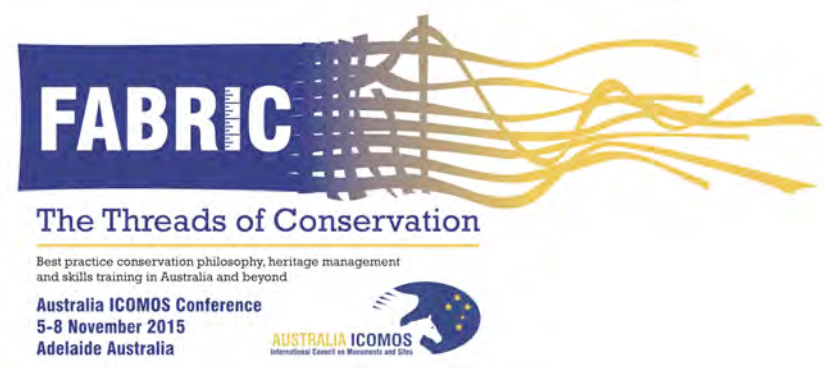
Conserving the Heritage of Heavy Timber Construction

Jim Staton

Proceedings of:



Background

April 2002 saw the then New Zealand Government decree that indigenous logging was to cease and the forest to be administered as public conservation land by the Department of Conservation (the Department). Restoration work that required the use of indigenous timber by the Department had to be signed off on a case by case basis by the Director General of Conservation. Many projects were completed but involved small dimension timber easily sourced from existing supplies, these have now dwindled as the market moved onto the use of plantation timbers. Accordingly the price of indigenous timber, including recycled timber from old buildings and demolition yards has risen dramatically, making many projects expensive, and in some cases cost prohibitive. Macrocarpa is widely used as an alternative but quality and supply is irregular. Various other species are imported into New Zealand, such as plantation grown Purple and Green Heart from South America that are mainly used for the replacement of wharf piles and structural members in harbours.

Stamper batteries

13km east of Reefton, on the South Island's West Coast, stands the Lord Brassey stamper battery, built in 1898 as a ten head. Foundations for a further ten heads were built in 1902 but only five were added, the mine finished in 1906.

This isolated battery was saved from oblivion through a new phenomenon in outdoor recreation, but more important is what went into the restoration, the decision to use large dimension radiata, the skills and issues required to achieve the end result, and to ask how sustainable is this approach for future projects. To the south the smaller Golden Lead battery foundation (of 1891) had been retimbered two years prior, with that success the Lord Brassey seemed a less technically daunting project (The Golden Lead has iron kingposts and braces, the Lord Brassey had timber kingposts and braces).

Figure 2: The Golden Lead stamper battery prior to restoring the foundation timbers in 2008 (Jim Staton)

Figure 3: Lord Brassey stamper battery foundation condition 2012 (Jim Staton)

As the Golden Lead and Lord Brassey stamper battery sites do not have road access, flying was the only available option, this meant flying beams that were within the load capacity of the local helicopter company.

Two key problems were:

1. Most surviving New Zealand large timber structures are built of Australian hardwood, New Zealand kauri, rimu or red beech, replacement like for like is difficult to source.
2. In New Zealand the remaining skilled tradesmen required for this work, the likes of bridge carpenters, have, or are close to retiring.

The key conservation improvement objectives for the battery restoration projects were to:

1. Source radiata as an alternative timber
2. Carry the traditional skills and methodologies into the future

The steps involved were:

1. Planning/assessment/consultation
2. Potential opportunities
3. Source a bridge carpenter
4. Source suitable trees
5. Milling large sizes
6. Preservation treatment
7. Season beams while avoiding warping or checking
8. CIMS safety operational procedures
9. Site preparation
10. Transport from site
11. Cut to required final sizes and pre-assemble major components
12. Transport to site
13. Pre-treat end grains & joint surfaces
14. Assemble on site
15. Involve younger, less experienced craftsmen
16. Create video records and thank all those involved

Planning/assessment/consultation

Between 1975 and 2007 several attempts had been made to restore the Golden Lead and Lord Brassey stamper batteries. Site surveys and Conservation Plans were completed but Departmental resourcing simultaneously went through a period of decline, this combined with the lack of public site visitation lead to the abandonment of any further interest in the sites.

Potential opportunities

2008 saw mountain biking taking off as a more extreme sport, the myriad of old mining machine and pack tracks in the hills around the Reefton area provided an ideal basis for developing what is now an established route known as the Goldfields Journey, a journey that takes one past many 1880 to 1951 era gold and coal mining heritage sites. At 77km long the journey comprises a combination of four wheel driving, mountain biking and tramping experiences, developed by the Department and supported by the local community the Goldfields Journey provided the leverage required for the restoration of the Golden Lead, followed by the Lord Brassey stamper batteries.

Source a bridge carpenter

There are situations that develop where all the ducks come into alignment, this opportunity usually presents itself for only a short period, the trick is to capture the moment and develop it into reality, then all the pre-planning that sits in the files has value again. In this case a local building contractor, Dave Hawes, became a Department of Conservation Ranger. His entry into working life included 11 years as a bridge carpenter with the New Zealand Railways, so skilled in the use and working with large dimension timber, also local staff had a master chainsaw operator plus two others with advanced carpentry skills and a project manager determined to get the work done, the die was cast.

Source suitable trees

Early mining companies in the Reefton goldfields utilised heart red beech trees in the immediate area for their stamper battery foundation beams, in the present day climate of conservation of indigenous forests the felling and use of red beech on site is not viable, not only politically, but also practically because trees around these sites are second growth forest that do not possess the durability of virgin forest trees. Additionally to mill on site, size then adze to proportion and position the very heavy beams would be disproportionate to available resources. On top of this the majority of the New Zealand timber supply industry is geared to providing small dimension radiata or douglas fir sawn timber for building houses and farmers fencing materials, or poles for barns. Timber supply merchants in the South Island were approached with the list of beams required, for the Golden Lead the requirement was for three 305 x 305mm by 3.6m, six 4.5m, three 5.4m and twelve 262 x 480 x 900mm mortar box radiata beams, regular timber suppliers replied that they only supplied the market with small dimension timber. However one sawmilling firm thought they could supply the requirements, they reserved the right to go out into their plantation forest to find the most suitable standing trees before committing to the order, this was achieved and the logs delivered to their sawmill.

For the Lord Brassey battery the same sawmiller was approached and responded in the same way, applying due diligence as the timber size was larger with the five king post bearers being 350 x 350mm and up to 5.7m long. The King Posts required eight 305 x 305mm x 3.6m beams, mortar box verticals were six of 305 x 470mm x 1.7m plus 12 of 305 x 555mm x 1.7m, the total timber requirement for the Lord Brassey was 29m^3.

Milling large sizes

To ensure a consistent product the sawmill management and staff were given information on the projects, engineering grade beams with few flaws and no bark were required, this was duly

achieved. The sawmill staff became interested and involved in the project, asking for updates as the work progressed.

Preservation treatment

The location of both stamper batteries is in tall rain forest, given that the West Coast of the South Island is renowned for its high rainfall CCA pressure treatment to H5 was specified.

Used for severe decay hazard risks such as ground contact where conditions of severe or continuous wetting may occur. End uses for this hazard class are house piles and poles, retaining walls, crib walling and horticultural supports.

New Zealand Timber Preservation Council Inc. www.nztpc.co.nz/hazardClassDescription.php

The timber was milled on the West Coast at Ngahere by Westimber Ltd, they have a timber treatment plant on site, but treats to H4 level only. The beams were treated to H5 in Christchurch, this incurred transportation costs to get the beams across the Southern Alps and back again to Reefton.

Season beams while avoiding warping or checking

Arriving in Reefton early December the beams were saturated from preservative treatment, well above the local helicopter lifting capabilities, they were stack filleted with a corrugated iron cover in an open situation. During the dry period Reefton temperatures reach 32°C, by the end of January the beams had lost 45% of their initial weight, bringing them under the helicopter lift capability. Such rapid loss of moisture from radiata usually results in twisting or warping, cracking of both surface and ends of the timber, to counter this an unusual protective coating was considered.

In New Zealand many cars have underseal applied to the underbody, this product is manufactured by several companies and readily available from automotive accessory outlets.

In our case we used ©CRC Bituminous Underseal, thinned with mineral turpentine until it became of brush on-able consistency, ensuring that the ends were thoroughly coated and applied around the other surfaces about 50mm from the end, plus brushing through major cracks on face surfaces. The surface needs to be dry, the timing of the evaporation of H5 treatment off the surface needs to be monitored carefully, requiring enough depth of dryness to get the mixture absorbed into the wood. On the end grain the underseal was carried into the wood fibre by the thinner for up to 50mm, sealing the wood from cracking. This application stains the wood, however, the discolouration disappears after a few months.

CIMS safety operational procedures

The New Zealand Co-ordinated Incident Management System (CIMS) was used on both sites as the overriding management and safety system, this safety system applies a clear structure of command and reporting. The on-site manager scheduled the work and who did what work. Only those that were required directly on site were allowed inside the immediate work zone, once a person completed their assignment they vacated the work area and awaited their next task. Briefings (Job Safety Assessments and tool box talks) were held at the start and end of each day. One other formal position was Safety Officer, a person that kept an independent eye on the whole work site, including the accommodation and cooking/eating facilities, this person was empowered to close the site down immediately if they noted a potential threat that could cause injury, once the threat was resolved work resumed.

Site preparation

The Golden Lead battery involved removing approximately $4m^3$ of soil from around the foundation beams then holding up and stabilising an estimated 13 tonne of iron while removing the rotten beams plus site preparation, then manually handling 8.2 tonne of beams into place under the ironwork. Approximately $7m^3$ of soil and debris was manually removed from the

Lord Brassey, all of the foundation beam remnants cleared and all bolts and other iron fittings recovered. Additionally the camshaft had dropped in behind the mortar boxes requiring the team to manually raise the three tonne shaft up the hill by two Turfor hand winches, anchor it in place for the duration of the rebuild until required to be placed back on the battery. The stamper rods, followers and shoes were flown out to a nearby clearing to reduce the weight on the mortar boxes.

Transport from site

At the Golden Lead all work was completed on-site as only the foundation crib-work and the top section of the mortar box vertical timbers were replaced.

With the Lord Brassey battery having wooden kingposts all of the supporting structure had to be reconstructed. Only the top section of one kingpost remained intact. As this section had a number of fittings and bolts attached it was flown out along with all the other iron fittings recovered from the site e.g. nuts bolts, washers, tensioners, stamper rod guide blocks, camshaft pedestal blocks and caps, nearly two tonne of fittings were flown to the road end then taken to the workshop to be prepared for re-use.

Cut to required final sizes and preassemble major components

At the Golden Lead battery all timber fitting was completed on site, however the Lord Brassey battery was not as straight forward as the height of the camshaft was not known plus the engineers and archaeologists drawings of the battery structure were not consistent. Both missed the kingpost back stays, nor had they found the end of the kingpost bearers at the back of the framework, probably due to this area being covered in rubble and building remains from the hillside above, also embedded in there was the camshaft and a water pipe. No historical photographs of the inside of the battery building have been located. Photographs from the

1970’s were the earliest available, these were consulted and bolt positions measured after the foundation beams were dug out, this gave enough information to determine placement and size of the back braces, once the brace size was known additional timber was ordered. In the rebuild all but three of the original nuts and bolts were used. The four kingpost sets and berdan frame were fabricated in the Reefton workshop. All of the brace birds-mouth joints, cross sectional recessed faces and chamfered king post tops were completed by adze.

Use of an adze - the old saying is do not give an inexperienced person an adze without close supervision, some training was given on the use of the adze on the Lord Brassey battery, but when it came to the crunch the adze was put aside by the younger members of the team in preference of a small chainsaw. The heritage and skill values associated with the safe use of an adze was then lost as technique in its use must be regularly practiced. The on site manager, Dave Hawes, demonstrated his ability to shave half a millimetre face cuts across large surfaces time and time again with complete accuracy.

Transport to site

All materials for the Golden Lead battery were transported by hiab truck to a farm opposite the valley in which the battery is located, everything required for the project was flown on site, including two huts and a toilet.

For the Lord Brassey the flight distance from Reefton is 13.4 kms, with longer and larger sectional sizes of the beams this distance exceeded available helicopter funding. On a ridge 6.5 km from the battery is an opencast coal mine, permission was obtained to fly the beams from this location, which is 260m higher than the battery site. The elevated site enabled the helicopter to maximise its lift capacity and straight line fly the beams into position. The Lord

Brassey battery rebuild required 28 tonne of new beams plus all other materials and equipment, two huts, shear leg set, food etc to be flow in.

Pre-treat end grains & joint surfaces

Although treatment of beams to H5 standard is consistent through the end and surface envelope it can be inconsistent through the centre portion of a beam. All cut or adzed surfaces and joints were coated with ©Koppers CN Emulsion, this copper naphthenate product has a toothpaste consistency and can be applied on a vertical surface up to a 6mm build, being bright green in colour the public's reaction can be mixed, but it fades away to the natural timber colour after a couple of months. Holes bored in the beams were soaked with the liquid version, ©Metalex Timber Preservative. Care must be taken when using such treatments, clothing and hair will be stained by these products, the manufacturer's instructions must be followed at all times.

Assemble on site

While the helicopter landed each of the beams close to their designated location there was still a substantial amount of manual handling for cutting the various brace slots, drilling holes and recesses for iron fittings then moving them into position. To shift bulks of timber around easily 25mm hemp rope 2.7m long with eyes at both ends were used with the weight being taken over and across the upper back and shoulder of the people moving the beam, always four people to shift a larger beam with one person watching and advising on slip and trip hazards. Logger's cant hooks were used to roll the beams. Short lengths of scaffold pipe were used as rollers on both sites to position larger beams.

Simple items such as 250mm bridge spikes (large square timber nails) driven into a beam provide handles for pulling and positioning, leather gloves need to be worn. Also useful for

winching beams, put a chain through the spikes near the end of a beam and hook on the wire rope, an easy winching technique.

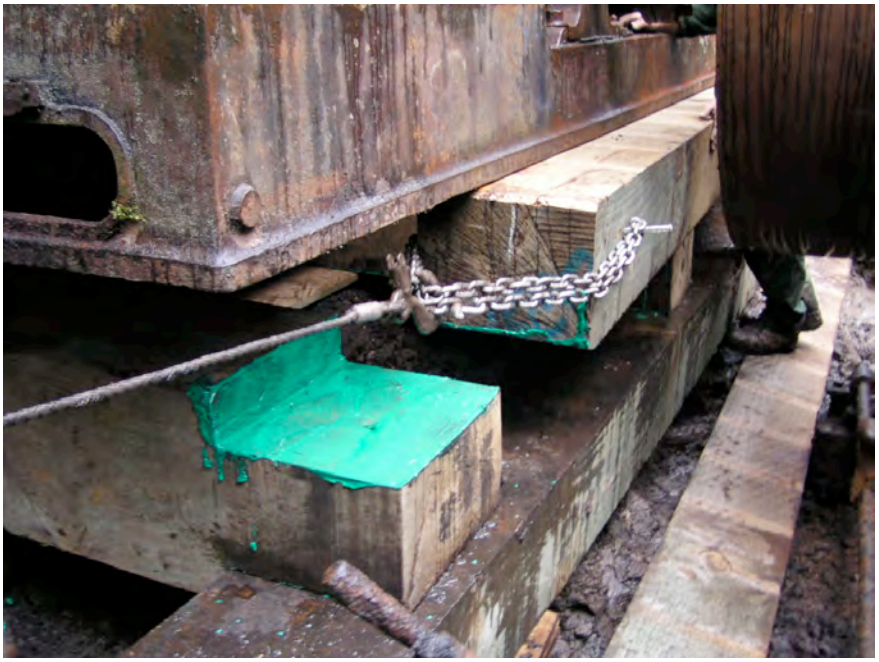


Figure 4: Big River sawmill engine foundation replacement, use of bridge spikes and chain with hand winch to slide beams into position. Note the Koppers CN Emulsion colour. 2006 (Jim Staton)

At the Lord Brassey battery site to lift the three heavier items a set of shear legs with a three tonne chain block attached was positioned over the item requiring lifting, they were the pelton wheel and two berdans. Shear legs are difficult to manoeuvre by hand, initial positioning was done by helicopter as the total weight of the legs exceeded the physical ability of the team, then 25mm hemp rope was used to shift each leg to get stability, any such heli-lift has to be factored into the helicopter flight programme.

Figure 5: Lord Brassey battery, Jim Staton tightening the last nut, shear legs positioned above the berdans.

Tom Williamson filming the restoration. (Shaun Burnett)

Where bolts went through beams, or where iron fittings touched treated timber they were liberally coated with a product called ©Res-Q-Steel, this product is a non-drying compound used extensively on fishing boats to protect wire cables, pulleys etc from chloride corrosion. The bottom line is that the use of iron fittings in conjunction with CCA treated timber requires fittings to be isolated from the timber, especially if they are galvanised.

All new timbers were year branded with a branding iron heated with a gas torch. Any artifacts located during site preparation were mapped and recorded, if they were not part of the structure put back in place where found and buried again.

Involve younger, less experienced craftsmen

The Golden Lead project had five Departmental staff and one volunteer on site over a three week period, the author as project manager was 60, the on-site manager 53 and the youngest in

his early 30's, a cabinet maker with exceptional skills in working with wood and iron objects, a competent team, but we did not actually pass on many skills to each other.

The Lord Brassey battery rebuild was carried out over three years on several short visits, a total of eight weeks in the forest and four weeks in the workshop involving a total of 34 people. By the end of this project a range of skills were passed onto the younger rangers. Many of these rangers have now moved on and are actively involved in heritage management. All of the people involved in the Golden Lead battery were on this project, and getting towards retiring age, and it appears that as much as such projects are a satisfying and an educational experience the Department is not producing new "heritage project champions" with the range of experience required. Contractors can be employed to do the work, but these jobs always need one person's vision, selling the idea, getting support from managers, having the organisational skills to pull together a good team and sort out the logistics to see these projects through.

This sort of work involves the practical use of labour intensive equipment and manually manipulating heavy timbers, within the Department of Conservation ranks there is only a very small number of people who have the technical nous, and interest to take on these difficult and big restoration jobs (although other staff are usually willing to get involved if a project gets the go ahead).

Create video records/thank all those involved

Projects such as these should be professionally filmed for training, publicity, public record purposes and to inspire other heritage groups, this obviously adds to the overall cost of the project and must be allowed for in the funding applications. For the Lord Brassey restoration each person that worked on the project received a letter of appreciation and a DVD produced by Tom Williamson Productions Ltd who followed the entire project from start to finish. Tom

Williamson has produced a number of DVD's on New Zealand industrial heritage subjects. To enquire email twproductions@paradise.net.nz

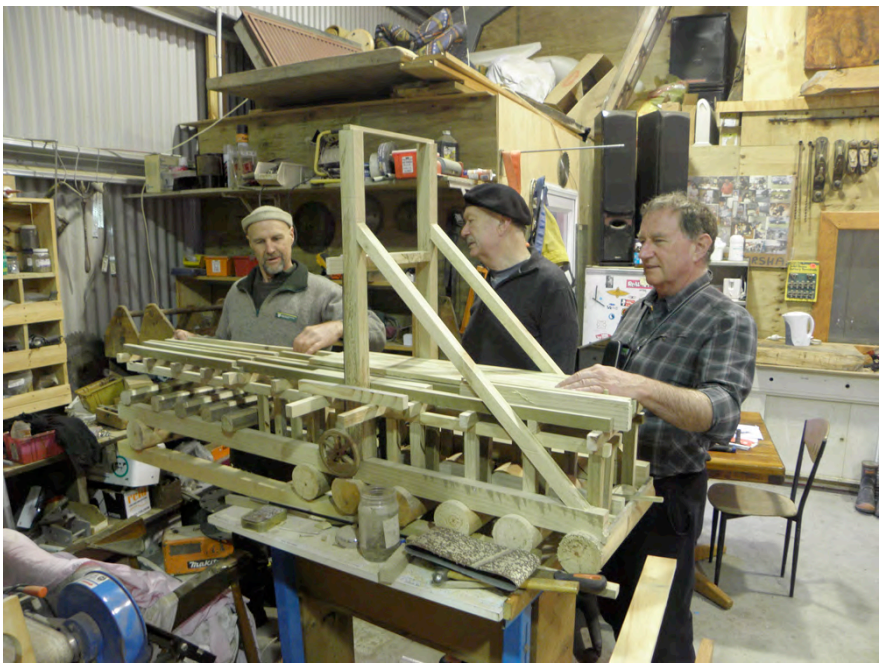


Figure 6: The next think big project, model of a full size kauri sawmill to be rebuilt in the Waitawheta Valley (Neville Ritchie)

There is no doubt that in future major big timber restoration projects will be subject to more scrutiny, especially as to whether such expenditure will result in bringing history to life, for this is the essence of this type of work, be it restoration, replication or repair. The royal "we" must ensure that any such work leaves a legacy of a good result and associated heritage conservation outcomes combined with reasonable longevity, as the question will be asked, will this work encourage more visitors, especially to the more remote sites.

How sustainable is the application of large dimension radiata beams for heritage structure restoration, rebuilding or replication, in the author's opinion, very sustainable so long as the treatment is set at H5 or H6 level, the appropriate treatments are applied at the construction stage and a maintenance regime is set in place that is achievable. For the stamper batteries the next structural inspection can be up to 30 years away, if not more.

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Visit the Department of Conservation web site at www.doc.govt.nz, click on Heritage