

12. OTHER TREATMENTS

12.1 CONSOLIDANT

Many historic structures in New Zealand have been treated with a 'consolidant' to harden dozy wood so that it has similar wearing qualities to sound wood in such situations as deck planking on footbridges. The consolidant used, formulated by Jack Fry, is a solution of polyvinyl butyral (PVB) resin in t-isobutyl alcohol. Current theory suggests that there is no clear advantage in using consolidant in most situations and that in some situations it may promote rot by impeding the exit of moisture. It may also reduce entry of fungicide during subsequent re-treatment. Theoretically one would expect a buildup of moisture below the consolidant, and a tendency for the consolidated layer to eventually slough off. An effective consolidant could also inhibit uptake of preservative at the next re-treatment. Consolidants are apparently not widely used overseas for remedial treatment of historic structures.

Theory and the overseas technical literature seem however to be confounded by practical experience and results. Several people have used the Jack Fry consolidant and report good results from it. By functioning as a water-repellent, such a consolidant may make an important contribution to slowing down weathering effects [see section 12.3]. The hardening of the surface could reduce mechanical wear on timbers where this is a problem - as with the decking of bridges still in use by pedestrians.

Another consolidant is based on an epoxy resin and has a great reputation amongst people repairing wooden boats. It is, however, quite expensive.

Use of consolidant is not currently recommended for general use, but neither is it proscribed. If it is decided that consolidant is needed - e.g., for deck planking - then it can be bought ready-mixed from Jack Fry, and he can provide instructions for its use. If large quantities are needed it would be better to buy PVB resin (a powder) in 25 kg packs and make up solutions on the job. Acetone is reported to be a better solvent than alcohol.

12.2 FILLERS

Apart from the polyurethane foam suggested for internal voids, fillers in general are not recommended, especially for holes on horizontal surfaces. Fillers - for example fibreglass/resin 'bog' and the various silicones - only work when in contact with sound wood from which moisture can be excluded. Such conditions will almost never prevail in the timbers of an outdoor historic structure. Putting filler into wood is like putting fillings into teeth - the hole has to be absolutely free of any rot, otherwise rotting will continue and the filler (or filling) will eventually fall out or lift out. Builders bog really only works on timber which is kept dry by a subsequent 3-coat paint job.

There may be some places on an old structure where there are holes in sound wood which would be worth filling - for examples holes left when sleeper spikes are withdrawn from rail beams. New high-tech versions of old-fashioned bituminous mastics are probably most appropriate.

1 2 . 3 W A T E R R E P E L L E N T S

Water repellents have been little used in remedial treatment of historic structures in New Zealand. There is some experimental evidence, e.g., in FRI graveyard trials, to show that repellents could make a worthwhile contribution to prolonging the survival of historic structures. Further experimentation on historic structures is planned.

Water repellents help prevent rot by reducing moisture uptake in wood thereby slowing down the leaching out of preservatives. By reducing the fluctuations in moisture content repellents are also important in helping to prevent checking and fissuring due to weathering.

Water-repellents intended for use on cedar weatherboards and on patio decking etc. can be bought in hardware shops. Some are solvent-based, some are water-based. All are quite expensive, and they generally confer repellency at the surface for only two to four years. They may provide repellency below the surface for several more years.

If CNE is being used as the surface preservative then at least three weeks should be allowed for CNE to soak in before the repellent is sprayed on. One advantage of CNL is that water repellent concentrates can be mixed into and applied with the preservative itself.

Repellency of a timber surface is easily tested by lightly spraying water onto a dry surface. If the droplets coalesce into tight spherical beads then the repellent is functioning. If the droplets flatten out and soak in then there is no repellency, at least on the surface. It may well be that the repellent is still working quite effectively a couple of millimetres below the surface, which is useful for internal rot control, but isn't much help in stopping surface rot or weathering.

1 2 . 4 O T H E R P R O T E C T I O N A G A I N S T M O I S T U R E E N T R Y

It needs to be stressed that (a) when moisture content (MC) is below 20% fungal activity ceases (but resumes again when MC goes over 20%), and (b) the less water that gets onto or into the wood the less preservative gets leached out. Moisture levels go above and below 20% according to the seasons. The aim of reducing water entry is to increase the amount of time that moisture content is less than 20%.

All reasonable efforts should be taken to reduce the access of water to wood surfaces, and especially to end grain. The end grain at the top of a post or pole can rot nearly as fast as at the groundline. A well-fitted metal cap (nailed on at the sides rather than through the top) can prevent this. Wherever possible, damp courses should be laid under sills. Flashing of densotape or electricians shrink-

tape around the rods on a Howe truss will reduce water entry to thrust blocks [fig. 27].

Nearby vegetation should be cut back to avoid excessive shading. Moss, lichen or other vegetation should not be allowed to grow on the structure, no matter how picturesque it looks. Paint could be another option in some instances, particularly on endgrain. See Appendix 4.2.

12.5 MAINTAINING WATERLOGGED CONDITIONS

There may be rare situations in which the best way of preserving a structure is to make sure it stays waterlogged continuously, perhaps by installing a sprinkler or trickle irrigation system. Such situations can be envisaged where timber is too damp to be treated by conventional methods. Kauri in particular seems to last forever if kept waterlogged. See Appendix 4.1.

12.6 DAMAGE BY INSECTS

Damage by insects is not generally a big problem on New Zealand historic structures, especially those made of durable eucalypt. Any in-section tunnelling in wood however is undesirable because the tunnels provide access for moisture and rot fungi.

Copper naphthenate and creosote are toxic to insects, but both are toxic to insects. In most cases CNE or CNL alone will be sufficient to control low-level threats from wood-boring insect life. The TCMTB in Polegel also has a strong deterrent effect on insects. Boron is a powerful insecticide at the concentrations recommended here.

If it is believed that additional protection is needed, then permethrin, a synthetic pyrethroid, is reliable, enduring, convenient and cheap. It is about as safe as an insecticide is likely to be. It is usually sold in both oil-miscible and water-based formulations which can be diluted with mineral turpentine or water respectively and sprayed on. Borer generally attack from below so it is particularly important to spray the undersides of beams etc. Permethrin can later be painted over if desired. The oil-miscible formulation can also, be added to CN treatments, but it is hard to see why this should be necessary.

13. SCHEDULING & COSTING

13.1 TIMETABLE FOR A TYPICAL PROJECT

If we assume that a relatively complex stabilisation project is concerned with a bridge spanning say a 25 m watercourse or some other structure of equivalent size, then the stabilisation operations might be scheduled as follows:

Calendar year one

- January Initial assessment. Two people for one day on site.
- Office: Prepare proposal and budget for business planning purposes. Secure funding for cleaning down structure and making detailed inspection and assessment in next business year.
- July New business year begins.
- November Clean down the structure. Waterblasting is more comfortably done in warm weather. Two people for two days on site
- November Measure up the structure. Two people for two days on site.
- Office: Prepare scale plans & elevations from measurements.
- December Detailed inspection and assessment. Three people for three days on site.
- Office: Make decisions about what to remove & replace.

Calendar year two

- February Prepare proposal and budget for completing stabilisation in next business year.
- July New business year commences. Order timber, preservatives, other materials and equipment. Seek out abseilers and other special assistance.

Calendar year three

- February Repairs. Depending on the state of the structure, this may take anything from two people for one day to five people for seven days on site. Assume four people for four days.
- February Control of surface rot. If weather conditions are suitable this can commence immediately after repairs are completed. If weather is not suitable, other jobs can be done until the weather is right. If weather conditions are completely unsuitable this job can easily be put off as late as April. Assuming conditions are reasonable it will occupy two people for three days (including setting up and dismantling of ladders, pollution control arrangements etc.).
- February or March. Control of internal rot, groundline rot. Internal rot may take two

people two days, pole/pile bandaging will take two people one day for every five piles bandaged. Assume 10 piles = four person-days. In remote locations much time and money can be saved by combining as many operations as possible into each trip.

March Any work with consolidants, repellents etc., should be scheduled at least three weeks after application of CNE. It could very easily be left until the first annual inspection. Two people for two days. There are several ways in which a less complex operation could be telescoped into one business year. For example if the structure is in relatively good condition it may well be possible to do the detailed inspection and assessment right at the beginning, prior to waterblasting. The timetable, it should be noted, is concerned only with what needs to be done to the structure, and is not concerned with such distractions as production of conservation and engineers reports etc. by outside consultants.

13.2 OPERATIONAL COSTS

Calculating the likely cost of a stabilisation project is difficult, because it will be done when there is little definite information on how bad all the rot really is. Using the numbers of people and workdays likely to be needed for a medium-sized, but complex, operation the following suggestions may be of some help in budgeting.

Labour Up to 70 person days on site. 50 person days more likely.

Transport Assume a minimum of seven visits to site, involving 14 one-way trips by whatever mode of transport, involving widely varying numbers of people and amounts of gear and materials.

Waterblasting

Hire of waterblaster.

Repairs Will vary from nearly zero to by far the largest expense in the whole operation.

Control of surface rot.

Calculate the amount of preservative required by allowing half a kilogram per square metre to be covered.

Control of internal rot and other 'special situations' [i.e., those situations described in section 11].

Assume two insertion holes needed at each end of each significant component. Multiply number of significant components by four. Add on the number of insertion holes demanded by 'other special situations'. Multiply number of significant components by four.

13.3 MATERIAL COSTS

Costs of the main materials/services will work out roughly as follows:

Control of surface rot (CNE, CNL, or thickened creosote)

per sq. m. of side grain surfaces \$4

per sq. m. of end grain \$12

Control of internal rot (inserted boron)

per hole (rod, paste & plug) \$3.50

per cubic metre of wood treated \$600

Control of groundline rot (bandaging, Polegel)

per pile done professionally. \$250

per pile, materials for DIY \$100

Retention assays

10 copper assays \$150

10 boron assays \$150

Timber identification, per sample \$80

14. SUBSEQUENT CARE AND MAINTENANCE

14.1 ANNUAL INSPECTION AND TOP-UP

An annual visit for inspection and maintenance is recommended for any historic structure treated for preservation as described above. Tasks will include

1. Visual inspection for any signs of incipient failure in any of the treated components.
2. Visual inspection for any evidence that the preservation is not successful, e.g., fungal fruiting bodies on treated surfaces. If there are doubts, surface samples can be taken for laboratory assay to determine the concentration of preservative present. A rectangle of surface wood 2 mm thick and 20 mm by 10 mm in area should be taken with a clean 20 mm chisel and put in a small clean plastic bag. Spot-tests are also available for testing for the presence/absence of copper and boron.
3. Top-up red-plugged drillholes every year and brown-plugged holes every second year initially, and less frequently once it is known how fast the holes are emptying. Green-plugged holes (treated with boron foam but not permanently filled with polyurethane foam) should be re-treated with foam every eight years, or whatever time schedule is chosen for re-treatment [section 14.2].
4. Check groundline bandaging to make sure that soil is not over-topping the bandage, and that the bandage is not leaking or damaged.
5. Take photos at the photo points established at the original pre-treatment inspection. Use the same brand and type of colour slide film each time photos are taken, to enable better comparisons to be made from one year to the next. (The colour of colour prints varies enormously from one processing machine to another, and prints are more likely to fade than slides.)
6. Trim back vegetation to reduce dampness on the structure.

14.2 RE-TREATMENT

No treatment to prevent fungal rot in timber will last forever. There will always be some leaching out of preservative, and there will always be some weathering taking place which will open new access to untreated wood for decay fungi.

Re-treatment will probably be necessary according to the following schedule:

1. Control of surface rot. Re-treatment will probably be necessary after five to eight years. It should not be necessary to waterblast before re-treatment. If waterblasting is necessary then re-treatment was probably deferred for too long.

2. Control of internal rot. Unless serious new rot has become evident no internal rot control should be needed other than that specified for annual maintenance. Holes which were permanently plugged originally should be checked for loose dowelling and re-plugged if necessary.
3. Control of groundline rot. Bandages may need recharging or replacement bandaging after 10-16 years (i.e., two re-treatment cycles). A decision on when to re-treat could be based on assays of preservative retention levels, as measured by laboratory assay of 20 x 40 x 2 mm surface samples.

Better information about scheduling re-treatment should eventually become available from the Waikino tests. Experience so far has shown that preservatives are lost from upward facing horizontal surfaces about twice as fast as from vertical surfaces, so it may be necessary to retreat horizontal surfaces twice as often.

With any luck, re-treatment will be a relatively cheap and quick operation, carried out at the same time as an annual inspection.

14.3 THE NEED FOR GOOD MONITORING AND DOCUMENTATION

It is vital that any preserved structure be carefully monitored, and that detailed documentation about treatments and any continuing deterioration is gathered and kept. The only real way we can ever tell how effective treatments are is to keep looking for signs of continuing deterioration - a pole that has started to lean over, once-firm wood that has become dozy, a crack that has started to widen, and so on. Detailed documentation, especially photographic documentation, will provide the earliest possible warning that something is not right, that something is about to fail, and that something will have to be done about it.

Detailed documentation of the entire stabilising operation will always be important. If we are to identify the cause of a failed treatment we need to know exactly how much of what particular chemical at which concentration was applied by what method, and what the weather was like before, during and after. We need to know all of the same information if we are to improve future treatments on the basis of past experience.

There is going to be continuing pressure from the VAMpires, OSHtocrats and other safety czars within DOC to mutilate or demolish historic structures on the basis of perceived but not necessarily real safety issues. If you can produce the documentation to show that a particular suspect-looking beam has actually been sounded, sampled, scanned, drilled, drenched and drained, and that it hasn't got any worse in the past ten years, then you have a good chance of persuading an engineer not to replace it with some monstrosity of tanalised radiata or steel RSJ.