

## **The Car-Shops: Project II - 2003**

### **Build a Denver South Park & Pacific Waycar Rolling stock in 1:20.3 Scale**

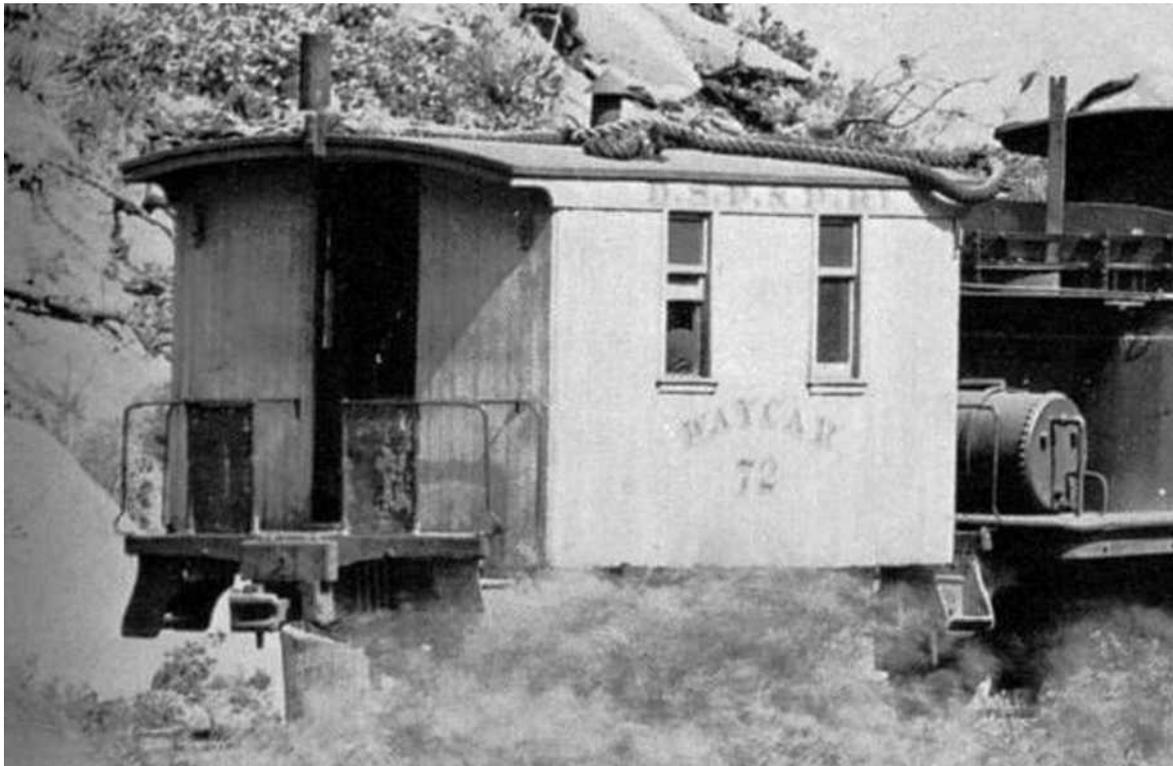
By Peter Bunce - United Kingdom.

<http://mylargescale.com/articles/articles/carshops/waycar/waycar01.asp>

#### **Chapter 1 - The Body**

The Mason Bogies that some of us are building ought to have something to pull; an easy choice would be a 'Waycar' or two! This will be a short 2 chapter construction series outlining the construction of a classic DSP&P Waycar in a scale of 1:20.3.

I have written a short 'potted' history of these cars, which covers some of the information regarding these vehicles. Here I have done a short introduction, there is more information in the 'potted history'. My waycar is about 1883 or so, which was just after the Denver & South Park had fitted the Westinghouse Brake, which replaced the Eames Vacuum brake system.



## A Little Background First

The South Park 'Waycars' or 'cabeese' (plural of caboose), are quite well known vehicles – light in weight and for American ideas they seem to be very small. This is not really the case however; recently I was looking in some back issues that I had found of the Railroad Model Craftsman magazine and there was a series of articles on the mighty Pennsylvania Railroad – they in the 1880's has cabeese that were almost identical in both size, layout and number of wheels. They did however have more windows, a cupola, and bunks. The South Park ones were said to easily fall off the track, and were just as easily put back on again, and only having four wheels as well – they also looked very English in design The early D&RG cabeese were also 4 wheeled, and were very similar.

Notwithstanding that these waycars are well known, finding sufficient information for modeling purposes in any scale is a bit difficult. There is in the Jan/Feb 1992 issue of the magazine Narrow Gauge & Short Line Gazette an article on building one in 1/24<sup>th</sup> scale; this article contains a drawing by Charles Brommer, and shows the early version of the smaller ones built. Later in Colorado & Southern days the under frames had to be changed to a new design because the precursor to the Interstate Commerce Commission issued new rules, which meant that had to have air brake systems fitted. Amazingly before this they only had an air pipe and pressure gauge so that the guard could monitor the airline pressure. There were also other changes. In this re-built form a drawing was made by Harry Brunk, who has built a HOn3 layout of the Clear Creek (Colorado) area. Both these authors have given me permission to use their drawings for which my grateful thanks are due – thank you to both. Another great 'Thank You' is due to John Cummings, a member of the MLS site for his assistance in copying the 3 part article by Derrell Poole that appeared in the magazine 'Outdoor Railroader' – that has been very useful and as usual has also 'popped up' some more questions that I do not have answers to. Thank you John.

There were various lengths (12ft 4inch; 12ft 11inch; 13ft(No. 73), & 14ft 10inch, and were painted either white or light yellow, and D&SP red (oxide) as well, this color is believed to be a dark (like US Tuscan Red?) red/brown color, if you put some brown or black (the latter does have a tendency to 'kill' any color,--

which is why I think that a dark brown will be better), into a 'red oxide' you will be 'getting there' with the sort of color I think the D&SP brown oxide was. I will not go further with colors, which can be a very complicated subject indeed.

I live in England, which tends to make life a bit more difficult with the collecting of US Railroad information. This has been eased considerably by the advent of the Internet, not forgetting our own magnificent site – I joined after putting 'Mason Bogie' into 'Google', and finding the site from there.

That is a short 'history lesson' over – it is time to start building – I will build two waycars, which will be in two colors and of different lengths as well. Both are of the early (Denver & South Park), design.

For More background information about the Waycars of the DSP&P RR, please refer here:

**[A Short Potted History - The DSP&P Waycar](#)**



## A Potted History of ‘Denver South Park & Pacific Railroad’

### Waycars

This is NOT anything like a complete history, I have found and begged all the information I have – it has all been amassed because I like the South Park, and its rolling stock. I am building 2 of these waycars and will primarily concern myself with the early days, including a bit of the time when the DSP was controlled by the Union Pacific. My time period is round about 1883 or so. The only Colorado & Southern details included will be minor and mainly of the new under frame required by the Interstate Commerce Commission’s predecessor which required them to be fitted with air brakes; before that there were only handbrakes (the Armstrong system!), and an air gauge and pipe. These alterations were from about 1912.

I have received permission to use the drawings that Charles Brommer did and also Harry Brunk, both of these drawings being published in that marvelous magazine ‘Narrow Gauge & Short Line Gazette’. These drawings will be available to MLS members with some additional drawings by me. There has also been the great assistance of John Cummings of this group in sending me copies of an article by the DSP expert, Derrell Poole. Thank you, John.

Finding information is difficult, made more so by the fact that records are totally incomplete and at times do not agree with each other. There is a very good book by Ron Rudnick, on DSP freight cars, BUT it does not include Waycars. I should add that I live in the UK (England), which adds to the difficulty.

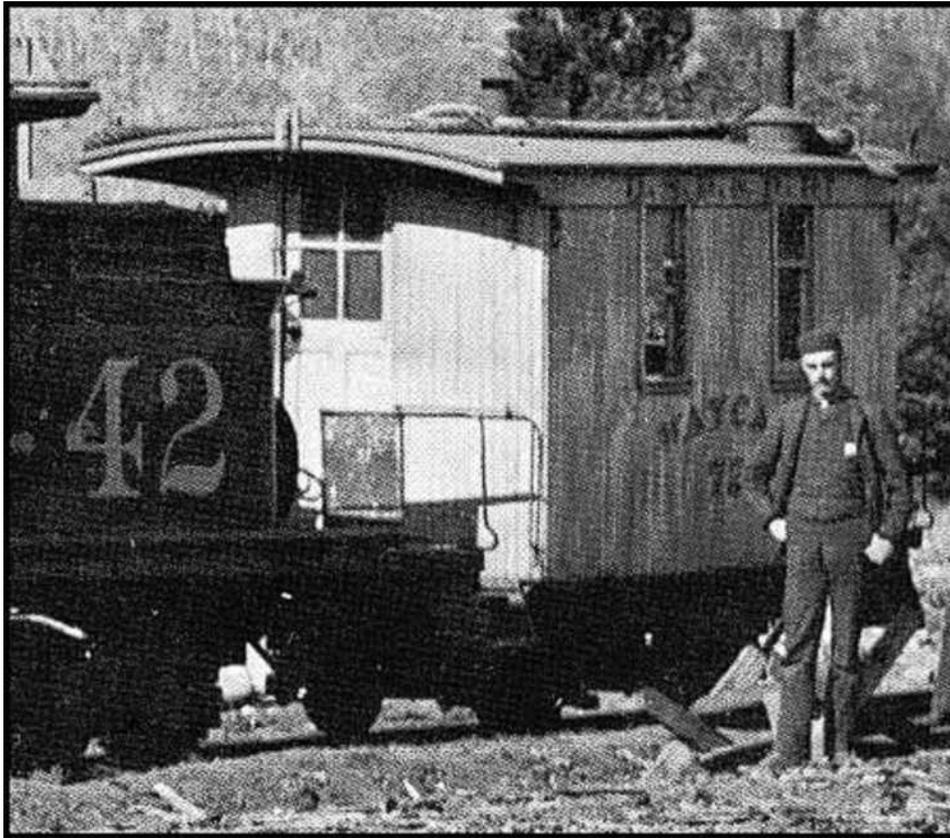
The Waycar, did not appear till circa.1880’s; before that the line was too short, (& lack of cash?) to need them – instead coaches were used as accommodation for the conductor – generally ‘combines’ were used, of which there were many. This is why early photos show these on the rear of trains, and of course there were ‘mixed’ trains run in the timetables of the time, which would look the same. The lengths of the body were 12ft 4inch, 12ft 11inch, 13ft (for number 73), and 14ft 10inch with a 9ft wheelbase that had a form of equalization in the center between the wheels. The Colorado Central, with which the DSP interchanged also, had two.

There is also a lack of clear photographs – not surprising really, this is what was the ‘Wild West’ and such things were if at all, very far down the list, and photographs are more likely to be ‘general views’ normally, not what I consider for modeling if at all possible. Of course the shining exception was William Jackson to whom we are all indebted, and that is because he was employed by the railroads for publicity purposes. Here in the UK we have very sharp photographs which are called ‘official’ photographs – taken with a large ‘plate’ camera with about 2 hour exposure per plate – no wonder they are sharp! In the USA there are such photographs by Pullman, and the other locomotive, car & wagon building companies but distance precludes me from them; mind you I do buy the books containing them when I find them! So, I make do with what I can find. They also were destroyed in wrecks and such like and the records are VERY incomplete regarding all these waycars, this applying especially to their early years.

The ‘Outdoor Railroader’ magazine articles by Derrell Poole (Aug/Sept1995, Oct/Nov 1995 & Dec ‘95/Jan 1996 issues), are very detailed and I list here some of the detail from it, and also from the Short Line Gazette article. The waycars were numbered from 60 upwards, and I have (after Derrell Poole) grouped them as follows: numbers 60 – 71 very little known; these may not have had the word ‘waycar’ – just the number in the normal position, and have ‘strap iron’ steps up to number 68. Number 69 (there is a question over the length of 69 as well – is it the rearmost one of the photo at Cascade?) had the box type steps (as my ‘extra’ drawing); 72 – 78 built from 1883 ‘ish., 79 more expensive than the previous ones – longer, said to be 14ft 10inches over the body (exc. verandahs)? Number 79 was said to have the word ‘Caboose’ replacing ‘Waycar’ and a removable lamp (which would be what I can a ‘pot’ lamp (read US oil lamp?)) on the center of the vehicle there was also a variation of the corners, they were made rounded instead of square, the radius was about 6" - scaled up from an HO drawing. The last numbers of DSP waycars were 80 – 82. Finally there were 2 of these vehicles owned by the Colorado Central; these had the words ‘COLORADO CENTRAL R. R.’ on the letter board, and ‘WAYCAR’ on the body – one number was 25; it had the curved handrails (US – corner irons?), according to a drawing by Derrell Poole.

The Ron Rudnick book has mentions of them (nothing else), and from there the following information has come – first Colorado Central – built Oct & Dec 1883, numbered 26 & 27 (but see above – this is what I mean re conflicts!). Now to the DSP, the Union Pacific controlled the DSP from Jan 1<sup>st</sup> 1881, and in 1883 3 caboose were built with the numbers 76 – 78, in 1884 numbers 81 –82 were added. By 1885 the ‘*Official Railway Equipment Guide*’ listed the caboose as numbers 60 – 79, this list as of ‘Jan/Feb 1884’. Finally there is a one line entry re some 4wheel flat/coal cars – these could be the under frame of wrecked caboose, with no body. I would suspect that the equalizing system was also removed from these vehicles.

The Union Pacific in 1885 renumbered them – how long it took for these new numbers to appear on the vehicles themselves is not known. The new numbers were 1500 – 1520. The colors of these vehicles could be white, straw yellow, and possibly caboose red. There is mentions of red, thought to be boxcar red, but George Sebastian- Coleman thinks that caboose red is more likely, as black lettering will show up on that color, but not on Boxcar Red.



Now to the vehicles and some (minor) variations in them. There are 3 different end doors, which could be as a result of repair or renewal. I have added small drawings of the other two to the C. Brommer drawing. I have also drawn the 'box style steps as well – in my opinion these will be stronger and less likely to be damaged than the strap style step; they also should have been safer for boarding the waycar. Perhaps that is why the change was done? Mine will have a variation of the 'box 'style steps. The C. Brommer drawing has been enlarged and seems to have no distortion were I can check. The side windows were in two sections; on top of the main window was a small section towards the outside, the main lower window slid upwards behind this top section – the same system as coaches used. Derrell Poole shows a window with a 'cross style' glazing bar – this had no opening section. Number 64 is said to have had special vertical handrails; later there were two sets of end handrails, one set being on the end of body.

Number 72, which was built by the Union Pacific, did not have a set fitted on the body. Later the 'curved' shaped style (which seemed to have become the standard design for caboose) was fitted and these continued into C & S days. The C&S had to do a lot of rebuilding of these now very old caboose: that included the new under frames, with working air brakes being fitted, cupolas fitted in two positions; etc., but these are all 'out of my time'.

Photos - For those that have the Mineral Belt books, in Vol.2 (yellow cover) on page 178 there is in the upper half a photo at Breckenridge. This shows what I think is the 'long' version in a dark color, it also has the 'box style steps, and has the curved handrail on the body side also included and 'not seen before' is a vent at the nearside corner – from a toilet? It is just poking up past the roofline. There is also possibly a lamp on the roof. Derrell Poole does show a lamp in his 'Outdoor Railroader' articles, set centrally on the roof, but it is a different shape!. Also in Vol. 2 there is also a photo of Hancock Station, on page 308 (top) with a dark color waycar on the extreme right hand side – the far handrail appears to have been damaged at some time and bent inwards. This is possibly also one of the longer waycars, and has vertical handrails on sides, and on the end balconies only.- no curved handrails on the body.

This photo is now available on the web; try Hancock Station as a 'search' phrase, the photo has a couple of consolidations in the center of the photo. The date is said to be 1885.

Particularly for C&S modelers there is an article in the magazine Outdoor Railroader (which is now called Finescale Railroader), in the Aug/Sept 1996 issue. This is about building a 1/24<sup>th</sup> scale version and there is a small drawing included. This drawing shows the rebuilt under frame, including the airbrake system. In effect a totally new under frame was fitted, without tie rods between a new set of pedestals (which held the wheels), of a different shape, in addition end ladders were required, and rooftop walk boards (like boxcars), and cupolas began to be fitted, these required new stovepipes which were taller to avoid those cupolas. In some cases windows were removed from the sides.

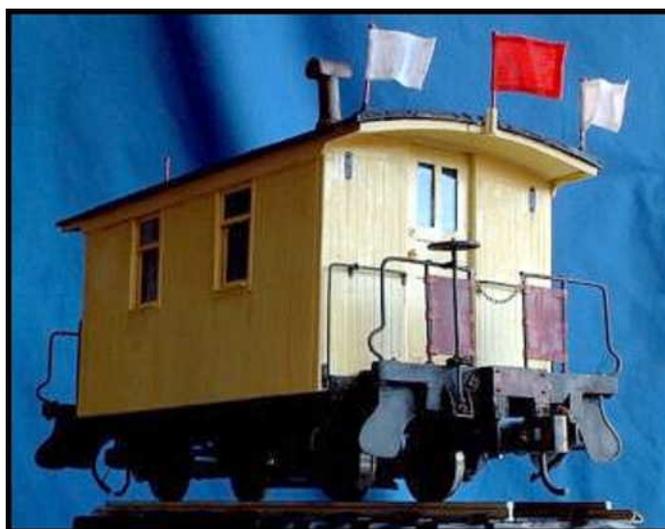
Could I also recommend the book, by Harry Brunk, published by Benchmark Publications, on his HO narrow gauge layout titled 'Up Clear Creek on the Narrow Gauge'? This has a number of chapters on the C&S versions of these vehicles; I have included in the drawings a part of one of these drawings, with permission.

Finally there is also a C&S drawing, shown as 1006, in the Carstens Publications book – 'Slim Gauge Cars', on page 77. This drawing is of the vehicle said to be at Silver Plume; I think this is now at the Colorado Railway Museum, and is shown with the 'late version' under frame& air brake. This drawing is the same as the one in the Outdoor Railroader article.

There is a good selection of C&S photos of these waycars, in the book 'Narrow Gauge Pictorial' Vol. 8, which has some 33 pages devoted to them. These are all C&S photos, and all have cupolas. Etc; however there is some good details in there.

That concludes my very short history of these little cars; it only applies to up to approximately 1885 or so (there are little bits past that). It is not intended as a complete 'rundown' of them, and there is a lot missing especially of their time with the Colorado & Southern. For that period & other information I suggest the 3 articles by Derrell Poole that I mentioned earlier and the Narrow Gauge Pictorial book are acquired.

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## Construction

This waycar is some 13ft long over the body; with square corners, which I built first, with the under frame being attached to the completed body.

We have been allowed to provide the drawings originally done by Charles Brommer, Harry Brunk and others. These have been supplemented with some of my own sketches to aid construction. Please download the entire PDF set of drawings for this project here and refer to the along the way.

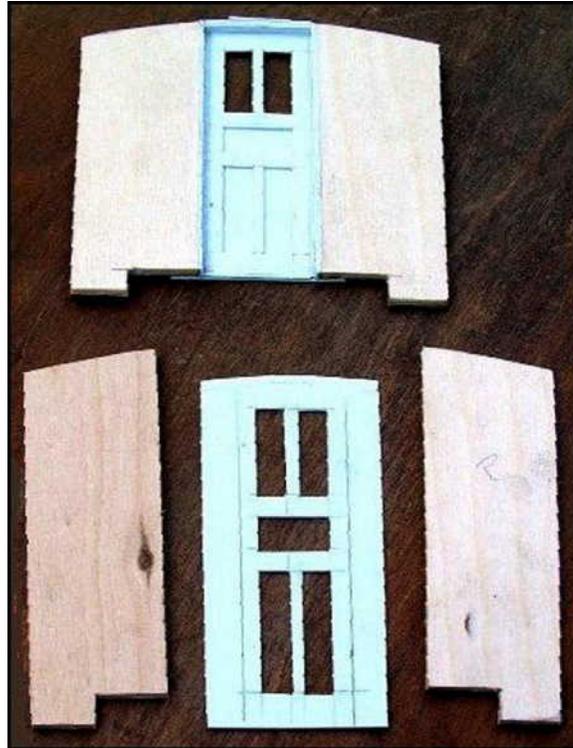
### [Download Waycar PDF's](#)

The construction is of an inner body, made of 1/8<sup>th</sup> inch (or 3mm) plywood, which is covered all over in planked plastic card, having a 3-layer roof. A point here – remember to allow for the thickness of your planked plastic card (for the exterior) when marking out; you will need to allow two thickness' worth. The sprung under frame is one that I found over here in the UK, as are the wheels, which are unusually large for American freight vehicles; mine are 31mm; the drawing has 34mm diameter ones. There will be a cosmetic outer (prototypical), under frame that will hide my under frame. The under frame will be made second, and I therefore start with the body.

Let's start with the ends, made in three sections, 2 of plywood with the center section (which is the door), made of .030 plastic card, with an inner layer of the same. The two layers are required; because the doors are paneled - choose your door design from the 3 available in the drawings. I have added to the magazine drawings with some extra ones that were needed as I was building. The plastic card pieces are made larger than required being approximately 2" wide with the door in the center– do not forget to scribe a groove for the edge of the door. Then scribe another line not so deep – this will be where the plywood panels, which will have an edging of plastic will be glued up to.

The paneled (second) section is only fitted to the lower part of the door, at the back, leaving a ridge for fitting the 'glass'. For this and the other windows I have used sections from old & broken CD 'Jewel' cases – this clear styrene sheet is 50 Thou thick – nice and strong and large pieces are not needed; the maximum is 2" x 1.5" and this will be nearer to 1.5" square when complete. For the end doors you will need two-

pieces 1.25" wide x 1.5" long; cut them and store them in a safe place they will not be fitted till the end of the painting. Glass can be used, but I prefer something that will not shatter. You do not have any broken cases? – They can be bought by themselves and in ones, quite cheaply, and there will be lots left after this vehicle. I am going to try this styrene on larger pieces for 1/20<sup>th</sup>-shop buildings in due course with their quite large windows.

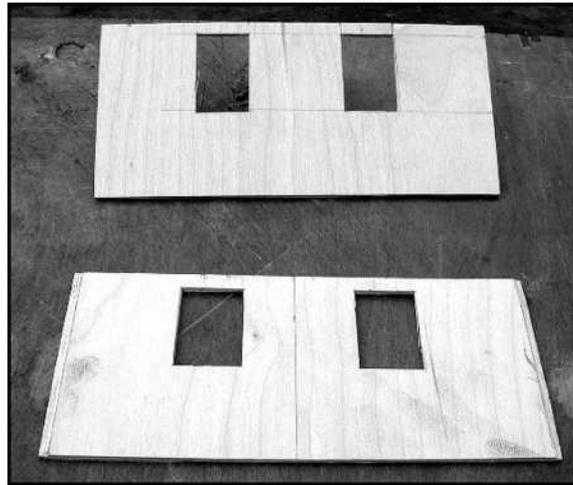


*Photo of the ends, the upper one is assembled, the lower one shows only the upper (paneled) piece for the door.*

The two outer end pieces are cut next; make a pattern to ensure that they are all the same the radius for the roof is 12.5 (scale!) feet. Note that the bottom has a cut out part; this is for the main 'end-to-end' frame members to run through and where the floor planks at each balcony end will fit. I cut my ends to fit into a single ply rebate cut into the end of the sides (this was done to give a greater area for gluing the body carcass together), and in addition I allowed for some .030" strips of plastic card to edge the door frame. Cut all four & true them up to your measurements. Now put them to one side and start on the sides.

Nice simple rectangles for the sides, but the windows need to be marked and then cut out. First add to the window size 1mm extra all round – this is for the strips that will line the window aperture later. Be careful at the top edge of the window, it can be rather weak; you cannot use too much force cutting out near there. Mark out the sides off the drawings; onto the plywood, and in the window rectangles drill through at the corners after marking their location with a small drill; mine was about .030" but the size is not critical; this will give you the location of the window corners on the back, and allow you to cut the windows from both sides. Then scribe the window shape on both sides; the holes will stop your scribe at the corners. Leaving the sides on the sheet, cut out the windows; to assist with the corners, in addition to the drilled holes get a sharp narrow (1/4 inch or so), chisel and with the tapered part facing the inner 'waste' you can cut through at the extreme corners, done carefully it saves having to cut the corners, and helps re that possible weak point at the top. Then cut through the rest of the shape with a sharp Stanley type craft knife and a steel rule, working carefully from both sides. When the window cuts are complete you can cut the sides from the —

sheet and if you are cutting the single ply rebate at the corners do it now – ON THE INSIDE! – Again you can use a chisel for this but be careful with it, and work away from you for safety. Finally some marking out is needed, again on the inside: near to the top, say 15mm down, mark out the sides and ends with a line – this is for some plastic card scrap about 20mm long to be fitted in the corners (see below). In addition mark a line for the floor, (which will also be 3mm ply), this line needs to be some 10mm up from the bottom edge of the floor. On to this line fit 4 pieces of strip wood to which the floor will be glued. When in position it should be level with the end cut outs, which are below the central doors.



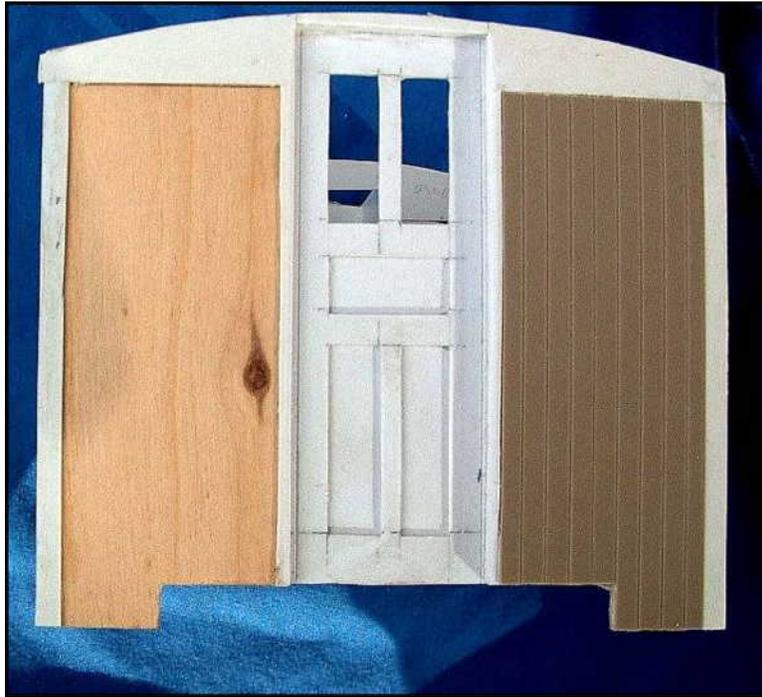
*Photo of the sides (it is in black & white, I was experimenting) showing the cut-outs for the windows.*

All finished – you should now have complete sides, and the ends in 3 bits each; glue the ends together: there is very little ‘clearance’ above the door; in fact the door virtually touches at the outer corners of it. Glue all together ensuring that the cut out in the center is 75mm wide – the main under frame beams will fit here and the end balcony planking will also go here later. Do not forget to leave space for the plastic card edges to the door – these later will be ‘rounded off’. I use UHU, which is a West German clear glue to fix the ends together; you will no doubt have your favorites. When dry, construct a small ‘infill piece’ for above the door and round the top of to match the roof curve. Now glue the sides & ends together, clamping the assembly till the glue dries. Before releasing the clamps fit some square strip wood in the corners, but allow for a right-angled triangle of plasticard, (mine are 25mm wide, and .060" thick), to be fitted in the corners near to the top – this is to make quite sure that the body is square! Fit in the 4 triangles in and some scrap pieces underneath to add to the gluing area, onto the line as I mentioned above.

Now the floor - a rectangle with two small cutouts in the center at each end (to allow for the plastic card inner door panels), there is no need to have these cut-outs closing the gap; in fact they would be better with a small gap. This will allow air pressure to equalize itself inside & outside; you must have an air passage to stop any ‘bowing, though it will be unlikely I think. Glue the floor, onto the 4 pieces of strip wood (using wood glue), and when dry you can release any clamps that were holding everything square. Your (inner), body should now be complete and quite strong. To endure all is stable spread along the edges of the floor more glue – you do not want it separating in the course of time. Glue can be added both inside and underneath the floor as well.



against; it comes down to just below the upper edge of the window cut outs leaving space for an .020" strip, which will be fitted later. Now you can plank the sides – I needed two pieces per side because the area it wider than the planked sheet; be careful with the join and it will not show. Leave all to dry.



*Photo of the end part clad, showing the plastic card edges to the plywood end panels, and the white corner pieces.*

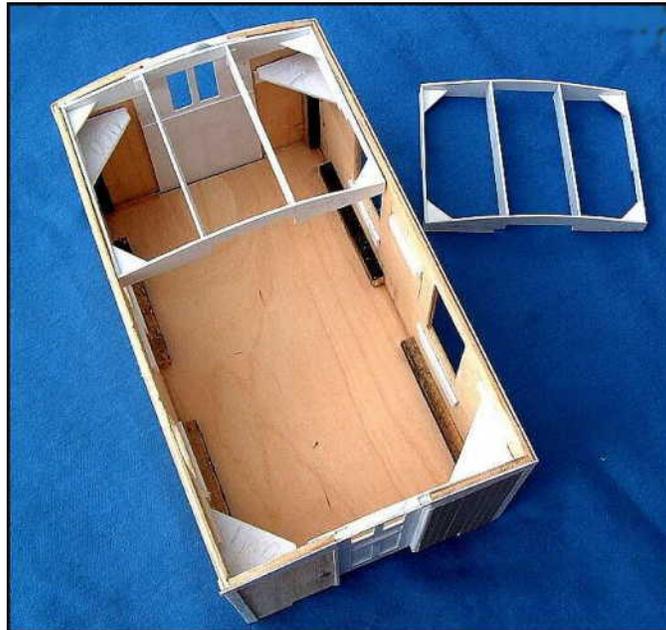


*Photo showing all the body now clad (note the join in the cladding sheets), the letter boards, and the internal reinforcing pieces, and the horizontal strips for the roof to sit on; the pieces for the window glass to sit on. The letter boards have their internal end filler (planked) pieces fitted.*

I found that the planking was not defined enough in this scale; to enhance my plank lines I ran an ‘Olfa cutter’ (or ‘skrawker’) down the lines to add some definition. Not too much though you do not want individual planks as they might fall off! Letter boards– these are ‘very fiddly things’ especially the very weak ends before some assistance is given to stiffen them. First cut them from .060” sheet (or 2 x .030” & laminate them) as the drawing. When both are cut also cut some arc shaped pieces for the outer ends of —

the balcony verandahs at 3mm deep and again .060" thick; this time it is preferable to use two pieces because one can be cut to fit inside, and the outside the corners; again these are to 12.5ft (scale) radius. Now glue onto the body sides the letter boards, and be careful of those projecting ends; then glue the arc shaped pieces onto the outer end, you may need some tape to hold the joint together whilst the glue dries. Next cut some planked sheet to fit into the rectangle that is between the body end and the balcony roof end – the planks run down the length of the body; this needs to be curved (bent!) and glued in. I used some small square strip underneath the projecting bit of the letter board ends to give a greater gluing area. Now, at last, the ends are quite strong, to assist this strength some more add another square strip underneath the arc shaped end piece to again provide a greater gluing area – nice and ‘stiff’ now, to be made even better towards the end of the body assembly.

We now need a roof; invariably these have a tendency to dip in the middle so I decided to make a three-part roof, with the inner part fitting inside the top of the body, and then 2 layers of 1mm thick plastic card, which are the roof ‘proper’. I could not fit a central end-to-end stringer due to the very small clearance above the end doors. The first inner roof has 4 arch topped pieces of .030” plastic card as formers for this inner roof. They are joined together with 4 lengthwise pieces and all of the square joints strengthened with corner fillets. This inner roof will need some trimming to fit around the end doors and the windows, this will require some of the lower edges removed; it will not affect the strength of this part, which will be glued to the two upper layers.



*Photo showing the roof formers – these two will be joined together with more stringers, and are then covered with the first (thin - .020) roof sheet. Note the cut-outs for the door; the same thing is needed for the windows as well.*

The two upper layers can be ‘rolled’ over the edge of a table to form the very shallow radius – ensure that the ‘grain’ of the plastic card runs down the length, otherwise you will have difficulty curving it – how do you find the ‘grain’?; - bend it between your hands before cutting, one way bends easier than the other. You may need to buy large sheets – the roof is over 10” long on my model. I glued these two upper sheets together with UHU, and then these two to the thinner one with Plastic cement – note the holes in this sheet that is to allow you to have a greater area for gluing, a brush full into each after gluing the outer edge. When dry paint the top of the roof with any old preferably a dark color, enamel paint – and immediately sprinkle very fine sand onto the surface = a nice rough roof, without the aggravation of trying to stick —

sandpaper/emery paper down around the edge. Give it another coat (or several – to build up the color), of your ‘weathered’ roof color(s) to seal the fine sand in. DO NOT use your best brushes – they will be ruined!



*Photo of the roof, part way through weathering it . Weathering is with earth/dark brown, and rust colors. I think that some more work is needed, with more colors.*

## **Stove Pipes or Chimneys**

I made mine from some 8mm tube for the main pipe and 12mm tube for the larger piece at the bottom; fill any space between them with a strip of .010" and then glue all together. The inner (smaller) diameter piece is 37mm long, and the outer piece is 7mm long, at their longest (before the slope is cut). When dry, fill the top edge of the space between the tubes with filler, finishing it off to a slope, and cut the bottom edge to the curve of the roof, and then fit a 16mm diameter (.020" thick), disc on the base – this will represent the flashing around the tube/roof join. I have made the tops from a half piece of tube. The edge of these pieces has had the edges thinned down on the inside. A final ‘thin’ cover is a piece of paper My stove pipes were made from (unused & discarded), syringes; I have given the measurements and diameters for those that do not have access to such things. It is fitted 60mm in from the end, and 27mm from the side. Ensure that it sits square in both front and side view, and if required fill the bottom edge to get it right; mine was done twice before it was OK.



*Photo of the two stovepipes – made together, (this is a ‘CRUEL’ close-up) they are only just over 30mm high, one is painted and in position, the other shows how they are made. The cover to the top is a small piece of an (old) heavyweight brown envelope.*

Back to the body, which now needs some detailing adding to it. First edge the side windows; these edges are still raw plywood, add some plastic card strips (I used .020") to the all the edges the upper one should be hidden behind the letter boards— you did allow for these strips when cutting the windows didn't you? – If not cut them 1mm larger now, and then start to fit the 3.5mm wide strips into the window cut out sides (and top & bottom), over the exposed plywood, do not fit the bottom edge piece before sanding that edge to a slope to allow the fitting of a windowsill later. I used UHU glue here. At this point, after looking at photos I think that Mr. Brommer is wrong on his drawing; there are ‘capping strips’ both covering the edge of the body (the plywood), and on top of the planking, the drawing seems to show just the cover strips for the window aperture. These strips (on top of the planks) are again .020" thick, cut at 2mm wide – fix the two vertical edges first then between them fit a 5.5mm deep (.030" thick), windowsill, (which will project slightly), then at the bottom under this sill fit the last strip. These strips should also cover the ones just fitted (covering the plywood edges), when all is dry sand the join between them so that it disappears. There should now be no edges of plywood left except for the bottom edge, and that can be sanded smooth, and in due course painted.

Time now for the handrails, of which there are 3 variations. The first is for the early vehicles, with the separate steps, which had strap iron strip fixings, with these the lowest step was extended towards the center of the waycar. This style had a short vertical handrail on the side of the body as the Charles Brommer drawing. I originally modeled this style, but later realized that for my model it was wrong – a change was instigated! The second style has what I call coach style steps; these have enclosed steps and have a right angled handrail on the end of the body at each side; these were for the brakeman (conductor?) to grab in addition to the (all styles) handrails on the end beam. The third style, which may have a simplified step design and is the Colorado & Southern style had in the body side an arc handrail as well, I have drawn this handrail, but there were variations in the length and arc of it, from photos that I have.

The first style of handrail can be made as follows. Mark, and ‘center pop’ for the holes on the sides – they are just inboard of my corner pieces, and drill them to your wire size. I have fitted short 33mm long, vertical handrails. I first used some .060" steel rod, but this looked to be too thick (scale 1.25 inches diameter plus a bit for paint), then I substituted .050" piano wire instead; they look better (scale 1" diameter). This wire is extremely stiff, for the end balcony handrails I will use the larger (.060") K&S brass wire, which will be easier to shape! When all the handrails are done fit them but DO NOT glue them in: fit at the top and bottom a NBW (nut, bolt & washer) casting. In the USA you have ‘Grandt Line’ (I am not certain they make the size needed). I used the Cambrian Models version here in England. Then remove and save the handrails (of which style you have chosen), for fitting after painting.

My replacement handrails are to the second style, (for the steps see the under frame chapter), which are fitted to the end of the body, they are an upside down ‘L’. The longer (vertical), portion is fitted close to the outer edge of the body running from just above the bottom edge of the body; they fit into the corner post and must not encroach on the body as the sides of the steps are very close at this point. The handrail is 40mm long vertically, and 35mm wide (horizontally) plus some for the bend and also some for the right angled bends that turn the handrail ends for fitting into the body. I again used .050" piano wire; on the horizontal part there is an additional fixing, which is 8mm in from the bend (from vertical to horizontal), this fixing could be a ‘handrail knob’ if you have some 4mm reach ones. I did not so they are made from twisted .025" copper wire (in the UK 15 Amp fuse wire), ensure that the hole for them is drilled at the same time as the other holes, the inner one being just outside the rounded edge to the end doors. Thread one extra handrail fixing on before the handrails can be glued in position, or stored for fitting later. When these ‘body end’ handrails are fitted they need some tiny pieces (2mm x 2.5mm x .010") of black plastic card fitting to the bottom edge of the two horizontal fixings and upwards on the vertical part at its lower end. These represent the fixings for the handrail, round off the outer corners, and make a ‘V’ that fits against the handrail and glue in position. Fit to each a piece of .030" rod to represent the fixing bolts, with two on the vertical one.

The handrails can be painted black, or a longer-lasting idea is to use 'GunBlue', which will chemically blacken them, it will also work, though more slowly, on brass wire. Be careful with this stuff; follow the instructions, it is a powerful chemical. Eventually there will be a handrail, on the outer end of the balcony, as well, for those the under frame needs to be built.



*Photo of partially painted body, with a couple of (different thickness) handrails, and one fitted. The roof is shown upside down with the .020" roof being uppermost – the holes are for extra gluing points. The roof will finally be glued in position. The interior has had its first coat of black.*



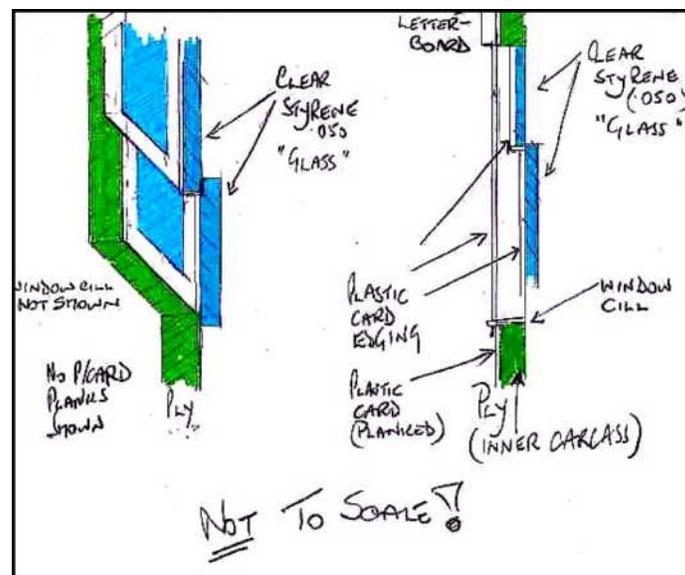
*Photo of the new handrails, showing the fixing bolts. Taken much later in the build, some weathering can also be seen on the balcony and the end.*

The inside can now be painted, including the floor, (both are black in my case), and when dry the exterior can also be painted. First use an undercoat on the exterior – mine will be painted what I consider is a match for Union Pacific Straw Yellow; I looked at the Humbrol paint called 'pale yellow' – it looks like pale yellow ochre – not good! I eventually settled on the Humbrol 'Linen' color, ref. Number 74, and have used-

that; being such a pale color the undercoats will even out the different (plastic card) colors, before the top color coat goes on. The 'new recipe' Humbrol paint is well known for being very thin and not covering well, therefore the body will be painted in (undercoat), white, and (intermediate coat), pale yellow on top of that, before the top color is finally added. Finally when the vehicle is complete I will add some 'light' weathering to the body; the ends and under frame will have a greater amount of weathering.

The side windows are now fitted, made from the styrene used in CD 'Jewel' Cases (not the polythene ones!). I found when cutting this clear styrene that quite a considerable 'lip' is raised by the cutting; this can be reduced by either using a 'skrawker' (MicroMark – plastic cutter), or by dragging a reversed heavy knife blade across the intended 'cut line' to start with. In addition cut/groove both sides of it. This 'groove' which can then be deepened with a knife, and then 'snapped' apart; when cutting is complete ensure that all the 'lips' are removed, as failure to do so will mean that the styrene will fail to 'seat down' properly.

The small upper windows are made first and the edges, including the bottom edge, are covered with .020" plastic-card to represent the frame. Be careful with the glue – I use water thin liquid style and a fine brush to apply it. When all are done they can be glued in, the back of them being level with the inner edge of the plywood; to ensure that they will stay in the correct position fit a very narrow strip at the top of the (inside of) the window aperture. This needs to be inside the body width, because the roof will be glued down here. When these top windows have dried in position, the lower section, which slid up inside the top windows,(like coach windows), can be fitted. These are also made with pieces of clear styrene, and fit onto the 'scrap plastic piece', which is fitted below the windows, inside the body; I used clear glue (UHU) to fix them here. Then fit to the bottom & sides (none at the top – that is hidden by the upper window), strips of .020" to represent the window frames. When all are dry paint them the same color as the body, any paint that gets onto the glass can be gently removed when it is dry with a sharpened wooden cocktail stick, used like a small chisel, to lever it off. Using this wooden stick should not mark the styrene. To assist in covering any marks on the clear styrene, after removing them I use a coat of Future Floor Wax (inside and out), put it on with a brush, and let it dry overnight; wash out your brush in water. If you need to remove this coating 'Household Ammonia' will take it off – beware of the smell! Your windows should have an extra gloss after using the 'Future' Aero-modelers use this stuff on airplane canopies to make them shine.



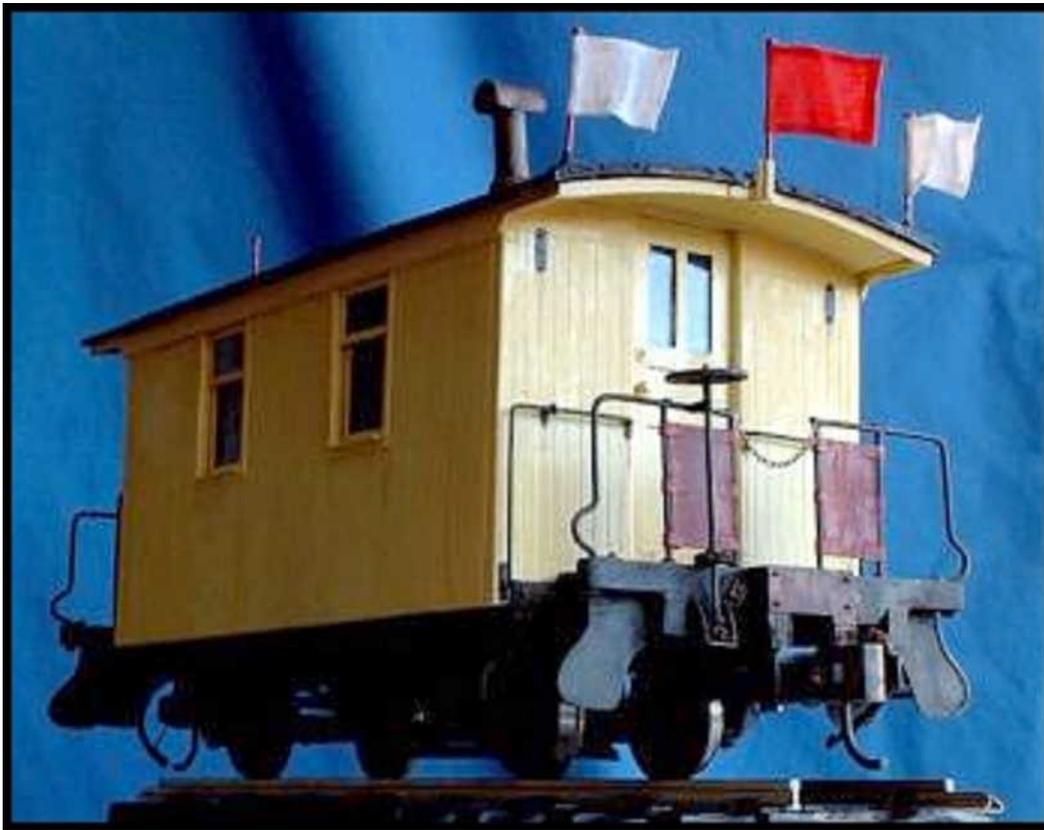
Side view drawing of window, showing relationship of window sections to plywood inner carcass. Ply is colored green, clear styrene is colored blue; plastic card left uncolored.



*Photo of the body, ready for a topcoat, with the windows fitted. The end door has been painted with topcoat already, and one handrail is in position. The interior paint will need to be touched up!*

The body is now virtually complete, except for fixing the handrails (if they were not fitted earlier), and transfers (or decals) – for these see later in the under frame chapter. For the doorknobs on the doors I have used a couple of gold painted ‘glass-headed pins’. You can also add a couple of keyholes from small discs of either gold foil or gold painted discs – add a small vertical line for the keyhole. The body color choice is yours – they can also be white, or caboose red; all have black lettering, some of these waycars had white shading to the lettering. I have a sheet of decals for this waycar from Larry Larsen: BUT they only include one number – 60, so you will need to find another number if required. These decals I believe were produced from the Charles Brommer drawing, and the side lettering is rather small, I have expanded on this in Chapter 2. The waycar numbering starts at 60 and runs to 82 (DSP numbers), further details are in the ‘sources’ I mention in my ‘potted history’ article. Do not fix the roof, then you can turn the body upside down and fit the under frame to it, when that is complete, the fixing of the roof will finally complete your model, but that is for later. The under frame needs to be added first.

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## **The Car-Shops: Project II - 2003**

### **Build a Denver South Park & Pacific Waycar Rolling stock in 1:20.3 Scale**

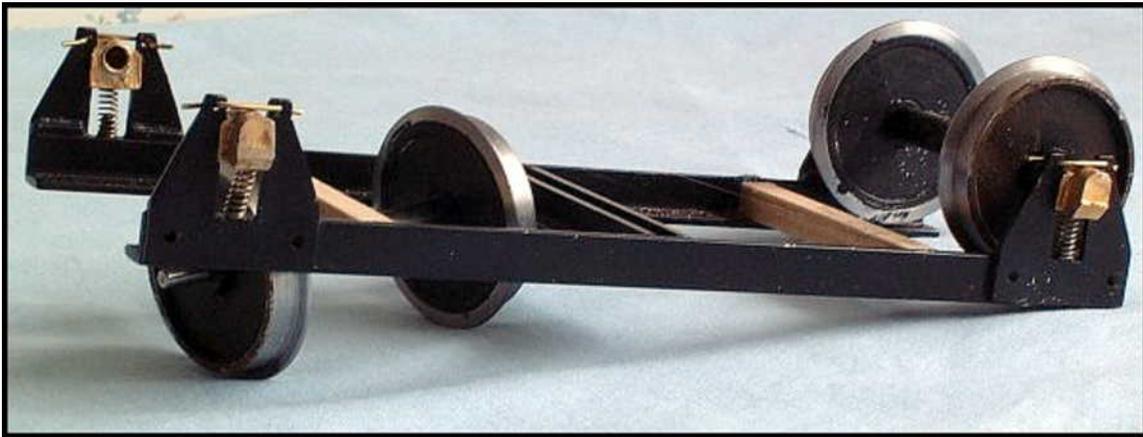
**By Peter Bunce - United Kingdom.**

**<http://mylargescale.com/articles/articles/carshops/waycar/waycar01.asp>**

#### **Chapter 2 - The Under Frame and Completion**

This is where the compromises start! Any under frame in any scale has to accommodate out of scale components – as a result they cannot be made totally to scale. BUT we can have a good try, doing our best to have to outer (viewable) parts to scale at least! My chassis is built onto the upside down body, which is why the roof was been left off at the end of Chapter 1; the model can be kept upside down quite easily and safely. I have made a supplementary drawing for various bits of the under frame as I made them; the main drawing is still the one by Charles Brommer. I have drawn out some of the patterns that I have used in this under frame and they are shown on the drawing ‘extra\_for\_Underframe.PDF’, to assist builders.

I was very lucky because I found a sprung commercial chassis that is virtually the correct length (out by 2mm), and it would fit inside the main (outer) chassis members. It is made from heavy section brass angle, with brass horn plates added. There are coil springs for suspension. I have taken a photo of it for those who wish to make one for themselves.



*Photo of chassis, with one set of wheels out, note also the extra wooden beams; the brake shoes will hang from these.*

Right at the beginning of this ‘build’ article, I said that the wheels for this American vehicle quite large. I have used some (English) wheels by a company called Tennille; they are 32mm diameter and they required some plastic card discs back and front to cover the spokes but that is all.



*Photo of the end of the under frame, showing outer & center beams and the extra beams for the Kadee coupler. Also, one of the pedestals is shown.*

The outside chassis members – main body bearers - are 15mm x 6mm are cut to size from the main drawing, and any work to ensure that your chassis fits is done on the inside face. I needed to thin the width down slightly inside, to allow my chassis to fit inside. These end to end chassis members are longer than the body; they extend to the outside face of the end (cross) beams, and support those beams as well, cut out a piece from the top of these main (body) bearers beam to accept these (end) beams. They are also the supports for the end balcony (planked) platforms. When these main body bearers have been cut to full length with the end cutouts (which are on the upper edge) to accept the end (cross) beams glue them to the floor and against the edges of the cutouts in the end panels; they should be 75 mm apart over the outside faces. Ensure that your chassis will fit inside (if using the same sort of idea as mine).

I made my end (cross) beams in pieces (they are 12mm x 8mm in size), and all were glued together. In addition to the Charles Brommer drawing style there are other designs for these end beams. See Mineral Belt (green cover page 163) and Narrow Gauge Pictorial (Vol. 8, Page 114 on, this book has photos of C&S versions) and also the articles by Derrell Poole in Outdoor Railroader magazine if possible. The 'bumper' plate glued on after getting the beam shape right, then this bumper is covered with a piece of .020" plastic card to represent the steel plate covering adding the 4 square bolts from plastic card.



*Photo of the top of the end beams showing the balcony planks (.060 plastic card), and some of the fittings on the end beam (yes I had to add the bits at the end!).*

On the end beam itself and close against the central block are the projecting ends of the tensioning rods that on the prototype ran full length under the floor, and could be tightened when they became slack. The (prototype) ends were threaded; my model has a round (7mm x .030") washer plate, then the square nut (2mm square and deep), and finally the end of the rod. (2mm diameter and a short length – which would be dependent on how much it has been tightened up – mine have around 2mm showing). This 'non-working' assembly has 2 of these nut, bolt and washer units per end, made from plastic card. It is quite a simple shape. Later (in C&S days) the washer plate especially was much more complicated, and the end beam gained grab rails, coupler lift bars, ladders etc. as well. My (one of the early versions) end beams can be seen in the above photo. Now drill the six holes (.060" clearance) in each beam for the handrails as depicted in the drawing. The handrails will be made later. When they are complete glue them across the ends of the main body bearers, and into the cutouts; they beam top should be slightly (by .060") proud of the main body beams.

Moving back to the main beams, they need the pedestals (in the UK called Horn plates) fitted. In the USA you have some sprung pedestals, which could possibly be used (made by Ozark), but I think they may be to 1.22.5 scale. I can only suggest that you check the drawings against them, or possibly see if the ones from the soon to be released Hartford kit can be bought separately. Otherwise they are easy to make; if you use an internal chassis the pedestals are cosmetic; the vehicle has a short (9ft) wheelbase, possibly these vehicles could be un-sprung? Another possibility is the same system as the little Bachmann 'bobber' caboose – that has a slotted upside down 'U' shaped piece of steel that holds the axles, that have a very small amount of 'up and down' movement by means of a vertical slot. The complete assembly can be fixed to the floor with two screws.

I have fitted a cross piece, between the main beams, where my chassis ends; these are 14mm in from the end of the body. Between these and the end beams there are two more beams, which are 8mm deep and 56mm wide (the same as the end beams). Glue these in position and then add two more pieces at each end to the same dimensions but only 55mm long with the inner end being cut to a 45-degree slope. On the prototype the coupler fits between these (extra) beams. I found that using Bachmann (truck-mounted) couplers a Kadee coupler box needed to be fitted below these beams. If necessary set them slightly wider to accept the Kadee 'box. The outer end of these (extra) beams runs under the end beams, and is just a tiny bit 'proud' of them.



*Photo of a pedestal – this has the main .030 layer colored grey, to show the outer added edge, and the three bolt heads as well.*

I have also made a 'full size' drawing' of this 'base layer' part, on the under frame drawing. The added 'edges' are from .040" x .020" plastic strip, which I found can be bent round, gluing as you go quite successfully, occasionally it will break, if it does cut it back to a less curved area and join it there. The 3 square bolts are pieces of .060". When complete glue these pedestal fronts onto the main beams, the upper edge of the axle box slot is level with the lower edge of the main beams.

Inside these are the (cosmetic), springs – made from .030" plastic they have four leaves, 50, 40, 35, & 30mm long, check the width you need: mine had to be slightly less than the drawing and needed a semi-circular piece removing at the back to allow the coil springs clearance for moving. Finish them off with the spring holding band in the center – 5mm wide of .020" plastic-card, fixed in front and on top of the spring. The axle boxes are next; make a pattern for the sides, (. I have made a small drawing of the side of the axle box, including the area between the 'pedestals') the vertical line on the side is where the pedestal fits; add a piece of .040" x .020" to represent the axle box slides. This drawing is less the thickness of the plastic sheet (top & bottom, and sloping front), and build up. I made mine from .020", as they needed to be hollow to allow for the sprung axle boxes on the chassis. Each one has some 12 pieces of plastic in it, and I made all 8 (for 2 waycars) at the same time! Once started I might as well finish some of the difficult bits all at once. All the extra pieces are shown, with the face for their application shown by the arrow(s).

The curved 'scroll' ends on the outer end of the cosmetic springs can be made next, these are rather small, and have a very sharp bend. I laminated mine from a center strip of .012 brass(to hold the shape), with a .010" (inside), and .020" outside plastic card strip glued on, when dry fill the outer edge, to make a smooth outer face. I used 'Tippex' typewriter correcting fluid (from the bottle), try it, and sand it smooth when dry. I have heard modelers express disbelief at this idea, but it works for me.



*Photo of the component parts of the 'scroll Irons' the lowest one has the 'Tippex' filler applied.*

The equalizing beams fit on the inner ends of the springs. I made these, which are of an inverted 'U' section, from .030" plastic card: make a pattern to start with and then cut 8 copies, two per beam, fit together with distance pieces of 2mm square, the upper piece goes onto the top edges of the sides. When dry round off the upper edges of the inverted 'U' section.



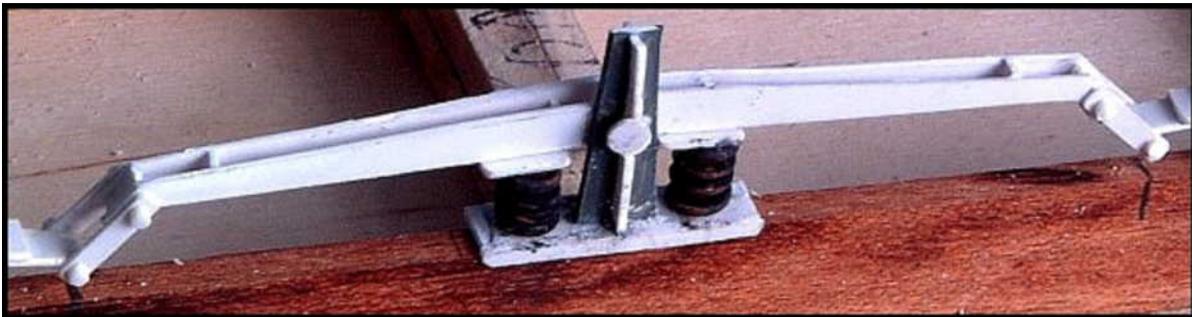
*Photo of the fully assembled equalizer bars (the top one has the 'swing links' fitted, also the spring pads, but no bolt heads). In addition there is a spring unit and the copper coil springs, which need to be 'trued up'.*

Whilst these are drying the 'swing links' – the small pieces at the end of both the scroll irons and the equalizer bars; can be made. All are from .020" plastic card; those for the outer 'scroll irons' are 8mm long and the inner ones slightly longer at 10mm long, lightly sand the sharpness off the corners, and fit two bolt heads to each using slivers of 1/16<sup>th</sup> inch rod about 1mm long. I fitted the short ones first, before fitting add a couple more 'bolt heads as the (C. Brommer) drawing to each scroll iron, then fix the swing links as the drawing, note that they almost touch the top of it. Put then on one side to dry, they will be fitted later. Move to the long equalizing bars with the 'turned up bits' upwards; to these fit the longer swing links as before. --

Make some coil spring pads that are fitted at the other (central pivot), end – these are .030" x 8mm x 6mm, and glue them on. The springs for the equalizing bars are from copper wire .045" diameter, and have 4 coils; they want to be 6.4mm high. Anneal the copper to make softer and coil around a piece of 2.5mm tube; cut to the approximate length, and file the ends flat and check the height – adjust them to be all the same. Do all 4 at the same time, fit them with a piece of tube to hide a ‘through view’, this represents the fact that I think they were nested (one inside the other), and store them safely till later. You can blacken them with Gun Blue or use paint later.

Before the under gear can be fitted a central pivot is needed for the equalizing bars; this is rather small, will not photograph well (I tried!), so I have drawn it on the ‘Under Frame’ drawing. The pad on the underside of the main body bearer is 25mm x 5mm with a 2mm deep edging, both made from .030" plastic card – this goes on the outside of the beam. The vertical pivot – nasty thing – have a look at my drawing – it is cross-shaped in section: on the outside is a small bit of capped tube on the front face to represent the pivot; it is made of .040 plastic card. Fix this vertical pivot off center, towards the outer edge, in fact just touching that edge as the extra bit (of edging), that was glued on.; glue it to the base plate and leave to dry.

When dry and get the assembled bits together and with the body upside down, beginning with the leaf springs, glue them on. Don’t forget to have all the bits upside down. The springs are glued to the inside of the pedestals, then on the outer end fit the ‘scroll irons’ and between the center pivot and the inner end of the spring fit the equalizing bars with the swing links wrapping round the inner end of the spring. The prototype has at the upper end of the ‘swing links’ a bolt, against which the spring can slide – this bolt is represented by the ‘bolt heads that were added earlier; the lower end also has a bolt, which was hidden inside a tube. I did not add either because they are virtually invisible, and as my suspension is non-working all can be glued up solid.



*Photo of assembled equalizer beams on chassis, and also showing the center pivot.*

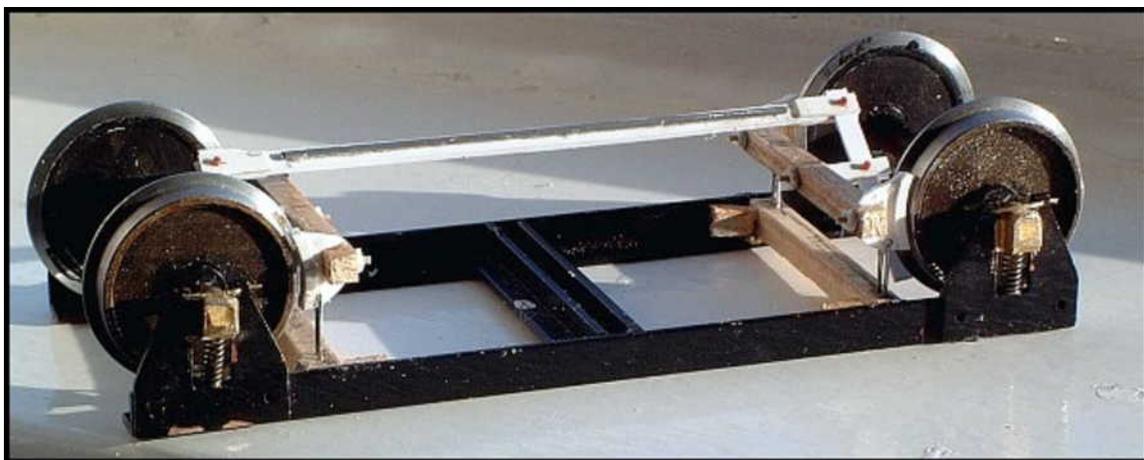


*Photo of the assembled spring, and the assorted assemblies for the spring ends.*



*Photo of assembled underside showing relationships of all the bits; the central hole for my separate spring chassis to fit into.*

Brake gear— made to fit onto my chassis. Brake shoes – draw on some scrap .030" plastic card a circle 1mm greater than your wheels, and then add another circle of 2mm greater diameter. Mark it out to 8 equal segments (divide the circle by 4 then divide the 4 to 8), these are the outer parts for the brake shoes. Cut both circles out of the plastic card so that you have the 2mm wide outer ring – this is cut into the 8 segments that form the front & rear of the 4 brake shoes. The center part is cut from .040" plastic card to the shape I have drawn out on the ‘Under-frame’ drawing. Use this to make a pattern; when ‘marked out’ center pop and drill the ends of the rectangular cutout part, and ‘part cut’ – it is totally cut out later. Carefully drill the hole for the brake hanger in the upper part; and the upper part of the brake shoes can be added, this will give some strength to the center part from which the part cut rectangle can be carefully cut out – this is where the brake beam will fit. Fit the remaining pieces to the rear of the brake shoes. For the ‘hangers’ I used metal paperclips, preferably those without the coating that some have. This wire needed is .035" diameter. Make four ‘U’ shaped pieces and thread them onto the assembled brake shoes; they are then glued into the extra wooden beams that I added to my chassis. Set them so there is a small ‘clearance’ for the wheels, which should not be impeded by the brake shoes, we do not want them ‘dragging’.



*Photo of the completed chassis with the brake gear virtually finished. This unit is fixed in position before I can add the remaining parts.*

Cut and fit two pieces of strip wood for the brake beams – mine are 5mm square; they should be 6 x 5mm but I could not find that size. They should project about 3mm past the brake shoes. Adding these beams will stiffen things up, ensure that the brake shoes are in a vertical position and also that the wire hangers are fitted into the strip wood pieces on the chassis. None of this assembly will take any force, so ‘superglue’—

can be used here. To the rear of the beams (facing towards the center of the vehicle), fit three 4mm diameter washers .020" thick, and then make three 3.5mm square nuts; drill the centers and fit 3 tiny pieces of .050" rod to represent the bolts, these are then glued onto the washers. The two outer ones should be behind the brake shoes (being the fixings for them), and the other in the center. This will hold (in due course) the diagonal pull rod that can be seen in my photo.

Working on the (removable) chassis, the brake rods – three are fitted to my chassis and are from .040" plastic card strip, with .030" pieces on the ends to represent the forked ends; make them to fit your chassis, using the large drawing. The long strip, which is 4mm wide, running between the wheels, will have a tendency to ‘droop’ – I have fitted a wire ‘strengthening piece’, which can be seen. Put this on one side and make the other pieces required. The (shorter) 3mm wide diagonal pieces are also cut to suit your chassis; I found that due to clearance reasons they needed to be shorter than the drawing (another compromise!) – the wheels ‘side to side’ movement is more than the prototype. Onto these diagonal pieces is a 12mm long ‘clevis’ is fitted in the center – made from 3 pieces of 3mm wide strip and finished off with a 4mm circular end piece – this will be the other end to the center bolt that was fitted in the center of the brake beam. When these two clevises are made they can be glued onto the brake shoe beams facing outwards, and at a 40 degree angle – make a pattern to get the angle correct, and ensure that both are the same way. When the glue is dry the short (diagonal) beams are glued to them with the clevis some 16mm in from the one end; now glue the long center beam between these ends. The other end of these shorter brake rods should be resting just clear of the inner face of the wheels. Do not forget that the wire-stiffening rod on the long (fitting between the wheels) rod should be on the upper face (which will be the bottom when the vehicle is the right way up!)

The outer end of those diagonal (end) rods is not fixed yet – they are at one end fixed to the under-frame, and the other continues to the brake shaft. Leave them till later. I now fixed my removable chassis in position, and fitted the hollow axle boxes over the cast brass ones. There is between the ‘pedestals’ a tie rod; this assisted in keeping the wheels apart (end to end) – when being both ‘banked’ and being braked. There is a possibility of crushing the under-frame, when the train was being banked and in these vehicles the equalizing system would have been destroyed as well – these tie bars assist in alleviating this. The drawing appears to show this as a flat strip. Plastic card in this situation will not lie straight for long, even if laminated; another compromise is made here then – mine is ‘U’ shaped with a piece of steel rod hidden inside (actually it is bicycle spoke rod! - .070" diameter), to stiffen it – I am not expecting a droop! The ‘U’ shaped channel (& rod) faces downwards, and is filled on what will be the lower edges; it is glued to the ‘pedestals’ and the rear of the central pivot point – hopefully they should be in a straight line. You can if necessary move the central pivot – use some extra liquid glue to release it and re-position it, then let it dry in its new position. When the equalizing beams fixings are dry glue some 3mm square (by .030"), bolts to the bottom of the ‘pedestal’ horns. Now everything should be all ‘locked together’: there is just a couple of cross beams, 20mm from the center pivot and on each side of it to add between the two tie rods. These are from .090" square (the same depth as the side tie rods), and have small fixing plates with bolts on the top and bottom; they fit on top of the long (horizontal), brake rod, and just be clear of it.

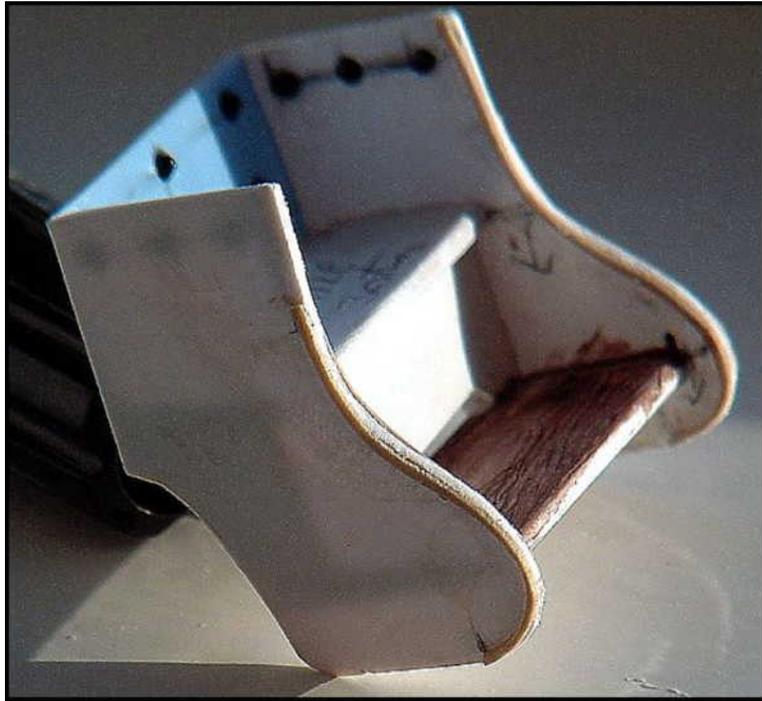


*Photo of the underside almost complete; I have shown the rod to the brake shaft, thought it is not yet fixed. One tie rod is in position, but again not yet fixed.*

Remember the extra brake rods that were ‘to be fixed’ – they can be done now – there is a short one that fixes behind the extra beams at one end (the left hand on the above photo). This holds all of the brake system still when braking forces were applied. It is made from bicycle spoke rod with the (inner end) having a forked end fitted, from .030” plastic card (file a couple of flats) for the card to be glued to. The outer end bent into a loop and this loop fixed at the end of the lowest (sloped end) beam with a piece of brass strip wrapped around the loop. Glue the loop to the inner under-frame beams it should be just inside the sloping end of the additional (for the coupler) beams. At the other end there is a longer rod that goes to the vertical brake shaft. Due to the compromise of a reduced length diagonal rod (which allowed clearance, for the wheels to move side to side – much greater than the prototype!) this rod need to be bent to have its end at the correct location, BUT do not forget the short length of chain! This chain is difficult to find in the UK – you need some with 3mm long links – and about 30mm or so long. This chain & the rod can be left till later, after the fitting of the vertical brake shaft; this will establish the bend that (may) be required.

Now that the very complicated under-frame is virtually complete, it is time to move to the end balconies, and the steps. The four sets of steps are next, I have chosen to fit ‘coach’ style steps, as they are stronger than the ‘strap’ style steps shown on the main drawing; from photos the coach style ones were used quite early. If you use these ‘coach style’ steps you will need a handrail on the end of the body; NOT the early (on the body side) style; these are used with the strap steps, which have a longer lower step, the extension being towards the center of the waycar. Mine have been changed! There were two styles of these ‘coach style’ steps, a ‘curvy edge’ version – which I think would have been the DSP style, and a later (?), style with straight edges –this style being quicker & cheaper than to make than the ‘curvy edge’ style. In C & S days both styles can be seen on one vehicle.

I built my ‘curvy edge’ style from .030” plastic card – make a pattern of the outer sides; and use that to cut all 8 that are wanted. There are drawings of both styles on the ‘extra steps for waycar sheet’ the pattern can easily be made from this drawing. The edges of the sides have some reinforcement that looks like half round strip fixed to each side of the outer edge. The left hand and right hand pieces are different, they are almost mirror images. The outer half round pieces go up to the end beam, and the bottom of the side respectively, the inner ones (on both) go to the top; all start at the same place, just after the bottom curve has stopped. I used our local suppliers (.030”) plastic rod, reduced to half round; this is quite flexible, and can with a small amount of pre-curving (around a (modelers) paintbrush handle), be glued on in stages without breaking. When complete, true up the edges with a file so it is smooth.



*Photo of the step unit complete, the slots in the backing to the steps is one of the variations available, there can also be a simple 'side to side' slot or no slot at all.*

The step boards are made of a lamination of two (.030"), layers – glue them together and round off the front edges; and add some 'grain' – I used a section of a Junior hacksaw blade, but you will have your own method I am sure. The two back plates to the steps are different sizes – the lower one is 10mm tall and the upper one is 12mm tall. When all has been glued up, add the 12 'bolt heads' to the inside. The completed units can then be glued into position on the outer faces of the deep main under-frame beams. The planks on the end balconies are made from .080 plastic card, and are 78mm x 5mm, except for the inner one which has an extra piece to fit inside the recess in front of the end doors. Add some 'grain' to the upper face of them. Glue them onto all four end beams – they should extend over the edges of the steps by about 1mm on either side; there should be approx. 2mm gaps between them, adjust them to have all the gaps equal.

The end railings were done next, I used brass .060" (1/16<sup>th</sup>) K&S wire, as this is easier to bend than steel piano) wire. Using a pair of needle-nosed pliers the bottom (half circle) bend can be easily done, by 'inching' the pliers along in 1/16<sup>th</sup> of an inch steps whilst forming the bend at the same time. Do all four at the same time, after verifying that you have the first one right. The vertical pieces can be cut from the same wire – you will need three pieces of the .060" K&S wire, with some left over to make a set for 1 vehicle. When all are cut, and the ends trued up, clean them, and then 'Blacken them' using a 'Gun Blue' liquid. Try the large (right-angled) piece into the holes that were drilled into the end beam earlier. Ensure that none 'pokes out' at the bottom – eventually a fake 'nut' will be fitted here. For the two vertical pieces a tiny collar is needed at the bottom end, I made mine from some 4mm Plastruct tube that I had in stock. Again make all 8, with an additional 4 (used later), at the same time. If you are good at soldering you can join all the wires together that way; there are 3 per unit. I preferred to use a Latex (epoxy) glue (UK Evostick; USA Walthers GOO?), which has some 'give' in it. At the bottom, (and inner end) of the outer part of the handrail where it goes into the fixing hole in the end beam fit a tiny piece of plastic card with an equally tiny nut on it – this represents the flattened end of this handrail and its fixing bolt. I have drawn this little fixing on the under-frame drawing. To finish off the top of the handrails above the vertical ones fit a small square of plastic card to represent the fixing bolt between the horizontal and vertical parts. All these —

very tiny bits were fixed with the latex (epoxy) glue. Touch up any parts that could not be ‘blackened’ with black paint.

The rectangles nearest to the center have inside them a piece of iron (?); made from .030", plastic card; fit some straps that (will), loop round to the back and hold these pieces in. I used some heavy paper (plastic card won't bend this far), on the front to give a bit of detail to the plate, it has a ‘hammered’ style finish, add the straps (two layers of paper) to this and glue it onto the front before painting. Paint the (4) panels Indian red on both sides and when dry fit in bending round the tabs to fix them, with an equal gap top & bottom. On one end there is the hand brake shaft and wheel – ensure that you get the correct end I didn't and had to change it! The brake shaft end is also the one that has the stovepipe on it when the roof is fitted later by the way. The shaft is part of a bicycle spoke, and a brake wheel (Ozark?). I made my brake wheel but I will change it later for a better one; it is 20mm diameter. This shaft fits into a small curved ‘U’ shape (see the under-frame drawing for a pattern) holder that is made from plastic card with a couple of distance pieces, of which the lower one has a central hole to accept the brake shaft. It is glued to the end beam and close against the large (left hand, when facing), tensioning nut on the end beam. Fit onto the brake shaft the 3 little collars (from the 4 that you put on one side - keep the other one for now). One of the tiny collars is just above the bottom of the shaft (to stop it falling through the hole), and two more just above that and still within the brake shaft holder; glue them all in position. Between the last pair will go the piece of 3mm link chain I mentioned earlier. Resting on the top of the end beam is the ratchet mechanism for the brake. The drawing appears to show that most of this ratchet wheel is covered up with a steel cover. The wheel itself is .060 thick with a .010 cover (total size 8mm diameter), leaving a small number of teeth exposed; at least you do not have many teeth to cut, I put in four, cut with a fine file. Run this down the shaft, and glue it to the upper face of the end beam and add the final little collar above it. To ensure that this brake shaft will stay vertical a little bracket is made that is fixed to the upper part of the handrail and the back of the brake shaft. This is VERY ‘fiddly’ indeed; cut it to fit (between shaft and handrail) and then run a vertical paper ‘edge piece’ around this making it a (very tiny) ‘U’ shape – glue it all up and that will add some much needed strength to it.



*Photo of the (brake end) balcony, showing brake shaft, end railings, and center panels, with some weathering started on this. The air pipe is shown fitted.*

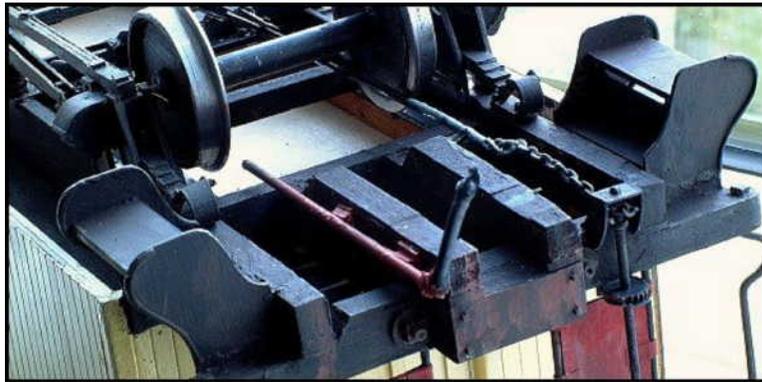
With the Waycar upside down again the final pieces of the brake gear can now be fitted. The small piece of 3mm link chain can now be wrapped around the brake shaft between collars 2 & 3, and one end is glued to the back of the end beam, then to the shaft and routed through the curved holder. The 'loose' end of the chain is now fixed to the shaft from the diagonal brake rod. My shaft was a bit of cycle spoke with the (outer) end edge filed flat and a hook glued onto it – the chain is fixed to this hook. You may need to add a fixing to keep this rod in position I think it would have had a loop somewhere to do just that. The other end of this shaft, which has a forked end, made as the rest of the brake gear, and is glued to the end of the remaining diagonal brake rod (which is without a connection), and should be tucked above the wheel – quite a 'fiddle' to get to! Fit to both the ends of these (diagonal) rods a tiny piece of rod to represent the pivots for them; that will complete the brake rod fixings.

The airlines are next, on the prototype they were always on the right hand side of the coupler when facing the vehicle, this means that they crossed over sides somewhere under the vehicle. Mine are two short unconnected pieces; the chassis is in the way. The air pipe is again made from .070" diameter bicycle spoke with a piece of 2mm flexible plastic (preferably black) diameter tube, 1.5 – 2 inches long on the end to represent the flexible pipe. These are fixed to the right hand side of the coupler beams when looking at the end, and level with the outer end of them. Wrap some strip round the part that can be seen to represent the fixing straps and also the slightly larger than the pipe (cast iron?) end casting – that the pipe goes onto. Fix these slightly proud of the side of the coupler fixing baulks (use some scrap plastic 'distance pieces'), and ensure that the pipe is clear of the rail level, by about 5mm. There should be an 'end' (to join two of them together) here; I cannot find out what they were like in the early days, I have not yet decided whether my Mason Bogies will have the Eames vacuum brake, which was before the Westinghouse system, with its well-known pump. I have 'settled' on the same style airline as is in the 'Narrow Gauge Pictorial' book (Vol. 8, C&S freight & passenger cars). This is what I know as a 'glad hand – because two fit together like two hands held 'palms' together, or clapping.

The 'glad hands' are made from a couple of plastic card disks with a minute piece of plastic rod, round off the end of the rod and sand it to half depth at the end and glue all together, and then into the outer end of the (air) tube. Paint dark gray and add a tiny spot of black for the air hole in the center. Glue a 2mm piece of paper around the outer end to represent the metal end of the pipe. These pipes had a chain to hold them up out of the way. A very fine chain can be made from a pair of (twisted) strands of .020" wire (in the UK – 5 amp fuse wire, which is .017), about 28mm long., I have fixed it above the (steel rod), air pipe and the other end is glued close to the (glad hand) end: will keep this pipe out of the way and possibly safer as well. This mock chain is not flexible as such, but being copper can be bent. There are photo's in the Narrow Gauge Pictorial of C & S cabooses with an extension to this pipe; the extension being about half as much again (say 42mm). I have taken an 'extreme close-up' photo showing the flexible air pipe, with the red painted on/off tap, and the 'glad hand' on the end. This photo has been enhanced for (hopefully!), better definition.



*'A cruel close-up' of Brake pipe and fittings for it; no chain is fitted to the outer end yet.*

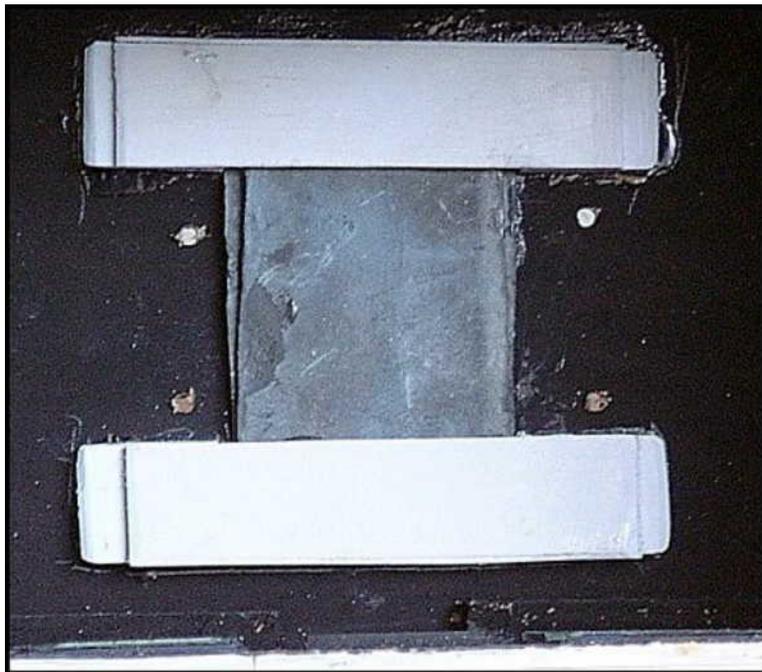


*Photo of the upside down end, with both the air brake pipe, (red oxide) and brake rod (gray) shown in different colors for ease of viewing. They end at my internal Chassis.*

The painting of the underside can now begin – it seems such a shame to paint it! I have used a brush – get one that it quite strong, NOT a good one, you will have to work around all the bits with it, and it is likely to do it no good at all. Try the ‘cheap’ (every thing under a ‘£ or \$’), stores – they should have the sort of brushes required – look for ‘bristle’ (white color) brushes, not the brown ones which are not strong enough. The entire under-frame is black to which I add some dark brown and/or gray as well, later some weathering can be added to give the color a bit of a ‘lift’ – it warms the color up, black has a habit of being a very ‘dead’ color. Rust on the brake blocks, and ‘earth’ colors everywhere, and around (and on), the axle boxes a small amount of gloss varnish to indicate spilt lubricant – that sort of thing. The tops of the steps, and the end balcony planks should have plenty of earth colors on them due to all the ‘foot traffic’ there as well. The photos show some of this started, this will be enhanced later.

Couplings – these vehicles used ‘Link & Pin’ couplers, Ozark make a set, and they fitted between the center under-frame beams lower extensions – the pieces with the inner sloping ends. However I am using Kadees 831’s, and these have been fitted to match up with Bachmann couplers, which being bogie mounted are lower than the scale position. They are fitted below the above beams; and needed the ‘tail’ lifting up a bit and then will match, though the Kadee knuckle is only half as deep. Bachmann for some reason will not sell their ‘knuckle’ couplings in England!

The weight of vehicle is rather low – my Waycar has had weight added to bring it up to just below that of the Bachmann bogie vehicles – it needed 4 ounces. This set the weight between that of their gondola and refrigerator car it now has a weight of 1.25 lbs. Glue the lead in, and then cover the ends of the glued weight with some plastic-card to ensure that it cannot come loose and move about. Ensure that there is an ‘air gap’ (drill holes in the floor!) to stop any deformation of the body when the roof is fitted, these are an extra to the small gap at the back of the doors.



*Photo of the extra weight and its extra fixings, the four extra holes for equalizing air pressure can also be seen. Paint all black before gluing the roof down.*

Glue the styrene ‘glass’ in the doors, check the interior paint is all OK, and the roof can be prepared for gluing on. Ensure that the sides/ends are level along the top edges, if necessary fill with plastic card to make level; the sides should have a slope to match the ends. If at all possible have a plastic card edge all round well glued on – use Epoxy glue, and roughen both surfaces to enhance adhesion. When this glue is dry the roof can then be glued on, and left to dry, having checked it all round, and especially at the ends where the end (balcony) roofs should be glued to the inside of the roof. Use some clamps here if required; in spite of precautions mine had begun to droop and fixing to the roof stopped this.

The photo’s of No. 72 in ‘The Mineral Belt’ Vol. 1 (green cover, page 163) which is after 1885 (the loco is in black), there is an what looks like a ‘flag holder’ at top center on the ends of the roof, with the fixings on the end of roof arc. This can be made from .020" plastic card, 16mm long cut to the same curve as the roof (12.5-ft radius) and some fine tube. Seal the ends of the tube with some glue – that will stop the flagstaffs falling through. The tube is made from 2mm diameter (K&S) brass tube (borrowed from my store for the--

Mason Bogie!) and the tube, and its backing plate (of .020" plastic card), are 10mm long., I needed some packing pieces to ensure that the tube was vertical., When it has been fitted paint it to match your body color. In the early days these waycars also were fitted with two other flag holders at the extreme corners of the roof, at the brake shaft end. I suspect that they went through the roof; they did not have much showing above the roofline, and are not shown on the above photo. These are made from 2mm tube, with some tiny pieces of .020" plastic card (3mm tall, 6mm long down the length of the roof, 4mm long across the roof), added to strengthen the projecting part. Glue the tube in, it should be fitted at the (underneath (internal)) corner and have some 4mm projecting. All can be painted (weathered) black as the roof. The flagstuffs are from .050" piano wire (which fits the tube) and are 40mm long, the top is from two .020" plastic card discs (2mm and 1.5mm) diameter glued on top. Make a small (drilled) recess in the larger one to make more space for the glue to grip. I suspect that these were wood; so paint them your 'wood' color; a nice rich red-brown for me.



*Photo of the flagstaff fittings before painting the outer ones weathered black to match the roof color.*



*Photo of the center, removable lamp, perched on a blob of 'Blu-stik' – ignore that 'blue' at the base!*

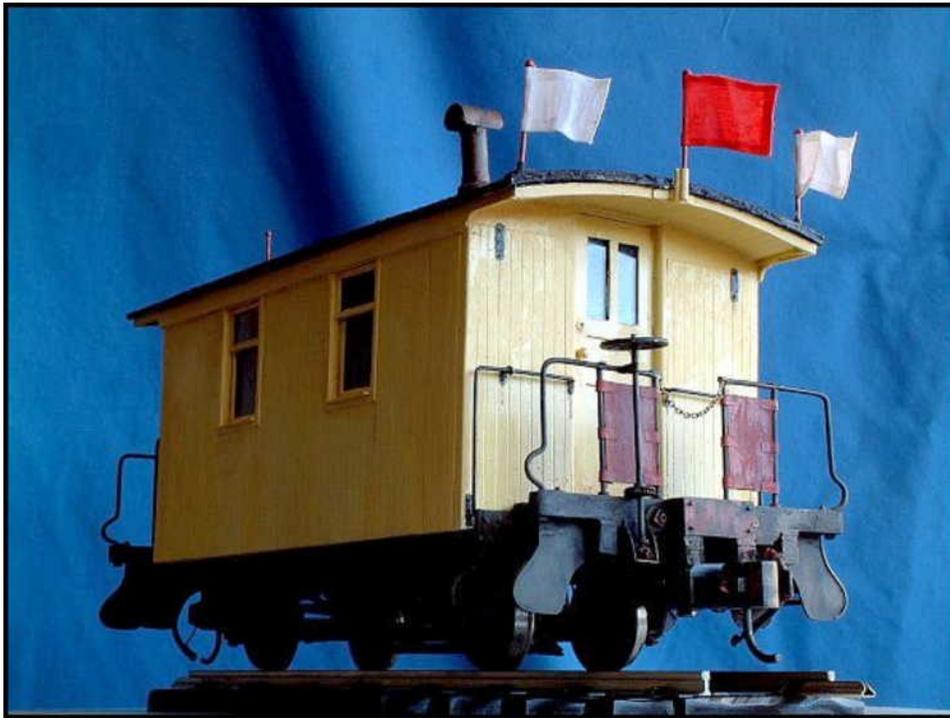
The articles by Derrell Poole in Outdoor Railroader shows a removable(?) oil lamp in the center of the roof. This is simple to make from a series of discs all from .030" plastic card. These are from the base upwards 1x15, 1x14, 3x12, 1x15, 1x12, 1x6, 1x8, 1x12, and 1x8 all are diameters and are in millimeters. Paint black, and weather it. If you wish to model the holder for this lamp, and from what happened in England, just use the first four discs (thus only 2 x 12), and glue in the center of the roof. In practice the upper two were a removable plug that filled the hole where the (oil) amp was 'dropped' into. Access would I guess be by ladder – none were fitted to these vehicles at this time: they came much later! I have added a small photo showing the construction and assembly of a lamp, before painting.

Weathering: a subject that cause a vast amount of opinions, and to a degree rightly. Some weathering is a good idea because it assists in showing detail, but I am against heavy weathering, to the amounts that (some) full size vehicles had, so I use what I call light

weathering. This is mainly on the roof and under-frame and end balconies have a good deal of weathering using earth, dark brown, and rust colors on top of the black and red oxide colors. The body will have, after the transfers have been fixed, some earth/dark brown colors added around the lower parts but there will not be a lot. After all I have put a lot of time into the model and do not want it to be a 'filthy color'!! However there can be added around the lower windows, which slid upwards don't forget, a pencil line right in the corner and the same for the doors on the end, this will give some added definition there.

The lettering (and number), on the side of No. 72 is about 7 to 8mm high; this is almost twice the size of the lettering of Larry Larsen's (water slide), transfer (I think he used the C. Brommer drawing); it is also shaded as well. The Derell Poole articles mention shaded lettering with the shading color as white. I am going to see if I can have some (single color) transfers made by a friend for this, and my second waycar.

We have now completed, with only transfers (decals) left to make, a complete 'ready to roll' Denver & South Park Railroad waycar. Time to sit back and admire it!



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