

AUTOCAR

1903 North Eastern Railway Electric Autocar Trust

Newsletter No.21 — Autumn 2013



The North Eastern Railway 1903 Electric Autocar Trust

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- Front Cover:** A postcard of the autocar, postmarked
“Darlington, 1904”.

October 2013

Welcome to the 21st issue of our newsletter. Work continues both at Embsay and at Loughborough. But — your autocar needs you! As Stephen explains in his piece, we need more volunteers for practical work. If you can help, please get in touch. It could make the difference between us doing a job to a basic standard and doing it well.

We have started to sell a few autocar items to help with the fund-raising — please see the rear cover. Profits will go to our contingency fund.

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New Members

A warm welcome to our latest new members, M Parsons of Staines, J Poppleton of Scarborough, M Warr of New Milton and K Read of Leyland.

Chairman's notes

Stephen Middleton

We are over half way, spent half our money and the project is half complete. Are we on target? Maybe, but what sacrifices do we have to make to achieve a good result? The engineering is being handled to exacting standards off site. At Embsay we have a core of four skilled volunteers, who every Thursday, work to a very high standard to ensure the woodwork and finishing is right. Is four enough? Sure, we will get the job done but if time is against us, shortcuts are inevitable, five coats of paint instead of twelve, just one sanding down between coats, and joints that are visible. Will we have time to line the autococh? Such corner cutting will give us a finished project in two years time but what kind of legacy will it leave?

If you have the required skills to help us complete to a high standard, please contact me and help make this a project that we can be proud of and that will last for many years, requiring minimum maintenance.

Thank you to all who have contributed so much in terms of time, money and support already. Now for the final push. Happy Christmas and have a good New Year.





Above: a view of the end of the power unit (Peter Van Houten)

Left: Alan and Geoff at work in the Autocar (Stephen Middleton)

Below: The Autocar's roof (Stephen Middleton)



Engineering Progress Report Sept 2013

Stephen Hoather

Since my last report, solid progress has been made on assembling the power unit housing. The HV end is partly cabled up, and design of the mounting brackets for the electronic racks and other equipment in the LV end is proceeding apace. Some of the external doors have been hung (these are removable to allow access for maintenance), and the fire resistant glazing units have been delivered ready for fitting.



Above: The power-unit housing with doors. (David Moore)

The battery box has been completed at Adey's and the internal spacers etc. are being made. The fuel tank is in three sections to fit inside the underframe depth, and one of these sections has been made and is ready for leak testing.



The independent review of the underframe strengthening plates has been completed. As is normal in this process, a number of detailed questions have been raised which are being addressed, but the important point is that our reviewer is satisfied with the general design. His review will also cover the various attachments to the underframe such as fuel tanks, brake cylinders and brake rigging to ensure these are sound, so there is still some more work to do – some of the forces imposed by the brake rigging are measured in tonnes, and it is essential that the mounting brackets are adequate.

All this is leading up to what we are calling “Big Bang” at Adey’s, when the underframe will be brought into their shop. I am maintaining a list of the various jobs needed in “Big Bang”, and the status of the drawings and material, to ensure everything is ready at the start – if we clog up their shop whilst we prepare drawings it will cost us a lot of money. Following discussion with all those involved, we have now decided to fit the cab desks and much of the heavier brake gear during “Big Bang”,

rather than wait until we move to a separate location near Loughborough. This will delay the start of “Big Bang” slightly, but will make it much easier to complete the underframe ready for testing afterwards.



Overhaul of the trailing bogie of the power car has been finished at the Boston Lodge works of the Ffestiniog Railway under contract, and they have also made an extra pair of lifeguards to fit to the (Driving) Trailer. Both Stephen and I have (separately) been on holiday in Wales recently, so we both took the opportunity to look at the bogie and the facilities in their workshops – very impressive.

On the brakes front, we obtained what we thought was a second hand-brake set as well as the last batch of equipment from Northern Ireland, so our expert, Steve Parkes came over to Loughborough to check that we had everything we need for the handbrakes and all the rigging, so that we could start designing and making anything that was missing.

Unfortunately, he found that one of the handbrake sets was of a different design to the first with lots of parts missing. Although this could probably have been fitted in the trailing cab, significant changes to the drawings would have been needed which would have delayed the project further. Fortunately, enquiries of the “5 BEL” project team revealed that they will soon have available a second standard SR type handbrake off a CIG unit which they are willing to let us have.



*Brake material
(Phil Coomer)*

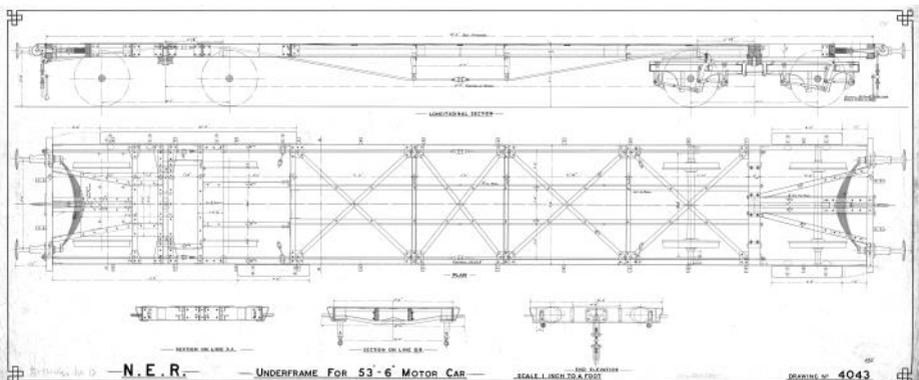
As with most restoration projects, the work is much more complicated and taking longer than originally envisaged. We are incredibly lucky to have Dave and Peter at Loughborough, and although Peter is working for us as a contractor almost full time, his time is split between preparing CAD drawings for items to be fabricated at Adey’s, and physically working on the engine housing unit itself. We are now looking for a volunteer to help at Loughborough – the ideal person would be an apprentice trained Fitter or Electrician, but someone with a background in car maintenance, plumbing or similar could be just as useful. If you live in the East Midlands and would be willing to volunteer say, one day a week at Loughborough, we would love to hear from you.

An Engineer's Perspective (continued)

Dave Moore—Volunteer Engineering Advisor to the Trust

The Autocar Underframe Conversion

The Autocar's underframe is approaching the point in the project where the process of turning an old coach chassis into a powered railcar is almost upon us. The original North Eastern chassis had many timber elements, and our choice of a slightly later vintage all steel frame for the Autocar takes us into the earliest period of steel construction, which is now commonplace. Our particular underframe has the very elegant Truss Rods and King Posts essential in maintaining the delicate appearance of the original vehicle. Later underframes in this style were gradually improved and strengthened as the all steel chassis technology developed to the point of eventually going away from Truss Rods and towards the central spine format. The all riveted construction of our early underframe is another ancient feature that sets it apart from modern vehicles. This is also considered to be another largely obsolete technology, and is superseded by bolting and welding these days. To complicate matters, unusual steel sections were employed on these early frames, such as the peculiar Bulb Angle solebars, a type developed for shipbuilding and only later employed in railway applications. It is difficult to integrate modifications into these old structures because they are difficult to analyse by modern means, and even more difficult to assess if they have suffered any corrosion damage.



Taking the old coach underframe, and converting it to a railcar was never going to be an easy process. It requires an understanding of these old construction methods that went out of use in rail vehicles by the 1950s. Paradoxically, the much more recent aviation industry persisted with riveting aeroplanes together out of formed sections, and still does it to a limited extent. Fortunately, when Don Carter was at Field Aviation Services in the early 1950s he was involved in designing conversions of war surplus Douglas Dakotas for further civilian uses. Although made in dural (and NOT aluminium as Don has to tell us all when we start joking about aluminium aeroplane metal never being used on old trains) the similarities are very clear. The stress analyst's methods are comparable, even simpler on our frame, as there are no stressed skin panels like there would be on an aircraft structure. (This was to come later on during the 1960s when Don was at Brush during the Type 4 Diesel build, when Gloster Saro were used as consultants on the all monocoque stressed skin loco body structures that were just being developed by Brush).



The top of the solebars were severely corroded due to being in contact for many years with wet wooden floorboards when it was in use as a crane runner. The resulting weakness of the solebars was demonstrated at Emsay when I stood on the end and found it was a bit like a trampoline. Both I and Steve turned a shade of white!

Left: An early view of the underframe, at Emsay (SG).

The underframe conversion design process began with an assessment of all the loads the underframe needs to carry, the Engine Housing, Battery Box, Fuel Tanks etc. It requires accurate estimates of weights of equipment, even passenger loadings. These are superimposed onto the basic chassis in its bare form and an assessment is done in the form of a Bending Moment Diagram for the finished chassis and an evaluation of stress levels are made. Strengthening and reinforcement is made where necessary, and a review done as to the probable fatigue life of the new design. This homes in on the most highly stressed areas of the conversion, and aims at reducing local areas of highest stress that could give rise to cracking and failure in time. It's easy to put something together that works, but for how long? Another aviation analogy again is the early marque of Comet airliner, whose oblong window frames eventually fatigued, leading to fuselage failure. We are just at the point now where these final refinements have been included in the design calculations and the final manufacturing drawings produced after our independent assessor has checked the conversion over.

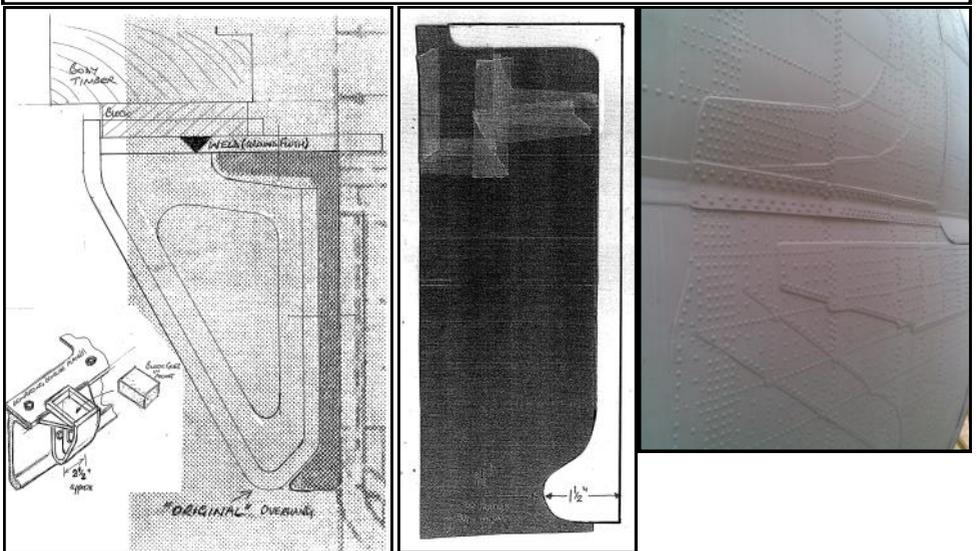
Remember that this is no straightforward 'repair' job, we are creating what in structural terms is a 'new' vehicle underframe, albeit using an old frame as the major building block. In modern times, this process is done using computerised methods and standard programs that do not exactly suit the analysis of ancient rusty carriage underframes! The process has been assisted greatly by the efforts of Nigel Yule finding an original drawing at the NRM that was very close to our frame, and then the efforts of Steve and Andrew Parkes in producing a CAD drawing to match it. This aids the manufacturing process greatly, as the conversion amounts to a full scale industrial process for which the Trust have engaged Adey Steel to work on to completion.

The basic principle of the conversion is a cross breed of ancient and modern, in that computer cut profiled top and bottom plates will be bolted/riveted to the existing chassis when debogied and on stands. This process started at Embস্য with the replacement of the badly corroded bogie pivot cross stretchers last year, and the forthcoming work continues this process with replacement of the headstock diagonals. An

ancient construction method is being employed along the whole frame, namely the provision of the 'doubler plate' method of strengthening a riveted structure by thickening the material section by overplating. This can be seen on many old riveted bridge structures to this day, where sections were added or enlarged by multi layering of the plates. Again, the aircraft designers got good at it, witness the elegant multi layered Vickers Vanguard wingroot in the photo below.

The associated extras along the length of the underframe all either bolt to the old frame, or get welded to the new material. Nothing is welded directly to the old Bulb Angle Solebars so as to be as kind as possible to the old material. Another curiosity is that the Autocar's vertically planked, and hence straight sided, carbody is actually rather wider than most of the underframes of the day. If you look at the old photos you will see that this was true with the original chassis. Hence, the requirement for what resemble 'shelf brackets' bolted through the solebars that support the lower horizontal timbers across their width.

Below (l-r): The principle of the body mounting brackets as being fitted to the solebars
 The profile of our Bulb Angle Solebars as traced off the Underframe
 The 'doubler plate' method of strengthening a riveted structure, as used on a Vickers Vanguard fuselage.



Autocar 'Cousins' - Historical Perspective

Simon Gott

We often say that the Autocar is the 'grandfather' of modern passenger trains. If it was, then it's probably safe to say that the 'father' was British Rail's first generation DMUs of the 1950s. But what relation would the Sentinels and Railmotors of the 1900s and the GWR diesel railcars of the 1930s be? They all had a significant input into the development of today's units. Last year, I started wondering about what a 'family tree' would look like. To be accurate, there would have to be distant relatives, some from overseas, and some breaks in the line of 'succession'.

Well, family trees and the relationships between family members are not something I know much about, so I didn't stay with the idea for very long. But I kept hearing about and being given information on other pioneers of petrol-electric propulsion and prototypes of multiple units. I was interested to see where they fitted into the history of rail transport in relation to the autocar. So over the next few issues, we'll look at some of the more interesting and significant of these.

This series is set in the twentieth century. There were earlier experiments but generally the story of railcars and multiple units started in 1902. In that year, Drummond, engineer to the LSWR, ordered an eight wheel steam powered railcar, which entered service in the summer of 1903. The GWR borrowed it and were impressed enough to order some of their own. Two types developed, a 'suburban' and a 'branch', the latter with a space for parcels. These could serve unmanned halts and operate services that a conventional loco-hauled train could not. Other companies, including the Lancashire & Yorkshire and Taff Vale Railways, also placed orders. Some of these steam railcars looked like carriages with part of one end taken up by a small engine-room, others looked like the result of a shunting accident - a fusion of a four wheel tank engine and a carriage.

Also in 1902, Vincent Raven, assistant CME of the NER, was facing the same challenge as Drummond, he developed a similar but different

answer and one which was far more innovative. A few electric trains were already operating, in London and Liverpool, and the advantages of electric power were well-known. With the addition of an on-board engine and generator, the petrol-electric autocars could take advantage of this without being restricted to electrified lines.

During the 1920s and 30s, most attention was given to steam-power. The GWR, despite being an early pioneer of steam railmotors, quietly dropped them in favour of steam push-pull trains. These gave greater capacity and operational flexibility and all the railway companies used them to some extent. The LNER also bought over 90 Sentinel and Clayton steam railcars in the mid 1920s, together with some unpowered trailers.

During the 1920s, diesel engines developed and became practical to fit in railway vehicles. The LMS Railway created Britain's first diesel-electric unit in 1928 by converting an electric unit. Three Armstrong-Whitworth diesel-electric railcars were constructed in 1931/32 for the LNER. Further south, the GWR introduced their famous diesel railcars.

The Second World War and a shortage of oil in the years afterwards blocked further development of diesel and diesel-electric engines for a decade. However, in the early 1950s, interest returned and a variety of new railcars and multiple units were constructed. The construction of these 'first' generation British Rail multiple units is often seen as the start of the history of multiple units, despite the innovations of the previous 50 years. Next issue, we'll look more closely at one of these.

Display boards or fastenings wanted

The publicity stand is starting to show its age. A number of components have either broken or been lost and the boards are well past their best. Does anyone have a set of boards or clips/fastenings we could have? Alternatively, if you see any advertised on special offer, could you let us know?

Autocar Shop

To help fund-raising we have some autocar themed items for sale.

- Fridge magnet (acrylic c90 x 60mm) showing the autocar at York. £2
- Travelling mirror (unbreakable and with case). £5
- DVD (a short film introducing the Autocar). £ 10

Post and packing for up to six of these items is 80p.

- Sweat-shirt - price tba soon
- Fleece - price tba soon

Post and packing for either of these two items is £3.50



To order:

Please send written orders and a cheque (payable to NER 1903 Autocar Trust) to NER 1903 Autocar Trust, Rose Lea House, 23 Brunswick Drive, Harrogate, North Yorkshire, HG1 2QW.

We plan to add a shop section to our web-site during November.