Network Rail's Engineering Work on the West Highland Lines.

The Northern of the two viaducts that carry the Fort William line round the Horse Shoe curve at Auch

Travellers on the West Highland Lines will be aware that services over the last 2 years have been interrupted by Network Rail possessions to carry out maintenance work. Observant window gazers will also have noted that some of the work has been on an ambitious scale. It is the nature of this type of work that Network Rail and their contractors are most active during possessions and at night. This fact and Network Rail's reticence to boast about their activities has meant that a lot of excellent and challenging work has been accomplished in very difficult conditions, and with little public awareness. The Society believes that Network Rail's work

North bound Caledonian Sleeper crosses the Rannoch Viaduct during refurbishment.

on the WHLs deserves recognition. This article in an attempt to set this on record. Details have been provided courtesy of Network Rail and this is acknowledged with thanks.

The West Highland Lines are a significant part of Scotland's Industrial Heritage. Their history and romance has been well documented in many excellent publications. Indeed it is the very nature of the 179 miles of main line connecting Oban, Fort William, and Mallaig to Scotland's commercial centre, and their often

seemingly tenuous connection with a challenging landscape, which makes a journey on them seem like an adventure.
The building of these lines was as much a financial challenge as a conquest of an unforgiving climate and terrain. The reader will no doubt think 'nothing has changed' and indeed they are correct. The financial, climate and topographical challenges remain. One important change for modern workers is the absolute dedication to health, safety, and the environment. When the railway was built life was expendable. Today it is rightly very different. In carrying out their work these issues must feature large in Network Rail's planning and logistics.


Dubh Eas Viaduct, Glen Falloch

Evidence of past financial constraint is clearly depicted by the imposing viaducts which are a feature of the North British build on the line from Craigendorran to Fort William. The viaducts are impressive structures on their concrete piers but the lattice steel frameworks of the bridges are conservatively engineered. This and the requirement to maintain the curved line of the track means that there must be a trade off between supported safe working loads and the speed of rolling stock which is certainly not generous. (Class 67 and the Caledonian Sleeper for example). It also means that regular inspection and control of corrosion is essential.

Network Rail have recently spent over £8M refurbishing three key viaducts, replacing life expired track, clearing vegetation and repairing earthworks between Helensburgh Upper and Tyndrum Upper Station and a further two on the Bridge of Orchy – Corrour section, namely the Gaur and Rannoch viaducts on either side of Rannoch Station at a cost of approx. £1m & £2.2m respectively. Of these the most visible is the viaduct north of Rannoch Station and the least visible, but by far the most dramatic, the Glen Falloch Viaduct over the Dubh Eas (Black Water).

Closure of the line allowed work at two structures; Manse Viaduct (between Glen Douglas and Arrochar) and Glen Falloch Viaduct over the Dubh Eas, to be implemented in unison, thereby maximising the use of the possession. The works were planned, in close consultation with freight and passenger operators, to avoid the peak tourist season. Work was programmed to minimise disruption to the public, by delivering the improvements as quickly and efficiently as possible.


Scaffold installation prior to refurbishment.
Photo: Network Rail

Glen Falloch Viaduct

Built by the Glasgow engineering company of Formans & McCall and opened on 11th August1894, the Glen Falloch viaduct carries the railway over the Dubh Eas, an energetic tributary of the river Falloch. It is 130m long, has one span of 36m and seven of 14m and has a maximum height of 43.9m, just 3.7m less than the Forth Rail Bridge. Comprising, wrought iron lattice main girders, over forty cross girders and a timber deck, the viaduct's ability to carry trains is vital in maintaining the operational capacity of this key route. The waterproofing system had reached the end of its useful life resulting in the deck becoming saturated. In addition, the structure required strengthening to meet modern loading codes and

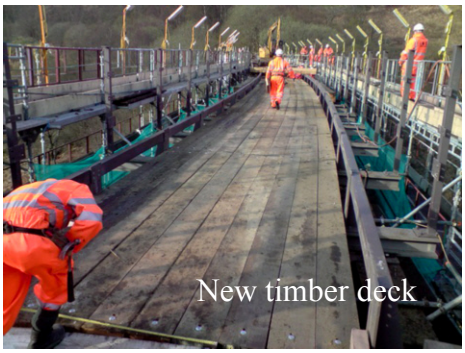
repainting in order to extend its service life and maintain its aesthetic appearance. £3.6M was invested in Glen Falloch Viaduct,

The work involved:

- fifteen new fabricated steel cross-girders to replace corroded girders,
- isolated steelwork repairs to corroded areas
- additional steel bracing to cater for modern lateral loadings,
- a replacement hardwood timber deck,
- new walkways for track patrollers and bridge inspectors
- gabion baskets for ballast retention on approaches to the viaduct
- new hardwood ballast retention
- modern PVC waterproofing system to protect the timber deck
- a new paint system to protect and enhance the structure.

Photos courtesy Network Rail

The original paintwork was stripped away using a dry blasting technique, prepared to provide an effective base surface profile before the new protective coating was spray applied.
Throughout the period of works the viaduct was encapsulated to protect the local environment from contamination and falling debris. Special emphasis was placed on the handling, storage and use of chemicals



Photos courtesy Network Rail

on site due to the location of a watercourse under the central span and the location of the viaduct within the Loch Lomond national park area. A full COSHH (Control of Substances Hazardous to Health) assessment was undertaken and this formed part of the site briefings given to all personnel prior to work commencing. SEPA, the Scottish Environmental Protection Agency, were consulted during the planning stages to ensure the works did not present unreasonable risk to the local surroundings. The viaduct spans a very deep and dangerously steep sided gorge. In such a demanding location, the erection of the scaffolding required to provide safe access and secure stable temporary working platforms for the workforce and the above mentioned encapsulation, was a major part of the project.
Work was completed on time and the track reopened to traffic to coincide with the start of the busy summer season. The work undertaken ensures that the viaduct will remain not only operationally effective but also maintain its aesthetical attractiveness for years to come.

Fillan Viaduct

The Fillan Viaduct after refurbishing. and repainting.

In contrast to the Falloch viaduct, the Fillan viaduct is very obvious to travellers passing through Crianlarich, as it carries the Fort William line across the main A85 Perth-Oban road and the River Fillan, immediately after Crianlarich station.

Costing £1.3m the refurbishment included strengthening weak components, repair of main girder bearings, removing old paint by blasting and application of a new protective paint system. The viaduct now looks very smart in its new paint finish.

Rannoch and Garbh Ghaoir Viaducts

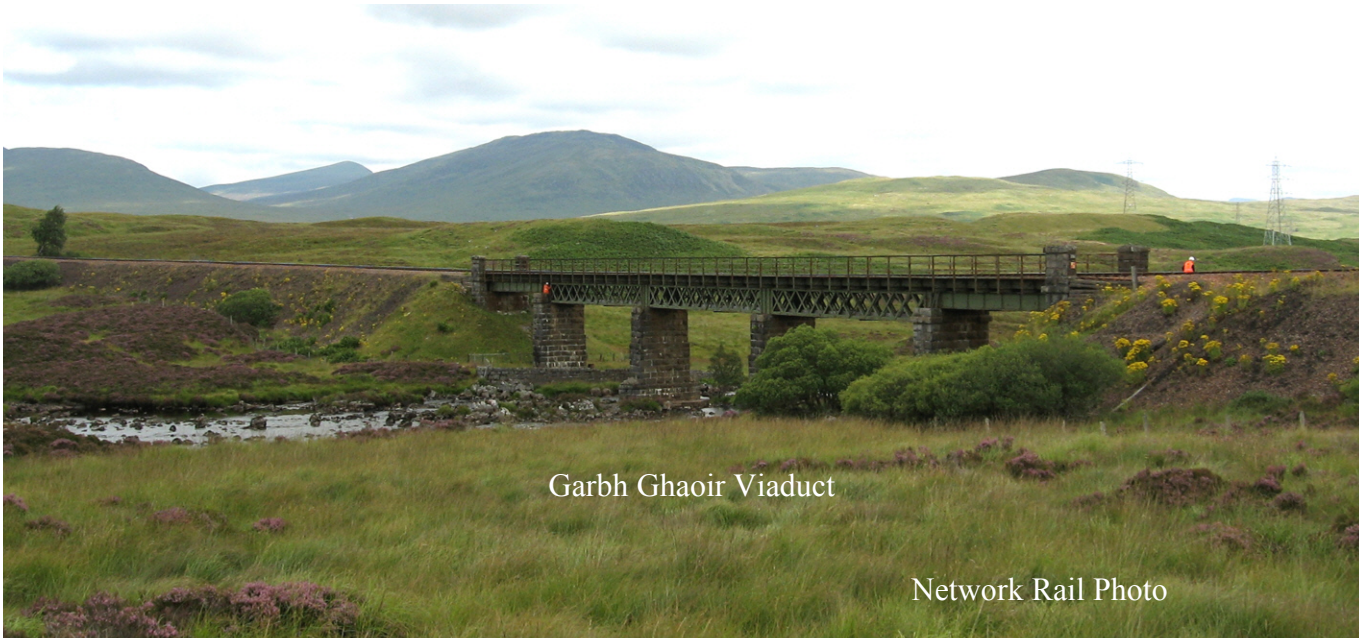
Fort William passengers can hardly fail to have missed observing evidence of work in progress at Rannoch and the impressive scale of the activity. The following is an edited contribution from TI Coatings of Bolton, Network Rails Contractor.
The moor, one of the last really wild environments in Great Britain is approximately 50 square miles across, and is intersected by the single track bi-directional West Highland line running from north to south through the centre of this barren landscape.
Network Rail commissioned the Bolton based principal contractor TI Protective Coatings to undertake the simultaneous refurbishment of two viaducts in this unforgiving environment. The first of the two structures,

Rannoch Viaduct, is located 300m beyond the north end of Rannoch Station. Each of its nine spans is supported upon masonry piers. The five span Garbh Ghaoir* Viaduct, the second of the structures, spans the SSSI designated River Ghaoir, and is located 1.2km to the south of Rannoch Railway Station.

Floating Roadways

In order to reach both isolated structures over the treacherous, ever changing terrain, TI Protective Coatings laid over 2.5km of aluminium panels to create two roads which would allow their vehicles to traverse the moorland throughout the eight month project. This floating roadway overcame the first of many challenges which would require innovative approaches to ensure a successful outcome.
Once the roads were in place, construction could start on the three site compounds it would require to properly manage the project. The compounds were sited upon floating sections of aluminium panelling. These areas had to be strong enough to sustain the weight of the facilities, vehicles and materials which would be stored upon it, whilst ensuring they could spread the load across the moor to prevent subsidence of the entire compound.

Restoration
Once the infrastructure was in place, the physical work began of restoring both structures after months of planning. Prior to commencing grit blasting operations, both bridges would undergo a full encapsulation to contain the high volume of dust created during the blasting process. Once the existing coatings and corrosion had been completely removed, TI Protective Coatings were in a position to apply the first coat of paint.
To ensure that the structures would be protected for a minimum of 25 years the Network Rail RT98 approved M24/014 system was selected, supplied by leading paint manufacturers Leighs Paints. To ensure a high quality, cost effective service was delivered throughout, all coats of paint were applied by ICATS accredited Industrial Painters.


Garbh Ghaoir Viaduct

Network Rail Photo

Both structures were alive with a mass of different tradesmen. While coatings were removed by grit blasters in one location, painters would be applying new coats in the next. In the completed sections steelwork repair operatives would be carrying out the replacement of corroded sections of the super-structure. Beneath the structure, masonry repair specialists worked upon replacing and re-pointing areas of the masonry piers and abutments, whilst specialist piling contractors carried out the replacement of the ballast retention walls either side of Rannoch Viaduct, gaining access with Road/Rail Vehicles.

Cantilever scaffolding
Despite this, the project wasn't without its challenges. The structures unique location combined with its age posed a conundrum for the scaffolding contractor. The usual slung scaffold was not suitable, and the alternative to build from the ground up was impossible due to the ground conditions in the area beneath the structures.
The solution was to cantilever the scaffold between the two masonry piers either side of the span, so that loadings were distributed into the substructure. This allowed Bolton Northwest Scaffolding, a division of TI Protective Coatings, to erect an intricate three tier scaffold accessed via a 4 storey aluminium staircase. The scaffold would go on to be fully encapsulated, and provide a safe working environment within which the refurbishment could take place.
The significant number of steelwork repairs on both structures also proved challenging. All trackside walkways across the two structures required renewal over a distance of 560m. The existing timber walkway beams had to be safely extracted, then the top flange of the supporting girders were prepared and painted before a galvanized Eurogrid mesh panel was installed. All of this took place during midweek possessions.

Jason Worrall, Rail Project Manager for TI Protective Coatings comments: "These particular jobs required a lot of initial planning and forward thinking before any work could be undertaken. The unique environment in which these sites were situated posed many challenges, but I am pleased to say that all were

overcome. These jobs are part of a long list on which we have worked with Network Rail and I believe that our work here has ensured that our relationship will continue into the foreseeable future."
In total over 8,400 litres of paint was applied to Rannoch and Garbh Ghaoir* Viaducts, taking 8 months to complete - some four weeks ahead of schedule.
** Garbh means rough or rugged. Ghaoir has several possible meanings but one is to describe steam escaping. When the river is in spate this would fit well.*

Earth Works.
The West Highland Lines pass through an area of high rainfall, winter freeze-thaw cycles and over ground whose surface is a mixture of bog, shattered rock, and unstable moraines –the legacy of a not too distant ice age. While this makes a great contribution to the West Highland's world class scenery, it creates a constant challenge for track maintenance and passenger safety. Over the last 3 years Network Rail have completed track and embankment stabilisation and related safety work on the line at locations in the Ardlui and Tyndrum areas, costing almost £4m . This type of work will continue and between 2009 and end of 2010 another £3m of planned work was scheduled for the line between Ardlui and Roy Bridge. The work comprises de-scale and de-vegetation of slopes, rockfall protection, including bolting and netting.. The work is chiefly carried out on weekday nights but includes 29hr disruptive possessions and a 4 day closure.

The Future
The Gaur (Garbh Ghaoir) viaduct is scheduled to have new decking and waterproofing work (estimated cost £800k) in 2010. At the same time similar work will be carried out on the Tulloch Viaduct.
Network Rail anticipates spending £2m -£2.5m per year between 2010 and 2017 on earthwork at 30 different locations which have been identified for remedial action.
Tulloch Viaduct will undergo deck renewal and repainting shortly and similar work is scheduled for the Finnart viaduct above Loch Long in 2011/12.
RETB Control and Base Station renewal work is also scheduled in the period 2010/11.

A

steam special charter train leaving Rannoch Station and starting to cross the Rannoch Viaduct

The Oban and Mallaig sections of the WHLs
We will try and bring you more information as it is made available by Network Rail. For the present Network Rail have advised: "Work on the railway structures is being prioritised on these lines. Where there is synergy with possession requirements on the WHL work is planned accordingly, for example Inverhaggernie Viaduct will be carried out at the same time as another smaller structure at the start of the Oban line. There is work planned on Succoth Viaduct in 2011/12 and longer term works planned for Orchy Viaduct (painting) and Glenfinnan Viaduct (general maintenance) as well as various culverts on these lines."
The Society aim to keep members informed on this important work as information is made available.