

AUTOCAR

1903 North Eastern Railway Electric Autocar Trust

Newsletter No.16 — Summer 2012



The North Eastern Railway 1903 Electric Autocar Trust

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- Front Cover:** The autocar, showing progress made on the
boarding at the saloon end. (Alan Chandler)

July 2012

Welcome to the 16th issue of our newsletter. This is an issue which focuses on the engineering side, with an article from Steve Hoather with his preliminary thoughts on the autococh — which has recently been moved to Embsay in readiness for restoration to begin — and another from Dave Moore, looking at the design of the autocar’s fourth engine.

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New members

A warm welcome to Mr. J Dagger of Southport, Mr. L Penfold of Birmingham and Mr. J Priestley of Bedford.

Chairman's notes

Stephen Middleton

The last quarter has been both celebratory and salutary for railway heritage and has affected the autocar trust in several ways. Firstly the ghastly accident on the NYMR was a shock to us and our sympathies go to all concerned. It is a reminder that safety is paramount. With that in mind our host railway and trust partner, Embsay and Bolton Abbey Steam Railway is holding a series of track safety seminars and all working volunteers must attend if they are not already qualified. My wife and I took the course and it made us think as never before about the dangers posed by working so close to heavy, unforgiving, wheels and machinery. E&BASR is to be congratulated for its' initiative.

Railfest was the other side of the coin, celebrating the history, present and future of railways focusing on record breakers. It was a fantastic event that the rotten weather could not spoil. Stately Trains LNWR 12 wheel saloon was invited and it looked great next to Hardwick. In exchange we had a stand in the Heritage Railways arena and the Autocar Trust was well represented, handing out hundreds of leaflets and talking to many interested people.

Following considerably more work than anticipated the autocar's under-frame is ready to go to Loughborough for completion works. I am looking forward to seeing the underframe return as a powered unit ready for the 'top' to go on. In the meantime we can crack on with the autocoach. The work never stops!





Matt working on the adapter plate which goes between the motor bogie and underframe. (SM)



Some of the engine room roof panels after a thorough clean and treatment with anti-corrosion primer. (SM)

Engineering Progress Report

Stephen Hoather

The big news this time is that Cummins have now completed the design of the power unit assembly. As the radiator is a 'bought in' item, they, understandably, wanted a deposit from us before placing the order with their sub-contractor. It also helps our cash flow to pay in stages, as this is probably the biggest single item of expenditure in the project, so we have now paid the deposit and the power unit should be delivered towards the end of August.

The design team came to Embsay at the beginning of May to take some further detailed measurements. The drawings for the engine housing are progressing well, and will be ready for review by our independent structural engineer shortly. In the picture below, you see Peter Van Houten and David Moore (right) with the electronics rack which will house the engine control system, wheelslip prevention system and other electronics. This was recovered from a Grand Central HST power car



when it was re-engineered, and generously donated to the project by its owners, Angel Trains. The rack has been refurbished and re-wired by Noel Craigen.

Work on the underframe continues at Embsay. Having fitted the wooden headstock extensions, we are modifying the buffers and couplings to suit the new configuration. The underframe should have been lowered on to its bogies by the time you read this - the delay was due to the logistics of clearing vehicles which were stabled outside the shed to enable the motor bogie to be moved in.

Before the underframe and bogies leave for Loughborough we will arrange for an Ultrasonic Axle Test (UAT) on all six axles, as this is an

Below: *Peter Van Houten tries out the template for the engine room roof which he made from the drawing. The clerestory section was spot on, but the profile of the side sections was slightly out. (SG)*



essential requirement before any test running. No, you didn't misread this, when I said six axles I meant it – two motor axles and four trailers. We obviously only need two of the trailers for the autocar, and have provisionally selected the two which have the thicker tyres, but until the UAT has been done we will not know whether the axles are sound. We will also UAT the autocar's axles now this coach has been moved to Embsay.

We have recently bought some surplus electrical control jumper sockets of the type used on HSTs, and these will be fitted to both ends of the autocar and the inner end of the trailing autocar to enable the latter to be used as a driving trailer. The pile of parts we are collecting in our store is becoming quite impressive!

Most of the brake valves and other components we need have now been removed from the scrap vehicles, and are at present loaded on pallets, ready for moving to Railway Brake Services's workshop who will overhaul them ready for our use. We are still struggling to find a 12" brake cylinder for the engine end of the motor coach. Stuart Hiscox helpfully made a list of over 30 preserved Post Office vehicles, and we have now approached the owners of all but three, but none are prepared to sell us a cylinder (or have not responded). Patience is a virtue in this game!

The Engineering team is concentrating on the autocar at present, but I will shortly visit the Search Engine at the NRM to look for drawings of the trailer autocar - in particular the underframe - so that we have all the available information ready when needed.

Publicity update

The exhibition stand now has a laptop to show Michael Massey's DVD on. A big thankyou to George Moffat for donating the laptop to us and to Alan Chandler for turning it into operational condition.

The stand is booked for Scarborough MRS's exhibition (at Pickering) on the 18th/19th August and the Leeds show on the 27th/28th October.

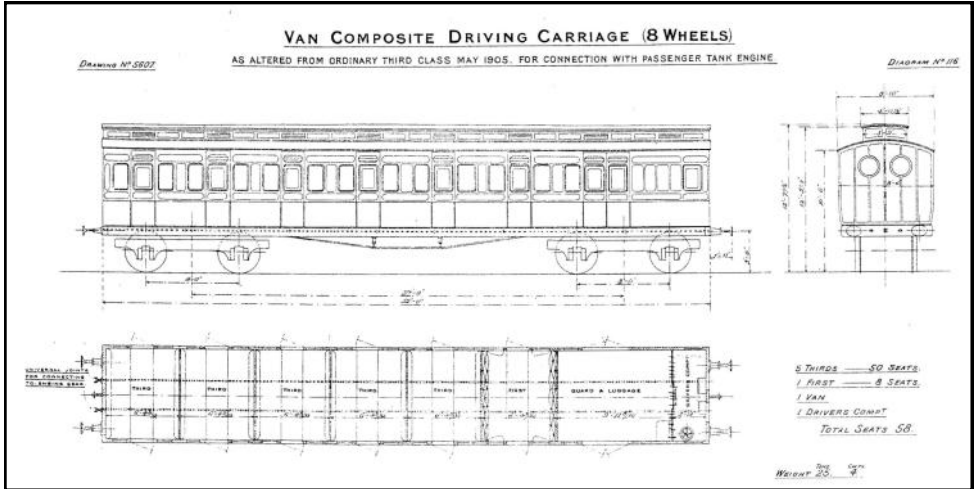
Autocar timberwork

The tongue and groove boarding is being tacked onto the non-engine-room end. As the photos show, the autocar has a bow end and this requires extra care when placing the boards.

Photos: *Alan Chandler at work.* (SG)



The autocoach:



Above: NER plan of this type of coach. Courtesy Mike Grocock.

Below and opposite: *The autococh as it currently is.* (Alan Chandler).





The Autocoach — some engineering thoughts

Steve Hoather

By the end of June, work on the body of the autocar had reached the stage where there was little more that could be done before the body is lifted over to the correct underframe - for example it would be unwise to fit the glass in case it gets broken during the lift. The departure of Stephen's LNWR saloon to Railfest made space for the trailer car (3453) to be brought to Embsay to enable work to start on the body and interior whilst the power car underframe goes to Loughborough for strengthening and fitting of the power unit.

The estimate is that there is about a year's work on the body of the auto-coach before we need to go into the details of the engineering, but whilst we were both at Embsay recently we took the opportunity to have a look inside and make an initial assessment. The work needed comes under several headings:

Conversion to Dual Brake

Although the vehicle was (presumably) built with air brakes, like all NER vehicles, it now has vacuum. We wish to retain the vacuum facility to enable it to run in other trains, so we will add air cylinders and a distributor, reservoir etc. A complication is that the Passenger Emergency chain, when we fit it, will have to be dual, so we will have to obtain both air and vacuum PC valves. Apart from this, most other brake equipment should be obtainable from scrap BR vehicles, but the centre longitudines of the underframe are wooden, so we may struggle to obtain adequate fixing points for the cylinders.

Cab

The coach was at one time a push-pull driving trailer, and the driving end has two circular windows of 14" diameter, which is small by modern standards. In order to have the driver's eye level in the middle of the

window we will need a seat which can be raised and lowered, and it may need to be mounted on a small plinth to get the height right. We will also need to find a suitable windscreen wiper. The combined cab and guard's van has double doors both sides which will enable us to provide wheelchair access, and we will also provide a lockable cupboard so that spares and manuals can be kept securely on the autococh.

Cab Controls

These will be similar to the power car, but space is less of a constraint. The brake controller will be air only, but the existing guard's emergency vacuum valve will be retained.

Electrical Wiring

At the non-driving end we will fit a jumper socket (we have recently bought some surplus HST ones) and fit conduit and cabling to the cab. Lighting will be fed from the alternator and battery on the power car.

Heating

The design of both vehicles allows for heating to be added at a later date, and on the trailer this will be 110v electric, fed from the alternator. Whilst the seats and compartment partitions are being fitted, it would make sense to at least fit conduits and draw wires for the heater cables, but we do not need to decide yet, and the final decision will probably depend on finance. We discussed whether to fit steam heating at our last committee meeting - the coach has a two inch main steam pipe on the underframe, but it is probably badly corroded. If we decide to make provision for steam heating as well, it would be best to renew this pipe before any additional equipment is added to the underframe.

Our general conclusion was that there was no need for any immediate decisions or work on the engineering aspects of this coach for some time. Stephen and his team will soon start on the bodywork and interior.

An Engineer's Perspective — Traction design

Dave Moore - Volunteer Engineering Advisor to the Trust

Readers may be wondering why it is taking some time for the HLF funded power equipment to appear. Basically, you just can't go out and buy this off a shelf, let alone expect it to fit and power the ancient vehicle it has to drive. Then there are other mechanical issues such as the air brake system, the reworking of an old underframe of a different type to the original, and the list of adaptations goes on at some length...

Then, we need to subject our plans to a design scrutiny process, as in recreating the autocar the way we have to, it's closer to creating a new vehicle in outline terms than it is to restoring an old one. This is not at all like restoring, say a Mk1 coach, where if you do the repairs in the correct manner you get back to what you started with. With the autocar, although the body is original, and the underframe is also old, the power and brake systems are new designs to fill huge gaps in the vehicle as none of the original survived.

So the challenge is to recreate the NER's pioneering electric autocar in a manner that is sympathetic to its original design, whilst being compliant with the regulations and requirements of modern times. Even though its operation is limited to heritage railways, it still has to conform to the relevant standards, and have a worthwhile level of performance and reliability to make its operation a practical proposition. This is where the autocoach (trailer) comes in. From the outset, the project has relied on the rebuilding of the autocar in its two car form, with a Driving Trailer (in modern parlance) making it into a two car set. This boosts the passenger capacity and makes it a more practical unit to use on preserved railways. Thus, the autocar is designed to become an emissions compliant diesel electric, air braked, two car Unit, which drives on one motor bogie.

Having decided that a petrol engine in a wooden bodied vehicle was not a good idea, the challenge was to engineer an appropriate diesel electric power equipment system for the autocar. This is where a significant irony became apparent, in that this vehicle which was the starting point

for modern traction, was going to need some of the most up to date technology to rebuild it. With the mandatory requirement of an emissions compliant diesel engine for new installations, this old vehicle would need one of the newest diesel engines available.

The last time a new diesel electric drive system was designed and built in the UK for a mainline style vehicle was in 1989 for the Class 60. This autocar, with all its power equipment 'upstairs' in the body, just like the steam railcars of yesteryear, requires a locomotive style approach to its design. So, 109 years after this country built the first mainline internal combustion electric drive system, and 23 years after it produced its last one, we have to create one from scratch just for the autocar.

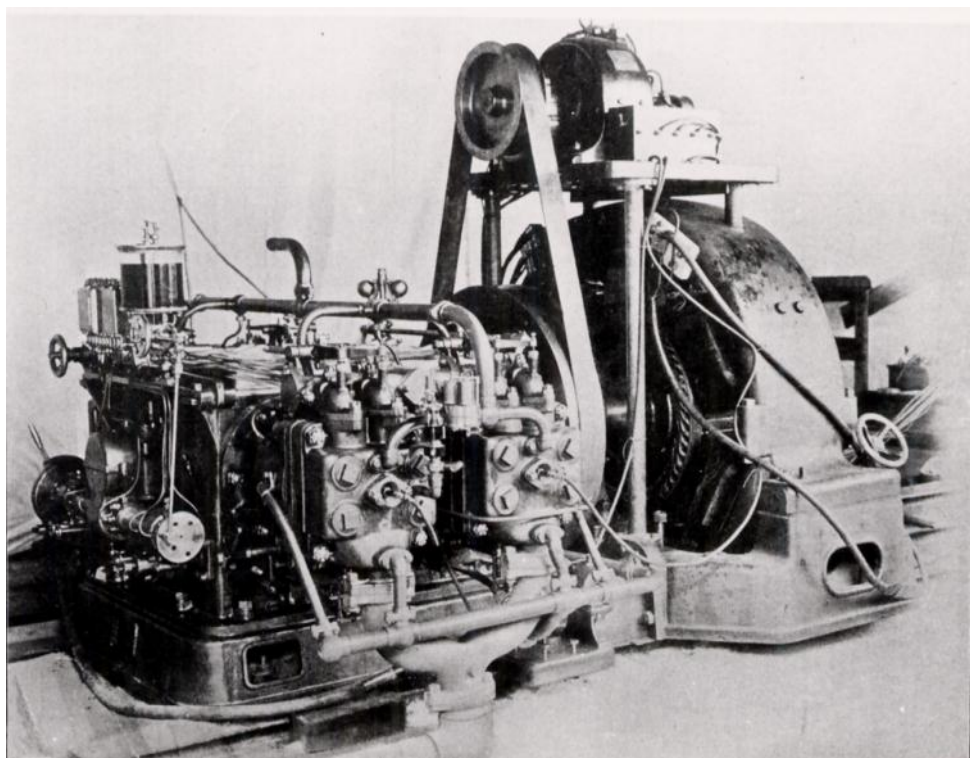
The design process involved to accomplish this is in some ways more difficult than a completely new design, as the constraints of preserving the look and the form of the original vehicle design can often be in conflict with more modern methods. The basic redesign process starts with evaluation of what the precious remains of the original vehicle amount to, and then by finding an appropriate means of filling the gaps remaining by adapting other vintage equipment, or by design and production of new elements. This combination approach to vehicle restoration, where original is mixed with other vintage items, and augmented by some new elements, is a proven method of working. The difficult part is to decide on the core building blocks of the rebuild, and then work outwards from there.

POWER EQUIPMENT

This design process starts with evaluating the engine types available that fit the application, both in pure technical terms and regulations. We needed an engine with Tier 3a emissions compliance to get approval for this 'new' installation. It does seem bizarre that the world's oldest non-steam railcar gets classed as a new application as far as its engine is concerned, but those are the rules, and they effectively close off a myriad of possibilities for using existing engines in the rebuild. So we start from scratch in this department.

That also means that the electrical machinery (generators / alternators) that a 'used' engine would come attached to are also out of the game. Often, many re-engineered partial rebuild vehicles have used existing electrical machines coupled to new engines. The problem in this case is that all the old engines ran at lower speeds than the modern emission compliant engines, hence their electrical transmission machinery cannot be used either. So, a completely new power generation engine/alternator setup is also required.

From the safety viewpoint alone, the old method of mounting equipment on the chassis in an open layout, with rotating parts, high voltage terminals, hot exhausts and a dozen other hazards, let alone the noise from it all, was completely out of the question. Quaint as it may be, we were not prepared to go down the NER's original route, so it occurred to us that although the enthusiasts will know that the rebuilt autocar has



Above: *The second engine - a Wolseley - showing the open layout. (KHST)*

not retained its original engine and equipment, most passengers will not know this. So, not wishing to spoil the illusion, and with some care taken in the approach, the new equipment could be disguised in a tasteful manner by creating an ancient looking power equipment enclosure to address the problems of the original layout. All the power equipment, including its electrical power and control gear making up its transmission, are to be built into this assembly.

The 'engine housing assembly' seemed an appropriately old fashioned title to use, it could even have been termed that had the North Eastern decided to build a box around their equipment. Researching what was common practice on industrial equipment at the time reveals how rarely this was done. Open equipment layouts were the norm, with the safety risks being mitigated by a "Just make sure you don't poke your fingers in there" approach!

MOTOR BOGIE

Critical to the diesel electric power equipment design are the traction motors and drive gears. It was apparent that the most appropriate way to recreate a motor bogie would be to take an existing, old style design, with Direct Current traction motors, and remodel this for the autocar. This was found in the form of the very suitable 1955 Southern Region bogie -the lower speed 75 mph variant known as the Suburban version. Equipped with two classic English Electric model 507 traction motors, the tractive effort and traction power characteristics of the bogie would be compatible with the traction electrical supply available from the engine / alternator unit.

Critically, the autocar's performance on track at the design stage is always considered under the most difficult of circumstances. To have the autocar trundling up and down between Embsay and Bolton Abbey is obviously a much easier duty than hill climbing the North Yorkshire Moors with the trailer in tow. So for design purposes, the vehicle is considered as being a two car multiple unit with two powered axles, and a combined weight of around 75 tonnes. The trustworthy E.E.Co type

507 traction motors form a critical element of the design, and the lower geared bogie favoured for this project was sourced as described in a previous article in the Newsletter.

UNDERFRAME

The ex-crane runner underframe sourced for the project is all steel, unlike the original NER chassis which had many wooden structural elements. Although somewhat corroded in places, study showed it to be worthy of the restoration and conversion required for the project. Firstly the underframe has to be restored back to a condition worthy of its re-use. This simply takes the underframe back to a serviceable condition, but only to a state fit for its original use as a coach. The next process then converts the coach chassis into a railcar chassis with all that entails, i.e. carrying power equipment, fuel tanks and batteries. Then, as described previously, consider the fact that the autocar will be either pulling or propelling the Trailer when in service. Thus, the underframe is part way to doing the job of a diesel electric locomotive.

The obvious problem with the modestly corroded state of the underframe is that the original repair process for such defects would be to scrap the affected sections and rivet in new ones. Whilst simple, and requiring no welding on ancient steel sections, only some of the damaged sections could be replaced by remaking from new. The 'Bulb Angle' solebars are so exotic as to be irreplaceable by modern means, and methods have had to be developed to recover these most critical elements of the structure by sound means to make them fit not just for the original purpose, but the further functions of a railcar. To restore and modify this ancient structure takes some time and consideration, and involves analysis and calculation of the stresses and loadings involved, and evaluation of its compliance with the required standards to render it fit for passenger service. The original underframe was almost certainly inferior to the converted underframe that will result in this case. The NER drawings show a fairly improvised conversion of a standard coach chassis was employed in 1903.

Building the Medley 7mm scale model Autocar

Richard Marsden



Photos by Richard, showing the model in NER livery. Medley Models is now known as NER Days, though is still based in Leeds. (Ed.)

First, apologies for the delay in this final article. A house move led to a hiatus in modelling. This was also taken as a much-needed opportunity to finally organize my tools and other modelling supplies. Anyway, as you can see from the photos, the big news is that the autocar has been finished!

The roof (white), bogies and underframe (black) were spray painted with aerosols. The interior was brush painted with Phoenix Teak Base Coat (P395). The cream and red ('vermilion') were painted using an airbrush. Phoenix Vermilion (P994) was used for the red. For the off-white cream, I initially purchased a bottle of Floquil "Antique White", but this proved to have a slight green tint instead of a cream tint. I eventually I used Humbrol Matt White with a hint of the Teak Base Coat.

For the main windows I used microscope cover slips. These are extremely delicate, and were cut to size using a diamond scribe. I initially tried a tungsten-carbide glass-cutting wheel, but the scribe was much more accurate and did not cost that much more. Canopy glue was used to attach the windows.

The cover slips would have been too delicate to fit to the clerestory, so I

chose to use clear styrene sheet instead. This also allowed the windows to be easily misted, as per the prototype. The prototype's window misting probably included a pattern, but I kept mine plain. This was applied with emery paper and a fibreglass brush, using opposite diagonal strokes. Whilst researching the best way to glaze the clerestory, I found that some people also used silver paint on the inside of the styrene. I experimented with this, but after comparing it with prototype photos I decided it looked too opaque.

Transfers were from Fox: one sheet of FRH 7376 (four NER Coats of Arms), and two sheets of FG 1304 (gold letters). Masking tape was used to align the (very long) words.

The figures are a mixture of Border/Invertrains, Blackberry, and Slaters. The plastic models from Slaters are cost effective but tend to look too modern. Invertrains stocked a number of figures of a suitable age.

The lamps are DJH LNER lamps. Initially I planned to fit working lights but I found the lamp wiring in my NER V1 brake van was extremely delicate, so I chose to keep these unlit. A Digitrax DCC decoder with suitable lamp wires has been fitted, so working lights could be fitted at a future date.

And that is it! So who makes a 7mm scale kit of a NER Diagram 116 clerestory autocar....?

