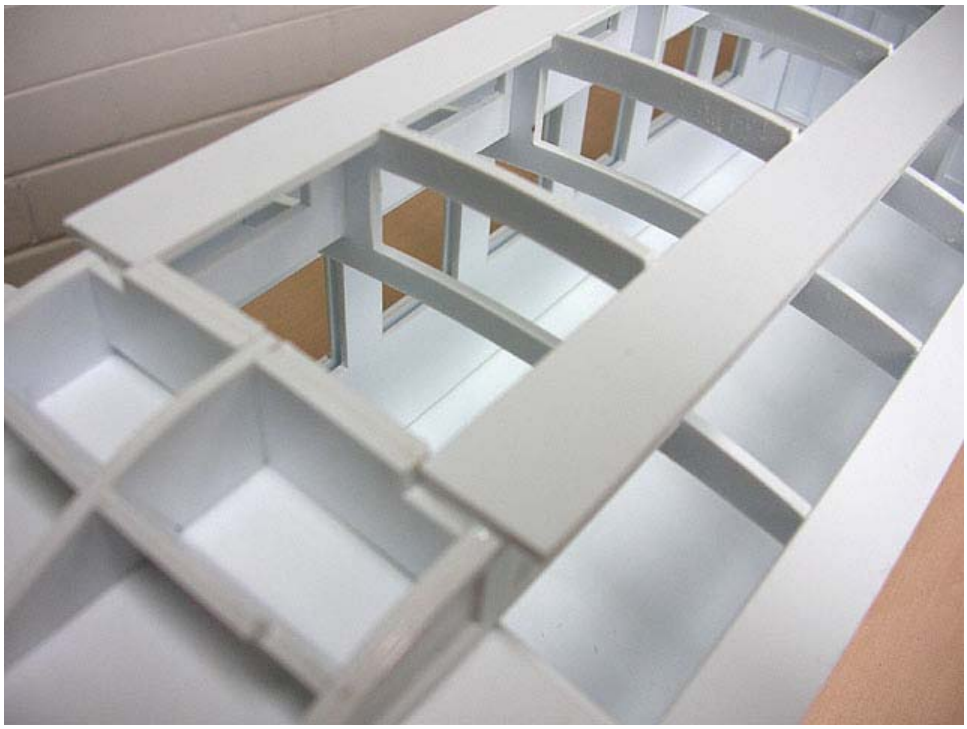
The car, with the corners finished, and upper fascias added, with the roof cornice in place, ready for the final elements of the roof to be installed, will look stylishly like this:

At this point, now add the final 0.5mm thick, 1.5mm wide batten strips to the corners of the car. Two strips required per corner, running full height of the car side, up to the Letter Boards. One strip either side of each Quarter Round corner. Do this detail on both 1870s and 1880s car designs.

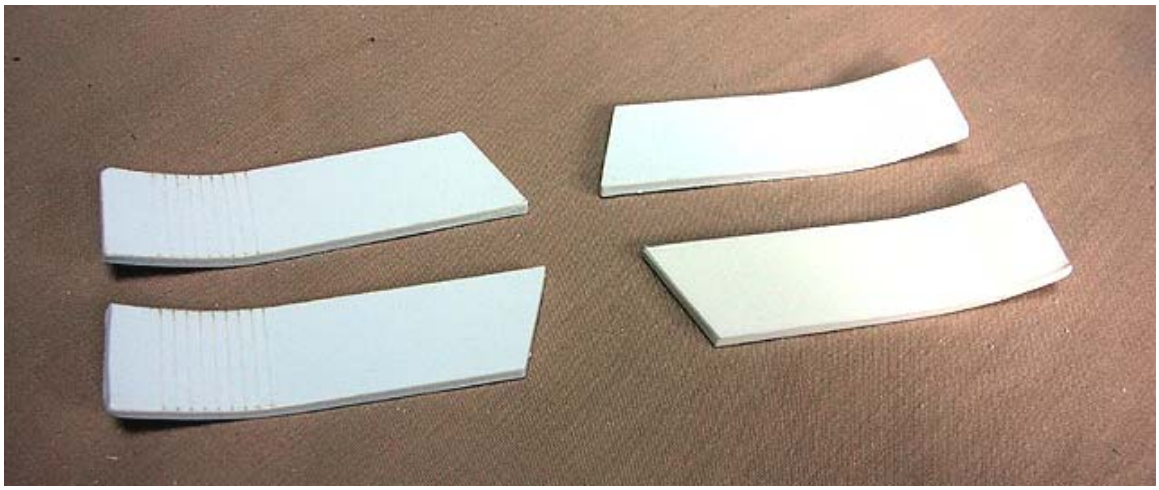
Step 19 - The Clerestory Eaves.

One of the neat things about the Carter cars, which is a little different from other duck-bill cars, is the way Carters had quite a wide eave extending out from the face of the clerestory. This gives the clerestory windows some shade and a nice recessed look. To make the eaves, we follow a similar method as we did on the lower roof eaves moulding.

Refer again to the ***PDF entitled "Clerestory Roof"***
We add a 15.6mm wide strip of 2mm thick styrene to the length of the clerestory, which will overhang the clerestory face by some 5mm. Like the cornice, this 15.6mm wide strip will also help to bind the clerestory area together and provide a stable backing to the final roof layer to be added. At first we just add the main eave strips, some 422mm long, which extend only between the outermost rafters like this:

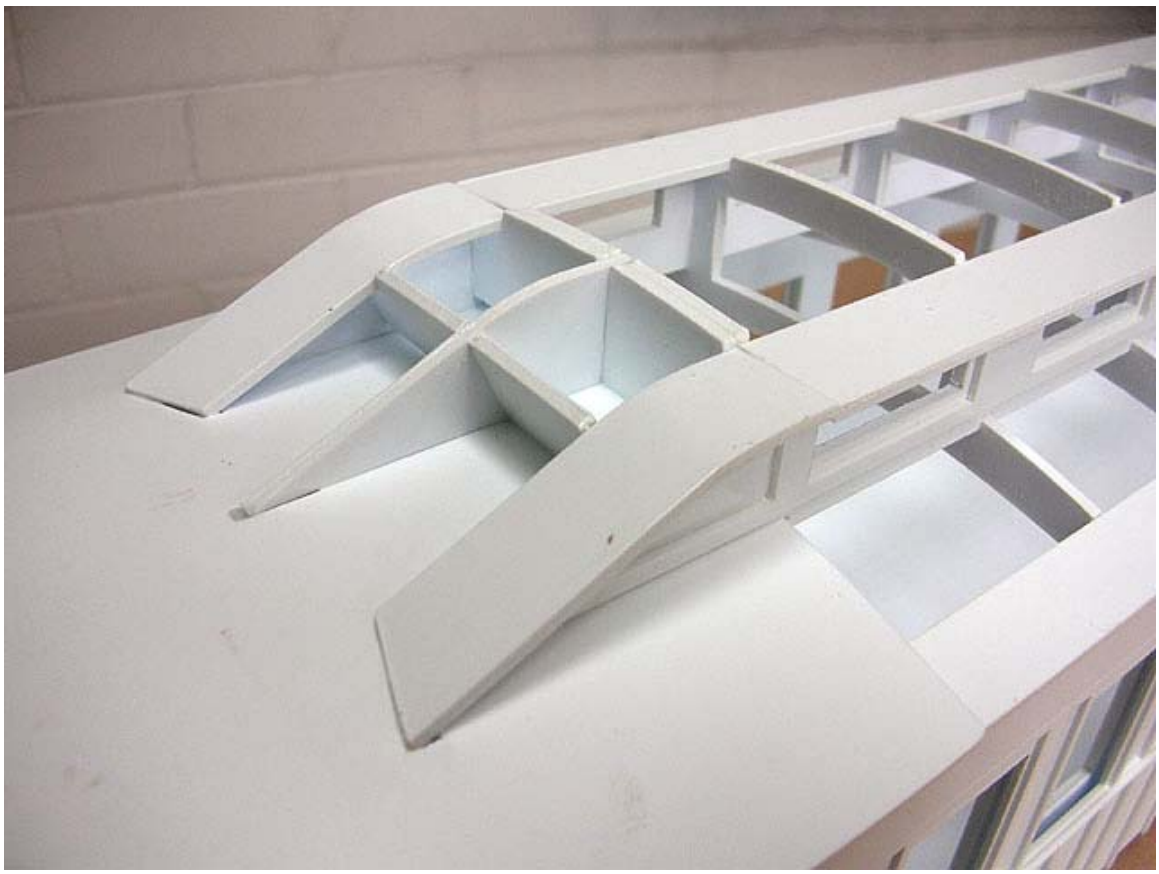


Referring back to the ***"Clerestory roof" PDFs***, you'll find the templates to 4 small '***Duck-Bill Eaves***' These are the eave sections that curve down to the main roof as part of the duck bill. The angled end meets the main roof, while the square end butts into the main eave strips. Note that you'll need to heat and bend the upper ends of these duck-bill eaves so that it follows the curve of the duck bill shape cut in the ends of the clerestory parts. The 4 duck-bill eaves, cut and bent to shape look like this:



Note that the parts provided with the kits come with scored lines to one side. The scored lines show you exactly where the bend is to occur in these eaves parts. Please bend the eaves parts with the scribed lines facing to the INSIDE. If you bend these with the scribing to the outside of the curve, the parts will instantly snap along those scribed lines!

Next, weld the duck-bill eaves into place over the ends of the clerestory. The bottoms of the eaves will dip nicely into the slots provided in the main roof like this:

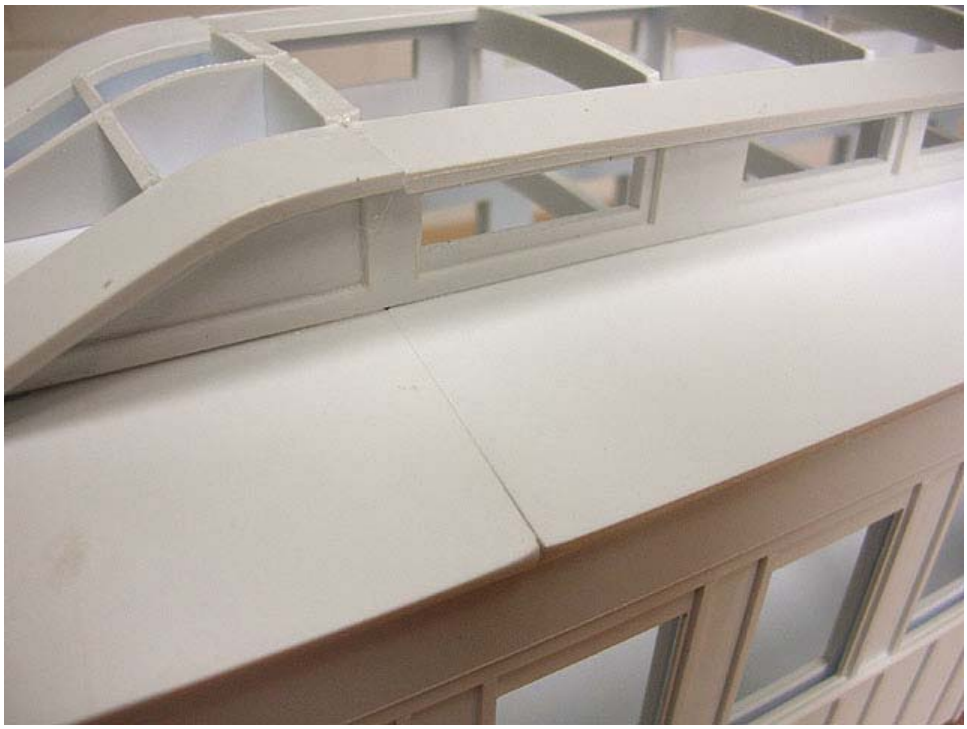


Step 20 - The Main Roof.

This bit is easy. In your kit there are two 422mm long, 34.5mm wide 2mm thick panels of styrene. These are the two roof panels that run on top of our cornice back to the clerestory, and run between the two finished end roof assemblies. Since the curvature of the roof is so slight in the areas where these panels run, you can actually add these panels without any bending at all and still get away with it, especially if you're going to finish your roof with a tar paper look or pressed metal look. If however you want to do it right, then you need to apply the slightest of a bend down the length of the 2mm thick styrene. I only slightly warmed the styrene over the gas flame and bent it in my hands. Only the slightest of cupping is needed.

Next weld the roof panels into place, butting the ends into the end roof assemblies. The edge that runs up to the clerestory wall will clip under the outer 1mm layer of the clerestory, and butt hard into the inner 2mm clerestory layer. I used the polystyrene cement for this, including running a zig-zag- glue line along the top of the eaves moulding to bolt the roof down to the eave nice and strong. With the main roof panels added, your car will look like this:

A close up of the joint between end roof and main roof elements:

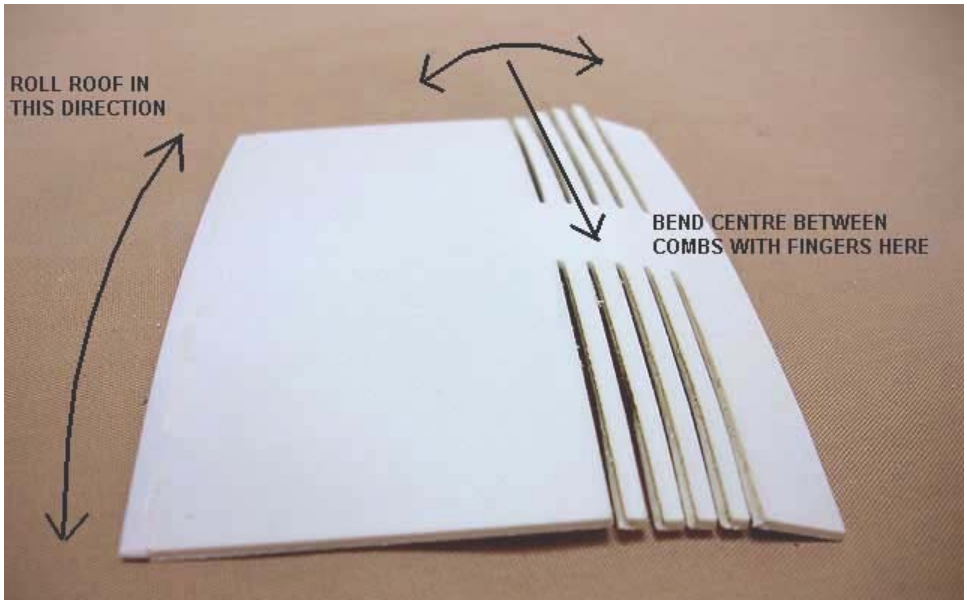


and a view of the eaves molding, main roof, clerestory and eaves in place:

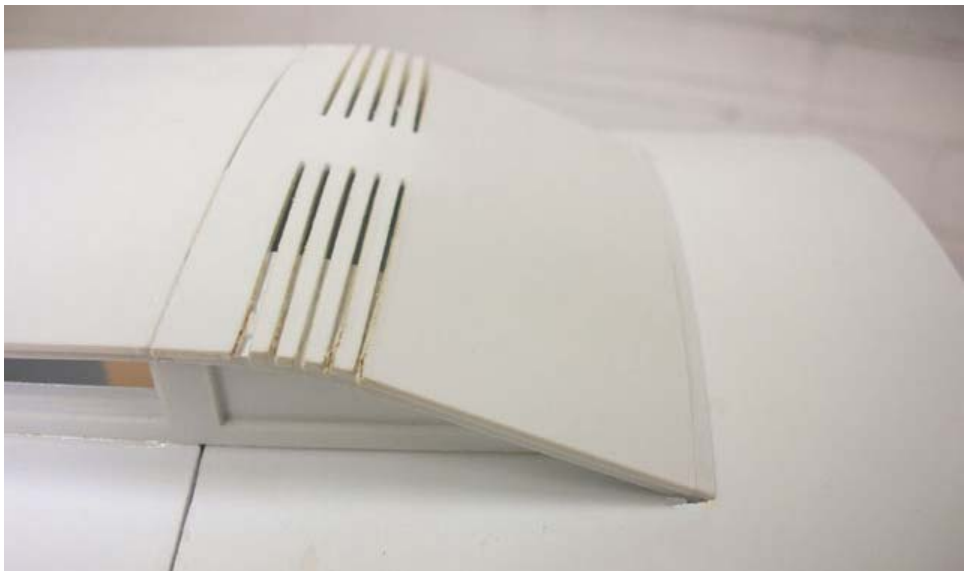
Step 21 - The Duckbill Roof!

OK, it's crunch time, the bit that scares most people away from building passenger cars - the making of the duck-bill roof!

Following the **PDF entitled "Clerestory Roof"**, there are two 1mm thick parts called '***Duck-Bill Roof'.***
Actually, it's pretty darn basic in our kit. The two 1mm thick roof panels are cut with a comb like structure at one end. First thing to do is to get your rolling pipe and foam base again and roll the roof to a curve down its length, ignoring the comb area. This places a curve across the styrene, in the same line as the main roof. No heat is needed for this, and the curve is again only slight.
Next using your index fingers and thumbs, bend the centre of the roof between the comb area only to form the curve around the upper duck bill, like this:



Next, take your pre-bent duck-bill roof and weld it to the duck-bill framing already in place on your roof. Use the polystyrene cement and apply a line of glue along the tops of all the frame members and central spine member. Also, run a line of glue along the outer top edge of the eaves over the duck-bill area. Drop the duck-bill roof panel down onto the framing, making sure the bottom edge butts into the main roof. Centre the panel up on the eave members. The 1mm thick roof panel will overhang the eave by approx 1mm. The duck-bill roof panel, welded into place will look like this:



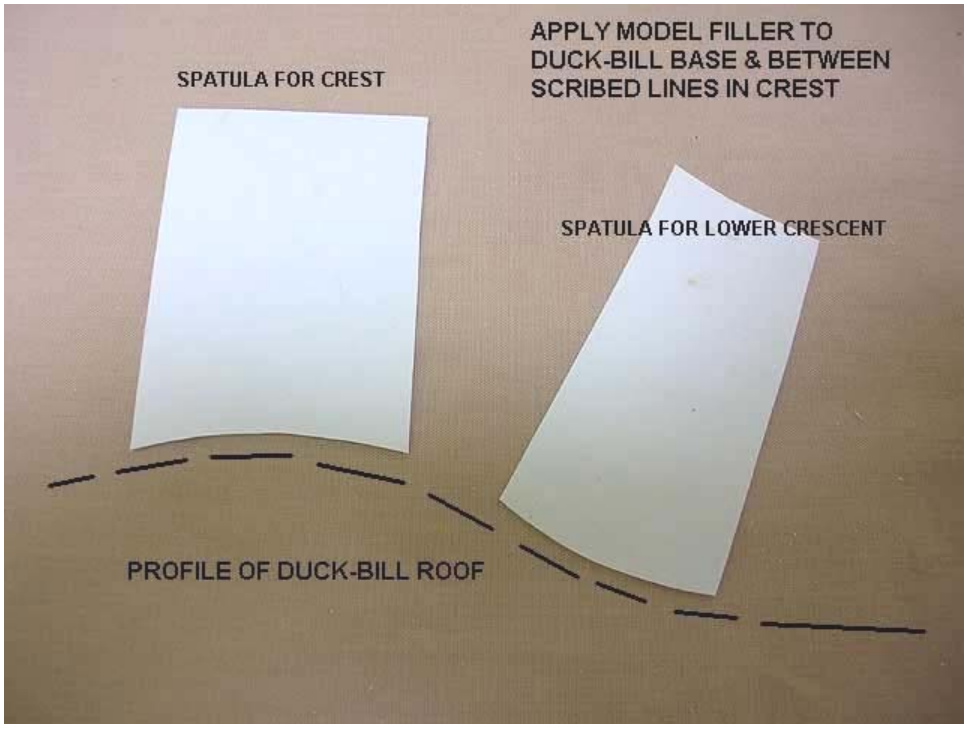
Finally, apply the full roof to the clerestory (also as seen above), by cutting a 422mm long, 78mm wide 1mm thick rectangle of styrene. This clerestory roof panel will butt between the two Duck Bill roof ends. Apply a gentle bend to the clerestory roof panel, just to take the stress out of gluing to down to the car. Apply polystyrene cement to the outer top edge of the eave strips and along the tops of all the rafters. Drop the roof panel into place and centre it about the eaves, such that approx. 1mm of the roof overhangs the eaves. Use a line of clothes pegs along the edges of the eaves to clamp the edge of the roof down. The completed roof will look like this:

The Roof - Harald's Kit - In order to allow for easier bending of the roof parts in the wood kit, Harald has replaced all the 2mm thick parts as shown in the above roof design with 1mm thick equivalents. Where the cornice levels at the clearstory and main car body are 2mm thick in Doug's and the styrene kit, Haralds are to be made up of 2 layers of 1mm material, laminated together prior to installation. In addition, the main roofing as made from 2mm thick material above is also made from 2 layers of 1mm thick wood in Harald's kit. The profiles are otherwise the same. To bend the wood parts, its useful to soak the wooden parts in cold water for 1-2 hours, then carefully roll/bend to the required profile. It may help to tape the parts onto the curved surface of say a large paint tin, and allow the parts to dry while held in that curved position. When dry, remove the parts from the paint tin side, they will hold their form well.

The Roof - Doug's Kit - The main roof area of Doug's kit is made from two layers of 1mm thick wood, in lieu of the 2mm thick styrene used above. Doug has also staggered the joints in the end roof/side roof so that the joints to not align for greater strength. Note the instructions provided in Doug's kit about this. To bend the wood parts, its useful to soak the wooden parts in cold water for 1-2 hours, then carefully roll/bend to the required profile. It may help to tape the parts onto the curved surface of say a large paint tin, and allow the parts to dry while held in that curved position. When dry, remove the parts from the paint tin side, they will hold their form well.

Step 21A - Smoothing out the Duck Bill Joints (optional).

Following the **'Clerestory Roof' PDF,** you will find templates to two 0.5mm 'spatulas' called ***'Duck Bill Spatulas'***. These spatulas are to be nice and bendy, and will be used to spread model filler into the comb area at the crest of the Duck-Bill and bottom edge of the Duck Bill. The two spatulas look like this:



I used Tamyia Model Filler, a grey plastic type filler that comes in a tube and doesn't need mixing.

The Duck Bill Crest.

Just apply a daub to the centre bottom of the spatula and spread it onto the crest area, filling the gaps in the comb. It will take several spreads, since the filler shrinks as it hardens. Apply additional layers after the initial layers are hardened. Sand and smooth it all out. Use the spatula as much as possible to spread the filler on, while keeping it smooth and flush with the actual roof material. Use the edge of the spatula to literally scrape along the roof profile, keeping the filler flush with the roof profile.

The Duck Bill base.

At the bottom of the duck bill, we want to round out the joint such that the duck bill panel doesn't visibly butt into the main roof, but curves into it smoothly. We do this by using the other spatula, again spreading the filler into the obtuse angle between the roof elements. Use several layers to round out the bottom of the duckbill.

Here is a view of the lower duckbill area, filled with epoxy filler, spread with the spatula:

Optional:

The above filling is totally optional. If you're going to use a tar paper or a pressed metal finish to your roof, like the finish the car has today, the comb area is hidden by other layers of material of your choice, and the lower curved interface can be built up with paper or thin styrene before the final roof finish it applied. I would recommend the filler approach if you intend to only paint the roof, and not apply any paper, metal or styrene panels onto it. It is perfectly reasonable to sand and paint the roof and for that I would recommend the fillers above, then simply paint it your desired colour.

I used Hi-Tac masking tape on the roof of my 1880s wood cars, and only used epoxy filler on the lower duck bill. I didn't need to fill the comb area. Here are some views of the Masking tape tar paper roof, a technique provided to us by Jack Thompson at MLS:

Step 22 - The End Platform Stairs.

Refer to the **PDF entitled 'End Platform Stairs'**. There are two design types:

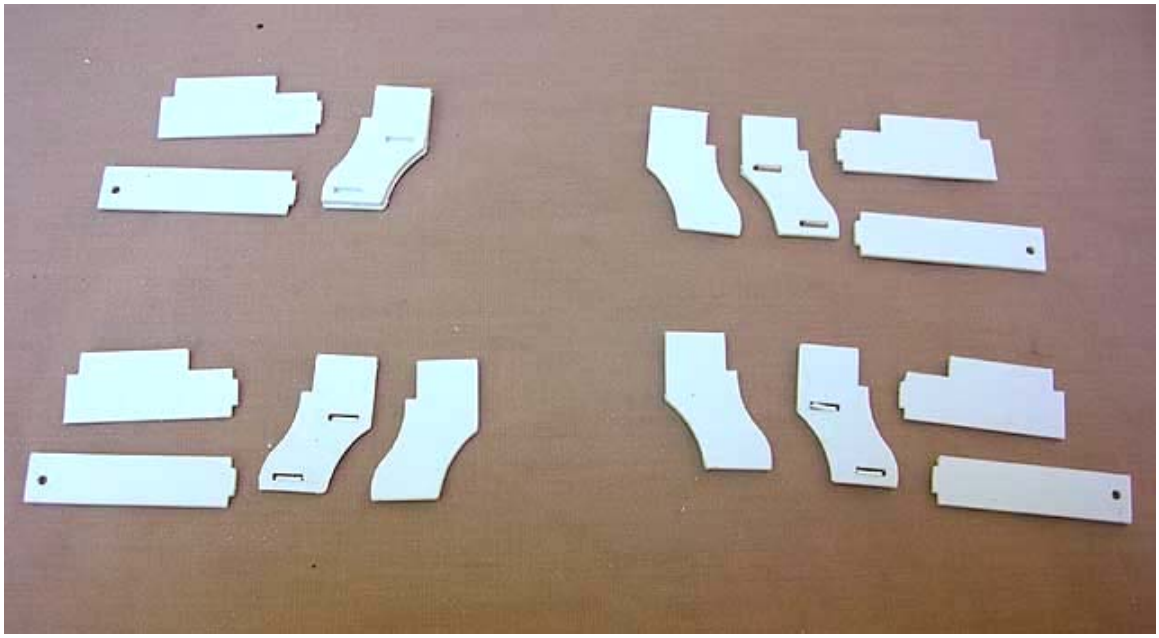
Passenger car stairs are made up of horizontal treads, suspended by 'step hangers', those shapely vertical panels either side of the treads.

The Original 1870s 'as built' design had the step hanger to the inboard side of the stair only, and an iron post supporting the other end.

The rebuilt 1880 versions had the step hangers to both ends of the stair and no iron posts.

You can use either one if scratch building. In the kits however, all of the 1870s board & batten designs come with only the iron post type of stair support, while all the 1880 planked sided versions come with the later fully enclosed stair design, complete with two stair hangers to both sides of the treads.

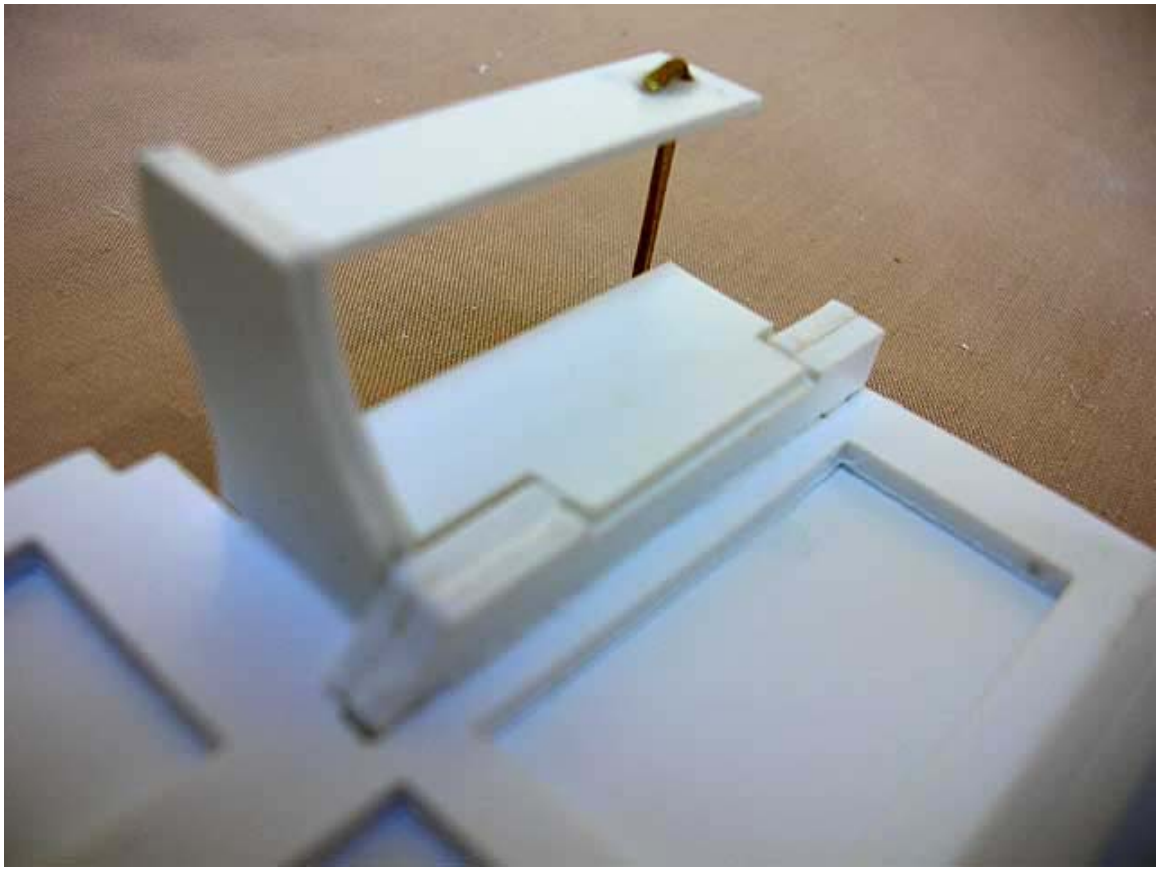
Lay out all your stair components, all 1mm thick parts. The layout is like this, except that the 1880 versions have twice as many stair hanger parts.



Make a note of left and right sides, as you don't want to assemble too many stairs facing the same way! It's best to slot them together without glue and test them on your model to get the right numbers of LH and RH versions (2 of each).

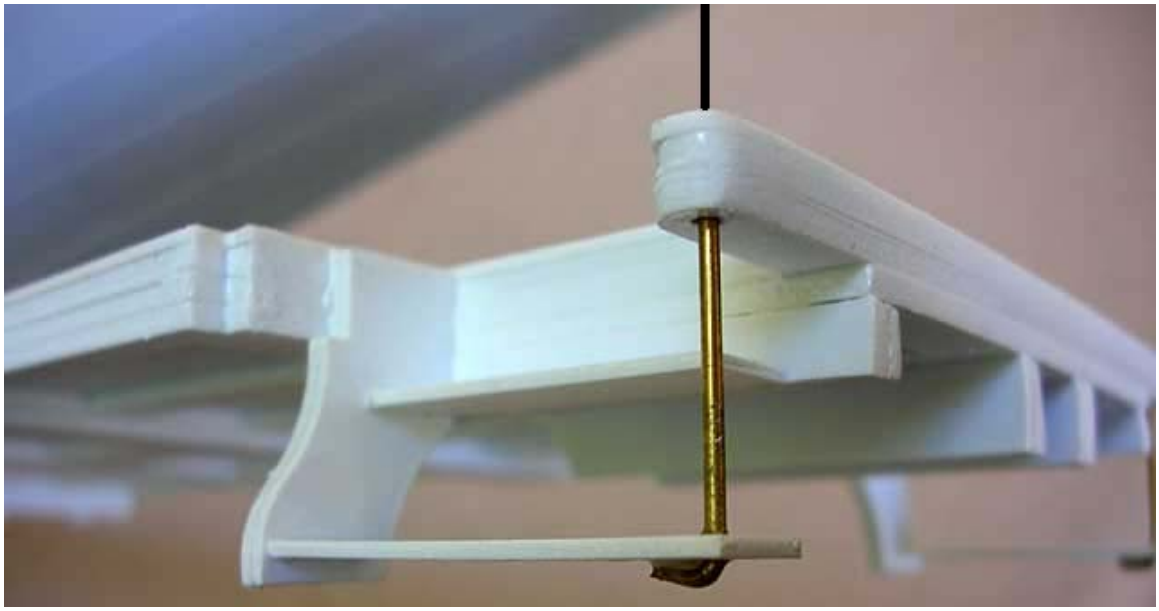
The stair hanger parts are made from 2 layers of 1mm styrene: the inner layer has slots cut it it for the stair treads to slot into, while the outer layer is plain and smooth. Weld the inner and outer layers together, matching their edges. Make 2 each LH and RH versions.

Next, weld the treads into the slots of the hanger by pressing the tread's tabs into the slots; the longer treads go into the bottom, while the upper treads have a tab along the rear edge, designed, to slot into the chassis framing for added strength. Then, weld the top of the stirrup to the car end, and the upper tread to the underside of the outer beam platform sill. It will all make sense when you see it go together. To support the free end of the lower step, use about 1.5" length of 1mm brass wire, bend the bottom to an 'L' shape for the tread to rest on, and run the other end of the wire up into the outer holes in the end beams of the chassis. Set it up so that about 0.5" of wire projects vertically above the end beam of the car. Use a drop of CA to hold the lower tread down to the brass rod base. All together, the assembly looks like this:



A view as seen from below, note how the upper tread has a tab that runs onto the bottom face of the chassis' outer beams.

A view of the stairs as seen from the outside. Note how the stair hanger assembly is welded to the face of the 7mm thick chassis block, set hard back against the end deck edges. Let the 1mm brass wire run 1/2" above the deck in readiness for the end rails to be applied on top.

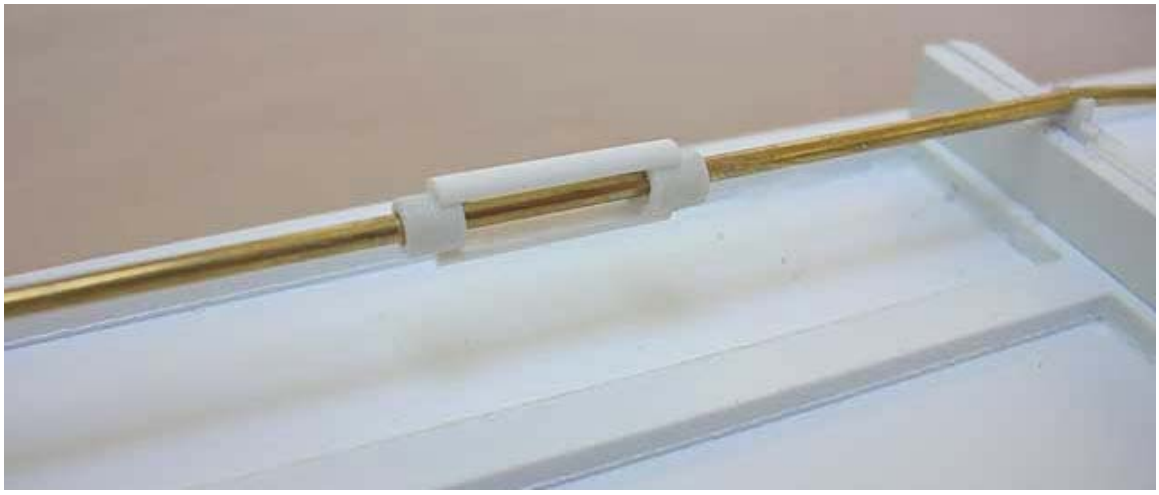


Step 23 - The Truss Rods and Turnbuckles.

There are two truss rods to add to the bottom of the car. Use two rods of 1.5mm brass wire to do this. In line with the truss rod chairs on the needle beams, there are 1.5mm holes prepared nearer to the trucks, where the truss rod ends will be inserted. Basically, you'll need to bend the 1.5mm brass rod into the truss rod shape, running between the two holes in the chassis, and sitting firm in the needle beam chairs. The ends of the rods will need to be bent into a sharp 'L' shape to be able to enter the vertical holes. We're faking the truss rods a little, only making what is 'visible'. In reality these truss rods did not insert into neat holes in the bottom of the chassis, but extended to the car ends, just below the car floor, and were tensioned at the ends with a nut and washer. The location of this nut and washer was that small hole cut into the car end walls, directly above the stair hanger!

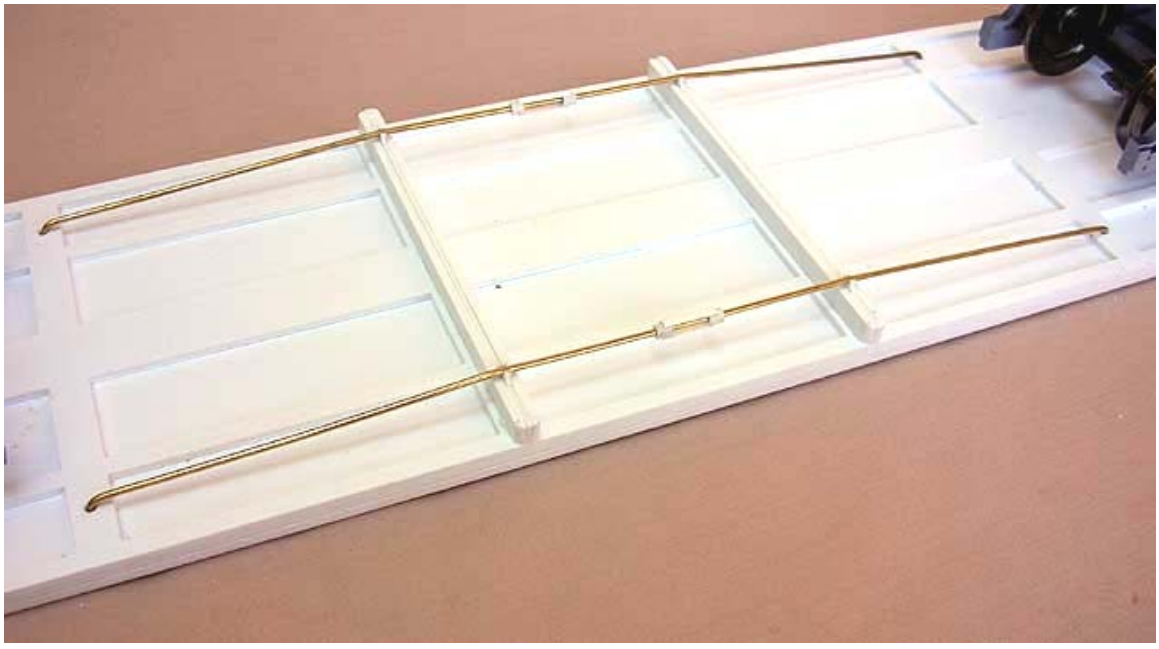
For the turnbuckles, you can either by an Ozark set, part no. 1005, or you can make your own. It is up to you whether you want to run the truss rods as two parts with the turnbuckle between then, or run them right through as one rod, with the turnbuckle slid into the centre, faking the join in the rod. I went with the single rod approach, as this is a much stronger design when handling the cars a lot, and when painted, the difference is hardly noticeable. Its up to you, however.

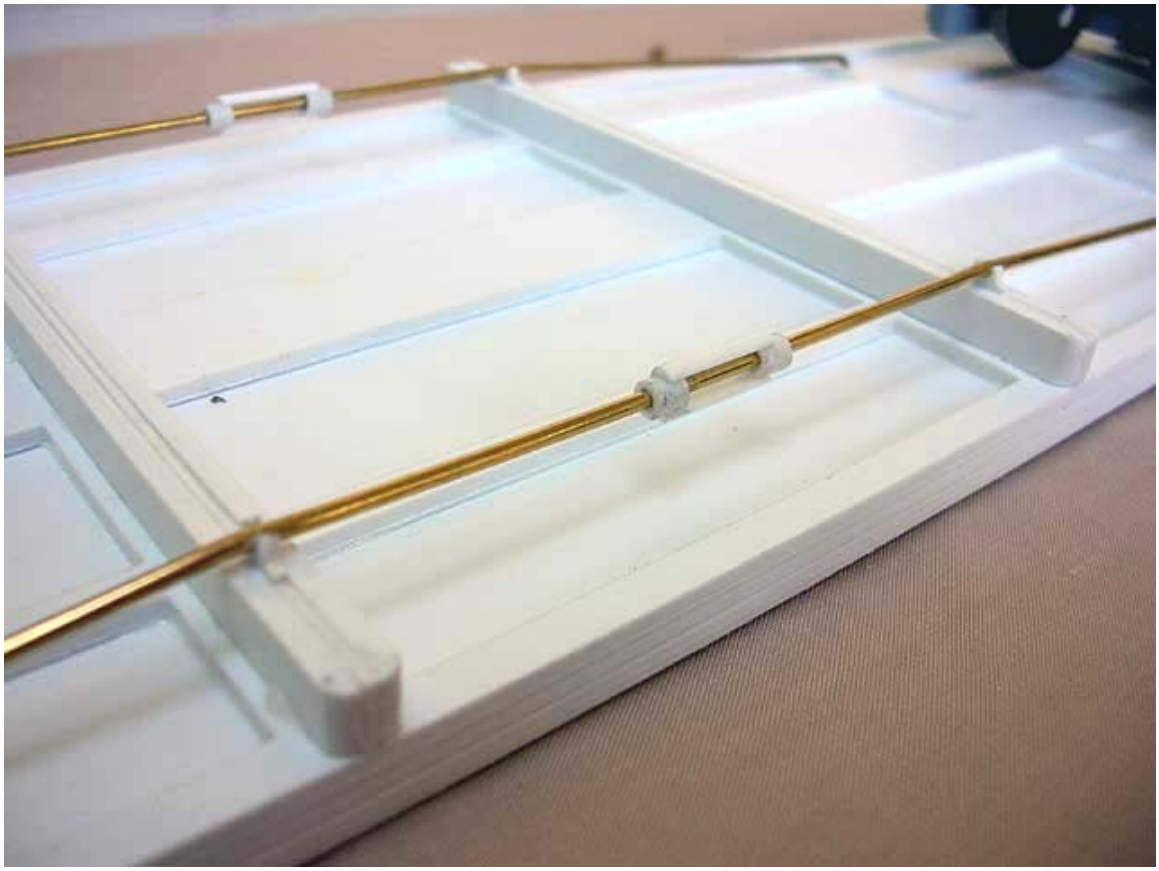
I made my own turnbuckles by cutting two 3mm lengths of 3.2mm styrene tube, and then using two 12mm lengths of my 1.5mm half-round styrene, applied two rods above and below the 3.2mm tubes like this:



This is the same 1.5mm half round we used on the window sills of the car.

With the truss rods and turnbuckles in place, the car chassis looks like this:





Next, I just screwed the Hartland trucks into position in a temporary form, your car should look something like this:

Step 24 - Detailing the Clerestory.

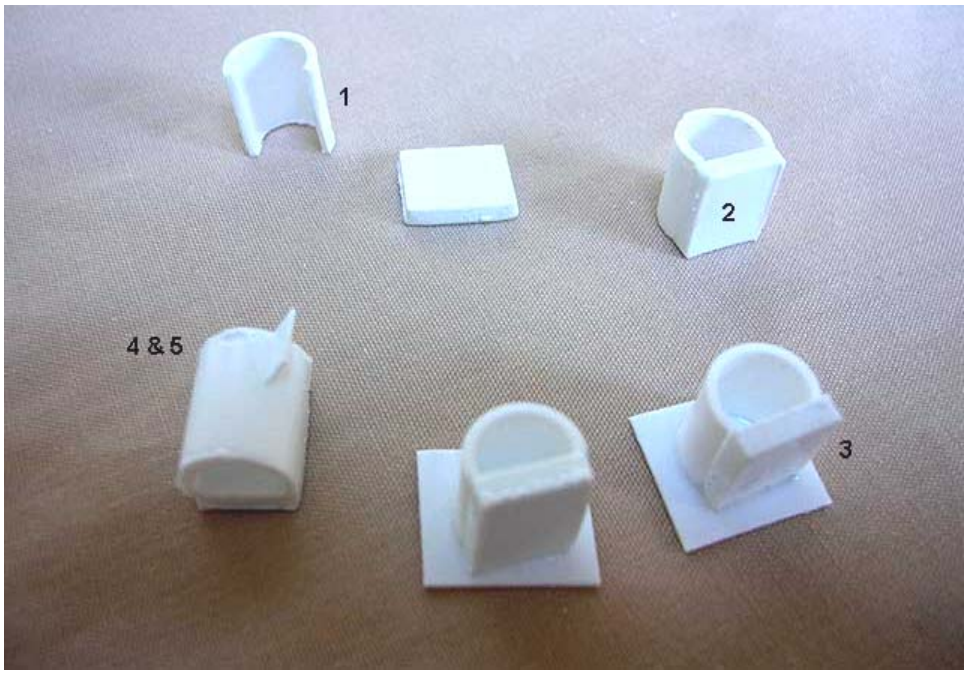
Many of the Carter Bros. cars had air scoop vents to the clerestory side, sometimes nicknamed 'bread boxes' because of their trunk-like shape. Since coaches could be run in either direction, it was normal for half these vents to face forward and half to face rearward. On the actual car in the museum today, the vents faced forward on one side of the car, the opposing vents on the other side of the car faced to the rear. It was a means by which air could be collected and distributed to all parts of the car, regardless of which way the car was travelling.

Following the **PDF entitled "Clerestory Roof -E "**, you'll find 10 squares of 2mm styrene **'Clerestory Vent Bases'**, forming the base of each of the bread boxes. These squares are provided as part of the kit, but everything else in the making of the vents is not provided.

Taking your 7.9mm Evergreen styrene tube, cut 10 lengths of pipe matching the longest length of the 2mm thick squares, 10mm long.

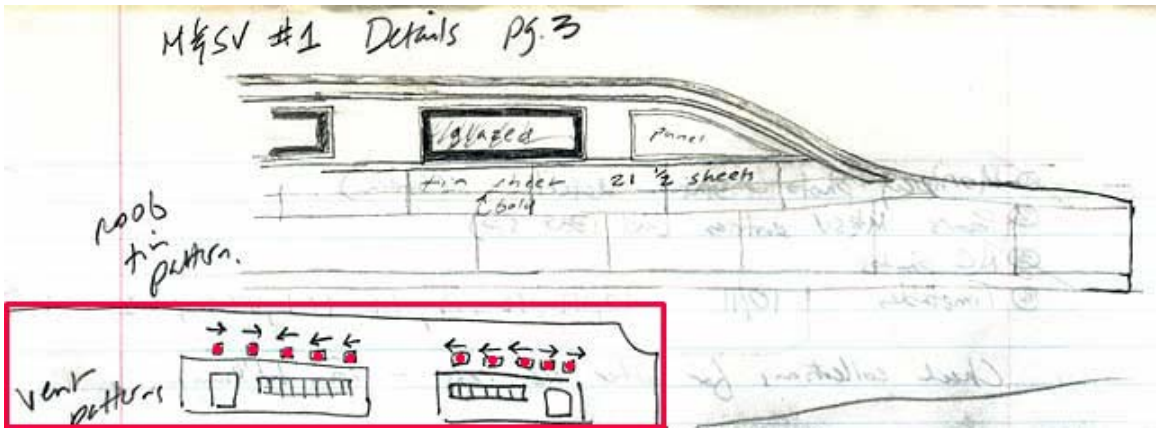
1. Trim off 1/3 of the tube lengthwise, forming a little more than a half pipe.
2. Weld the half pipe to the 2mm thick squares.
3. Apply a backing of 0.5mm styrene to one end of the vent.
4. Trim the backing after the glue has dried. I trim the backing in situ on the vent, to get a good match.
5. Apply a small tab of your 1.5mm wide, 0.5mm thick strip of styrene (same stuff as used on the car battens) to create the vane at the rear of the vent, where air can escape when the vents are closed inside the car.

The above is summarized in this photo:



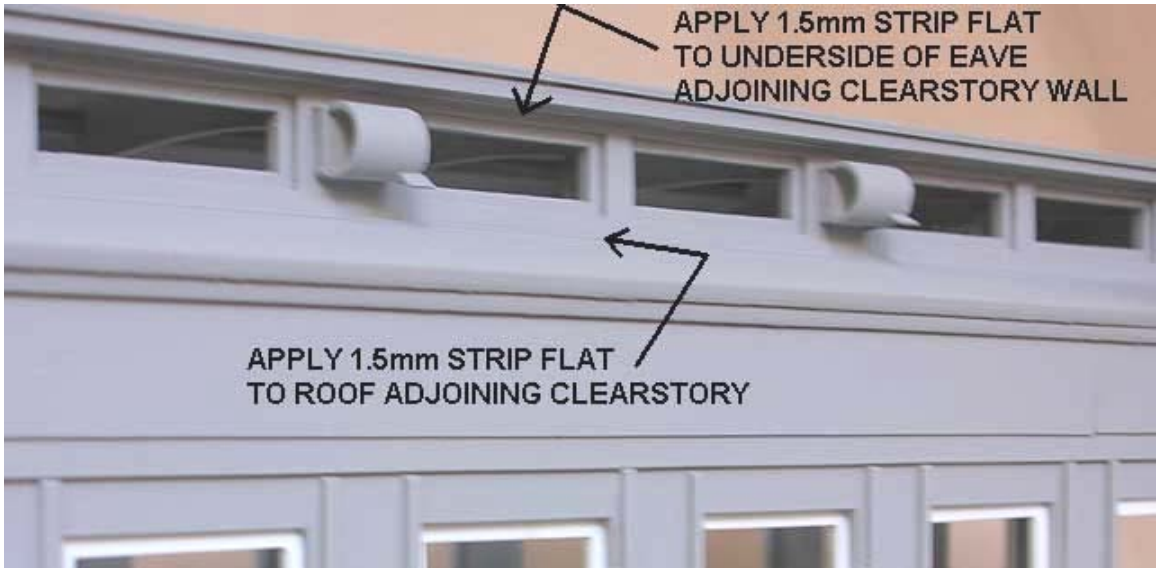
After all 10 vents are made, apply them to the clerestory, exactly centred between the window pairs in the clerestory. Here is a view of a vent installed:

The following are from the field notes of *Dave Eggleston*, showing which way the open side of each vent faced, as applied to the M&SV combine today. I would follow the same approach for the coach version, because you can see equal numbers of vents face both ways, diametrically apposed from each other. The arrows in his sketch indicate which way to face the open side of the vent. The little vane to the back end of each vent will face to the other direction.



Trims around the Clerestory.

The final details to add to the clerestory area are some strips around the interfaces between the eaves and clearstory wall, and between the roof sheeting and clerestory. I used the same 0.5mm x 1.5mm styrene strips to trim out the perimeter of the clerestory. Make sure to run the trims right into the tight angle at the base of the duckbill.

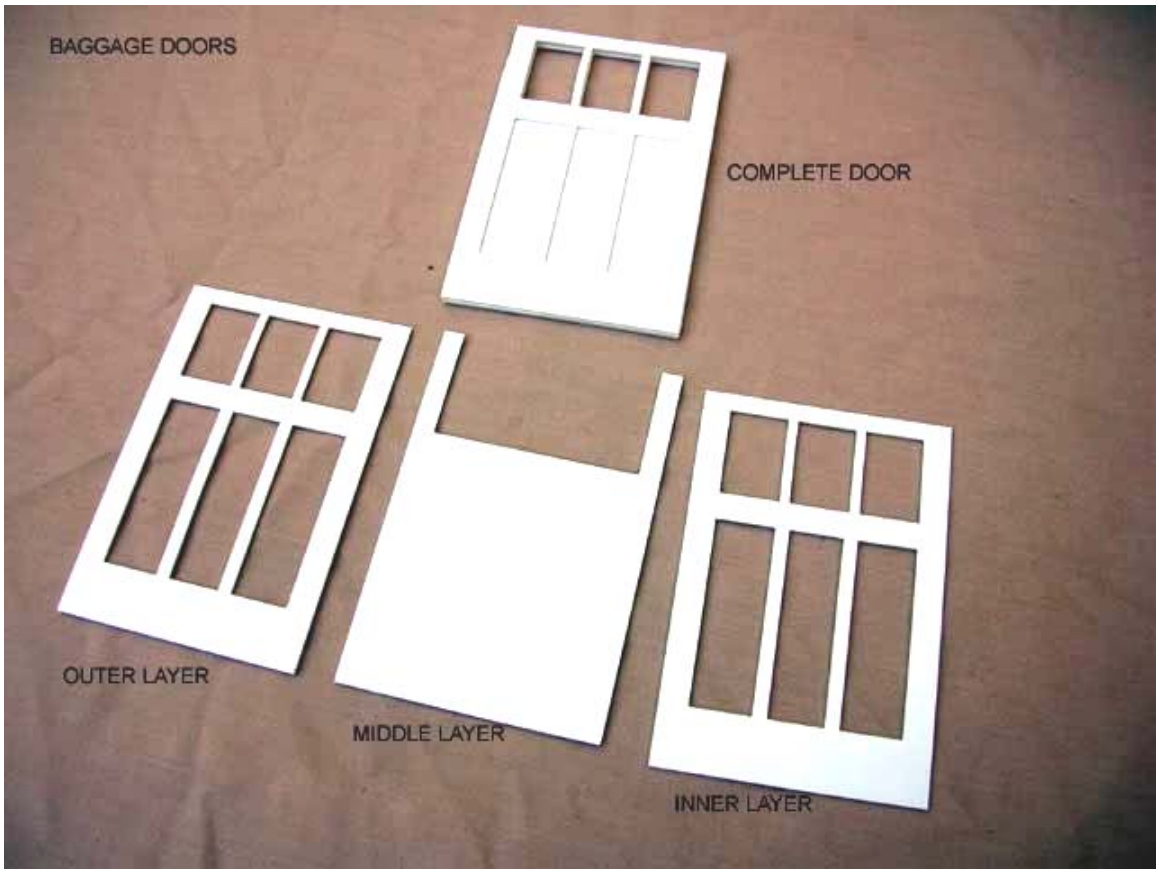


Step 25 - The Sliding Baggage Door.

Begin by referring to the **PDF entitled "Baggage Doors"** There you will find the profiles for the baggage door, made from 3 layers of 1mm styrene.

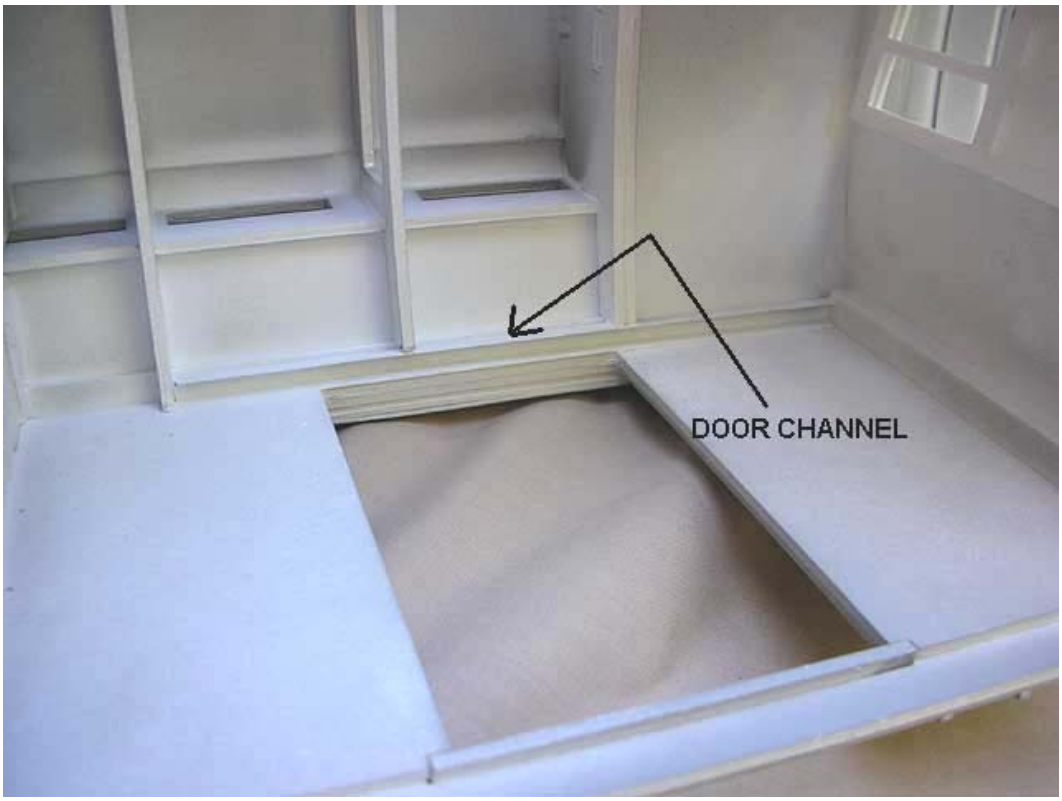
Basically, there are two identical outer layers and a solid central core. Like the end wall doors, the top of the middle layer has no upper frame to the top of the window. Weld the 3 layers together, by applying welder to the outer layers first.

Here is a view of the 3 layers to the door at the bottom of the view, and the finished door at the top:



After you paint and finish the door, you can simply slide a single rectangle of clear plastic 'glass' in through the open top of the door, no glue needed! Here is a view looking down on the door from the top where the glass slides in after the door is painted:

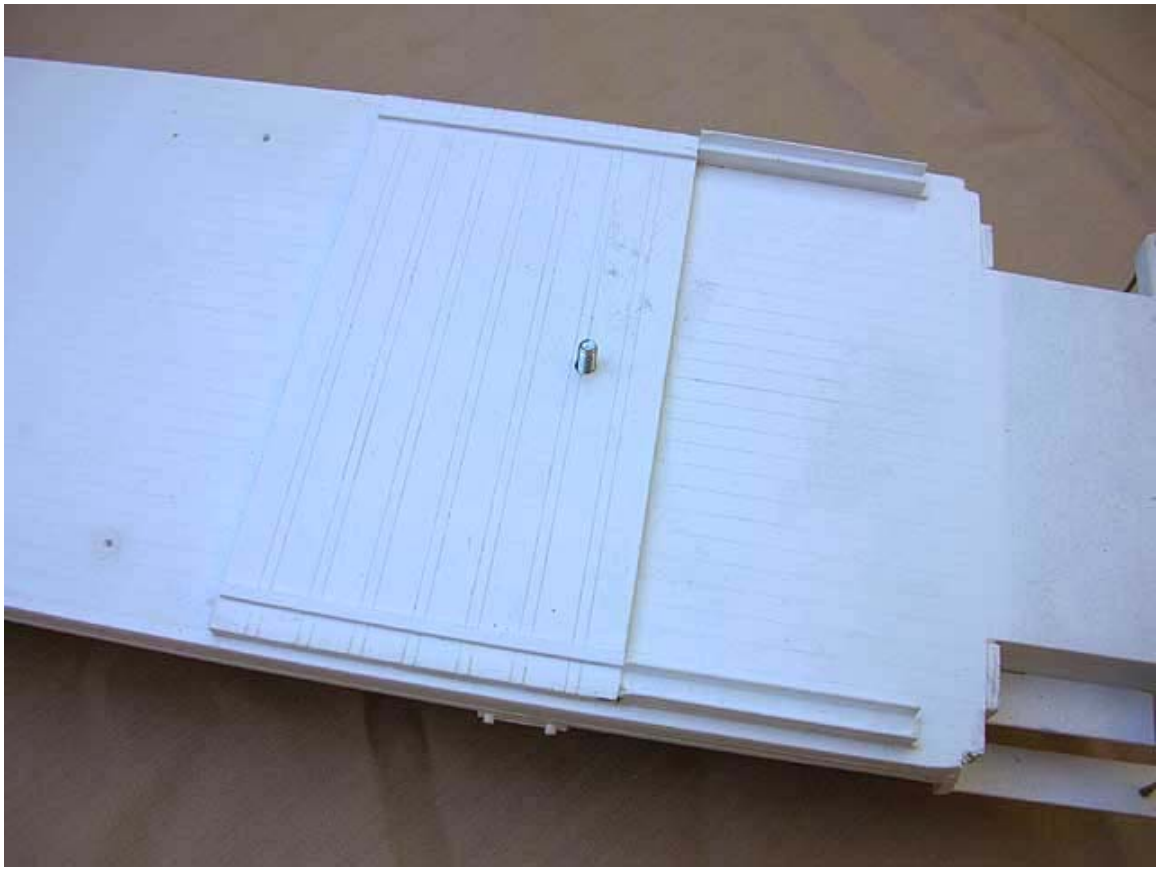
OK, let's review the sliding door tracks we installed while we were installing the rafters. Looking up into the roof area in the baggage compartment, you can see the two upper channels welded firm to the upper sides of the car walls. The channel is just wide enough to allow the top of our baggage door to slide. Here is the view looking up into the roof space:

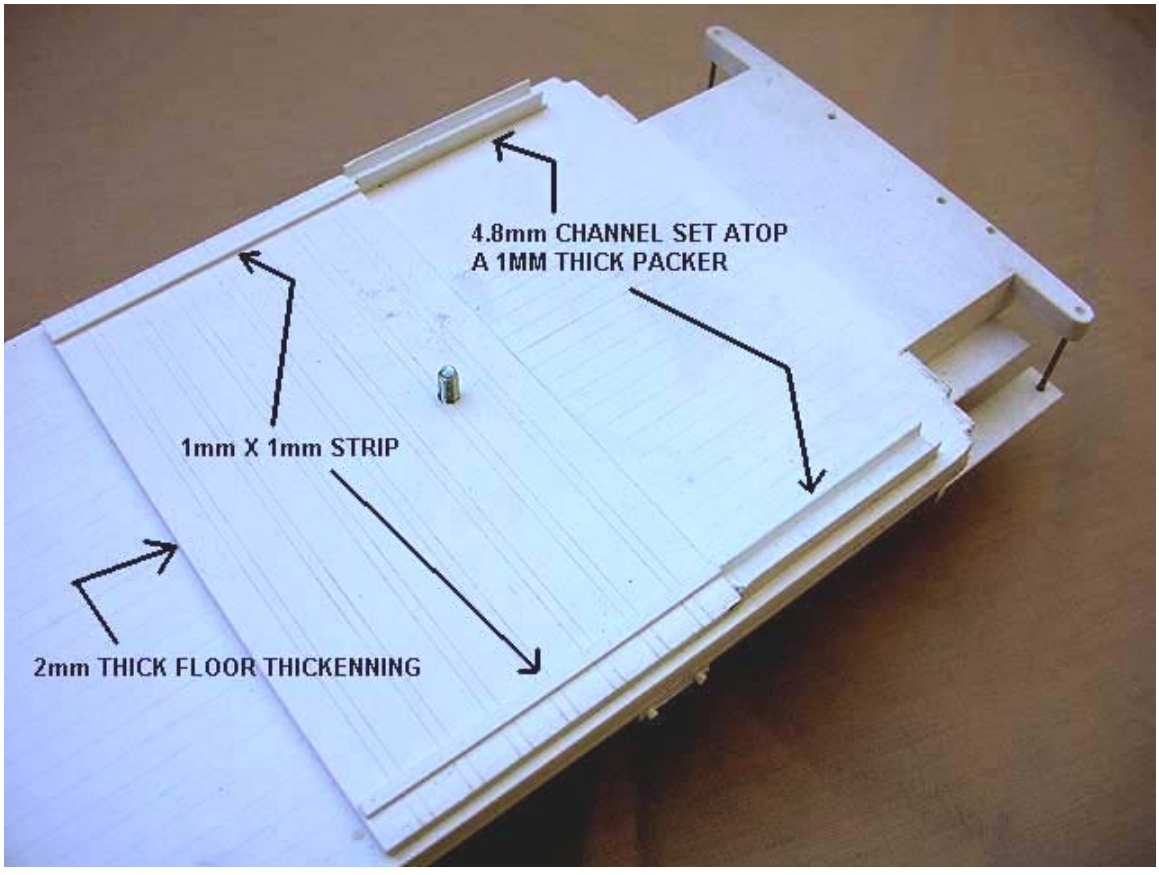


Since the car floor will always be removable from the car body, we'll attach the lower track for the sliding doors to the car chassis. When the car is bolted together with the floor in place, the sliding doors are set between the upper and lower channels.

To the floor of the baggage compartment at the doors area is a 2mm thick panel of scribed styrene - this represents the bump rails applied to the baggage area floor. Please refer to the components for the ***'Baggage Door Sill & Baggage Floor'*** in the **PDF entitled "Car Chassis -Upper Layer -C"** . Align the this panel onto the car floor, matching up the bolt hole for the Hartland truck. Weld it into place.

To create the rails for the sliding door onto the car floor, we need to apply some styrene strip to the 2mm thick raised up floor area, and some 4.8mm channel to the end of the car area. To set the channels in line with the 2mm thick floor panel, raise up the channel with some 1mm thick styrene below. Set the channels out such that the outer face of the channel is no less than 2mm inboard from the edge of the floor, and a good 8mm in from the end of the floor, where the end wall will come down. On top of the 2mm thick floor panel, weld a 1mm x 1mm strip of styrene, in line with the inside leg of the channel, effectively continuing the channel on top of the 2mm thick panel. The finished floor assembly will look like this:




4.8mm CHANNEL SET ATOP
A 1MM THICK PACKER
1mm X 1mm STRIP
2mm THICK FLOOR THICKENNING

Once the car is fully assembled with the chassis screwed to the body, you can apply the sliding doors by angling the doors from within, with the door tops in the track, pull up and lift the door base over the lip of the lower track and drop back down. Done. No door handles are on the external sides of the sliding doors! They must have pulled it back and forth from the inside, and via the panels and recesses in the door face!

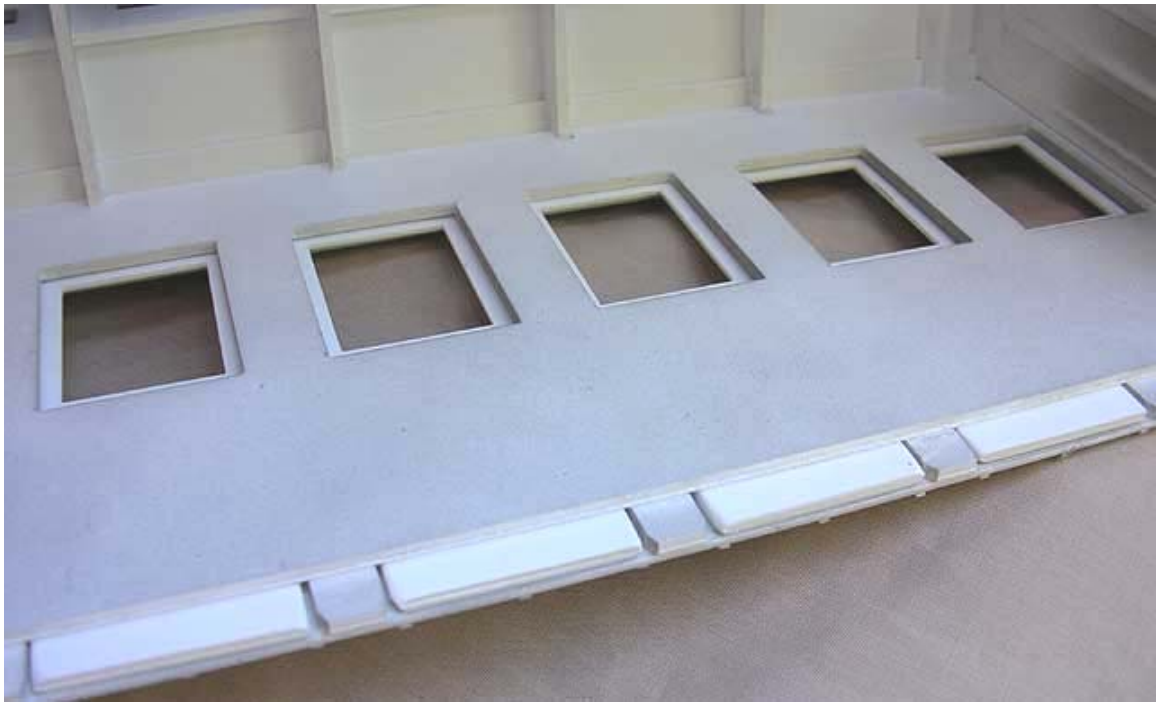
A note about the car floor:
The interior of this car kit is simplified. Enough is provided to give the impression of a car fitout, but relative to prototype, the rafters are thicker, internal wall panelling is almost non-existent, etc. The aim is to keep the insides simple, easy and cost effective, enough for the average user of these cars. As I once stated in the Mason Bogie Class, we don't play 'doll house' with our trains, but we want them to 'look about right'. Craig Hoefer will provide more detailed information about detailing out the interior of these cars to a much higher standard - this is not included in the kit.

Now about that car floor. For simplicity, we've used a flat sheet of scribed styrene for the full length of the car floor. This is perfectly adequate for our kits. The real cars however had a defined 'step up' from the end platforms up into the coach interior. You can see the step up in the thickness of the sill below the doorways in the end walls. See how the door does not run down to the platform floor, but is a good 3mm above the end platform floor? The inside level of the floor boards would be closer to the top of that door sill, i.e. a step up of 2-3mm. Our chairs are also adjusted to allow for the 'lower' floor, with that little tab detail on the chair legs. The chairs are 2mm taller than they need to be, to allow for the floor being 2mm lower inside the car body. None of this is important to the average kit builder, and the finished car will look and function correctly, with figures sitting at the right height inside the car. For people detailing the car interior, you may want to apply 2mm thick timber planking polished etc, on top of our styrene or laser cut wood floor, and trim the bottoms of the chairs (or slot the chairs into the wood planking).

Step 26 - Doors and Windows again!

After your car is fully painted, with all the external windows and doors painted separately, and with the glazing applied to the inside of these doors and windows, you will be able to slide the windows into the wall.

Windows:
Slide the window assemblies in via the open slots along the bottom of the car sides and end walls. Once in place, you can apply just a drop of welder toward the bottom of the window panel elements to prevent them from sliding out again easily. Just as a reminder, this is the system used: window assemblies are slid in from the bottom, with the full window frame element facing toward the outside and glass facing toward the inside of the car. The glazing can be applied loose, since it has nowhere to move once the window panels are slid into place, but you can also use a daub of glue if you like just to keep things together.



All the windows slid into place.

Doors.

For the two end doors and 1 middle wall door, you have some options. First, make sure you slide the glazing into the door, via the open slot in the top of the door. After that, you have options about how to fix the doors to the car you can:

- Simply glue the doors closed by welding them into the door openings and leaving it as that.
- Buy a set of 1:12 scale doll house door hinges, and apply the hinges to the doors and door frames to allow the doors to open.
- Use non-scale brass jewellery box hinges (heavy and strong) to hang the doors, allowing them to open.
- Do the old fashioned Walthers technique of using a 10mm wide strip of fabric tape and running the tape up the hinge side of the door, allowing the door to swing.

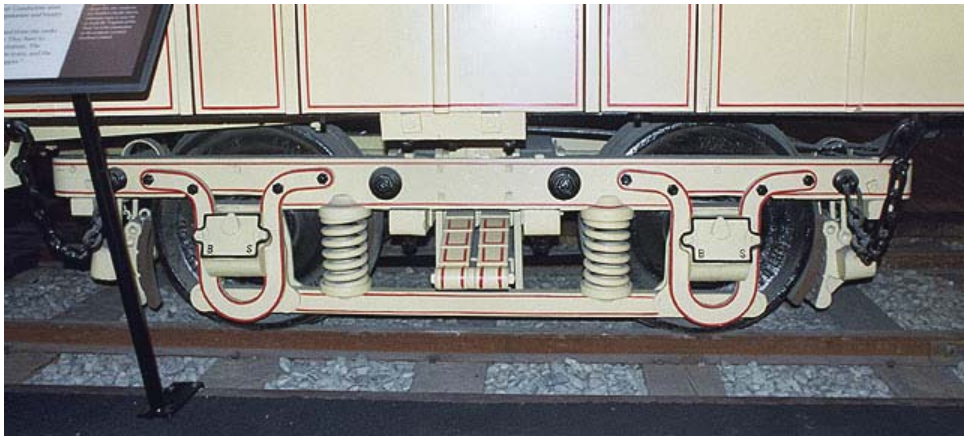
Finally, use some pins with orb pin heads as door handles.

Looking at the end walls of the car, the end doors will swing with the hinges on the right-hand side.

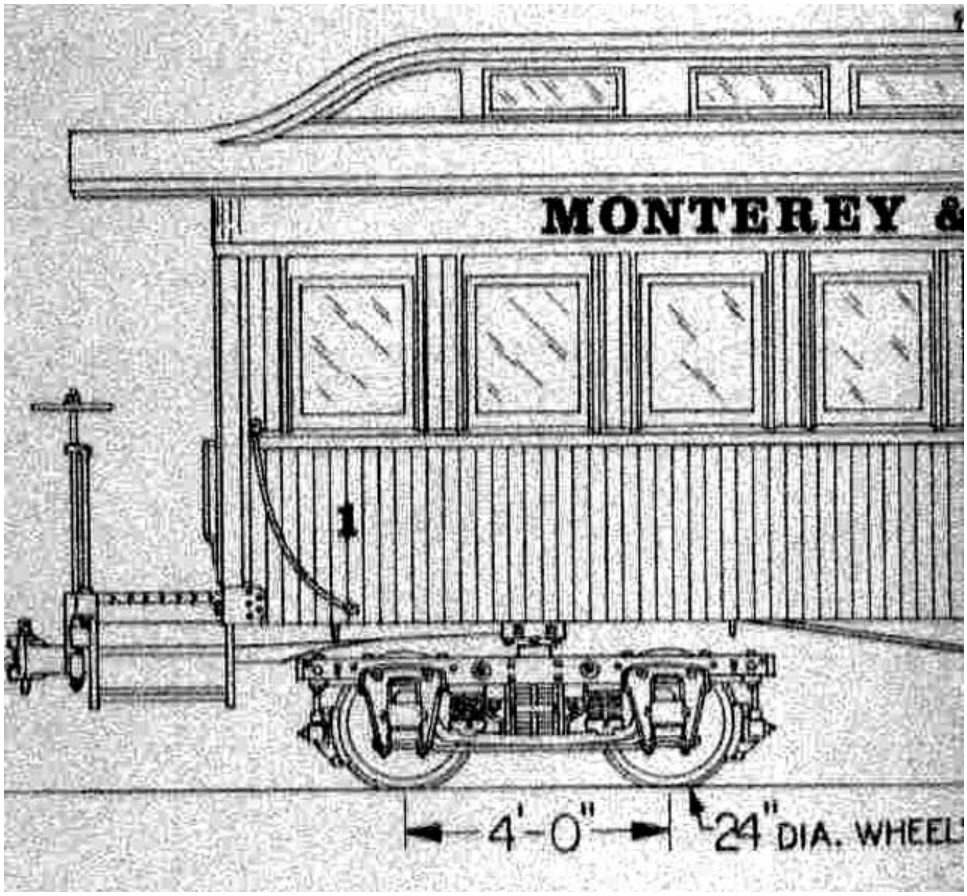
Step 27 - Detailing the Trucks.

The trucks selected for these cars are the closest RTR trucks to actual Carter Bros trucks on the market. As built, these cars were fitted with imported Billmeyer & Small 4' trucks. This was in 1874, before Carters began casting their own trucks. These are the same type as shown in the B&S 1875 builder's photo of 'Eureka' in the article by Kevin Strong. Sometime in their early life, these cars were refitted with 4' trucks built by Carter Bros.

Here is a view of the recreated trucks under the M&SV combine at the Museum today, note the B&S lettering on the journal lids.

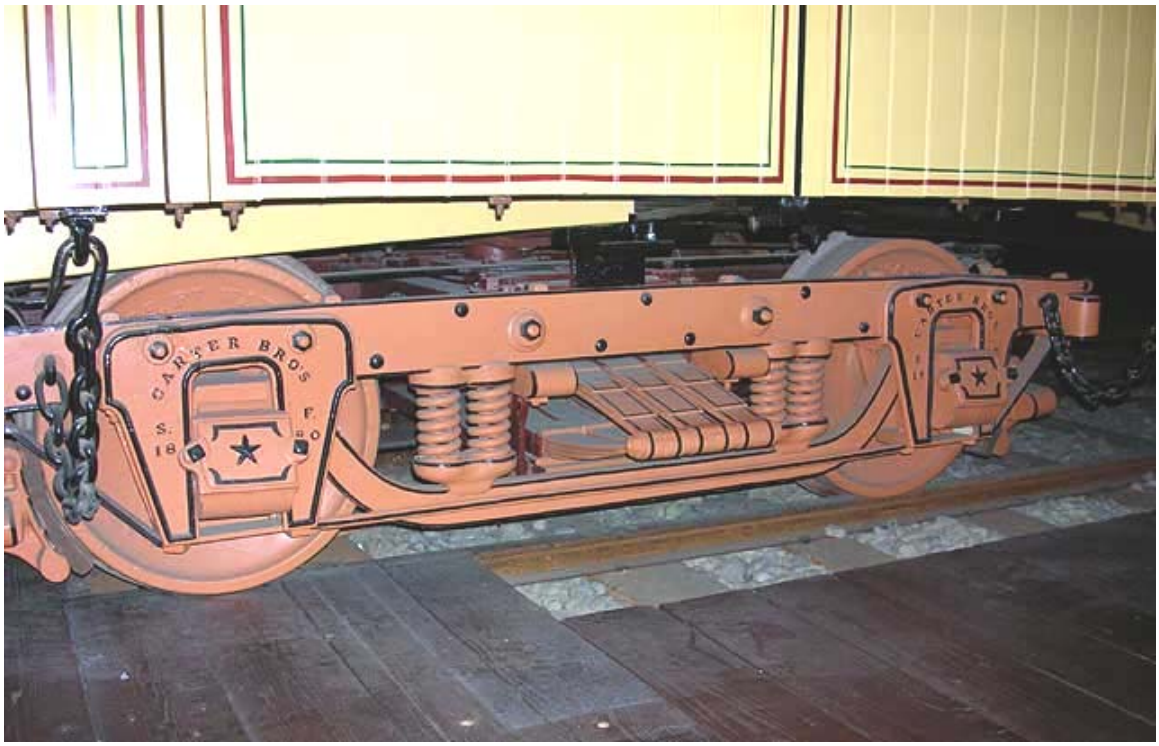


Here is a drawing of our M&SV combine, retrofitted with the Carter Bros 4' truck.



Note how the trucks were fitted with twin coiled spring sets, two sets to each side.

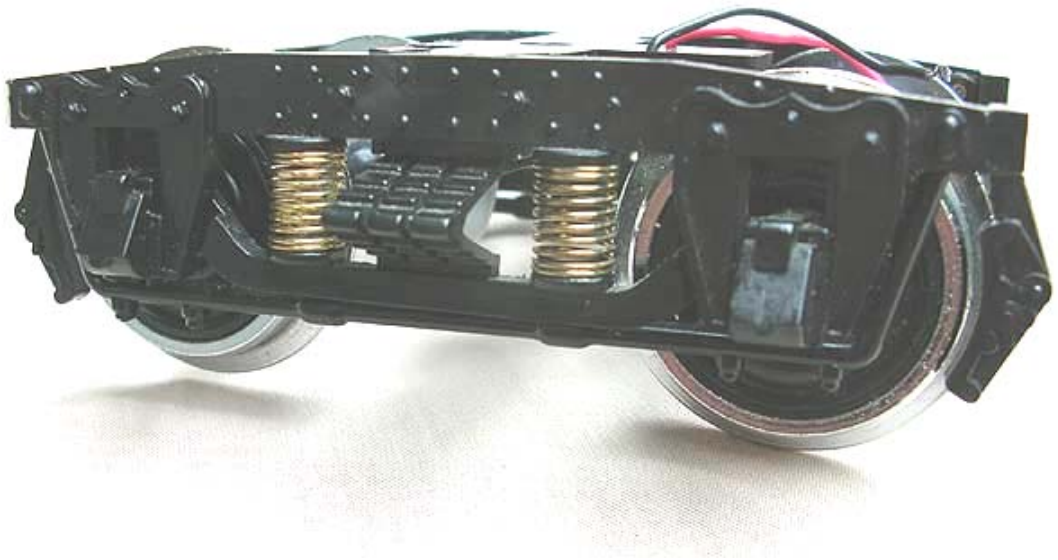
Here is a photo of the same design of Carter Truck, but in the larger 5' format. This is the truck currently below the restored 'Silver State' coach at the CSRM.



The ready-to-run trucks available to us for this kit are as follows:

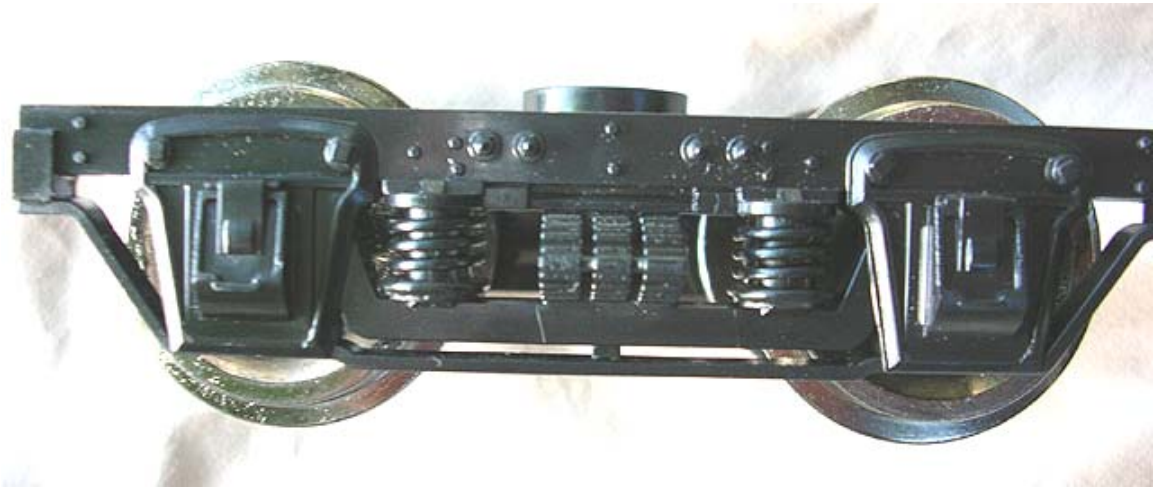
- Hartland coach trucks - axle spacing is a scale 4' 2".
- LGB coach trucks - axle spacing is a scale 4' 4"
- Bachmann coach trucks - identical in all respects to the LGB truck, 4' 4" spacing.
- AristoCraft Sierra truck - axle spacing 4' 3". - this truck also has spring journals like a real truck.

While all are close in overall axle spacing, in fact all being a tad larger than correct for 1.20.3 scale, stylistically the Hartland truck is easily the closest to the Carter Bros. prototype, and at $7 per pair are a real bargain. That is the truck of choice for the kits, but any of the four truck types above will be OK to use. Note that the three non-Hartland trucks are essentially the same in design, all have a different side frame and bolster profile to the Hartland truck, with the frames set higher relative to the wheels. This can cause some issues when applied to this car. The height of the frames on these three truck types will clash with the end beams of the car chassis. You can certainly use these trucks, but you will need to trim out the bottoms of the four beams (sill beams and draw timbers) to enable to the truck's frames to pass. Here is a view of the AristoCraft truck. LGB and Bachmann's truck are very similar in design to this. The AristoCraft version is the best of the three, as it has fully operating sprung journals.



The Hartland truck, being more like the prototype trucks used on these cars, has the truck frames lower down, and when fitted to the car with the single washer between the truck and car bolster, the truck's frames do not bind with the car framing. The tightest area is where the coupler shank on the truck passes below the draw timbers, with only 1mm to spare. If you are running rougher lines, and need the trucks to rock up and down more, and you want to retain this shank for a truck mounted coupler, then maybe sand about 1mm from the bottom of the draw timbers at the middle ends of the car.

Here is a view of the standard Hartland truck.

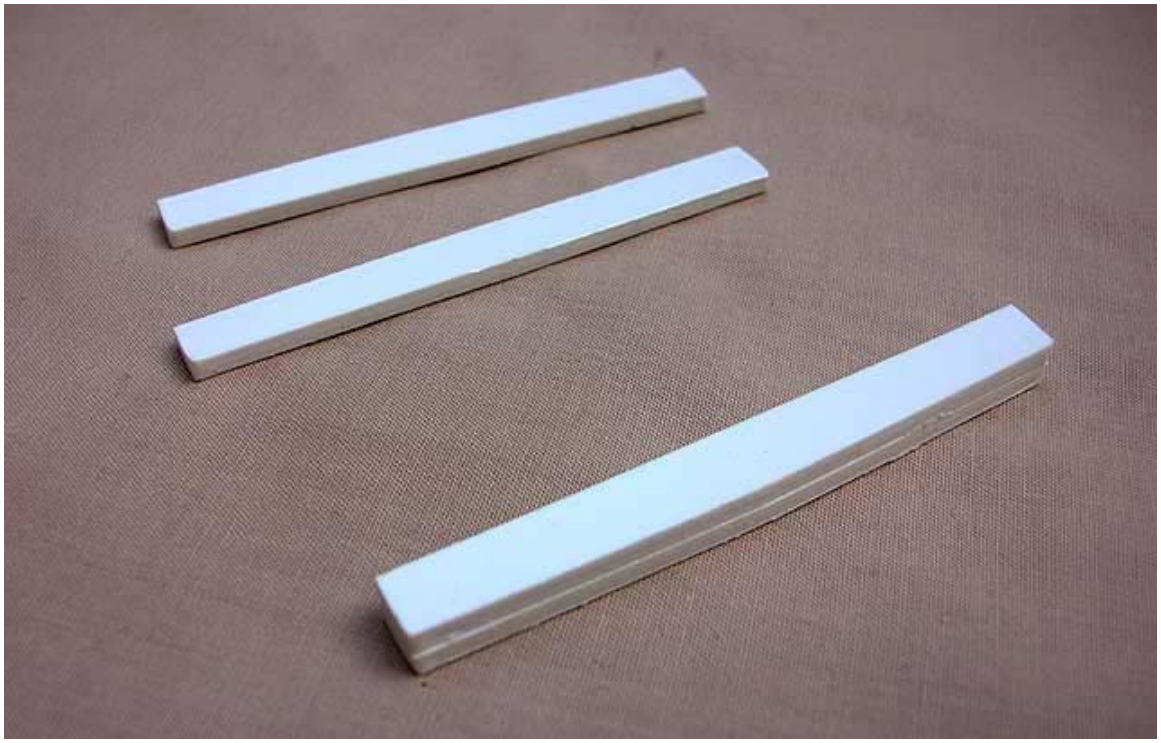


All of the truck brands come with moulded on simple brake detailing except for the Hartland truck. This however I believe to be an advantage because we're providing the laser cut brake rig parts in the kit to retrofit to the Hartland truck, with an overall better brake styling than the other trucks have.

The following info describes how to fit the brake rig to the Hartland truck. Anyone using LGB, Bachmann or Aristo trucks will not need to use these parts, but they could also be retrofitted to those trucks, should you desire, by trimming off the existing brake detail first.

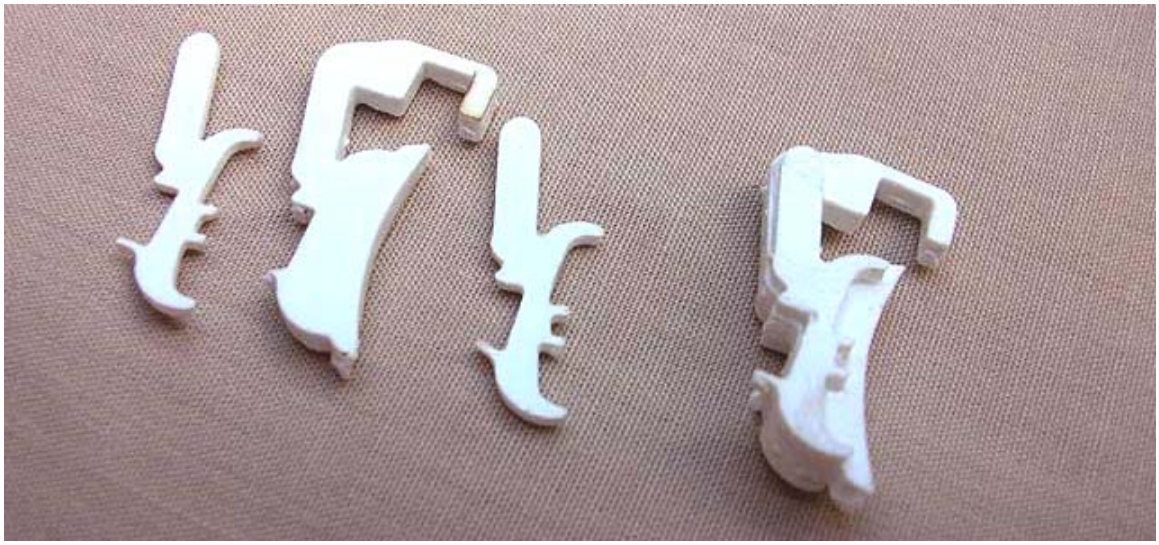
Following the **PDF entitled 'Brake Rig',** look for the brake shoes, brake hanger and beam parts.

We begin by making up the brake beams. Each truck has two brake beams, attached to two brake shoes each. Four beams are needed for the two trucks. The beams are made up of 2 layers of 2mm thick styrene, welded together like this:



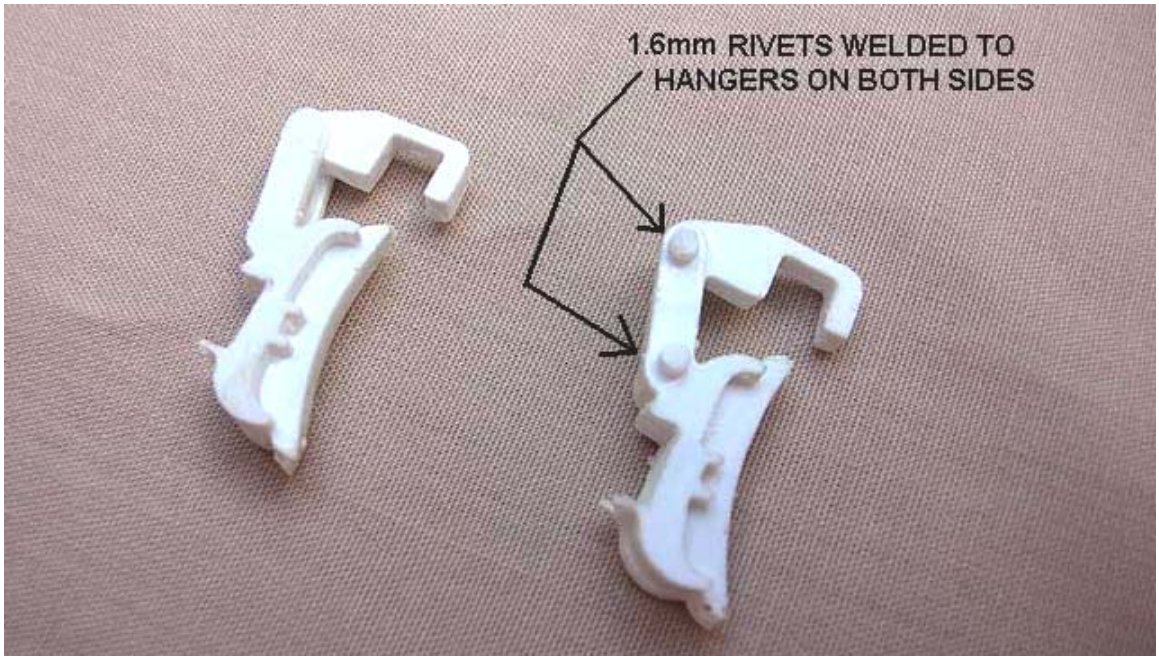
Each brake shoe/hanger part is made from 3 layers - a central 2mm thick shoe and hanger, with two 1mm thick outer layers.

Simply weld the 3 layers together with the rear edges aligned like this:

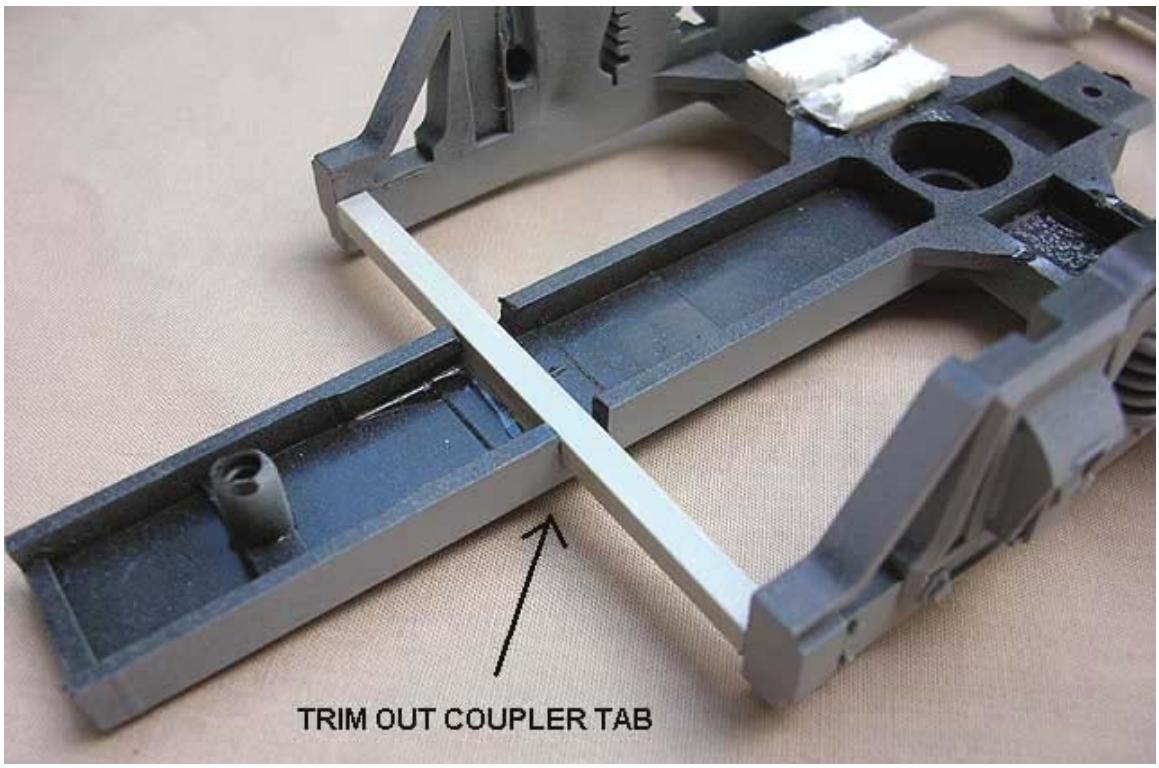


For the two trucks, you're going to assemble eight sets of the above brake hanger assembly, four for each truck.

Next, using your 1.6mm diameter 'rivet rod', dice up some 0.5mm thick slices of rod, and weld them onto both sides of the hangers like this:

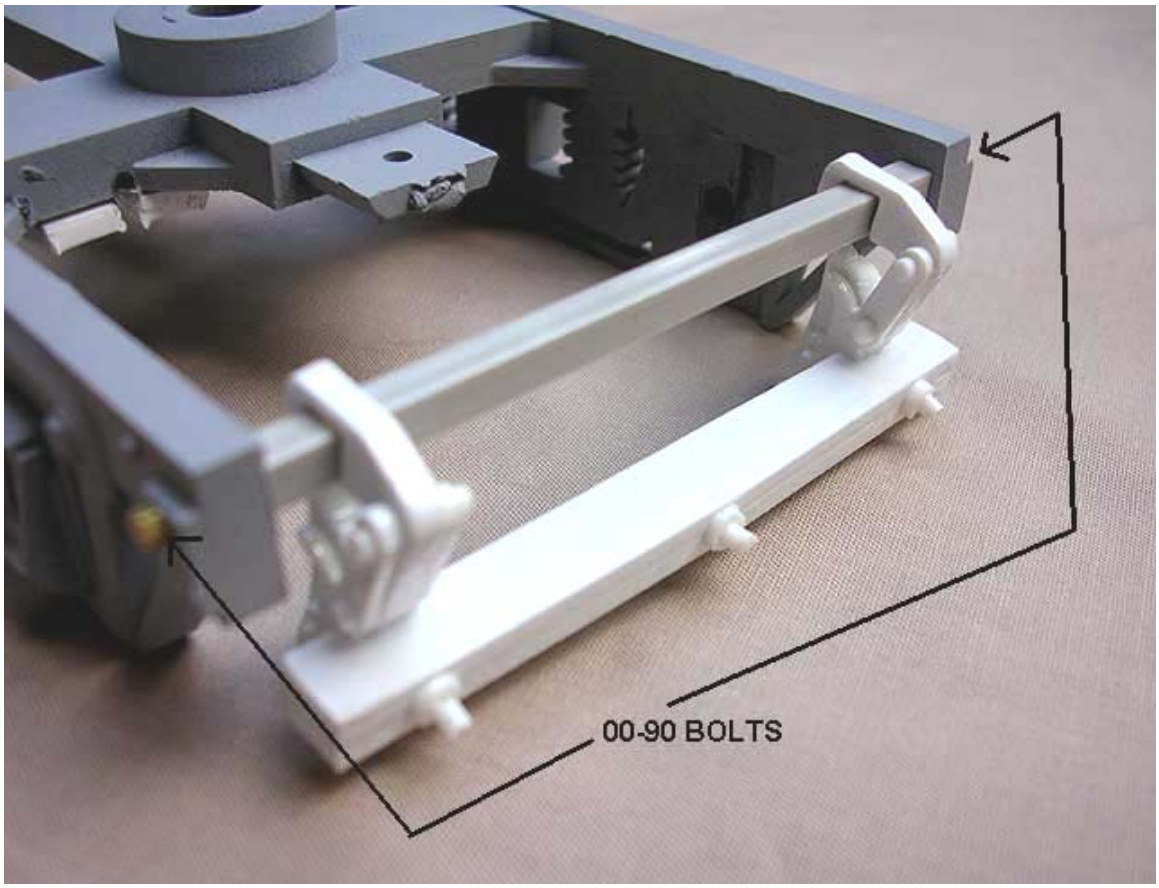


The next step requires a length of Plastruct 3.2 x 3.2mm ABS square rod. This is a grey rod with a 1mm diameter hole down the core of the rod. Trim two lengths of the SHS rod to run across the width of the Hartland truck, between the upper extreme ends of the upper truck beams. One end of the Hartland truck has a long shank attached used to mount a coupler. If you intend to keep this coupler mount, then you will need to trim out a little bit of the under side of the mount in order to let your 3.2mm SHS pass. The SHSs are attached to both ends of the truck like this:



To hold the ends of the SHS beams to the truck sides, drill and insert short 00-90 bolts from the face of the side frame through to the 1mm core of the SHS. Allow the bolt to thread into the truck frame side, but it will be a loose fit into the plastruct SHS. We shall always leave it a loose fit on one side only so that we can spread the truck frames and allow wheels to drop in, or be removed. Use a gap filling glue, or super glue to fix the SHS firmly to the bolt on *one end* of the SHS only. Leave the bolt loose into the SHS on the other end.

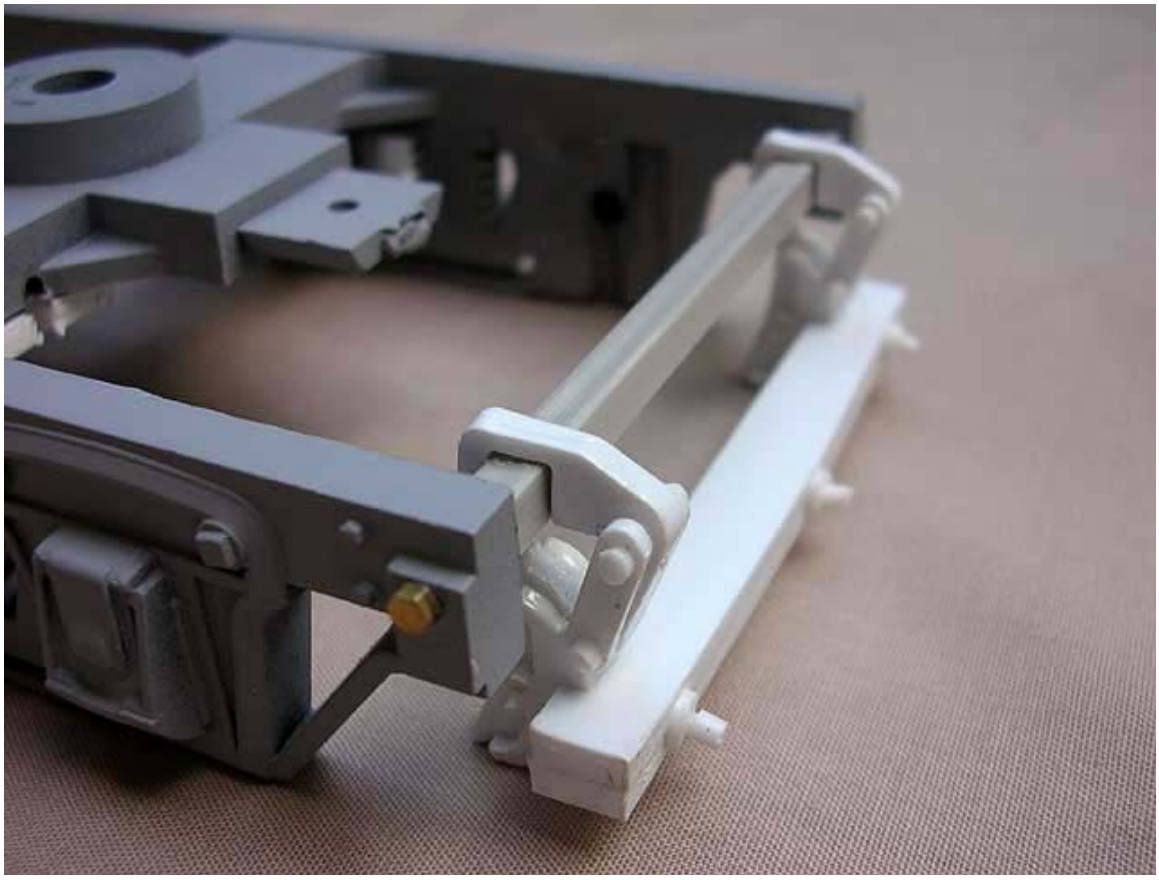
After inserting the wheels into the truck, slide your brake assemblies onto the beams. Space the brakes to suit the wheel width. Then weld the brake beams to the backs of the brake shoes, using the beams to space the brakes correctly relative to the wheels. With the SHSs bolted into place on the truck, brake gear hung off the SHS, and the beams welded to the backs of the brake shoes, the brake assembly will look like this:

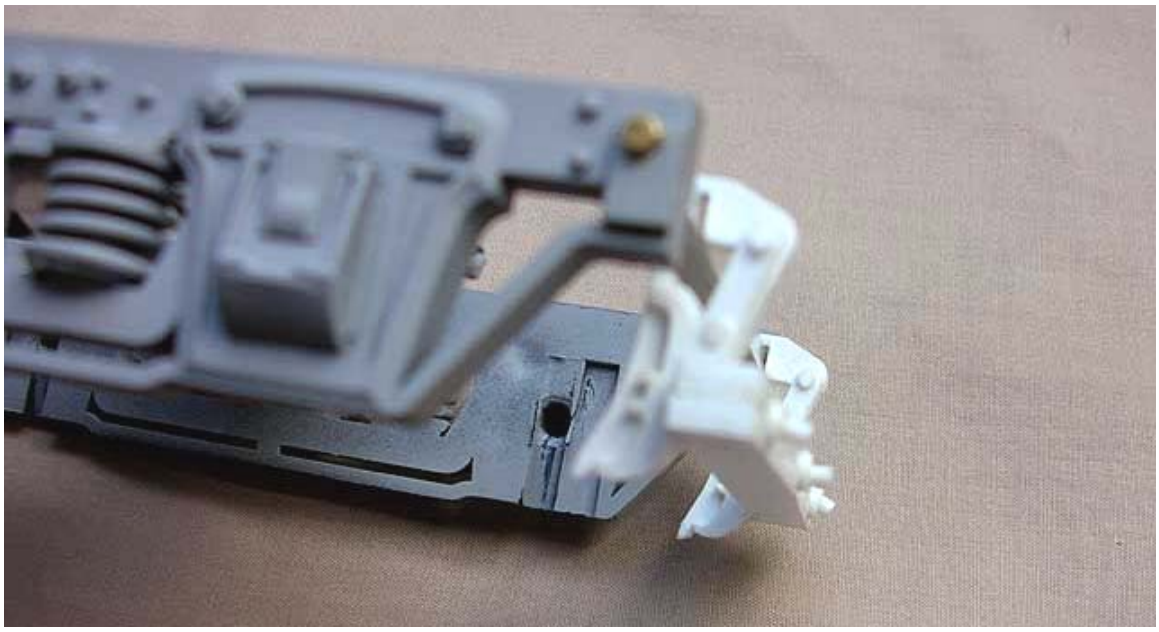


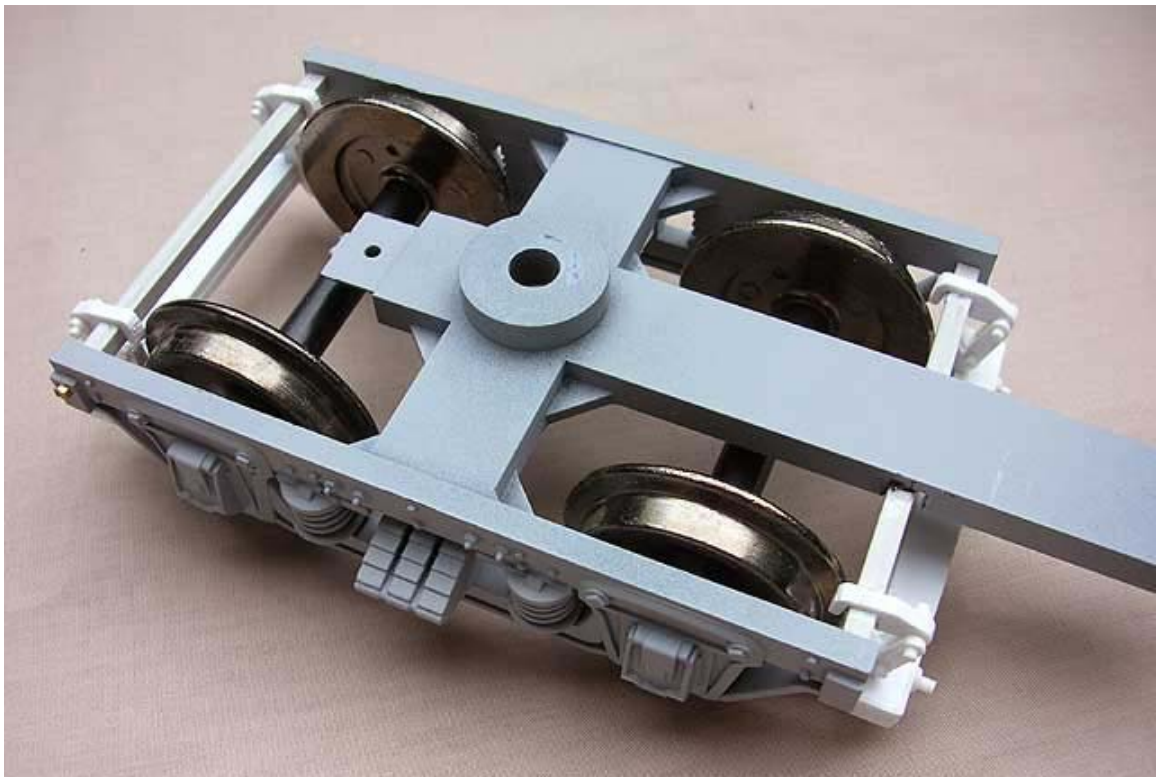
Note that the outer edge of the brake beam has a shallow curve to it, while the edge that is welded to the brake shoes is a straight edge.

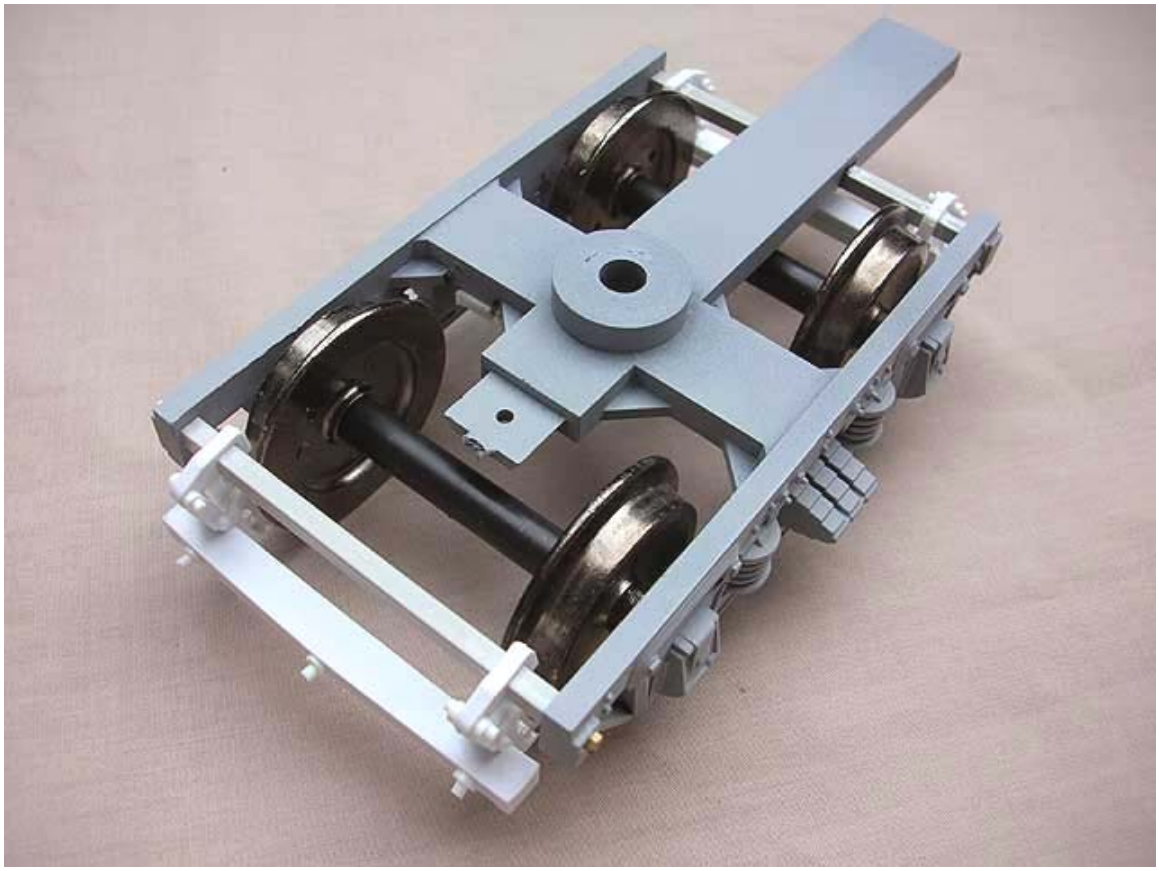
Onto the outer face of the brake beams, we need to attach three bolt and nut details. You can either use a 3mm nut/bolt/washer casting from Ozark or make your own like I have, using a 3mm and 1.6mm diameter rod. The 3mm rod is sliced into thin disks for the washers, and the 1.6mm rod diced into 1.5mm lengths for nuts. It's not perfect, but indicates the details of the truck brakes.

The finished assemblies applied to both ends of the truck will look like this:



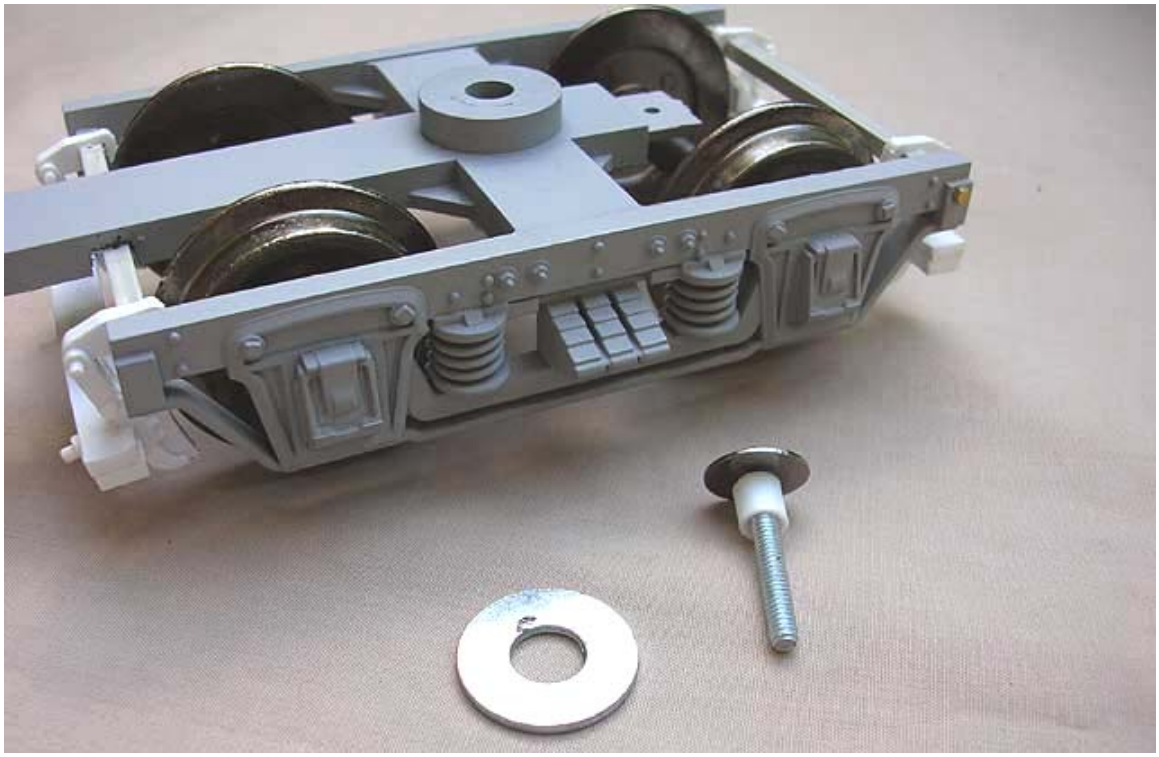






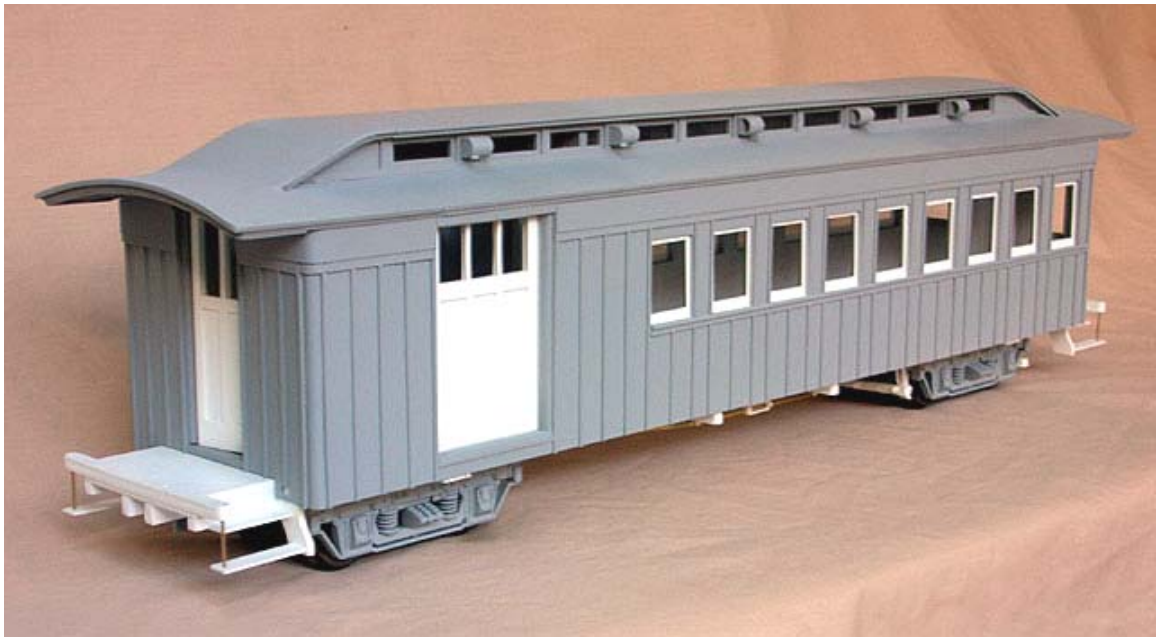
To attach the truck to the car's chassis, we'll need a large washer, about 1/2" diameter, a small washer, about 1/4" diameter, a short length of 6mm tubing (Evergreen). to help narrow the diameter of the bolt hole in the H-L-W truck and a bolt about 1/8" (3mm) diameter. I used an M3 bolt; a No. 4 has about the same diameter threads. In reality, you can use whatever bolts and nuts you feel comfortable with.

The 6mm tubing creates a bushing around the bolt thread. I was able to tighten the bolt hard to the tubing, while the truck remained free to rotate because the tube was about 1/2mm taller than the thickness of the truck bolster. The parts for attaching the truck are shown here:



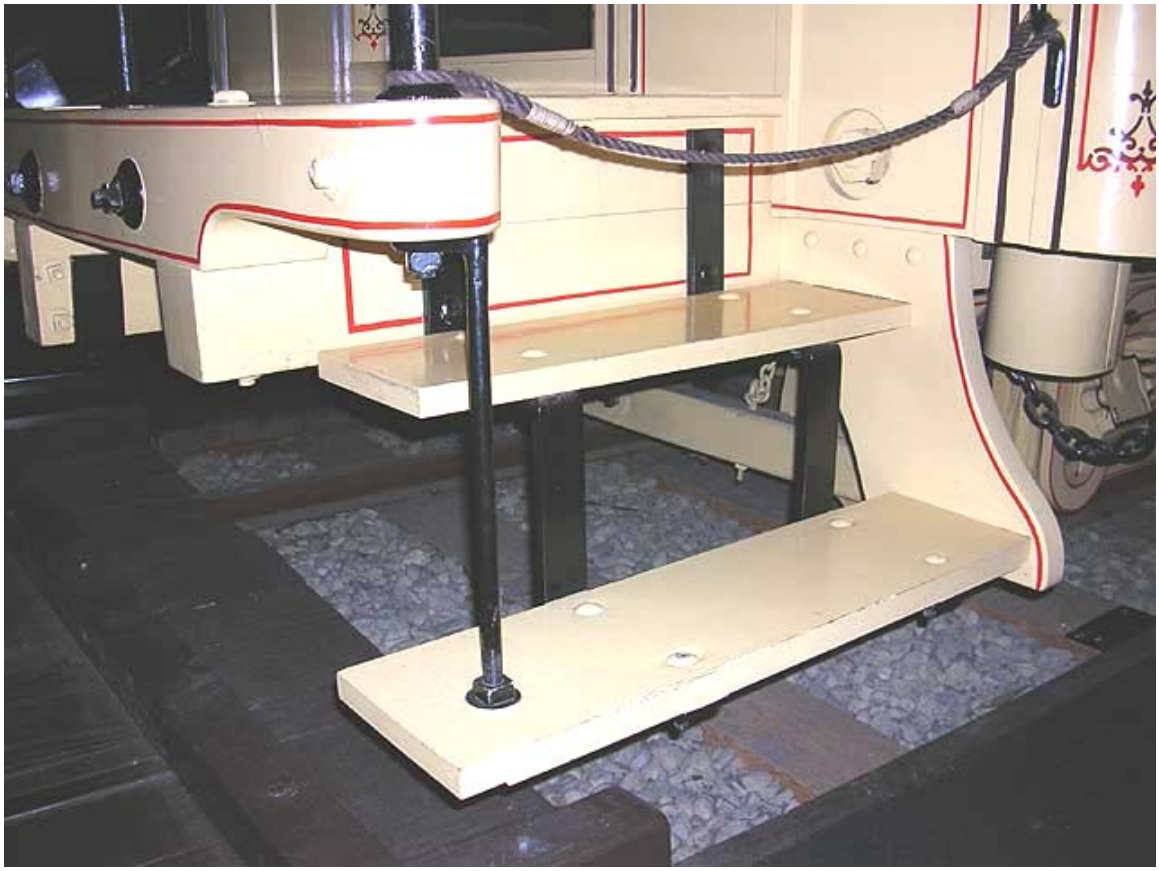
The large 1/2" washer is to be placed on top of the truck between the truck and coach chassis.

With the trucks attached to the car, your car will look something like this:

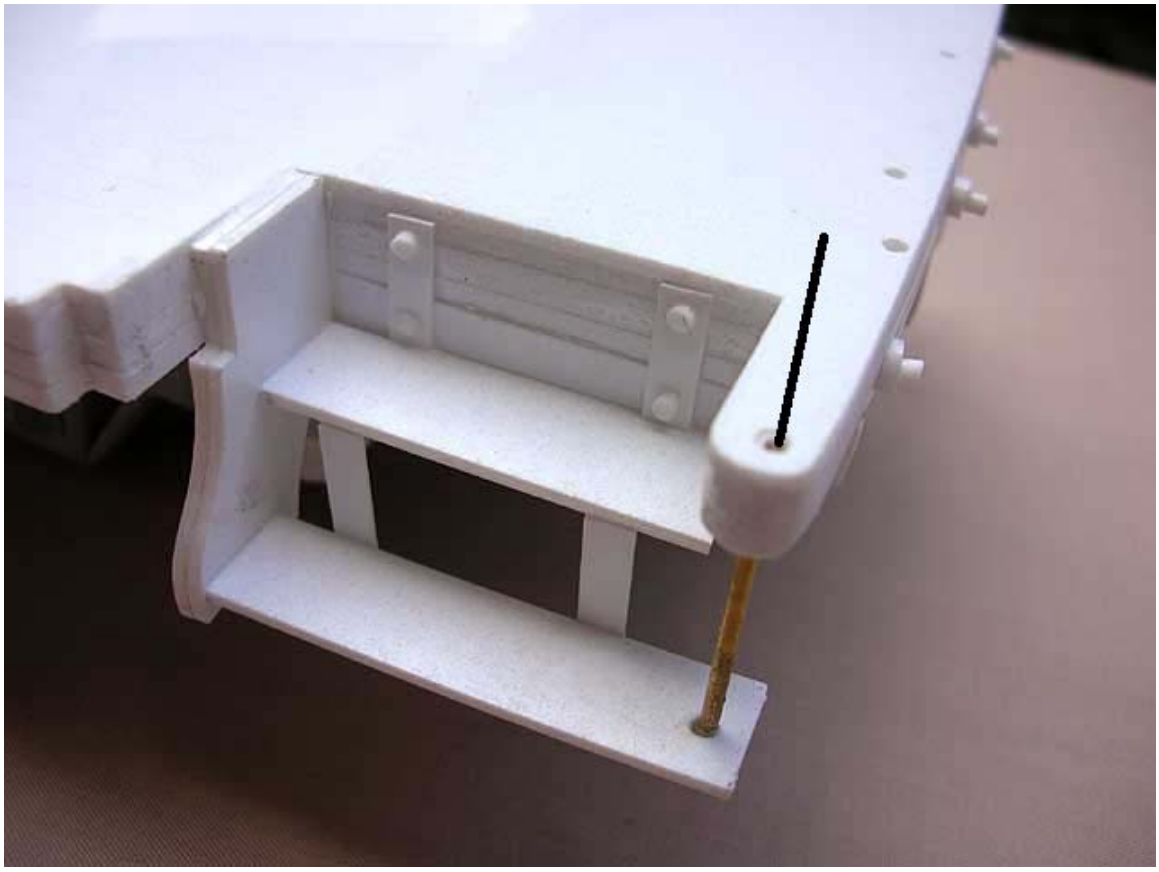


Step 28 - Details - the Steps.

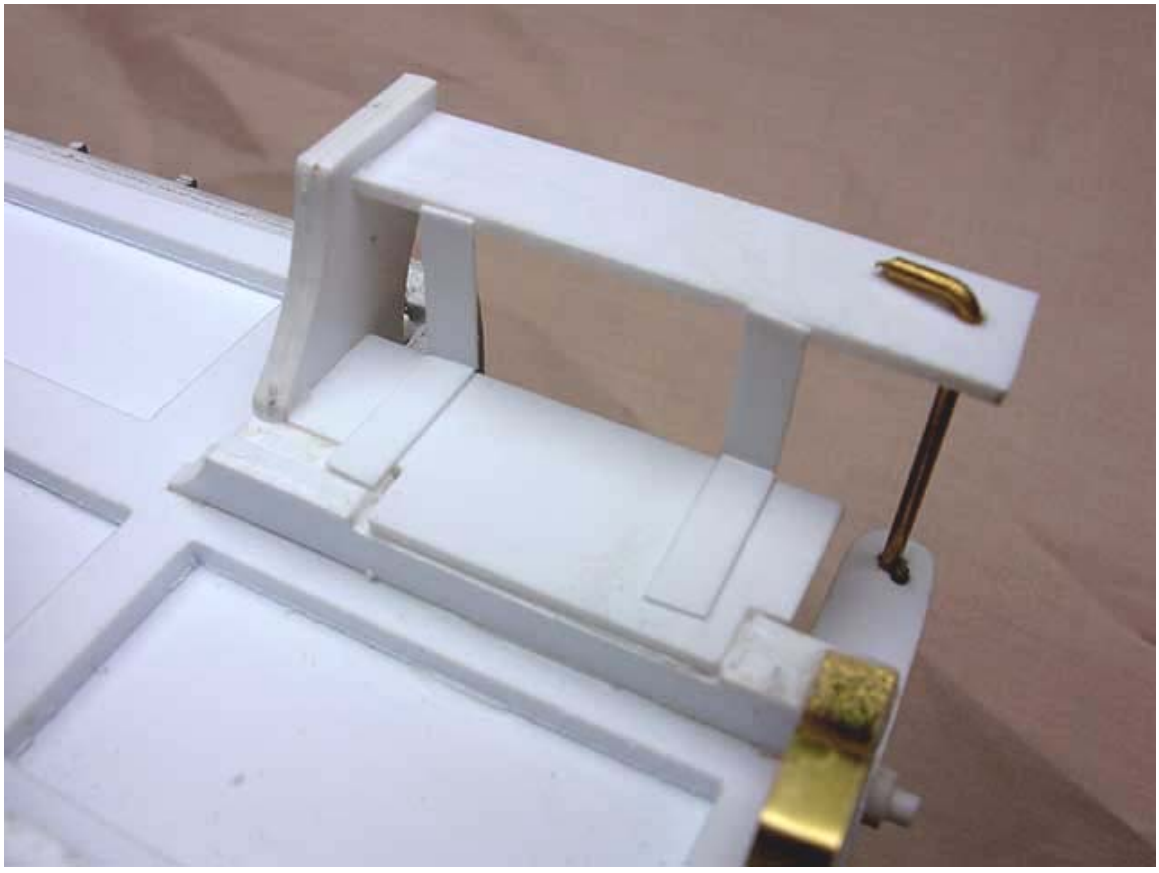
There are just a couple more parts to add to the end stairs for the 1870s, board & batten cars only. These only had a 'step hanger' to the inboard end of the car (whereas the 1880s cars had the step hangers to both ends of the stairs). On the outboard end of the stair, we have this vertical iron rod. which supports the end of the lower step. We added the rod back in Step 22. These types of stairs also had iron mid supports, called 'step irons'. You'll see them painted black on the prototype car at the museum:



Use your 0.5mm styrene sheet, and cut a strip 2.5mm wide. Weld two strips to the side of the platform sills, between the deck floor and the top stair tread. Next weld two more strips between the upper and lower stead like in the photo above. If you like the idea of the irons being actual stair shaped bent iron strip, you can make the same unit in once piece by bending up a 2.5mm wide strip of .005" brass sheet. I liked the styrene because we can weld the two bolt heads to the upper irons, per prototype. Also use the above photo if you wish to weld on those domed carriage bolts to the top edge of the hanger, and on the tops of the treads. The bolt heads to the step irons were sliced from our 1.6mm rivet rod.
From the outside, the step irons, welded into place look like this:



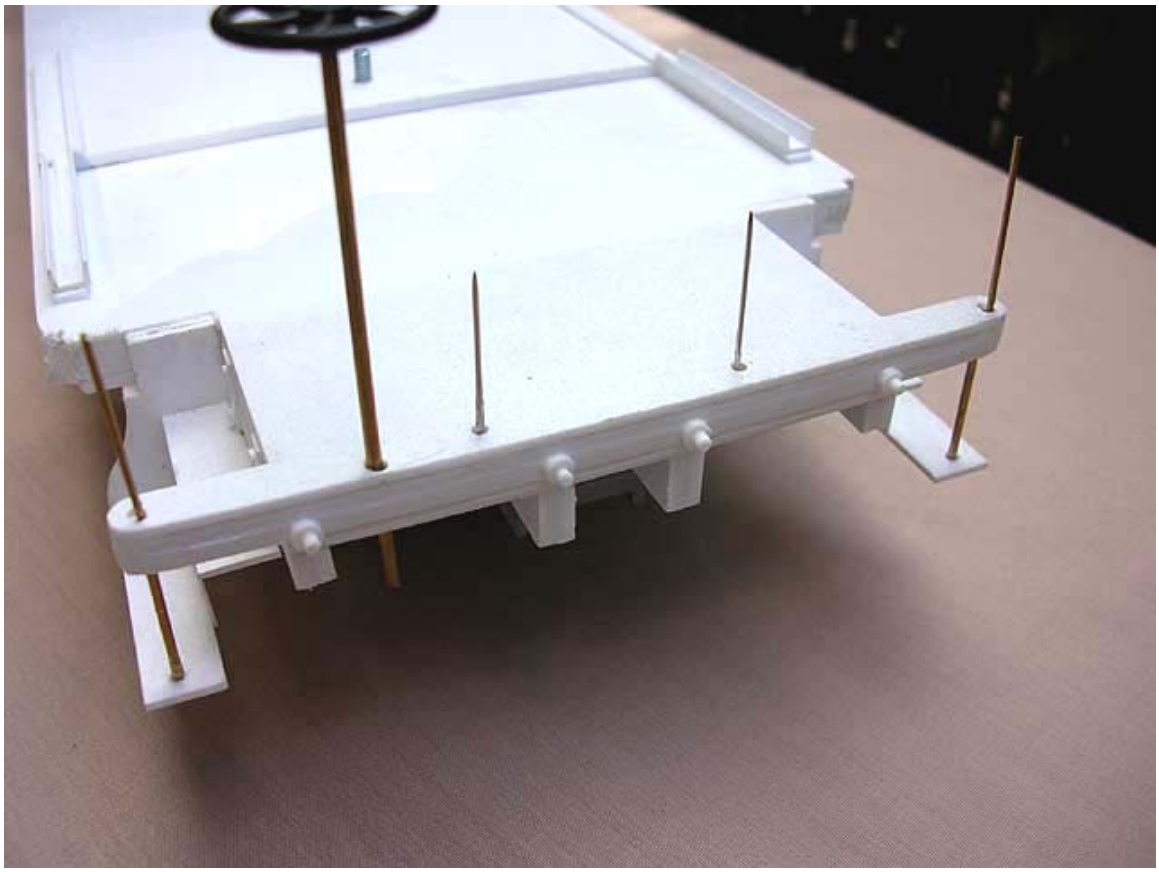
From below, I helped to support the rear of the lower irons, by adding the horizontal bars too:



Step 29 - The End Beam Washers and Nuts.

Like a freight car, there are a number of iron tension rods that run the length of the car, effectively clamping the whole thing together. The ends of the rods extend to the end beams, through the platform sill beams and the draw timbers. Across the end beams of the car are 4 exposed washers and nuts. Each of the 4 washer and nut details aligns with the edges of the 4 beams under the car ends. You can either use Ozark cast washer/nut details (which would be the best way), or slice up your own using 3mm and 1.6mm styrene rod, in the same way we made nut and washer details for the brake beams. You could use the same Ozark castings for both car ends and the brake beams if you wish. You will find the correct washer layout shown on the **PDF entitled "End Rails"**. I have not located the washers correctly in these photos. They shall be moved!

The four nut/bolt/washer details applied to the end beams will look something like this:



Ignore the vertical rods above the deck and brake wheel at this point!

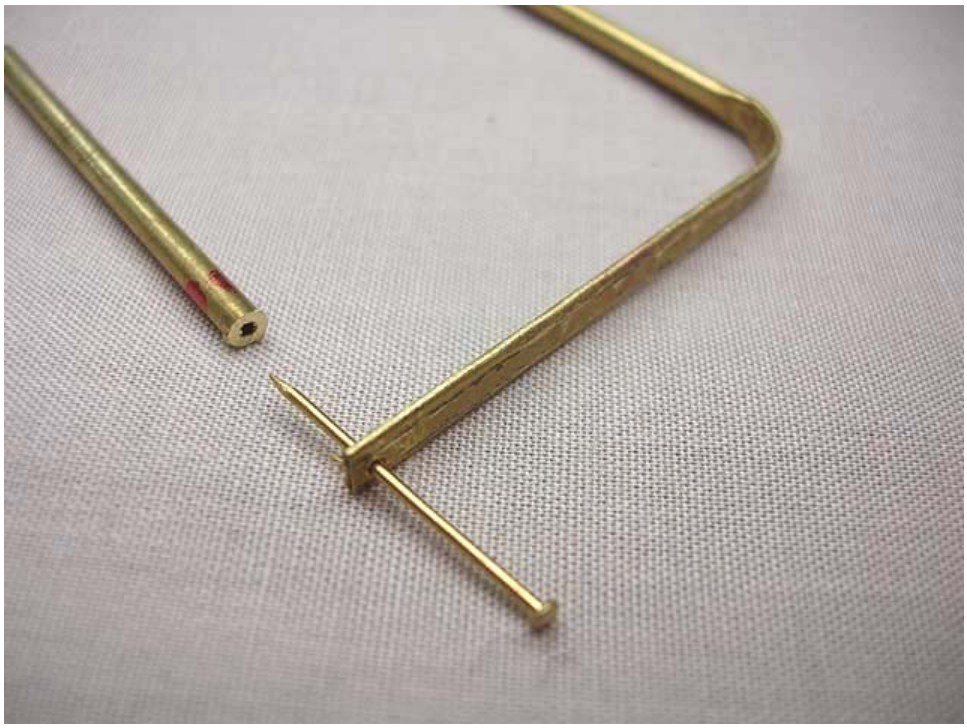
Step 30 - The End Platform Details.

Doug's Kit comes complete with white metal castings for the end rails. Also the car body rails are to be formed to a different (later era) profile as shown in the drawings provided with Doug's kit. Doug provides all the brass wire to do the body railings, along with castings for the fixing cleats at the ends of the railings.

The end rails are made using 2mm brass tube. The actual K&S brass tubes are around 1.8mm (0.070") in diameter, which is perfect. When looking at the K&S tubes, take a look at the hollow inside, for some reason they make two types of 2mm tube, both are the same diameter, but the inner hole is wider in one tube than the other. Either type is OK for use here, however, if you have the choice, and your shop stocks both types, get a couple of lengths of both types! I used the thin-wall tube with the wider core for the actual end railing, and the thick-wall tubes with the narrower core for the vertical stanchions. The thin-wall tubes will flatten more easily, which is a bonus in the making of the flat-topped end rails.

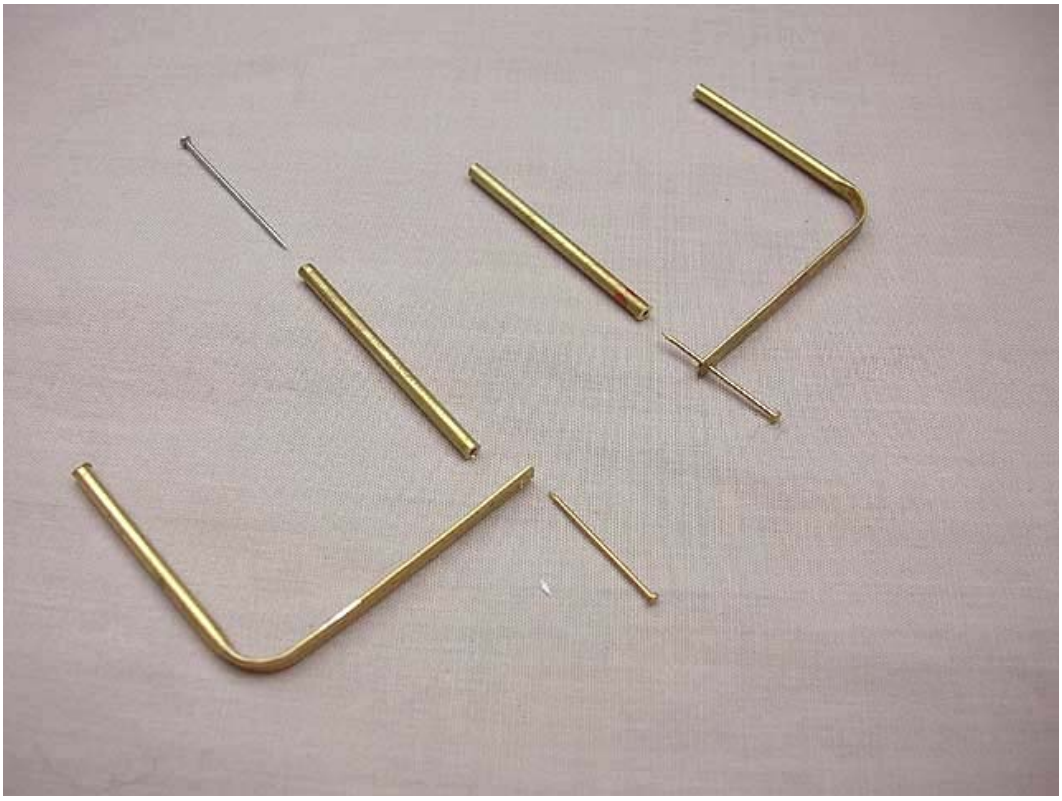
Follow the **PDF entitled "End Rails - B"**. Begin by cutting a length of 2mm tube (wide core), and using a vise, squash approx 35mm length of the tube completely flat. Following the PDF closely, bend the flat area, near where it returns to tube section, into a curved 90-degree bend. This will make the flat topped horizontal railing, and the outermost rounded vertical stanchion. About 1.5mm in from the end of the flat topped section, drill a tiny 1mm hole.

Next, cut out the vertical stanchions following the PDF for length. Using brass escutcheon pins of around the 1/2" length (cut them down if you need to), insert a pin through the outer hole, and run the pin down into the hollow core of the vertical stanchion. The almost finished end rail will look like this:

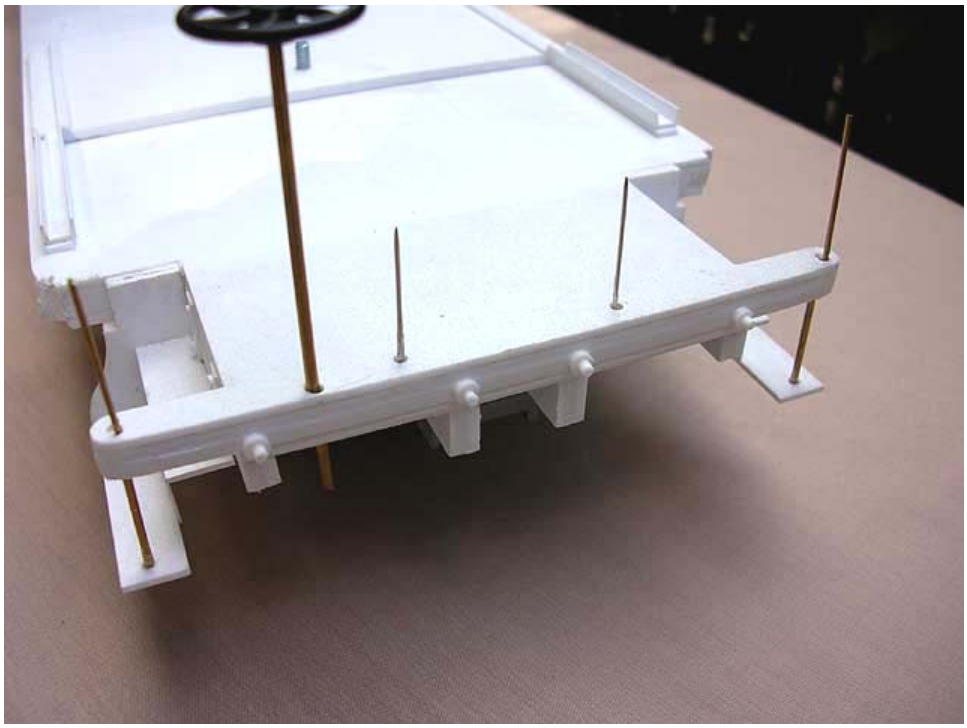


Lock the vertical stanchion to the pin using super glue, or solder if you like.

For a full end rail assembly, including two 'L' shaped railings, flattened on top, and two stanchions, the railing assembly as it goes together will look like this:

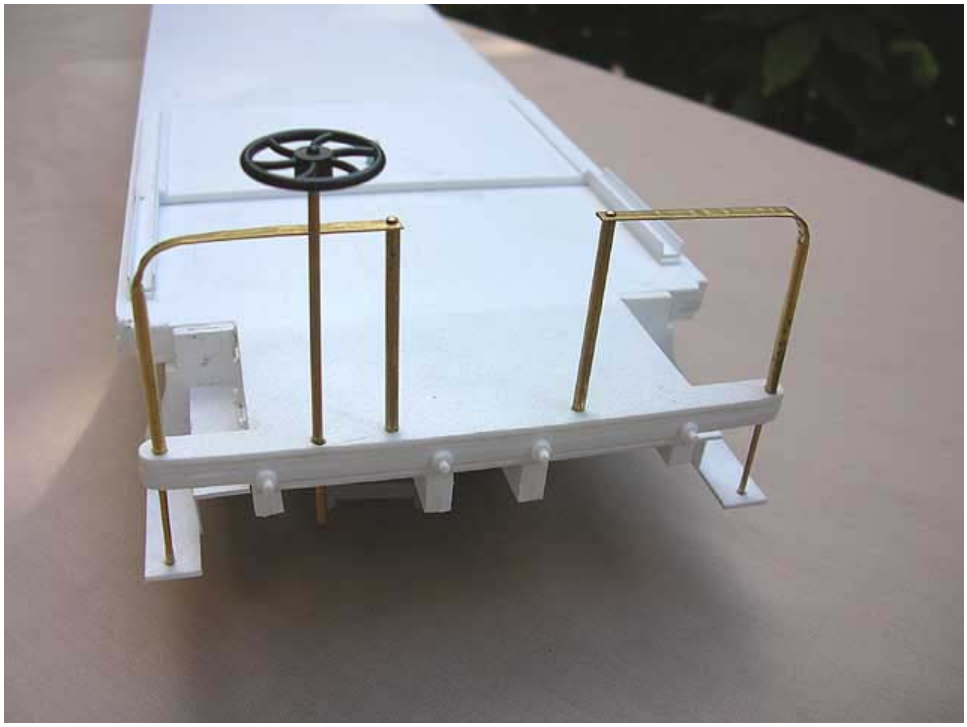


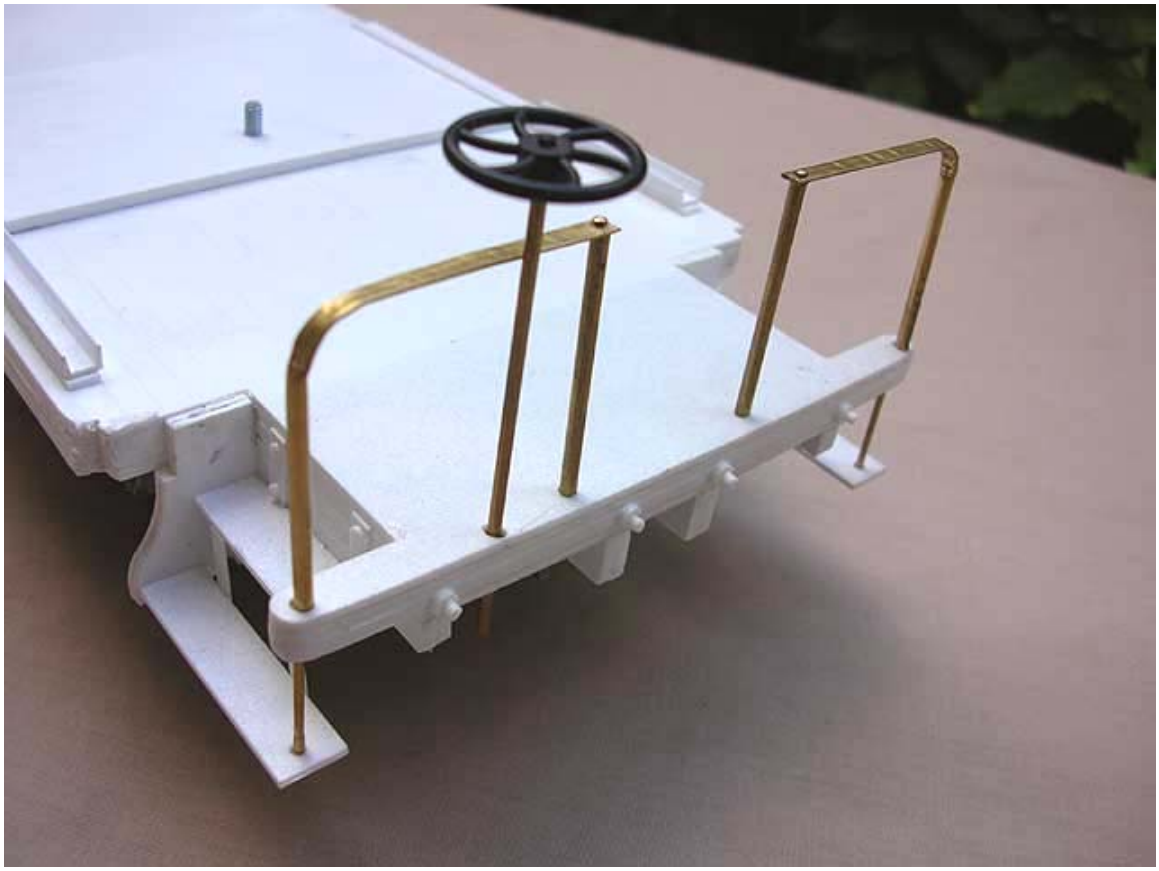
You can see in the above photo, that we can install the railing assemblies by using 1mm brass wire, or pins that run up vertically through the end beams of the car. Repeating the photo from before, you can see how I've inserted 1mm rods up through the end beams:



The outermost vertical rods can be the upper ends of the step irons from step 22. These vertical rods can slide into the ends of the 2mm tube railings. We then just drop the end rails down onto the vertical rods and use Loc-tite, super glue or solder to hold the railing tubes down onto the vertical rods.

Not shown in the photos: before fixing the railings to the vertical 1mm brass rods, apply a 3mm washer to the base of each stanchion. You'll see in the prototype photos how the bases of the 4 vertical stanchions had a wider area like a washer. I accidentally left them out while attaching my end rails! No way those rails will come off now, so I will have to fudge it while painting!



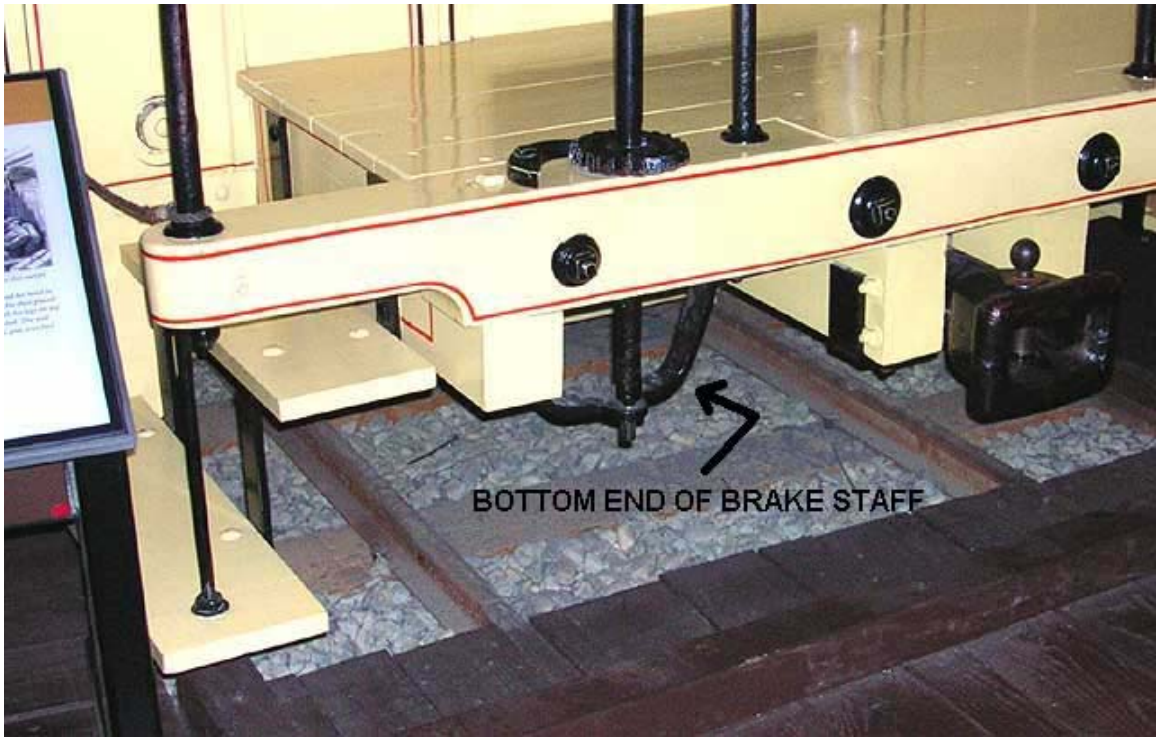


The brake wheels shown above were made using 1.5mm brass rod with a Hartland brake wheel on top. (I had them lying around, and they were about the right size). I would also highly recommend the Ozark brake wheel set, which comes with the brake wheel and ratchet at the foot of the staff. The Ozark brake wheel to get is Ozark 1019; one set includes two brake wheels, enough for one car. I used a small cog out of a long self destructed gearbox for the lower ratchet on my brake staffs (see photos later in this chapter). Also note, as seen in the PDF, the lower end of the staff should run below the deck, to a point just below the sill beams.

We also need to add hand rails to the car body. These are much thinner than the end rails. We can make the car body rails by following the **PDF entitled "End Rails - A"** and bend 1mm brass wire to the right 'L' shape. The ends of the wire bent into a tight 90 deg bend for insertion into the car wall. After the wire is inserted into the car walls, I applied a 5mm long, 1mm wide strip of 1mm styrene to simulate the cleat where the hand rails are screw fixed to the end walls.

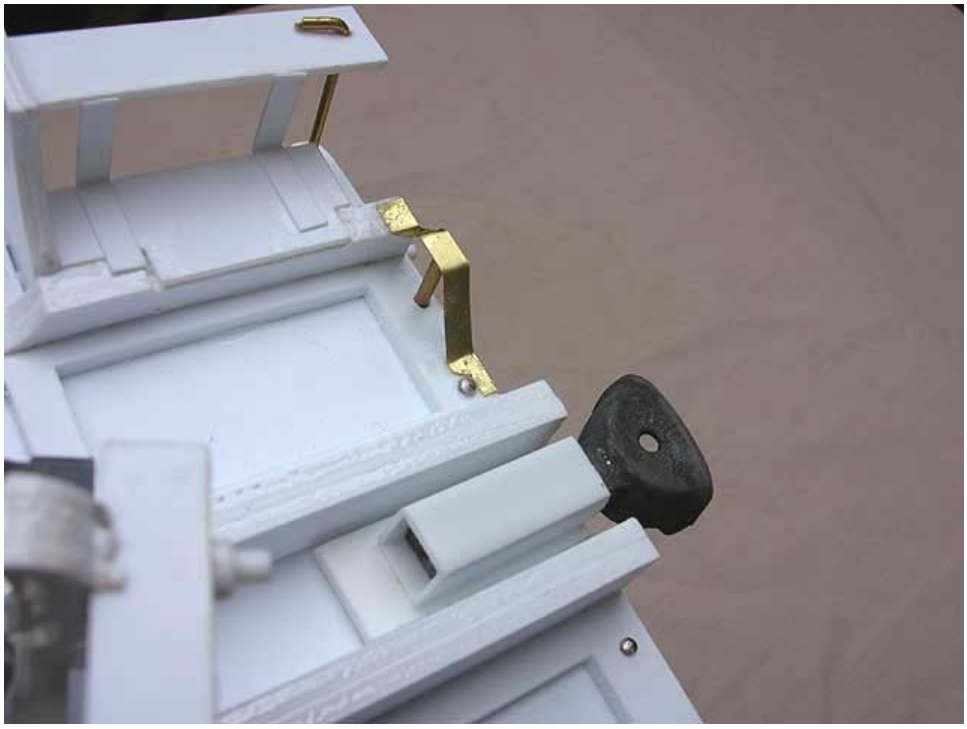
The railings applied to both ends of the car look like this:

We need to add a 'V' shaped iron bracket to the bottom of the brake wheel staff, something like this:



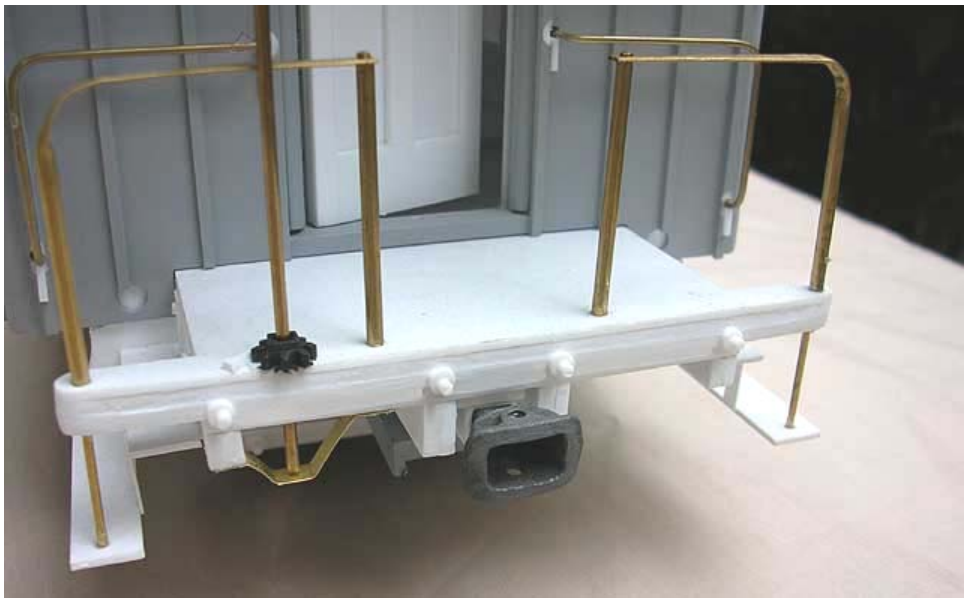
I used a 2.5mm wide strip of brass .005" sheet, bent to shape, and glued to the underside of the end beam using CA. It would be even better if you ran the 1mm rod that runs up into the end rails stanchion *through* this brake staff cleat, rather than cut around as I did!

Doug's kit comes complete with brake wheel, staff, ratchet and bottom end of the brake staff, no bending of anything is needed!



The above photo also shows how I attached an Ozark link pocket to the draw timbers. I used an Ozark 0019, inserted into our corner SHS styrene as used earlier in the project. It was a perfect fit. Then welded the SHS to the car body. I had these couplers lying around so I used them. Another coupler that would be perfect for style is Ozark 0022, which includes the spring assembly and would be attached to the draw timbers in a more prototypical way. Craig Hoefer in the next and final chapter will outline the Miller coupler and how to make one.

If mounting body mounted Kadee or Accucraft/AMS couplers, you'll need to trim out the draw timbers in our kit to suit. I'll be using the long coupler shank on the trucks to mount the couplers and leaving the body mount link pocket as a dummy.
With the brake wheel assemblies in place and coupler pocket installed. The car ends will look like this:



Step 31 - The Stove Pipe.

Doug's Kit comes Complete with a Stove Pipe casting.

You'll need to decide era, style and RR to determine where to put your stove pipe for the pot-belly stove. The early days saw the pot-belly around the centre of the car, and the stove pipe would project above the roof at the centre length of the car. If the coach had 13 windows, the pot-belly was behind the 7th window.

Later on, the pot-belly was moved to the end of the car, behind the last window. I'm modeling the combine as it looks today, restored, so I added the stove pipe to the end of the car.

The stove pipe was made from two lengths of Evergreen 6mm pipe. I then made up the lower, fatter section by inserting the 6mm pipe into the 7.9mm pipe we used for the car vents. This was them inserted into a short length of 12mm pipe. I used strips of 0.5mm styrene to fill the gaps between the pipe sizes. Only the 12mm pipe was contoured to the roof angle, the other pipes insert into the roof itself via a hole drilled. The hole is drilled as close to the inside face of the walls as possible, both end and side walls.
The stove pipe, mounted in place looks like this:

This is only one style of stove pipe, the photos show many styles, with the typical being a shorter stack, with a mushroom cap on top, much like Bachmann use on their J&S coaches.

The pot-belly stove itself is not provided in the kit. It can be made by hand using such things as Sculpy polymer clay or styrene tubes. Around town, especially in the tourist shops, you'll find these bronzed metal pencil sharpeners in the shape of all kinds of heritage artifacts, such as vintage cars, pepper grinders, clocks etc. They also make a great wrought iron looking pot-belly stove pencil sharpener that would do the job well. Go and seek one out!

Step 32 - Bolting the Coach together.

Back in Step 11, we assembled the car body corners by installing an Evergreen SHS's. Inside this SHS we installed a Plastruct ABS grey 4.6x4.6mm SHS. This SHS had a 3mm diameter core hole down the centre. The SHS's were installed in all 4 coach corners and to the baggage side of the dividing wall. On the passenger cars, you may like to add the mid length SHS to the inside face of the sidewalls, up to windowsill level.

With the SHS's all in place, the 6 SHS to the car will look like this:

Baggage end SHS's

Dividing wall SHS’s

Passenger end SHS’s

These SHS's are the six fixing points for screwing the car chassis to the car body.

Basically, a 1 1/8" long bolt will run vertically up from under the chassis and screw into the hollow core of the 4.6x4.6mm SHSs, fixing the car body down to the chassis in a very strong way.

You'll need to work out the distance inward from the chassis edges where the holes should be drilled. The holes need to to be drilled perfectly in line with the hollow core of the SHSs. You can make the holes slightly bigger than the cores in the SHSs, as the bolts only clamp the two assemblies together, the alignment of parts is already taken care of via the design of the car's assemblies. Another way would be to drop some paint or ink onto the bottoms of the SHSs and drop the car body down onto the chassis, letting the paint/ink wet the car chassis. Take the body away and you have left a mark on the car chassis where the holes are to be drilled.

Beyond all this, it is also OK to simply weld some mounting blocks along the base of car body and screw into them from the chassis.
For Doug's and Harald's kits, you'll be bolting into the wood blocks in the internal corners of the car.

Well, chaps, that it. This is now a complete 1:20.3 Carter Bros car, ready for the paint shop, and the insertion of the seats when you're ready.

There will be no more assembly instructions, so if you're happy to paint up the cars for your own road in the manner you like, you're good to do so now. Go and run the cars and have fun. Maybe contact Stan Cedarleaf about getting some road names printed onto decal sheet for the letter boards of your cars.

The next chapter may be a while coming. Craig Hoefer will be putting together the next chapter, and it will cover finer details, painting and decoration and interiors for the M&SV combine. The second chapter will be much more prototype-specific. The detailing of the interior will be to match the prototype as she looks today. This is not part of the kit, and much of the kit's roof framing will be altered considerably. This chapter will cover the colours used in California for cars such as these, and will include the decal decorations you may like to use to finish your cars.

Here are some views of the finished car, less painting:

Good Luck,
David Fletcher
April 2006.

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I'd like to extend my thanks to the following for making this class and kits possible:

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