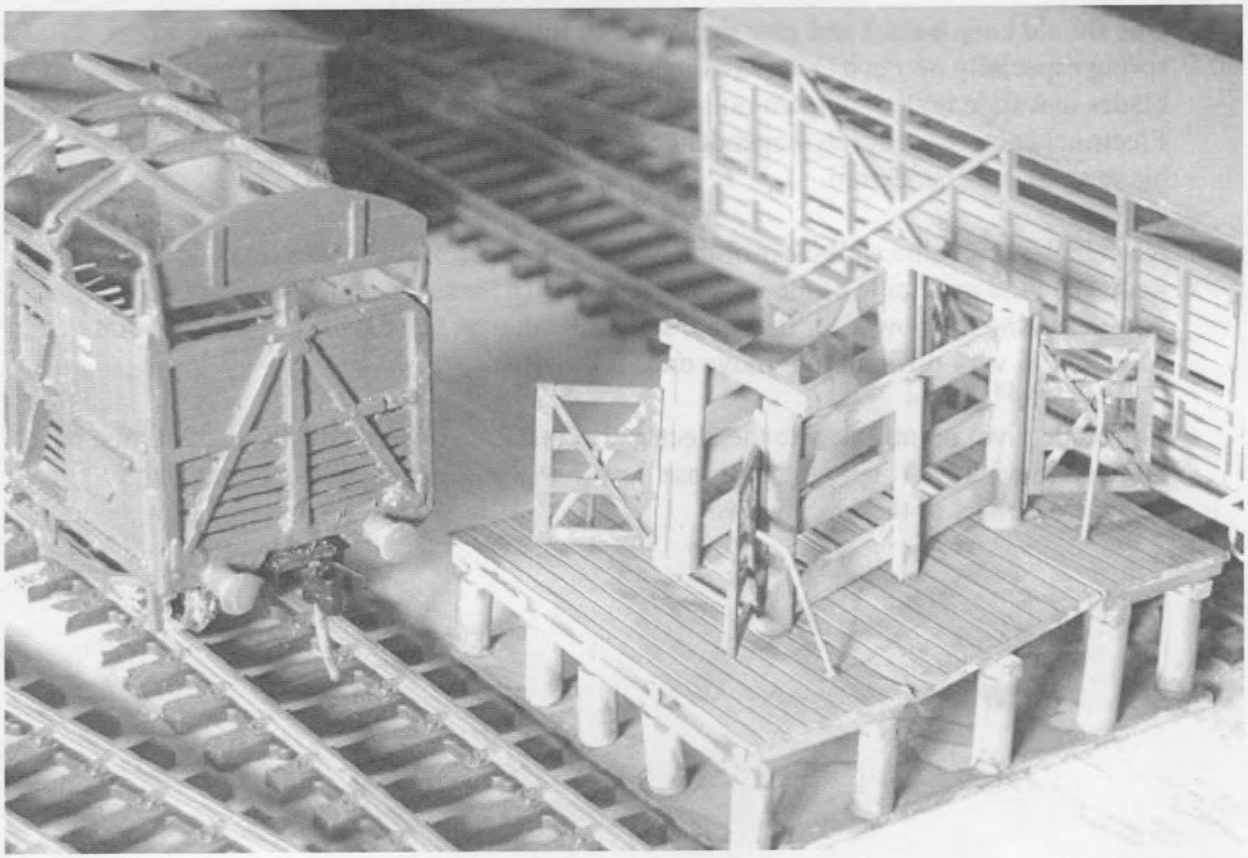
Styrene Modeling

Presented by Ken Edge-Williams
(With the Introduction from the Evergreen Manual of Styrene Modeling)



Cattle Transshipping Ramp on Westgate layout of Arthur Hayes

Four decades ago this would have begun with a selling job.

Before we could begin to show you how to build models from Styrene, we would have had to convince you doing so made sense at all. Back then, wood and metal were what "real" models were built from –and plastic was considered suspect. Although injection molded plastic kits had been around for more than a decade, many established modelers saw them as toy-like compared to the "true" craftsmanship of working with basswood or brass.

However all that has now changed, and for the better

Styrene is now universally accepted as the modern material for building models – all kinds of models. It's inexpensive, widely available, and above all, easy to work with. It brings the workability of clear soft wood to your workbench – but without the problems of wood grain, fuzz or splinters – and combines that workability with the crisp precision of metal.

Model building with styrene is faster and easier than with any other material.

Above-Half Way Siding and Cream Shed, totally made from Styrene by Jim Christie

Styrene is easy to fabricate using only hand tools, easy to cement, and equally easy to paint and finish to represent a variety of materials. And because moulded styrene is the overwhelming choice for commercially produced model kits and details parts, it is the perfect scratch building and detailing medium to complement them.

Styrene won't warp or well due to changes in humidity, and normal household temperature variations don't affect it. It is durable, stable, and bonds almost instantly. Styrene takes most hobby paints well, and does not require sanding or priming before applying finishing coats.

Publication by Evergreen on Styrene Modelling - considered the Bible of styrene modelling.

Why Scratch Build or Kit Bash Nowadays?

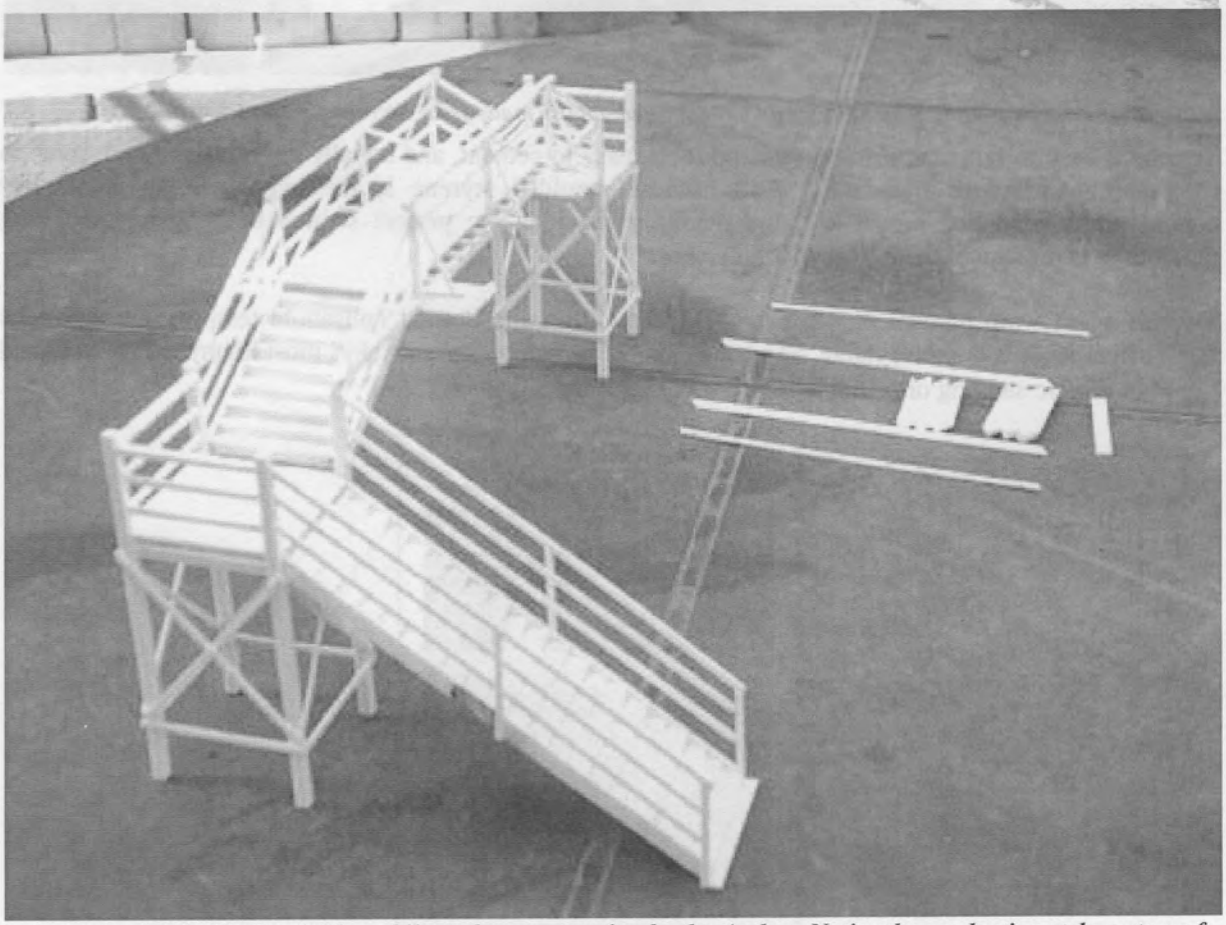
With all the prolific availability of models commercially now why would you want to build your models yourself?

The answer lies in the title of this convention i.e. "Modelling the Railways of Queensland" which by the very nature of the prototype is unique, different and unlike most other railways in the universe.

Until recently there was not a great deal of commercially available models, and even now what is available only makes a dint in the number and varieties that existed on the Railways of Queensland.

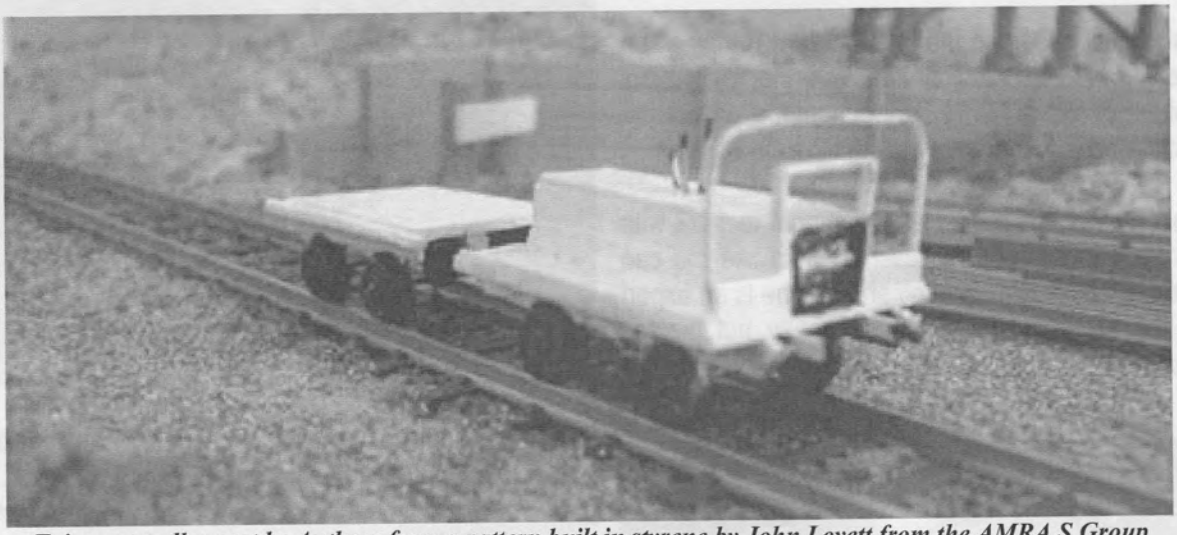
Queensland Railways and the cane railways had a vast number of styles and varieties and even differences in the supposedly same class of wagons.

Can you buy the Queensland style of buildings, or infrastructure, a footbridge, a bridge, an engine shed etc. etc. that suits your exact requirement every time?



A standard style QR Footbridge while under construction by the Author. Notice the production style system of making the steps.

Basically it comes down to the fact that due to the huge variety on Queensland Railways to model realistically you will have to do some significant scratch building yourself as it will be impossible for any manufacturer or groups to make kits or RTR models to fulfill all your needs

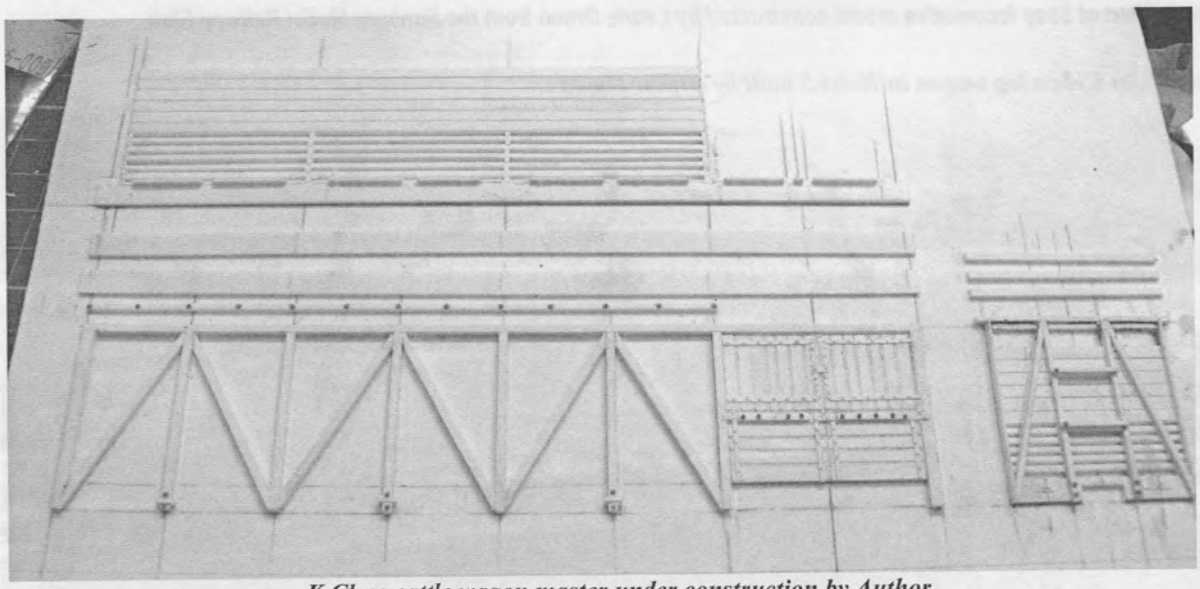


Fairmont trolley cast by Authors from a pattern built in styrene by John Lovett from the AMRA S Group

You can scratch build from the basic materials or you can be lucky enough to find a model that you can kit bash to make the model saving a lot of work in most cases.

Here is where styrene comes into its own as most commercial models are built from you guess it- Styrene.

You can use Styrene to build patterns for casting by yourself or a commercial caster and his is where Styrene is again an ideal material as it is impervious and does not react with the common used casting rubbers or requires any sealing prior to casting.



K Class cattle wagon master under construction by Author

What can I make from Styrene?

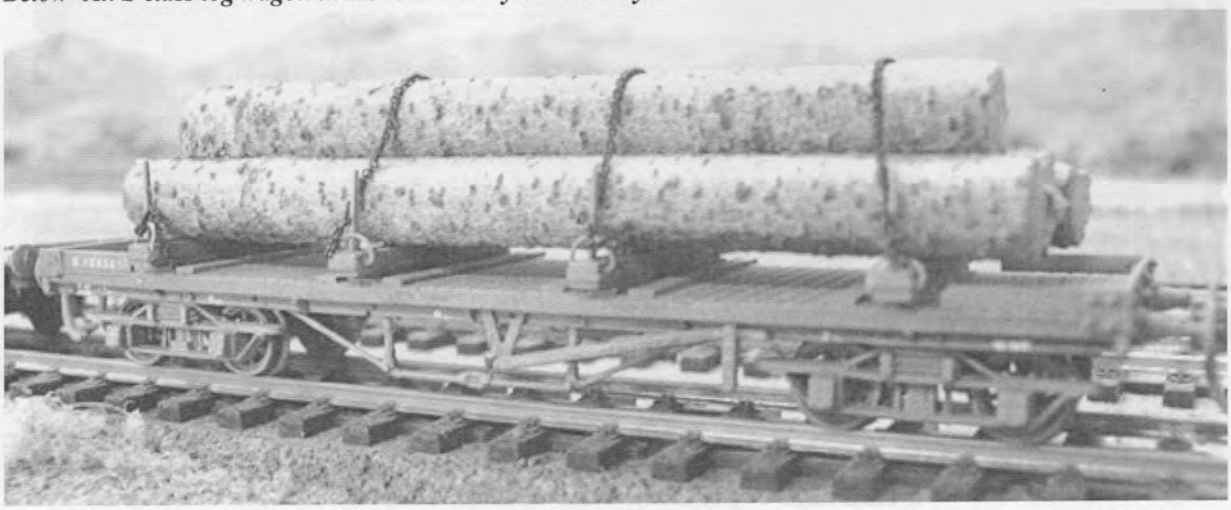
This hotel, based on the Red Beret at Redlynch on the Kuranda Scenic Rail line, was the first project built by Mick Henry of Brinsmead when he commenced to learn how to construct in Styrene

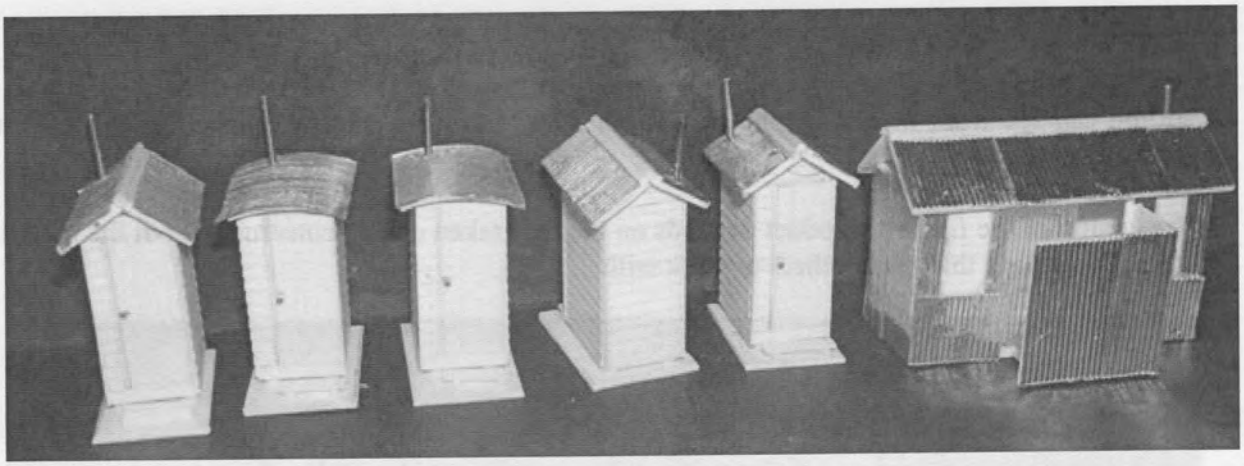
This proves it is a very easy material to work with as Mick has stated "as even a chap like me can build it." Mick sells himself short as he is an expert in the electronics side of the hobby but it does show what a first timer can achieve.

The water tank is the only reasonably complicated part of the Shay locomotive to fabricate. Laurie cut a piece of pine timber to the size of the tank and rounded the four vertical corners. Laurie used 5 thou styrene on top of the tank and as a wrapper around the tank. The two ends have a second layer that wraps around onto the sides about 10 mm. No.1 Grandt Line NBW's are then inserted into small drilled holes around the tank. These can be seen as black dots in the photograph opposite. The tank filler is some styrene tube and flat styrene. The light is a white metal casting, and could be lit if the wiring is allowed for. The hand rail is brass wire.

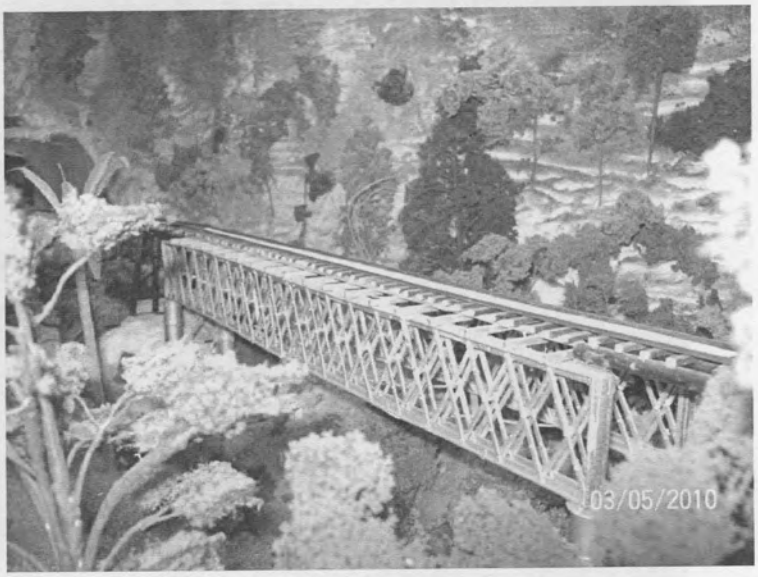
Above- Part of Shay locomotive model constructed by Laurie Green from the Sunbury Model Railway Club

Below- An S class log wagon in Hon3.5 built by Arthur Hayes

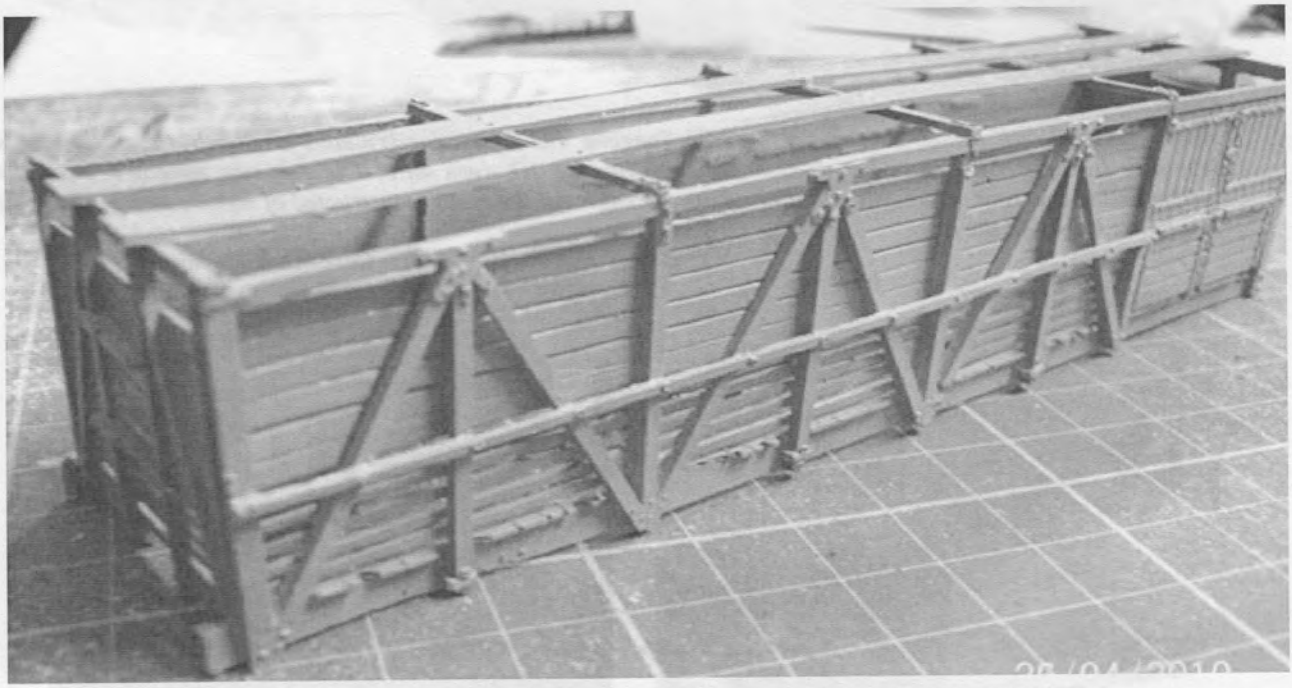




Styrene lends itself to multi-builds as shown by this series of toilets constructed by Arthur Hayes



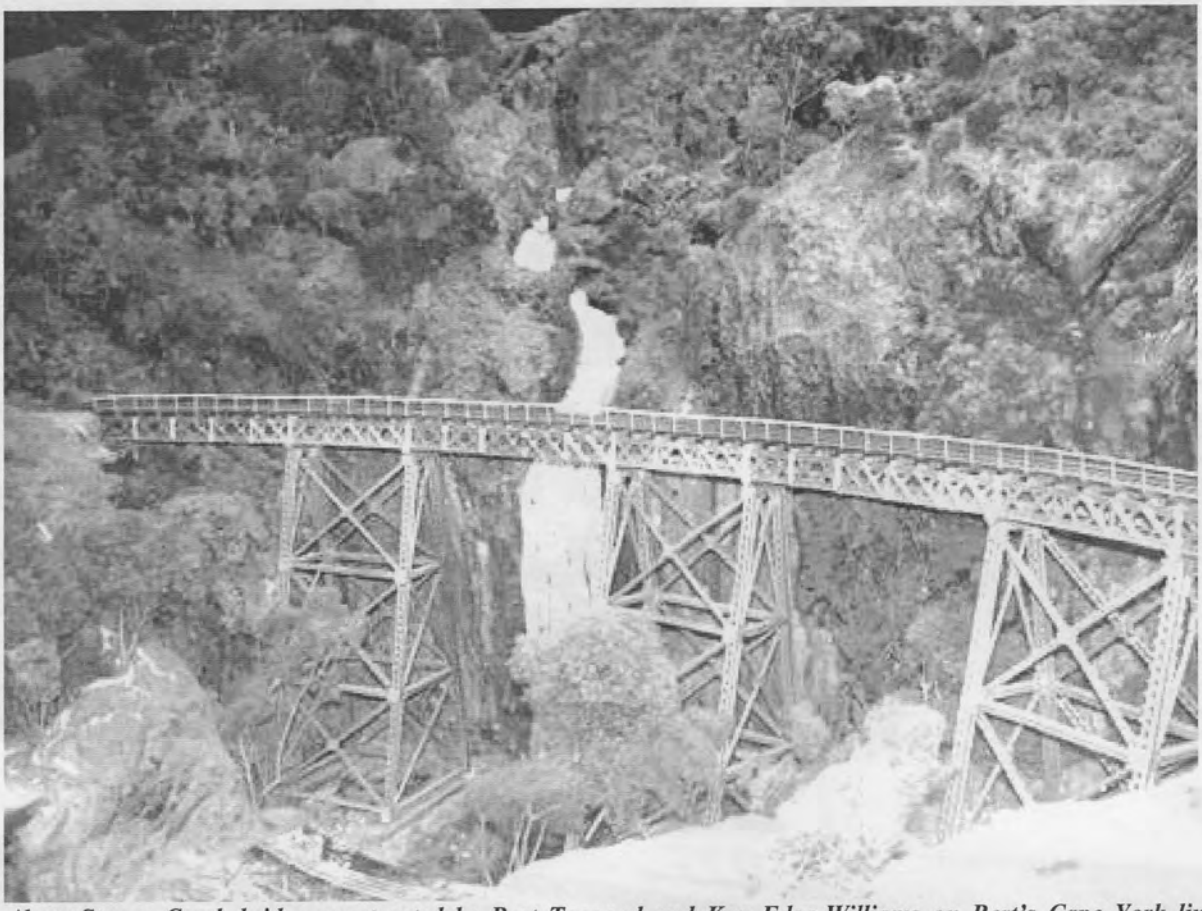
Bridge 11 on the Kuranda Range constructed by Ken Edge-Williams



A K class cattle wagon from a Styrene pattern master constructed by Ken Edge-William

So you can see from these few photos you can virtually construct any item you need for your layout from Styrene

The quality of the finished product depends on the care taken during construction but the material is more forgiving than most others to work with

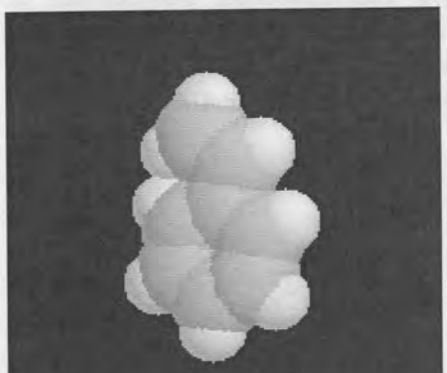


Above-Stoney Creek bridge constructed by Bert Toogood and Ken Edge-Williams on Bert's Cape York lines layout in Innisfail. This is to HO scale modified to fit 4ft 8-1/2 track on it. The only non styrene item on the bridge beside the track is the wire handrail along the edge. All the rest is constructed of styrene and can support two house bricks on the track.

Below- More scenes on Jim Christies On30 layout

What is Styrene?

Pure styrene is a colourless to yellowish oily liquid that evaporates easily and has a sweet smell. It is often mixed with other substances that give it a sharp smell. It is flammable.



3D representation of a Styrene molecule

Melting point: -31 to -30.6°C
Boiling point: 145°C
Specific gravity: 0.905
Vapour pressure: 4.3 mm Hg @ 15°C; 10 mm Hg @ 35°C

Styrene dissolves in some liquids, but dissolves only slightly in water. It is soluble in alcohol, ether, acetone, and carbon disulfide; it is incompatible with oxidisers, catalysts for vinyl polymers, peroxides, strong acids, and aluminium chloride. Styrene is dangerous when exposed to flame, heat or oxidants; it reacts violently with chlorosulfonic acid, oleum, and alkali metal-graphite, and reacts vigorously with oxidising materials.

Styrene is primarily a synthetic chemical that is used extensively in the manufacture of plastics, rubber, and resins. Workers, including those who make boats, tubs, and showers, are potentially exposed to styrene and its effects. Health effects from exposure to styrene may involve the central nervous system and include complaints of headache, fatigue, dizziness, confusion, drowsiness, malaise, difficulty in concentrating, and a feeling of intoxication.

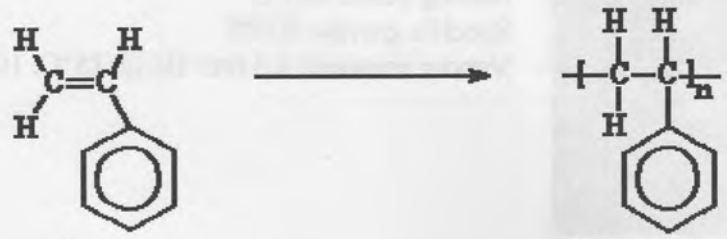
Styrene can accumulate static charges; hence special attention should be paid to take precautionary measures against static discharge

The carbon:hydrogen ratio of styrene is almost 1:1 resulting in considerable amounts of carbon oxides (CO_2, CO) and free carbon to evolve when burned. Burning styrene can generate large quantities of thick black smoke.

What is Polystyrene?

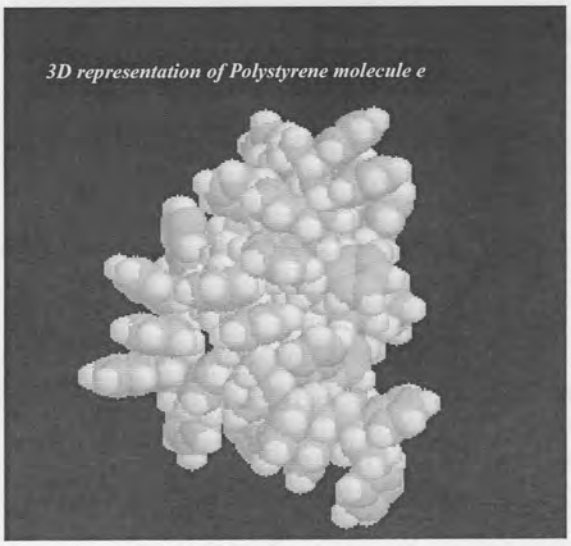
Polystyrene was accidentally discovered in 1839 by Eduard Simon, an apothecary in Berlin, Germany. From storax, the resin of Liquidambar orientalis, he distilled an oily substance, a monomer which he named styrol. Several days later Simon found that the styrol had thickened, presumably due to oxidation, into a jelly he dubbed styrol oxide ("Stryroloxyd"). By 1845 English chemist John Blyth and German chemist August Wilhelm von Hofmann showed that the

same transformation of styrol took place in the absence of oxygen. They called their substance metastyrol. Analysis later showed that it was chemically identical to Styroloxyd. In 1866 Marcelin Berthelot correctly identified the formation of metastyrol from styrol as a polymerization process. About 80 years went by before it was realized that heating of styrol starts a chain reaction which produces macromolecules, following the thesis of German organic chemist Hermann Staudinger (1881 - 1965). This eventually led to the substance receiving its present name, polystyrene. The I.G. Farben company began manufacturing polystyrene in Ludwigshafen, Germany, about 1931, hoping it would be a suitable replacement for die cast zinc in many applications. Success was achieved when they developed a reactor vessel that extruded polystyrene through a heated tube and cutter, producing polystyrene in pellet form.



styrene monomer **polystyrene**

Polystyrene is a **polymer** made from the **monomer styrene.** It is a liquid hydrocarbon that is commercially manufactured from petroleum.



At room temperature, polystyrene is normally a solid colorless and rigid plastic **thermoplastic.** However, this material may also be returned to a liquid state by heating and used again for molding or extrusion then re-solidified.

Thermoplastic is a plastic which is solid when cold, but which may flow and be re-formed multiple times with the application of heat. Styrene is a thermoplastic so can be vacuum formed or melted and injected into dyes quite easily.

Styrene is an aromatic monomer, and polystyrene is an aromatic polymeris, though the word styrene is used often inaccurately to refer to Polystyrene or in the UK the term **Plasticard** is used often. For our purposes they are the entirely same item.

It is used to produce many products for industrial and consumer use. In fact, its presence as a plastic in everyday life is second only to polyethylene.

When burned, polystyrene yields black carbon particles, or soot. When completely oxidized, only carbon dioxide and water vapor remain.

There are several different types of polystyrene produced. Extruded polystyrene is considered to have as much tensile strength as unalloyed aluminum, but is lighter and more elastic. This is the material used to make a variety of molded products that range from plastic tableware to CD cases and model cars. It is also used to produce medical and pharmaceutical supplies.

In many plastic products, the polymer is only one constituent. In order to arrive at a set of properties appropriate to the product, the polymer is almost always combined with other ingredients, or additives, which are mixed in during processing and fabrication. Among these additives are impact modifiers, colorants, reinforcements, and stabilizers. Different additives cause slightly different effects in the plastics which explain why plastic from different kits act differently sometimes.

Polystyrene was first manufactured by BASF in the 1930s, and is used in numerous plastic products. Pure solid polystyrene is a colorless, harder plastic with limited flexibility which can be cast into molds with fine detail. Polystyrene can be transparent or can be made to take on various colors. It is economical and is used for producing plastic model assembly kits, plastic cutlery, and many other objects where a fairly rigid, economical plastic of any of various colors is desired. Polystyrene fabricated into a sheet can be stamped (formed) into economic, disposable cups, glasses, bowls, lids, and other items, especially when high strength, durability, and heat resistance are not essential. A thin layer of transparent polystyrene is often used as an infra-red spectroscopy standard.

Polystyrene's most common use, however, is as expanded polystyrene, which is a mixture of about 5% polystyrene and 95% air. This is the lightweight material of which coffee cups and takeaway food containers are made. The voids filled with trapped air give expanded polystyrene low thermal conductivity. It is also used as insulation in building structures, as packing material for cushioning inside boxes, and also in crafts and model building, particular

Polystyrene has become the standard medium in which most models are available today. Its popularity grew after the Second World War with the development of advanced mould and material manufacture. Revell and Airfix are pioneers that still manufacture many of their early kits. The Japanese have been able to create moulds of incredible precision. Tamiya is famous as the manufacturer of high precision model kits. Styrene has the ability to hold very sharp detail whilst being quick and easy to mould. Hence, Styrene kits are high quality and with the advances in moulding techniques we are seeing even more high quality kits and RTR products being produced

Polystyrene is non-toxic and is impervious to many chemicals, including water. It can be pliable or brittle depending on the formulation. Clear styrene is brittle and unsuitable for heat or vacuum forming but makes good window glazing.

Expanded polystyrene is usually not suited to model making as it dissolves with most of the standard glues used with polystyrene.

Note - ***Ultraviolet (UV) embattles and degrades unpainted styrene so it must be protected with pain for use outdoors where it will be exposed to sunlight. The much weaker levels of UV found indoors do not affect it.***

What is High Impact Styrene?

What would happen if we were to take some styrene monomer, and we put some polybutadiene rubber in the mix? We end up with the polybutadiene forming a graft copolymer with the styrene monomer. A graft copolymer has one kind of polymer for the backbone chain, with chains growing out of it that are made from a different kind of polymer. In this case, it's a polystyrene chain with polybutadiene chains growing out of it.

These rubbery chains hanging off of the backbone chain do some good things for polystyrene. They act to absorb energy when the polymer gets hit with something. This makes it stronger, not as brittle, and capable of taking harder impacts without breaking than regular polystyrene. This material is called *high-impact polystyrene* or HIPS for short.

For our purposes this is interchangeable with Polystyrene except can take hard knocks better.

What is Acrylonitrile-Butadiene-Styrene (ABS)?

ABS is a tough, heat-resistant and impact-resistant thermoplastic, the acrylonitrile providing heat resistance, and the styrene units giving rigidity. It is widely used for appliance and telephone housings, luggage, sporting helmets, pipe fittings and automotive parts

This is the plastic that **Plastruct ABS** products are made from and thus perform differently to polystyrene and do not use the same glues to join. It had a very rigid form so is excellent where strength is required

Usually the glues and solvents used on ABS will join to polystyrene.

ABS has been hailed as the best all around construction material since wood. Stronger and more rigid than many metals, easier and more flexible to work with than any previous plastic, cleaner and more durable than wood.

ABS is a thermoplastic terpolymer combining the best qualities of the Acrylics, Butyrates, and Styrene. It is more than half again as rigid as its cousin, Styrene, and size for size is nearly as rigid as brass.

Extremely resistant to most acids and alkalis, The ABS lustrous surface is unaffected by most chemicals and lacquers, a property unheard of in the early plastics

Unlike wood and brass ABS requires no priming sanding or sealing to enhance its hard finish.

How and Where do you Get it?

Styrene is available as clear sheets (may shrink when heat formed), white sheets, (susceptible to UV light breakdown and off gassing), and black sheets treated to withstand UV rays. Various patterns are available designed especially for scale and railroad models.

Shaped flat sheets include representations of

- Freight Car Siding
- Passenger Car Siding (Grooves run across the short direction to enable longer sides)
- V Groove Siding
- Drop Siding
- Clapboard Siding
- Board and Batten
- Square Tile
- Sidewalk
- Standing Seam Roof
- Corrugated Metal

Above- Arthur Hayes weighbridge showing the use of textured styrene for the bridge construction.

Size	
Inch	mm
.010 x .020	0,28 x 0,50
.010 x .030	0,28 x 0,75
.010 x .040	0,28 x 1,0
.010 x .060	0,28 x 1,5
.010 x .080	0,28 x 2,0
.010 x .100	0,28 x 2,5
.010 x .125	0,28 x 3,2
.010 x .156	0,28 x 4,0
.010 x .188	0,28 x 4,8
.010 x .250	0,28 x 6,3
.015 x .020	0,42 x 0,50
.015 x .030	0,42 x 0,75
.015 x .040	0,42 x 1,0
.015 x .060	0,42 x 1,5
.015 x .080	0,42 x 2,0
.015 x .100	0,42 x 2,5
.015 x .125	0,42 x 3,2
.015 x .156	0,42 x 4,0
.015 x .188	0'42 x 4'8
.015 x .250	0'42 x 6'3
.020 x .020	0,50 x 0,50
.020 x .030	0,50 x 0,75
.020 x .040	0,50 x 1,0
.020 x .060	0,50 x 1,5
.020 x .080	0,50 x 2,0
.020 x .100	0,50 x 2,5
.020 x .125	0,50 x 3,2
.020 x .156	0,50 x 4,0
.020 x .188	0,50 x 4,8
.020 x .250	0,50 x 6,3
030 x .030	0,75 x 0,75
.030 x .040	0,75 x 1,0
.030 x .060	0,75 x 1,5
.030 x .080	0,75 x 2,0
.030 x .100	0,75 x 2,5
.030 x .125	0,75 x 3,2
.030 x .156	0,75 x 4,0
.030 x .188	0,75 x 4,8
.030 x .250	0,75 x 6,3

Size	
Inch	mm
.040 x .040	1,0 x 1,0
.040 x .060	1,0 x 1,5
.040 x .080	1,0 x 2,0
.040 x .100	1,0 x 2,5
.040 x .125	1,0 x 3,2
.040 x .156	1,0 x 4,0
.040 x .188	1,0 x 4,8
.040 x .250	1,0 x 6,3
.060 x .060	1,5 x 1,5
.060 x .080	1,5 x 2,0
.060 x .100	1,5 x 2,5
.060 x .125	1,5 x 3,2
.060 x .156	1,5 x 4,0
.060 x .188	1,5 x 4,8
.060 x .250	1,5 x 6,3
.080 x .080	2,0 x 2,0
.080 x .100	2,0 x 2,5
.080 x .125	2,0 x 3,2
.080 x .156	2,0 x 4,0
.080 x .188	2,0 x 4,8
.080 x .250	2,0 x 6,3
.100 x .100	2,5 x 2,5
.100 x .125	2,5 x 3,2
.100 x .156	2,5 x 4,0
.100 x .188	2,5 x 4,8
.100 x .250	2,5 x 6,3
.125 x .125	3,2 x 3,2
.125 x .156	3,2 x 4,0
.125 x .188	3,2 x 4,8
.125 x .250	3,2 x 6,3
.188 x .188	4,8 x 4,8
.250 x .250	6,3 x 6,3

This is a sample list of what is available in the Evergreen range for strips
This is only a small part of what is available in the range of rods, tubes, shapes, telescoping tubing and many more.

Building strips and shapes as well as sheets combined with metallic finishes can also be found. Backing support may be needed for larger structures as sheet styrene bends easily

Most major Hobby Supply shop stock either Evergreen or Plastruct or if you are lucky stock both.

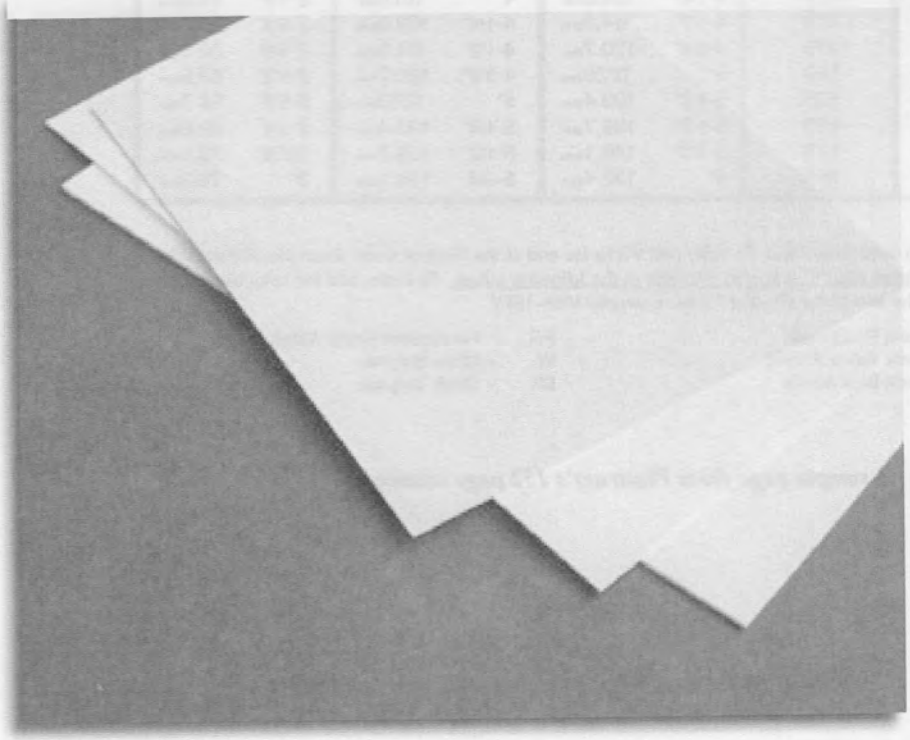
The range is huge so do not expect any but the large shops to have it all though most can get it in for you or there is the mail order companies that can do it

SLATER'S PLASTIKARD

The English firm of Slater's is another source that is available in some hobby shops.

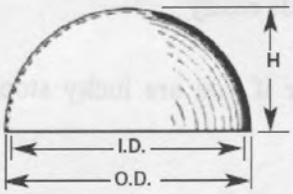
They have the fine micro-strip in packets of approximately 50 pieces and also have a range of plastic alphabet letters from the size of 2mm high which can be useful to make name boards.

They also have a wide range of 2mm thick embossed sheeting from various types of brick to stone but unfortunately most only come in 4mm or 7 mm scale so will not suit most of the popular scales in Queensland Modelling.



Plastic Stockist such as Cadillac Plastic or sign writing supply places will supply large approx 4ft by 3ft sheets of thickness of .25 millimeter upwards.

Be warned though that some of the large suppliers have a minimum value purchase which means purchasing several sheets at once.



HEMISPHERICAL DOMES

Use for vertical and horizontal tank ends when making storage tanks for oil processing plants, water, LP gas or food and grain. Great for school and craft projects, and home decor. Glue two together to make plastic spheres. Also great for eyes on puppets and robots. Precision Injection Molded in Acrylic, ABS or Butyrate Plastic. **Code shown is for Clear Acrylic.**

CODE	TO FIT TUBE	ACTUAL SIZE O.D.		I.D.		'H'	
VHH-12 •	12	3/8"	9.5mm	5/32"	4.0mm	3/16"	4.8mm
VHH-14 •	14	7/16"	11.1mm	1/4"	6.4mm	7/32"	5.6mm
VHH-16 •	16	1/2"	12.7mm	9/32"	7.1mm	1/4"	6.4mm
VHH-18 •	18	9/16"	14.3mm	23/64"	9.1mm	9/32"	7.1mm
VHH-20 •	20	5/8"	15.9mm	7/16"	11.1mm	5/16"	7.9mm
VHH-24 •	24	3/4"	19.1mm	35/64"	13.9mm	3/8"	9.5mm
VHH-28 •	28	7/8"	22.2mm	43/64"	17.1mm	7/16"	11.1mm
VHH-32 •	32	1"	25.4mm	25/32"	19.8mm	1/2"	12.7mm
VHH-36 •	36	1-1/8"	28.6mm	15/16"	23.8mm	9/16"	14.3mm
VHH-40 •	40	1-1/4"	31.8mm	1"	25.4mm	5/8"	15.9mm
VHH-48	48	1-1/2"	38.1mm	1-1/4"	31.8mm	3/4"	19.1mm
VHH-175	56/175	1-3/4"	44.5mm	1-1/2"	38.1mm	7/8"	22.2mm
VHH-200	64/200	2"	50.8mm	1-3/4"	44.5mm	1"	25.4mm
VHH-225	225	2-1/4"	57.2mm	2"	50.8mm	1-1/8"	28.6mm
VHH-250	250	2-1/2"	63.5mm	2-1/4"	57.2mm	1-1/4"	31.8mm
VHH-275	275	2-3/4"	69.9mm	2-1/2"	63.5mm	1-3/8"	34.9mm
VHH-300	300	3"	76.2mm	2-3/4"	69.9mm	1-1/2"	38.1mm
VHH-325	325	3-1/4"	82.6mm	3"	76.2mm	1-5/8"	41.3mm
VHH-350	350	3-1/2"	88.9mm	3-1/4"	82.6mm	1-3/4"	44.5mm
VHH-375	375	3-3/4"	95.3mm	3-1/2"	88.9mm	1-7/8"	47.6mm
VHH-400	400	4"	101.6mm	3-3/4"	95.3mm	2"	50.8mm
VHH-425	425	4-1/4"	108.0mm	4"	101.6mm	2-1/8"	54.0mm
VHH-450	450	4-1/2"	114.3mm	4-1/4"	108.0mm	2-1/4"	57.2mm
VHH-475	475	4-3/4"	120.7mm	4-1/2"	114.3mm	2-3/8"	60.3mm
VHH-500	500	5"	127.0mm	4-3/4"	120.7mm	2-1/2"	63.5mm
VHH-525	525	5-1/4"	133.4mm	5"	127.0mm	2-5/8"	66.7mm
VHH-550	550	5-1/2"	139.7mm	5-1/4"	133.4mm	2-3/4"	69.9mm
VHH-575	575	5-3/4"	146.1mm	5-1/2"	139.7mm	2-7/8"	73.0mm
VHH-600	600	6"	152.4mm	5-3/4"	146.1mm	3"	76.2mm

NOTE:

Now available in solid Gray ABS. To order add VG to the end of the Product Code. Example: VHH-12VG

Product codes listed with "•" are also available in the following colors. To order, add the color abbreviation listed below to the end of the Product Code. Example: VHH-16FY

FR - Fluorescent Red Acrylic
FY - Fluorescent Yellow Acrylic
FB - Fluorescent Blue Acrylic
FG - Fluorescent Green Acrylic
W - White Butyrate
BK - Black Butyrate

A sample page from Plastruct's 152 page catalogue

Styrene sheets are available in various thicknesses, and Evergreen Scale Models have a handy converter chart which helps a modeller decide which thickness and pattern size will best suit a particular scale project. The chart is also found on the back of all their packaging as well

Inch to Scale Inch Converter

Actual Size		Scale Sizes (inches)							
Inch	Nearest fraction	N 1:160	1/8 1:96	HO 1:87	OO 1:72	S (3/16) 1:64	O (1/4) 1:48	1:35	1/2 1:24
.010	1/100	1 1/2	1	7/8	3/4	5/8	1/2	3/8	1/4
.015	1/64	2 3/8	1 1/2	1 1/4	1 1/8	1	3/4	1/2	3/8
.020	1/50	3 1/4	2	1 3/4	1 1/2	1 1/4	1	3/4	1/2
.025	1/40	4	2 1/2	2 1/8	1 7/8	1 5/8	1 1/4	7/8	5/8
.030	1/32	4 3/4	3	2 5/8	2 1/8	1 7/8	1 1/2	.1	3/4
.040	1/25	6 3/8	4	3 1/2	2 7/8	2 1/2	2	1 3/8	1
.050	1/20	8	5	4 3/8	3 5/8	3 1/4	2 1/2	1 3/4	1 1/4
.060	1/16	9 5/8	6	5 1/4	4 3/8	4	3	2 1/8	1 1/2
.080	5/64	12 3/4	8	7	5 3/4	5	4	2 3/4	2
.100	1/10	16	10	8 3/4	7 1/4	6 1/2	5	3 1/2	2 1/2
.125	1/8	20	12	10 7/8	9	8	6	4 3/8	3
.156	5/32	25	15	13 1/2	11 1/4	10	7 1/2	5 1/2	3 3/4
.188	3/16	30	18	16 1/4	13 1/2	12	9	6 1/2	4 1/2
.250	1/4	40	24	21 3/4	18	16	12	8 3/4	6
.312	5/16	50	30	27 1/4	22 1/2	20	15	11	7 1/2
.375	3/8	60	36	32 1/2	27	24	18	13	9
.438	7/16	70	42	38	31 1/2	28	21	15	10 1/2
.500	1/2	80	48	43 1/2	36	32	24	17 1/2	12

As the sheets are produced mainly for plastic modelers and railroad modelers, the scale conversions given are from N (1:160) to G (1:25). Sheets are available in various thicknesses, from .005 to .125 inches (0.13 to 3.2 mm), suitable for everything from vacuum- formed model parts to building walls.

Sheets are sold by the thickness of the sheet, and by the spacing of the pattern in tenths of an inch. For example a V Groove sheet could be any of a number of thicknesses, and might have a spacing between the grooves of 0.1 inch, (.100) meaning there are ten pattern grooves every one inch. In 1:48 or O scale this gives you the scale equivalent of 4 ¾ inch wide siding, in HO scale it would be equivalent to 8 ¾ inch wide siding.

What tools are required?

Believe it or not I modeled for a period of 15 years with only the basic of tools namely Sharp Exacto knife, ruler, small file, compass and paint brush.

When I finally decided to increase my tools to make it easier and to do more demanding models I realized that the tools were not a luxury but a necessity to make life easier by a long shot.

The main thing is your knives should be good quality and sharp blades. Living in the bush blades were unobtainable and I used the blade for a year till next model show when if I remembered would buy a new packet and believe me it is better when it is sharp.

The cheap sets will often have flexible blades but that can be an advantage in some situations so also have a set of them that only cost about $2 for several handles and about a dozen different blades.

Also have a large knife like a Stanly or cheap snap off blade set for doing cutting on large sheets.

The next most important knife is the Olfa P cutter or its equivalent. It is the main scribing tool you will use.

You need a scale ruler and a right angled set square for measuring and a metal ruler for cutting with. A strip of thin cork or masking tape on the bottom will stop it slipping on the plastic.

A set of jewellers' files and a large file for shaping are required. Keep them for plastic work as if used on metal the teeth will have particles of metal trapped which can come lose and scratch the surface of the plastic and with Murphy's Law will be on the final file of a detailed model and wreck it.

A pin vise and a drill set for drilling holes.

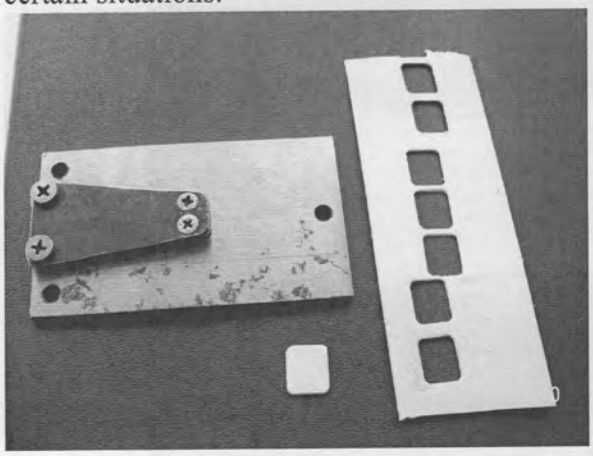
If you can a motor-tool like a Dremel makes life easier if a lot of drilling is required. Also this can be used with grinding and cutting blades to shape the plastic which is a lot easier than hand doing

Another fine tool is a dressmaker's wheel or a similar one made from clock teeth and a piece of tubing.

This is used to make rivets in thin styrene. Of course for a lot of dollars more you can buy a rivet press that will do the job even better.

A small brush in the mek bottle will do for the application of solvent but exposes you to too much fumes so the applicator bottle made by A-West does the job a lot easier and safer, especially if you knock it over.

Some other tools are a machinist square as per the picture which allows joining of corners easily. It uses magnets to hold the plastic in place while you glue it.
There are plenty of tools that can be made for certain situations.



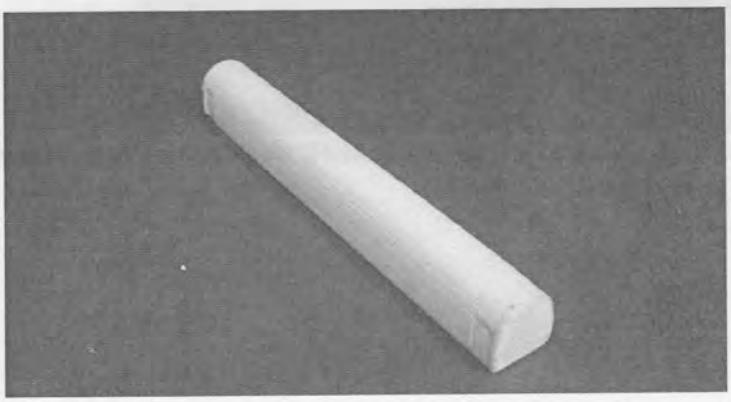
Here is a punch for making the windows for an 1800 class rail motor.

A more effective tool can be made by making a bar shaped to the window profile then using very large drill bit put a domed indentation in the end. This can be used as a punch to punch the windows out.

One of the tools used in styrene modeling is process or multi building.
Here you use systems to make the modeling easier or use jigs to ensure sameness of results.

Earlier in the footbridge photo we saw that instead of making each step, long strips were joined together forming several steps at once. When dried were then cut to length to the width of the steps using a miter box with a stop fitted to ensure the same length. It is easier to join the long length than trying to fit one step or riser at each time.

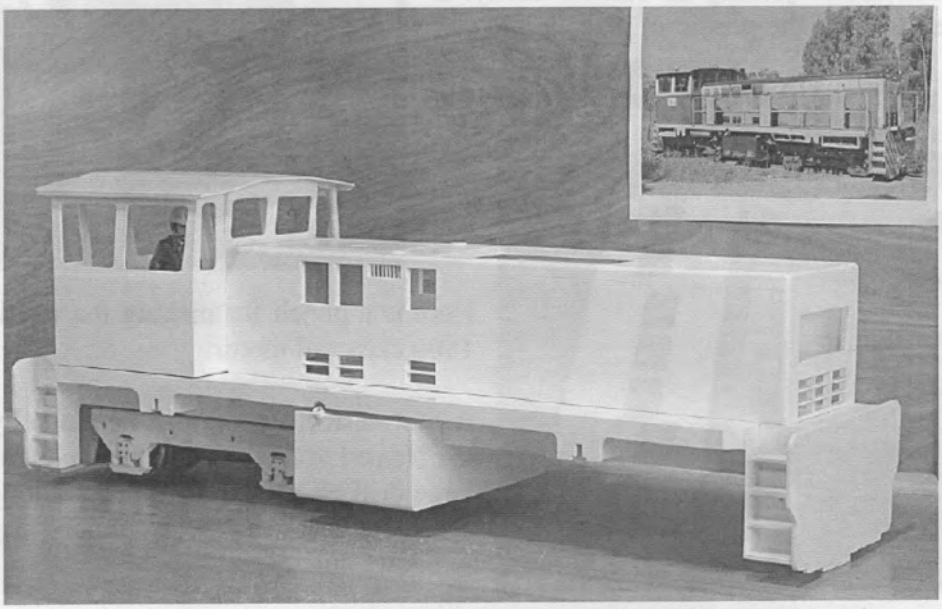
Here you see how you can make a frame to assemble an underframe and then you can cut to fit instead of measuring each piece following marks on the former.



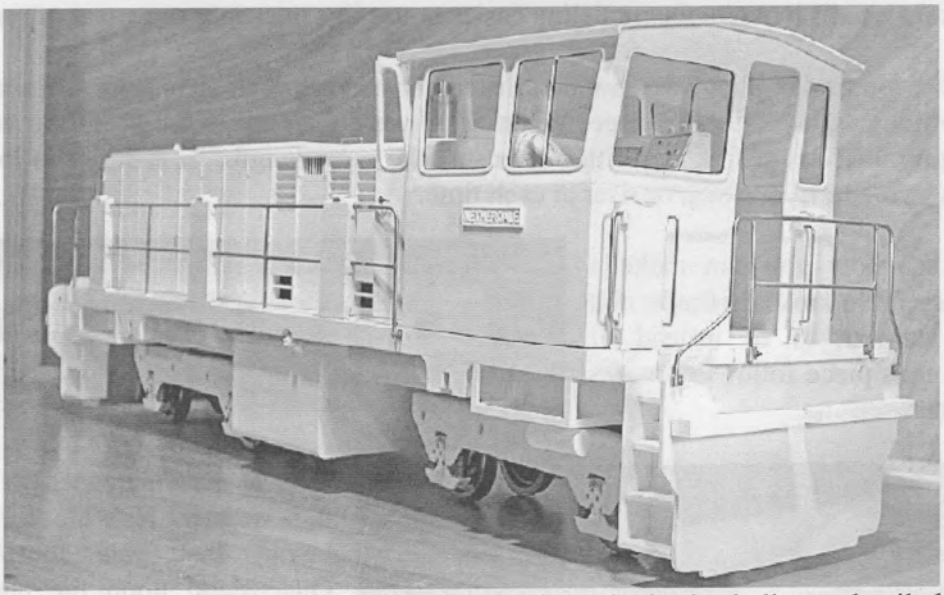
This is a former used to mould the ICE sets in N scale for the MLE layout that was touring around Queensland upon the electrification process. Styrene was taped to it and then immersed into hot water for a few minutes and then into cold to set.

Vacuum Forming is possible in styrene where you made a former out of wood just slightly undersize and then heat the styrene and drop over the former using a vacuum cleaner to create suction underneath it. The styrene drapes itself over the former and then sets.

When building a model you start with the basic shell and then add the detail just like Jim Russell of USA has done. Further details can be obtained from the CaneSig site.



Loco's basic body 'box' shapes under construction (above and left column next page) with holes left for windows, louvres, etc.



Here is the finished model ready for painting. Notice how the basic shell was detailed to gain the required effects.

What Adhesive and filler do you use?

Styrene does not glue in the normal sense as glues work rather it works as the similar method to welding metal
The solvent softens the styrene it flows together and intermingles and the solvent evaporates leaving a continuous joint. The solvent does the similar action that the heat does in welding

Methyl Ethyl Ketone or MEK for short is the main solvent to weld styrene together.
It is often the basis of most styrene cements and glues except the newer safer products based on fruit of all things.

Most of the bottles of liquid plastic glues such as **Liquid Poly**, **Testors, Mekpac** and others consist of MEK and additives to slow the evaporation process down thus different brands can be used for different purposes. A fast evaporating one for quick tack glue joint or a slow one for a long continuous strong bond

Plastic Weld produced by Plastruct USA is instantly tacky, sets in minutes, and bonds permanently overnight. This is a very good glue when using dissimilar plastics.

MEK is obtained also as a solvent in cleaning supply, hardware or paint supply companies and can be purchased in tines of 1 liter or more for only about $10 a tin

Clear MEK primer is used on under ground sprinkler systems and does not have to be coloured like the PVC primer on the plumbing system so can be obtained from shops that stock sprinkler systems. If you purchase it from a plumbing shop it has a blue or red dye in it which should not affect its performance but does detract from the appearance and could be a chance it shows through the paint

Citrolene as well as Limonene come from citrus fruits. They are terpenes with a cyclic structural part and it is this part that has the properties for attacking styrene. It is not as quite a strong solvent as the Tetra or MEK

Tetra which can be purchased from Simply Glues is a nitrofuran, which is a light volatile compound used in the production of Styrene

They all are light, volatile, residue less compounds in their pure state but all have the same requirement for safety-**Adequate ventilation** and **no naked flames** as most are explosive.

Walthers Goo will stick styrene to just about anything, but in larger jobs may cause distortion of the styrene if the evaporation of the solvents is delayed

NOTE WARNING- ***MEK is a strong smelling and flammable solvent and should be used in well ventilated spaces. It has the unfortunate side effects of dulling your senses so after a while the smell seems to vanish but the danger of inhalation is still present.***

If you dissolve raw styrene, such as a piece of sprue, in a suitable solvent then you get a goopy plastic that can be useful as filler. Messy way to do it though and it needs to be used with care, because if you put too much on you do run the risk of melting the work piece. A better solution is to use premixed putty - Squadron Green Stuff, Tamiya Putty or Milliput are some of the over the counter solutions.

Milliput is an incredible modeling putty from England. This is a product that some Modellers are not aware of.. Milliput is the 2 part, easy-to-use epoxy putty that molds like clay and cures to the hardness of porcelain. Use for scratch building, sculpting, repairing, gap filling, pattern making and customizing. It is ideal as well for military miniatures, ship model parts, dolls, dollhouse accessories, plastic models and thousands of other items. Roll it as thin as 1/64 inch for making super detailed scale parts can be sawn, drilled, filed, sanded and painted when cured. Smoothes with a wet finger and cleans up with water before it cures. It fully cured in 5 hours without heat or sooner with a hair dryer. Milliput advertises as the choice of master model makers throughout the world.

The problem with mixing up bits of styrene and solvent is it shrinks and additional layers need to be applied. This mixture requires a long drying time, up to 48 hours and then after final sanding, it keeps shrinking. Squadron green or similar is a better stuff to use

At a pinch you can also use polyester car filler, such as Isopon P-38, or a cellulose stopping paste, but again you need to be very careful and know what you are doing in order not to inadvertently melt the parts.

How do you bend it?

Hot water or hot air will soften the plastic and you can then bend it and it will stay the shape when cold again

Tie it to a former' dip in boiling water for a few minutes and then plunge under cold water.

To make curved styrene tape it to a can of the right dimension and fill the can with hot water for a few minutes and then empty and when cold undo the tape, then cut to size required.

Styrene based sprues from model kits can be made into thin rod by holding in both hands over a heat source such as a burner or very hot soldering iron and when gets soft enough pull apart your hands . With practice different diameter rod can be made suitable to make nut and bolt impressions or glued into scribe lines for representation of weld lines on steel fabrications.

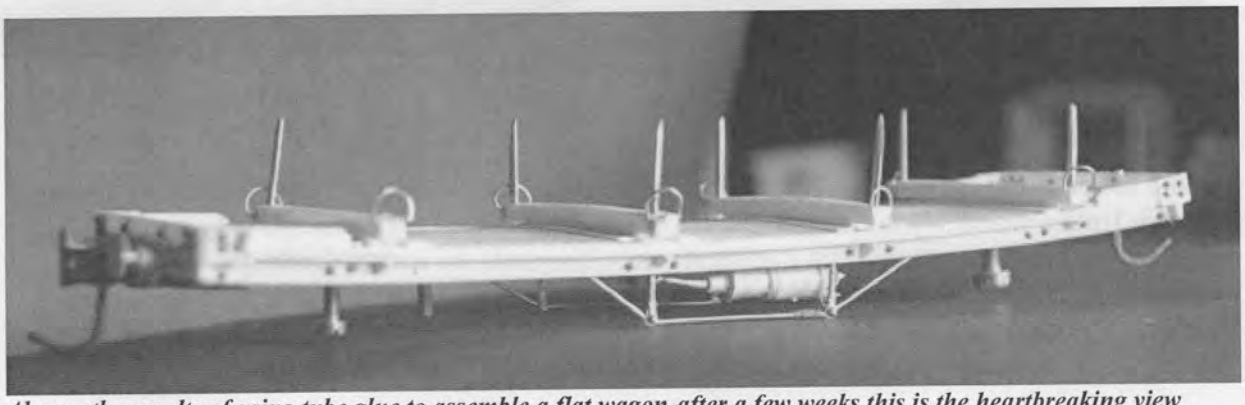
The following is used with permission By: Jim Banner of the Saskatoon Railroad Modellers Group

JOINING STYRENE

If the pieces of styrene fit tight together without gaps then solvent welding is the strongest way of joining the pieces. Solvent welding is done with a liquid that will slightly dissolve the two surfaces to be joined, allowing them to flow together and become one piece. The handiest liquid is any of the plastic cements sold for the job, for example Plastic Cement. Note that these solvents should be used only with adequate ventilation

A cheaper alternative which should ONLY be used outdoors or possibly in a properly constructed and ventilated spray booth is lacquer thinner. While it does not produce as good a joint due to its quick evaporation, lacquer thinner is an attractive alternative when building large scale structures and large amounts of solvent are required.

When the pieces to be joined do not fit tightly together, a solvent with some filler in it is required. This is where tube glue comes into play. The idea is that the filler fills up the space. This does happen initially, but over a period of time, as the solvent slowly evaporates through the bonded pieces of styrene, the filler tends to shrink, either weakening the joint or possibly distorting it.

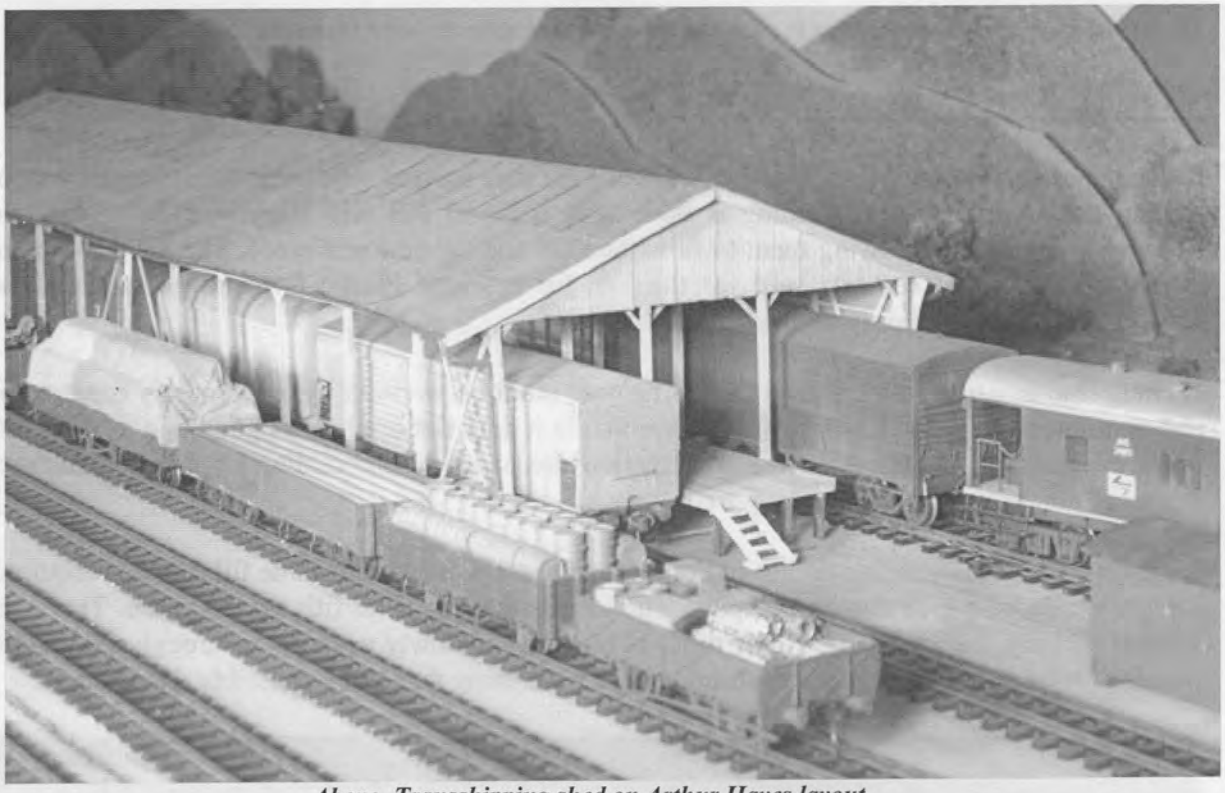


Above –the results of using tube glue to assemble a flat wagon-after a few weeks this is the heartbreaking view

Sometimes pieces of styrene need to be joined so that they can occasionally be taken apart and reassembled. This can be done using machine screws either with nuts or with tapped holes. Styrene taps beautifully using ordinary taps without lubrication. It does not do as well using self tapping screws. Styrene can also be joined with pop rivets, but backing washers must be used behind the work, and should also be used under the head of the rivet as well

Sometimes styrene needs to be glued or bonded to other materials. Many things work here, including some mixed solvent cements that will bond dissimilar plastics (make sure styrene and the other plastic are both listed on the label). For indoor applications, cyanoacrylates work well, but do not seem to last in outdoor work.

For small jobs, Walthers Goo will stick styrene to just about anything, but in larger jobs may cause distortion of the styrene if the evaporation of the solvents is delayed, for example when bonding styrene to metal.



Above- Transshipping shed on Arthur Hayes layout.

CUTTING STYRENE

on the list of things that make working with styrene a pleasure, ease of cutting must be close to the top. Unlike wood, styrene has no grain to worry about. And unlike metal, only two inexpensive tools are required for cutting styrene. The tools are a sharp knife, preferably with replaceable or snap-off blades, and a ruler or straight edge with cork backing. Self-stick cork backing is available. The cork keeps the ruler from slipping on the smooth surface of the styrene, and is worth its weight in gold in frustration avoided and in finger tips saved.

1. Deciding where to cut. Cutting lines can be marked on styrene with a pencil. Straight cutting lines need to be marked only at the ends, but curves should be marked for the full length. Curves can be laid out free hand or with compasses or by tracing around something with the right diameter, depending on the required result.

2. Scoring the plastic. For straight cuts, position the edge of the ruler EXACTLY over the cutting line. This is easy if you put the tip of the knife exactly on one of the pencil marks and slide the ruler up to it. Then put the tip of the knife on the other pencil mark and rotate the ruler until it again touches the knife. Recheck the first end, and then draw the knife along the ruler edge to score the surface of the styrene. If the knife is sharp, only a light pressure is required. Ideally, the ruler should be over top of the piece you want, so that if the knife wanders at all, it wanders into the scrap. For curved lines, it is often necessary to follow the line by eye. Try to keep the knife in contact with the styrene at all times, so that the score line is continuous. Often it is easier to turn the material than it is to turn the knife, so that you never have to cut at an awkward angle.

3. Breaking the plastic at the score. With the score towards you, bend the ends away from yourself. For straight cuts, this is a snap (pun intended). To convince yourself just how easy it is, try it a few times on a scrap piece of styrene. Also try snapping a piece that has not been scored, just to get a feel for how tough this stuff really is. Curves are a little harder to snap. Usually it helps to work in stages, first gently bending the plastic at the score line, working along from one end to the other. Then work back, bending a little more. Keep working back and forth, bending a bit more each time until the score line penetrates right through and the plastic separates

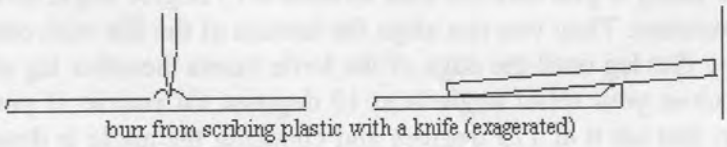
4. Cutting holes in the center of a piece by this "score and snap" method is somewhat harder. Round holes, particularly larger ones are not too bad if you keep working gently around them until the center breaks free. Rectangular holes, for example holes for windows, are more difficult. Often cracks will develop at the corners no matter how carefully you work.

One way to avoid this is to drill a small to tiny hole at each corner. (If you don't have a drill, use a heated pin to make the holes - just don't breathe the smoke. Then connect the holes with knife scores. On the front of the sheet, use the ruler as a guide and connect the holes in the desired rectangle.

On the back, connect the corners in a X. Press on the center of the rectangle from the front of the sheet to snap all the scores and pop out the scraps.

Above –Total Styrene scene of the Engine shed area of Jim Christie's layout

5. If required, is to remove the burr left from scoring. The fatter the knife, the duller the knife and the more pressure used, then the more material that will be pushed up on each side of the score line. See figure at left, below. This ridge can be felt by dragging a finger nail across the cut edge of the sheet (DO NOT drag your fingers along the edge, a cut edge can be sharp enough to cut you back!) In many applications, this ridge is of no consequence but in others, it does matter. It can cause enough separation between pieces that solvent welding won't work properly. The drawing in the figure below shows a vertical knife blade creating burrs as it scribes a horizontal piece of styrene. The right hand drawing shows two pieces of styrene being held apart by a burr on one of them.

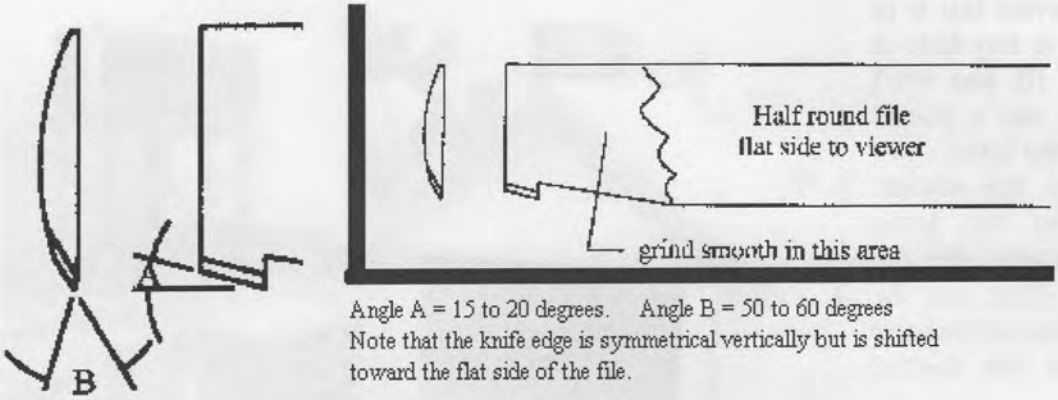


burr from scribing plastic with a knife (exagerated)

SCRIBING STYRENE

Scribing styrene, that is, making shallow grooves in its surface is a useful technique when it comes to replicating walls, blocks, tiles etc., or for simulating cracks or joints. Sometimes a knife cut made with a hobby knife is enough - perhaps for a crack that has formed but has not yet opened up. But often a good healthy groove is needed to make a strong statement that can be seen many feet away. How do we make the grooves i.e. how do we scribe styrene?

The answer is to use a scribing tool. The ideal one if your are fortunate enough is the Olfa P Cutter, or less preferable a Laminate/Formica knife, the kind that looks like a carpet knife with a little triangle of carbide set in the tip; you are in business and can skip the rest of this section. If not, you can make a serviceable tool from an old half round file, or even from a cheap new one, or a hacksaw blade using a bench grinder.



Angle A = 15 to 20 degrees. Angle B = 50 to 60 degrees
Note that the knife edge is symmetrical vertically but is shifted toward the flat side of the file.

In the diagram above, such a file is shown in the insert in the upper right corner. You are looking at the flat side of the file, and the tang would be out of the picture to the right.

The file is converted into a scribing tool in three steps. Firstly, the teeth are ground off the flat side of the file for about the last inch. This is to make it slide easily along your straight edge and getting it smooth is worthwhile. Next, a hook about 1/4" wide and protruding 1/8" or a little more is formed on the end of the file. It is formed by grinding away the bottom edge of the rest of the file, leaving the hook at the end.

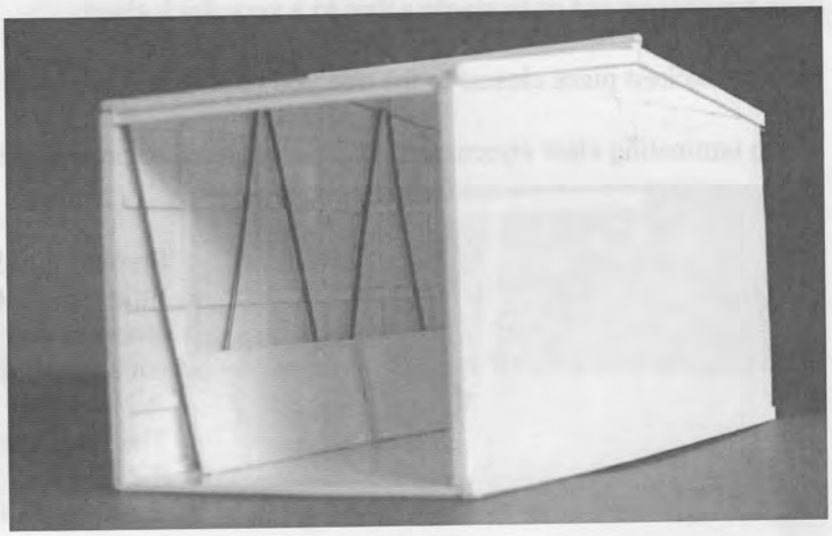
Then turn the hook into a sort of blunt knife. This is shown in the left side of the diagram above. The bottom of the knife must slope up toward the end, by at least 15 degrees. This relief angle is to allow the tool to be tilted up enough to let you wrap your fingers around the handle, and still allow the tool to cut. If relief angle is more than about 20 degrees, the tool will tend to dig in and tear the work.

It sounds hard, but it can be done rather easily if you take the time to draw a 15 degree angle on a piece of paper using a protractor or compasses. Then you can align the bottom of the file with one leg of your angle and slide the file along that leg until the edge of the knife meets the other leg of your angle. It is then easy to see how close your relief angle is to 15 degrees. Of course, if you happen to own a machinist's protractor, just set it at 175 degrees and checking the angle is dead easy.

Once you have established the relief angle, you can sharpen the knife. The knife should be sharpened to a rather blunt angle, somewhere between 45 and 60 degrees. This is harder to measure than the relief angle, but it is not so critical. Just draw angles of 45 and 60 degrees on a piece of paper and check by eye that the knife edge is between these two limits.

The knife should be sharpened its full length - not hard, it is after all only 1/4" long, and it should be sharpened to the same angle either side of vertical. If you are good with a grinder, it helps to sharpen only a little on the side toward the flat side of the file and a lot more on the side toward the round side of the file.

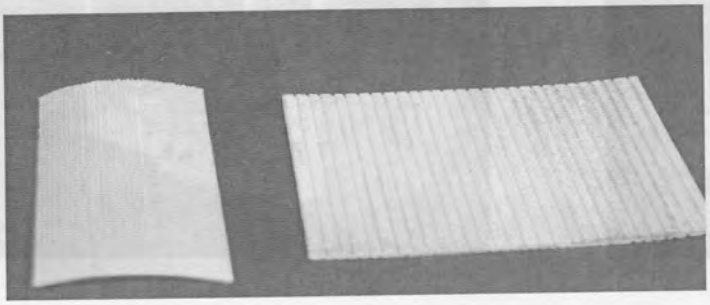
However, this is more than a necessity and getting the knife sharpened from end to end without destroying the relief angle is far more important. Finish off the scribing tool, if you want, by wrapping some duct tape around the file a comfortable distance up from the knife



Right- the truck unloading shed at the silo showing the scribed styrene and the timber framework prior to painting,
This is a part of the grain silo area on Arthur Hayes layout.

To scribe styrene with the knife or the scribing tool, first make pencil marks near the tops and bottoms of the lines to be scribed.

Next place the cutting tip of the knife or tool on the top mark of the first line to be scribed. Note that the cutting tip of the scribing tool is the end of the knife nearest to you. Slide the ruler over until it touches the side of the knife. Swing the ruler until it is the same distance away from the bottom mark, judging by eye. Lastly, draw the knife or tool toward you to make the groove.



Be aware that when scribing styrene that you do both sides as otherwise it will tend to warp as in the example shown to the left.

Tip 1 - if the near edge of the sheet being scribed is aligned with the near edge of your work table, the knife or tool will fall into space at the end of the groove rather than gouging your table.

Tip 2 - if the sheet being scribed is just a bit taller than the finished product, you can start scribing just a bit down from the top, which is much easier. If the sheet is already finished size, you can still start a little bit down from the top, then after all the lines are scribed, turn the sheet around and finish off the last bits scribing towards yourself.

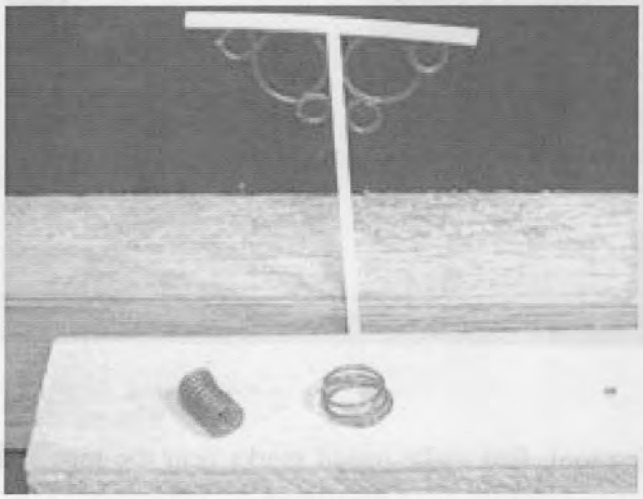
LAMINATING AND FABRICATING OF STYRENE.

The only downside to styrene is the tendency to warp when laminated together in layers unless braced sufficiently

The method used to help prevent this is laminate in odd numbers of layers as the stresses seem to even themselves out or laminate a thin to a very thick sheet.

Use the thickest piece closest to the one you require and then add the thin one.,

When laminating clear styrene great care is required to prevent crazing of the clear.

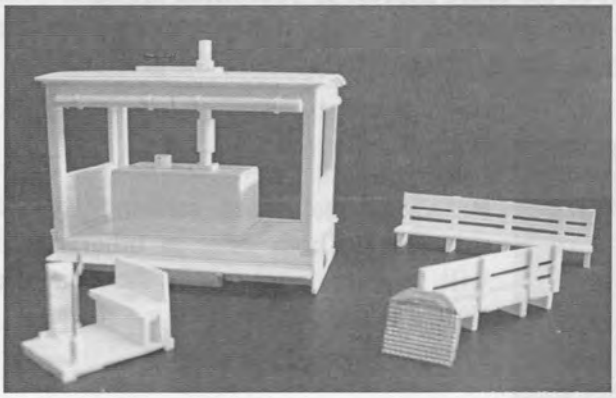


Styrene building is often easier to build the little up to the big. Here rod is curled around a rod and heated and cooled and then cut apart to form split rings.

The rings are then assembled into circles and the circles joined together to form the support post for a platform

This process can be used to make a wide variety of objects required.

This Rail Motor built by Jim Christie was made in little modules that could be painted and then assembled into the final product. Care is required to not put paint on the surface requiring gluing.

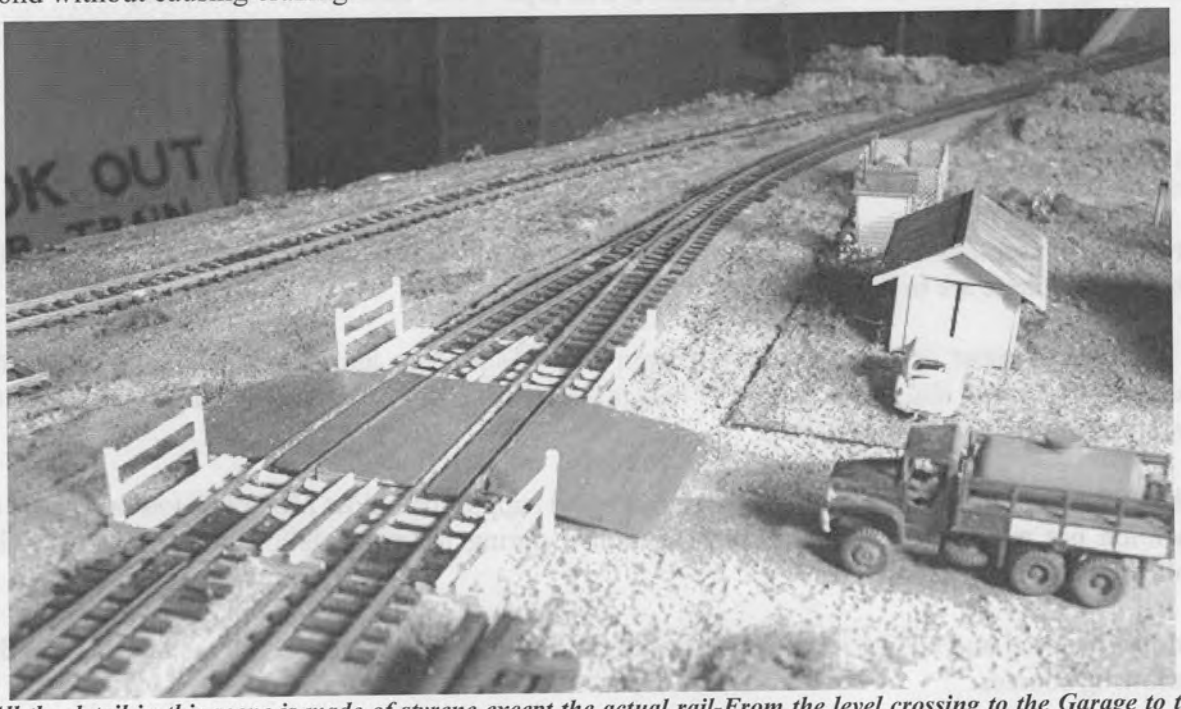


PAINTING STYRENE

Most paints will stick to styrene well enough to allow them to be used indoors in locations that will not require a lot of handling. For brush applications, oil based paints such as Testors flat colors, and various brands of water based acrylics work particularly well. Household latexes also work, but the heavy coats needed for color coverage tend to obscure fine details.

When brush painting lacquer or toluene based paints such as Floquil then a barrier coat has to be applied first. Floquil makes one and strangely enough it is called Barrier.

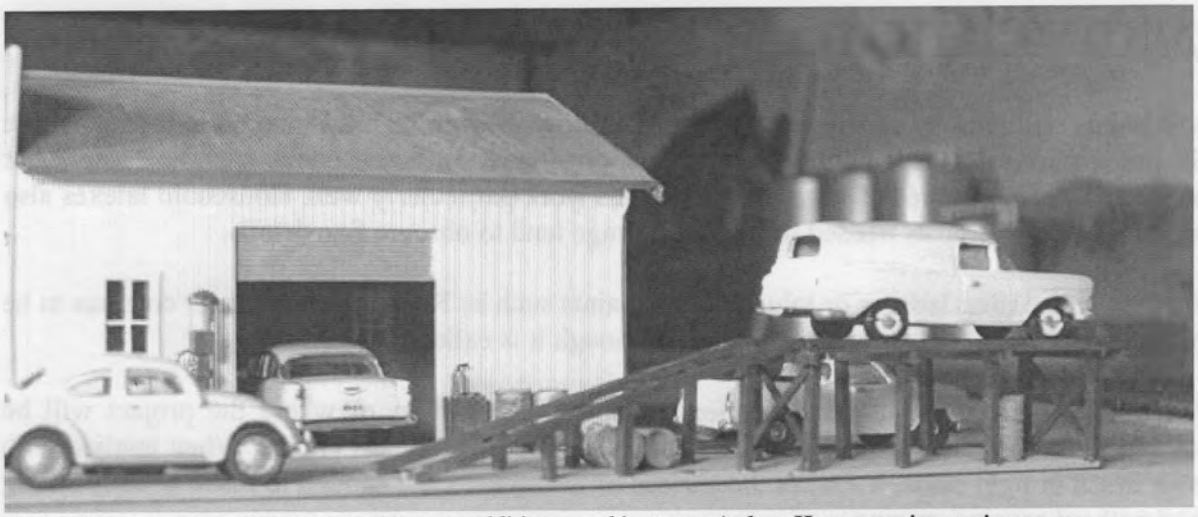
Where a lot of handling is required, for example rolling stock, or where the project will be exposed to the weather, lacquer applied with an air brush is the best choice. When applied with an air brush in light coats, it attacks the surface of the styrene just enough to make a really strong bond without causing crazing.



All the detail in this scene is made of styrene except the actual rail-From the level crossing to the Garage to the Chook pen and truck body. Paintwork is by Kerrie Hayes on a scene from the layout of Arthur Hayes.

A bit of practice with some styrene scraps goes a long way toward finding out just how light or heavy a coat to use. NEVER use spray cans of lacquer directly on styrene; the flood of material that they produce is guaranteed to cause problems.

Water based paints applied with an air brush; their advantages seem obvious; easy cleanup with water and no harmful solvents that require using a spray both and/or a mask to absorb the vapors. However, plain water may not completely clean the air brush, and a good mask to absorb the mist of fine droplets of paint is still necessary.
Often the durability of paint can be improved by applying a clear top coat over it.



Kit bashing can be as simple as making an addition to a kit as per Arthur Hayes service station ramp

EPILOGUE AND CONCLUSION

From the presentation today I hope you see the advantages of working with Styrene and the possibilities there are to achieve any model you wish.

I have learnt most of my information from other Modellers and developed their ideas and methods to suit my abilities and needs. This is one of the main benefits of belonging to a club or organization with fellow Modellers.

This presentation was enabled by the assistance and support of fellow Modellers too numerous to mention but many of their names are mentioned during the presentation or are a part of the following list of sources.

Source material and advice is acknowledged as and further information can be obtained from the following sources.

Your local hobby shop
Your local Model Railway Club
AMRA Queensland Branch http://www.brisbanemodeltrainshow.com.au/amra_qld_home.html
Evergreen http://www.evergreenscalemodels.com
Plastruct http://www.plastruct.com/
Slaters https://slatersplastikard.com/index.php
Saskatoon Railroad Modellers http://members.shaw.ca/sask.rail/
Sunbury Model Railway Club http://lauriegreensweb.com
AMRM – various building articles http://www.australianmodelrailways.com
Cane SIG Modelling Site http://www.zelmeroz.com/canesig/