TIMBER RESTORATION IN TRAMCARS

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At the Auckland Conference, four years ago, I presented a paper entitled "Woodwork — Restoration and Research". In terms of the restoration content of that paper, the greatest emphasis was given to the re-finishing of interior wooden panelling, so in this paper I wish to concentrate on the structural side of the wooden tram body, trying to give a few handy hints, spending some time looking at timber selection, and then to examine conflicts that we as restorers face when it comes to preserving historical accuracy in the face of numerous pressures, including that of being transport operators.

Once the decision has been made to restore a tram and the era to which it will be restored has been established, where do you start? My preferred method of attack is to break the job into a number of areas, and in most trams there will be about six distinct areas that can be worked on independently of the rest.

i) No. 1 (A) end
ii) No. 2 (B) end
iii) Left hand side
iv) Right hand side
v) Roof
vi) Main floor

For a number of reasons, but primarily to give greater focus to the work output of members, it pays to work on only one of these areas at once unless the work force is such that it is possible to work on a number of areas at any one time. The order in which each area is attempted will very much depend on the tram itself and the degree to which each area requires restoration. For instance, if the main floor and its sub-timbers are full of rot, it is logical that this should be the first area that is attacked so that the remaining restoration takes place on a sound foundation. If the work force can be split to work on more than one area at a time, only work on one side or one end at a time to leave the other side or end as a guide or a pattern, and in this respect work on the worst side or end first.

Having selected the area to be worked on, open it right up. Remove all panels, windows, fittings, etc., inside and out, leaving only the bare frame. It is only at this point that the full extent of the restoration required can be established. To attack each area piece-meal, say the bottom of one corner, then the top, followed by the next corner in the same order, is usually a very inefficient process. Tramcars are renowned for being "cans of worms" and if you know up front what is involved in the entire process, the job can be planned accordingly.

One of the key decisions or, if you like, dilemmas when planning the work flow is whether to replace or to patch. This largely has to be left to the people on the job to decide but your own museum's policy may influence that decision. The one thing to remember is that if patching has to be done on a large scale, the job will often be more time consuming than if a straight-out replacement was undertaken. It is at this point that we strike our first conflict, because if we patch, we keep much of the original tram but if we replace, we loose that originality and may start asking at which point does a restoration job become a replica.

What are some of the key aspects that should be weighed up when considering whether to replace or to patch?

i) How much rot is there? If it is significant, replace it.

ii) Are there any splits or fractures and if so where and how bad?

iii) What is the basic shape of the part like? Has it been twisted or bent? If so, replacement will be necessary. In trams with curved sides, the pillars are susceptible to developing greater curvature if the body has been twisted or is sagging prior to restoration.

iv) How complex is the part? Obviously the greater complexity of the piece the more difficult reproduction will be, but more importantly, the more difficult and time consuming matching will be.

v) Will the structural strength be affected by patching? While modern epoxy glues make a joint parallel to the grain stronger than the surrounding timber, the type of joint employed often weakens the structure. Take, for instance, the commonly used step joint. If you only have one step, the resistance to bending and ultimately breaking is reduced to almost half because at the end grain the joint is not particularly strong. The strength increases, of course, with the number of steps, but this then makes the entire job more complex and time consuming.

Irrespective of whether a particular part is patched or replaced, the other key consideration is that of timber selection, and the restorer once again comes into conflict with his 'museum' objectives. In a pure restoration sense, there is no alternative — replace like with like. At this point I am bound to hear all those museum treasurers out there screaming in agony at the mere thought of spending all the hard-earned cash on a few measly lengths of some fine expensive timber. Well, if that is the sort of reaction you would get from your museum executive, I suggest you ask them whether your organisation is a museum or not. However, there are circumstances where the selection of alternative timbers is quite valid, but it will still result in some heavy expenditure.

Availability and expense will normally be the two key determinants as to the use of the original type of timber. However, the guideline that I generally apply is that if it is seen and is varnished, such as interior panelling, the original type of timber should be used. If the work is hidden by other interior or exterior panelling and/or is painted, then a suitable alternative is in order. Where an item is quite large and parts of it are seen and varnished while other parts are hidden or painted, such as in many corner pillars, then an alternative timber may be used if a piece of the original type timber is laminated into the section that is seen.

If replacement timber is necessary and it is decided to look at alternatives, what are the properties and characteristics that should be looked for?

1. Strength

Where a structural element is involved, strength is of prime importance and most people would be correct is selecting a hardwood. However, watch your terminology because hardwood has two different meanings. When silviculturists in the northern hemisphere were running round classifying all their trees, they defined a softwood as any tree that had a needle leaf and propagated by means of a cone, while a hardwood has a broad green leaf and is often deciduous. While these relative classifications have some relevance in the northern hemisphere, they are unsatisfactory and confusing when classifying timbers from the southern hemisphere and tropical regions. For example Balsa, one of the softest and lightest timbers in the world, is technically a hardwood.

Luckily for us, the timber industry has developed a much more scientific method, in terms of physical properties, of classifying timber strength. New Zealand and Australia both use the same system, a seven point scale with S1 being the strongest to S7 the weakest. Timbers are classified into one of these seven categories according to a matrix of five different physical properties: basic density, modulus of rupture, modulus of elasticity, maximum crushing strength, and maximum sheer strength. Let us have a look at each of these in turn, for an understanding of these properties will help the decision as to what timber is best for a particular job.

i) Basic Density

Density is probably the easiest of all these properties to understand and is the measure of the relative weight of each timber, that is, the weight per unit volume of green timber at 0% moisture content. Density is expressed in kg/m3.

ii) Modulus of Rupture

Sometimes referred to as the modulus of bending strength, modulus of rupture is a direct measurement of the strength of wood in bending. It is in fact the maximum compressive or tensile stress in the fibres at the exact point and time of fracture and is usually expressed in megapascals (1 million pascals).

iii) Modulus of Elasticity

This is a measure of the stiffness or rigidity of wood and, for example, in the case of a beam, it measures its resistance to deflection and is usually expressed in megapascals.

iv) Maximum Crushing Strength

Known also as compression parallel to the grain, it is a measure of the maximum stress sustained by the timber under a load slowly applied parallel to the grain. It indicates the relative suitability of timber for columns and is usually expressed in either megapascals or gigapascals (1 thousand million pascals).

v) Shear

This is a measure of the ability of the timber to resist slipping of one part upon another and is normally expressed in megapascals.

2. Durability

Another important piece of information that should be known when selecting timber is its durability. Knowing the durability of a particular timber allows an informed decision to be made about its life expectancy or the type of treatment it should receive. It would be senseless to spend hours restoring a tram with a timber that has a short life expectancy unless it was given appropriate treatment.

New Zealand and Australia have once again adopted the same durability classifications. A four-step classification system is used to describe the durability of sound untreated heartwood based on its resistance to wood-destroying fungi, borer and insect attack.

Class 1: Very Durable	Suitable for long term use in structures exposed to the weather, and in contact with the ground.
Class 2: Durable	Suitable for use in the ground and for unprotected exterior use under normal conditions.
Class 3: Moderately Durable	Suitable for protected exterior work and for interior use. Not suitable for use in contact with the ground.
Class 4: Non-Durable	Not suitable for exterior use unless treated with preservative.

It must be stressed that these classifications are relative and the life expectancy will vary with the hostility of the environment and the end-use conditions. I personally believe that the best way to ensure maximum life expectancy is to treat all timbers with a preservative and paint them with a suitable primer.

Please also note that these classifications apply only to heartwood; all sapwood should be regarded as non-durable.

3. Other Qualities

Apart from strength and durability, there are other factors to consider such as a timber's working qualities. Does it machine well to a smooth surface or does it tear? for the sort of work we are involved in, machining qualities are important. Obviously in decorative panel work you cannot afford to have tears and nicks in the finished surface but, equally, in unseen structural items good machining qualities are important because of the accuracy to which we work.

Colour is also very important when considering replacement timber for varnished areas. However, a word of warning, many of the darker timbers, particularly those with a reddish hue such as mahogany, tend to bleach with prolonged exposure to the sun. Therefore it is important to match to a sample that has been freshly cut. This can be done by taking a piece of the original timber and planing off a portion of the surface (preferably on the back if you want to re-use that piece).

Consider also such things as a timber's stability, ie: its tendency to warp and twist before and after seasoning, and select only clears, i.e. those pieces of timber free from defects such as knots, shakes, splits, etc., which will only weaken the structure.

Where can this information be obtained?

First try your local timber merchant, who should have the appropriate reference material at his disposal if he is any good. In Wellington (N.Z.), we deal with the firm of J.L. Lennard Ltd which produces a set of handy information leaflets on each timber they deal in. These leaflets describe briefly the availability of a particular timber, its physical and mechanical properties, and its uses.

There are also a number of reference books available in libraries or for sale in bookshops. A handy little volume I have found extremely useful is called *Imported Timbers in New Zealand* by Stuart C. Scott. Like the leaflets published by Lennards, it briefly details, for each of the major types of imported timbers in New Zealand, their origin, characteristics, durability, strength, seasoning, working qualities and uses.

For assistance of a general or specific nature, the timber industry federations of our respective countries would be a useful source.

Everything we have been discussing up until now has been in preparation for the actual restoration work and, depending on the size of the area being worked on, will take a few hundred manhours, but it will be worth it in the long run. The key to good preparation work is the careful dismantling of parts, careful taking of notes along the way, careful labelling of parts for later use, and good careful research. Look out all the old photographs and any plans you may have. they will all help put the jigsaw back together later.

Equally, care is required during the actual repair process. The first step is to carefully remove the item to be worked on from the frame, be it a pillar, sill rail, cant rail or whatever. Remove the entire side frame if necessary. Regardless of whether the part is to be replaced or patched, it is much easier to work with it on the bench rather than a few metres above the floor.

Much time can be saved if patterns are made of all duplicated parts such as pillars. Rather than marking out each new piece by measurement, a pattern enables all parts to be marked out exactly the same and quickly, with the time-consuming measurement process required only once for the pattern. If plans are available, it helps to make the pattern from the plans and then check it against an original part. For permanency, use thin plywood for patterns.

Where there are numerous parts the same, much time can be saved if the work of cutting the basic shape from a given pattern is contracted out to a reputable joiner. This leaves your members free to do the final

shaping of joints and reassembly work. The size of your budget will determine just how much work can be speeded up in this manner. However, joinery costs for very basic shaping such as thicknessing and planing are quite modest and even if this is the only work contracted out, considerable time can be saved.

Apart from the strength of the timber itself, the other factor that determines the overall strength of the structure is the way in which the individual pieces of timber are assembled. Remember that the frame is an engineering structure and therefore should not be modified without reference to an engineer. Just as each piece of timber is a component of that structure, so is each joint and they should all be tight. If there are loose joints anywhere, remedial work should be undertaken.

I have devoted much time today examining issues relating to the repair of a tram body's basic structural frame. However, without its' cladding it would be a very draughty affair. The cladding itself, in most cases, adds to the strength of the frame, not so much from supporting weight, but from adding a degree of stiffness or bracing to the body. This is less so in tongue-and-groove sided bodies which are normally diagonally braced internally to compensate, but on wooden panelled bodies the panels are very often the only form of diagonal bracing and it is therefore important to assess the ability of existing panels to continue to do their job.

Before the days of plywoods, the side panels were a single panel of timber between 8 and 10mm thick. By the time we come to restore a tram, these panels have usually begun to split if they have not already begun to rot. Unless a split is repaired by gluing and supported by a piece glued to the back of the panel along the entire split, it will continue to widen under the stress of movements in the frame. Accordingly, it is often preferable to replace the entire panel with a sheet of marine ply or several sheets of ply laminated together in the case of curved sides. Because of the nature of plywood construction, it is resistant to splitting and therefore will last much longer.

Another useful use for today's modern plywoods is in replacement floors. A few sheets of ply are much easier to handle that several lengths of tongue-and-groove flooring with the added difficulty of cramming them together in a confined space. A plywood floor will also add rigidity to the entire tram chassis.

Earlier, I spoke about some of the conflicts that we, as restorers, have to grapple with when trying to preserve historical correctness and at the same time cope with the pressures of finances, availability of materials, the skills of members, etc. I would like to finish by examining this aspect in a little more detail and ask the question "How far should the 'pure original' be allowed to be changed when restoring a tram?"

Mr A.D. Bacon, in delivering a paper to the Tramway and Light Railway Society (UK) in 1982, rationalised some of the alterations made to trams at the National Tramway Museum at Crich with:

> "It is not, as a museum, content simply to restore tram-cars to their original state: it is a living enterprise affecting changes which in all probability the former operators would themselves have adopted had they continued to run the cars concerned. This is a far cry from the essentially passive attitude found in traditional museum circles, but it is in my view one which is every bit as worthwhile and infinitely more interesting."

A very interesting observation indeed. It is only fair to point out that this comment was made after describing how some design faults in the mechanical and electrical systems of a couple of trams were corrected, but I think it is useful to examine whether or not such a statement provides us with a guideline.

There are varying degrees of change. At the simplest level, there is change associated with the differences in materials that technological change has given us. For instance, one would have to be mad not to replace old plywood glued with a water soluble glue with a modern marine ply.

At the other end of the scale there is a major structural change. Let us imagine a tram in one of our collections which we find in our operations to be very slow to load and unload due to a narrow doorway. It is probably quite conceivable that if the original promoters had continued to operate the tram, the doorway

would have been widened to speed up loading and unloading. After all, they made quite major alterations to the bodies of most trams to reflect changing social conditions or public expectations. Sliding doors were fitted, open sections walled in, etc. but should we, as museums, charged with preserving an item of a past age, be allowed to make such a change in the outward appearance of the tram?

This is an extreme example of a possible deviation from the 'pure original', and I do not believe that any of us here today would sanction such a change on any of the trams in our care. However, those of us undertaking tram body restoration make changes to the 'pure original' through the use of different materials and, if we are not accurate in copying the original, have the ability to change the outward appearance of the tram. We also have to consider those little modifications which are made from time to time, such as adding rear vision mirrors or sun visors for safety reasons when originally there were none. How far are we prepared to allow these changes to go and for what reasons? In my view, Mr Bacon's comments are a useful starting point but need to be fleshed out so that our museum responsibilities are taken into account.

All our museums pride themselves on their excellent safety records and, to ensure they remain that way, each museum has in place a series of controls aimed at protecting members of the general public in their care. We all have operating rules, operators are trained before being let loose on the public, and in some museums statutory regulations apply to the licensing of both drivers and trams. But what of those other important items in a museum's care, the trams themselves?

To finish, I would just like to pose this one question: What checks and balances should our museums have to ensure the 'safety' of our trams from undesirable changes to their original form?

Chairman: Would someone care to comment on that last question? Would anyone like to ask Les any question on the replacement timber and construction?

John Radcliffe (AETM): In relation to that last question, it would be interesting to know how many people have made various changes because of statutory rules.

Les Stewart: I am sure most museums have added rear view mirrors and sunvisors and whatnot, things of that nature to their trams.

John Radcliffe: What do you do, for example, for fibreglass? Do you use it?

Les Stewart: Personally, no. I prefer, in terms of fibre-glassing, not to use it unless it is purely to patch a panel on a service tram prior to restoration. In a restoration job, if a panel had rusted through or wood had rotted, I say to replace that metal panel with a sheet of galvanised steel panel to add a greater life expectancy or in the case of a wooden panel, replace it. I wouldn't go and use fibreglass to patch an existing panel in a restoration job.

John Radcliffe: What about a roof?

Les Stewart: A roof? I have had some disquiet, but I would be willing to listen to the experiences of other museums in using fibreglass on roofs. Because of the possible movement in a roof, particularly one of timber slats as the base structure, the slats and the fibreglass would move independently and the fibreglass would possibly crack.

Trevor Burling (WTM): I think you have got to consider the difference between the two materials. The wood is one kind which is fibreous and the fibreglass is a modern technology, it's an epoxy of some sort and you would get an incompatability. Only for a patchup, fine, but for final work, I would not be too keen on that.

Les Stewart: At least canvas will stretch and move to some degree while fibreglass, although it is flexible, tends to be more rigid than canvas. I understand Sydney used fibreglass quite extensively on their roofs. Maybe someone would be prepared to comment....

Ben Parle (SPER): Only one car, 1497. You will see it tomorrow. It was one of the reasons why we got the car, wasn't it?

Norm Chinn (SPER): Yes, it is the only fibreglass-roofed tram Sydney had and, to the best of my knowledge, the fibreglass is still 100% intact. No movement, no cracks, and we've certainly stomped all over it like fairy elephants.

Peter Hyde (BTMS): I can add something to that. When we inherited our trams from the City Council, a number had fibreglass roofs and a number had canvas ones. The fibreglass roofs have all disintegrated by now while the canvas ones are still going strong.

Trevor Burling: Another comment there, too. Earlier on, Leslie mentioned the shear strength of wood and think of a place typical of a tram, perhaps one of the places would be a deeply waisted pillar where you have straight grain here and a bent shape [demonstrating with hand] with another straight grain here. You could get into a shear situation here with downward pressure there. That is one of the places where you would have to be careful about selecting woods.

Len Millar (TMSV): One place you have to check out is for a bumper....

Trevor Burling: Yes, the front portion of the tram.

Bill Parkinson (SPER): We have fibreglassed the gutters on the corridor cars, but they have very rigid framed bodies, there is no movement. The canvas is brought down over the top of the fibreglass and then it is painted with the canvas preservative to maintain a uniform finish. It protects the fibreglass. Most problems you get with fibreglass are from ultraviolet light which will destroy the polyester which makes up the resin. If you protect it under a layer of paint you don't get any problems. But you must use it in situations where you've got no sheer-back, otherwise you will have problems.

John Radcliffe: The S.T.A. are fibreglassing all the roofs of the H cars, they have done the first two. The first one they did sat outside without use for eighteen months and if it can survive that process....

Les Stewart: It would be interesting to see their trams after a number of years.

Len Millar: Speaking about roofs, the Met and ourselves agonise over what we should be doing to some of our roofs because some of our cars have had to sit out in the open for lack of storage space. We have all heard that story before. The distillation of our thinking is that we don't go to the Envelon the Met keeps on trying or keeps persisting with but go to a water soluble, thick plastic paint. It gives with the body movement and allows water to escape which may be sealed in, whereas Envelon will trap the water and potentially cause rot. We find that the plastic paint is most forgiving. It will fill any cracks in the paint on the top of the canvas and it's working well.

In response to your last question, the TMSV has a defacto policy in that any safety measure the Met applies to a tram we would be most loath to take off. One example comes immediately to mind; the line breaker and air compressor wiring tied in after the runaway at Riversdale a few years back. I can imagine what would be done to us in a court of law if we had an accident and the opposition was able to demonstrate we had taken off safety measures.

John Radcliffe: The opposite end to that is if you should add safety measures. In that case, we have two Brussels trucks equipped for airbrakes and the trams weren't airbraked when they entered traffic.

Les Stewart: That's right. That's one problem area with which many museums are faced, particularly with their older cars. They never had air brakes in service and when it comes to restoration, do you or do you not put air brakes on them. If so, how do you put them on in such a way as not to detract from the appearance of the tram.

Ron Grant (THS): I think Crich has taken this approach to an extreme. I don't know whether they have done it yet, with "John Bull" the steam tram, they do not wish to run it in traffic without effective brakes and of course it only had the good old `armstrong' brake or the reverse lever in the earlier period. With the Kitson at Christchurch, we prefer it to stay as an ordinary steam brake as the yard at the moment and it's quite an event. She gets her `blood-test' and passes it, so we cross our fingers.

Dick Hall (SPER): I was talking to the gentleman, who was out from Crich a fortnight ago, at Parramatta Park and he said it was originally built with Eames non-automatic vacuum brake.

Mark Skinner (AETM): I'll just get back to this roofing business as we have done a bit of research on it. We have actually used a product called *Dynol* which is different to the canvas, malthoid or fibreglass. It is actually a loosely woven fabric bonded to the roof timbers using a slow setting epoxy resin. The same resin also serves as a waterproof adhesive, and with the addition of talcum powder you can use it as a filler for wood and metal. The use of this particular material was suggested by a guy we had in as a contract carpenter. He was a T.A.F.E. lecturer in carpentry and also a member of the Pichi Richi Railway at Quorn. They have used some of it there on some of their carriages and, I guess, we are hoping that it will be a superior product. One of the points is, to draw some of the strands of this conversation together, if it is painted over and you can't tell the difference between that and the original, then you are getting pretty close to there not being an argument. Same thing with the floors. You talked about using a laminated timber instead of tongue and groove consruction, you can also use particle board in the same situation for the same reason again. Once it is covered over with either malthoid or slats, you can't see it....

Les Stewart: When the finished product looks much the same or exactly the same as the original, go with the new technology. I wouldn't use chipboard for flooring, as such, because it is not as strong as plywood, not as strong and waterproof as the old T and G timbers. In the case of roofs, I'm always a bit reticent about roofs. I'm never quite sure which way to go as there are so many options available. No one operator seems to have come up with the perfect answer as every operator is picking up different products and different methods of doing it. If there was one sure and tried method, everyone would be starting to use it.

Mark Skinner: I would like to make a comment on that. We had a team of about five guys and it took about half a day to do it once the roof had been cleaned down.

Alan Curtis (MOTAT): Can I just make a couple of comments there. They relate back to a conversation I had with another chap I know by the name of Stewart who has some connection with youself. Firstly, many museums are running more as operating tramway systems while others are developing more as tramway preservation organisations. There is a wide greyness in that line and I don't want to make any judgement on it; every museum runs their own particular show. There are two things we can do to answer your question, or to make it easier to answer that question as to whether you should repair or replace. One of those is to say there should be with every restoration very extensive documentation which explains what happened all through the preservation exercise so that we can say at some stage this floor used to be tongue and grooved, now it is plywood, etc. The other thing is to take the opportunity, especially where the technology has changed dramatically, to preserve some part of the old, and I mean preserve, not restore, but preserve in some sort of display area. An example here, and it is going to be faced by everybody who has a steam tram in time, is that boilers will need to be replaced. It is less and less likely that steam tram boilers which were riveted will be replaced with riveted boilers. They are more likely to be replaced with welded boilers so it is very important to keep a part of, at least a part of, the original riveted boiler so you can put that aside and say this is how it was made.

I would like to see, if I can make the suggestion, at the Wellington Conference in two years time, a workshop or discussion on the documenting of restoration projects.

Les Stewart: That is a very good point. Many of us are keen to get on with the job of repairing the tram or restoring it and don't like, or haven't got the time more like it, to spend time documenting what actually would have taken place. Talking about rivets, I was rather disappointed when I visited the Powerhouse Museum the other day to find they had replaced the saddle tank on the steam tram with a welded saddle tank, there were no rivets. The layout and presentation of the whole display was excellent but I felt that here was an exhibit that hadn't been restored to as it would have been in those days. Even if they had used false rivets, it would have been better that no rivets.

Howard Clark (SPER): It is interesting that the Hunter Valley Training Company went through that little exercise with our Balmain counterweight [dummy]. The steel top on the old one was rather rusted out. They decided, rather than trying to patch it to fix it, it was better to start again and build a complete new steel canopy on the top and they actually used false rivets on the welded shell. Externally it still looks like the original riveted construction. They were very concerned about that and they were particularly careful to keep it looking the same.

Les Stewart: We are all faced with operating trams in a public situation so how far do we go with originality. It is an issue we should all be facing, I believe, and setting up some sort of guideline within our organisation to ensure the restorers don't go off and do something that is not original or, for that matter, the operators don't take over to say, "Why don't we do this to make it easier for us," and change the whole appearance of the tram.

John Radcliffe: The extreme example of that fact is the H cars where the S.T.A. has replaced a lot of the wooden window frames and a lot of the doors with fibreglass painted with woodgrain and replaced all the steel sides with fibreglass, replaced all the steel beading with mouldings of fibreglass and in fact the whole technology of the tram in many ways is considerably different, but the appearance is ultimately still the same.

Les Stewart: The S.T.A. doesn't claim to be a museum does it?

John Radcliffe: No, but it might be well described as that.

Stuart Knock (MOTAT): Just a general query here on restoring trams. If you are restoring a tram, is it worth while restoring it back to its original class. For example, the Victorian W2 back to a W1 or W, or even the L class dropcentre section, which is similar to the W2, back to its four-door arrangement. Is this a well worthwhile exercise to do in restoration?

Les Stewart: This comes in to your initial decision when you decide to restore a tram you must make a decision as to what period you are going to restore it. Most trams had a mixture, a variety of changes during their life so you might decide that as you have, say, two W2s, you might decide to keep one in the condition in which it came off the road and restore the other one back to the W or W1 configuration. That's fine. It is part of the initial decision you make when you decide to restore a tram, what period you are restoring at present.

John Radcliffe: Of course, you have to decide how many variations are worth representing as the average customer is not going to give a stuff about it.

Trevor Burling: Some museums have the luxury of having several examples of a particular type of tram so you can make those decisions. We can put this one in this era, or whatever. We are lucky in that respect because we have four we can look at in this way, with our Fiducias. They don't change much, of course. We might have one car and another museum has a similar one, sometimes the museums have got together and and say, well look, we'll preserve one of this era and another of another era. Then you have got that coverage of the varieties.

Les Stewart: The important thing to make is, when you select the period to which you are going to restore to, that you actually restore the series in such a way that ther is quite a visible difference to the visiting members of the public. Just because one tram might have had a different type of handrail to another, doesn't mean to say you keep two of those and put one type of handrail on one and another type on the other, because if you did that you would probably end up having to keep thirty trams to represent a whole class of tram. The classic example is the Wellington double saloon, which is New Zealand's largest class of tramcar. It had four distinct periods, which were all distinctly different in appearance. The original form came out with an open centre and no doors on the motorman's platforms. They then went to a stage where they enclosed the motorman's platforms as the next step. The next step after that was a change to the whole front. They streamlined the destination area and the whole front of the line. The final form was a streamlined front with motorman's doors plus doors in the centre. You thus have four distinct steps in that tram's life and they all looked different to the public although they are all the one class of tram.

If you take the original open sided tram with no motorman's doors and you put a different type of handrail on one, you could say it is a different type of tram. But to Joe and Mary Public it is the same type of tram because they don't notice the different handrails.

Alan Curtis: We have a delightful example at MOTAT where we have one tram which depicts two types of construction depending on whether you are watching it comming towards you or going away. The two ends are quite different.

Frank Millier (ST&RPS): We only have only got one tram motor which is nearly one hundred years old and it has gone through a lot of different variations. We decided we were going to restore it to its last form when it was most efficient.

As there were no further questions or discussion, the Chairman thanked Les Stewart and declared the session closed.