



Building Bridges

A guide for volunteers carrying out restoration work on waterway bridges



Canal &
River Trust

Introduction

Welcome!

In this guide you will find suggestions and ideas that are designed to help you and other volunteers carry out restoration work on the bridges of Britain's canals and waterways.

Working in Partnership

Waterway Recovery Group (WRG) is the national coordinating body for voluntary labour on the inland waterways of Britain. WRG is part of The Inland Waterways Association (IWA), which is a registered charity. To achieve its aims, and that of IWA, WRG (and its regional groups) work with regional and local canal societies to run weekend work parties and week long work camps (Canal Camps) every year, helping restore the derelict canals in Britain.

The Canal & River Trust (CRT) formally took over the work of British Waterways on the 2nd July 2012. The Trust are responsible for 2,000 miles of canals, rivers, docks and reservoirs, along with museums, archives and historic buildings and ensuring these assets are maintained, preserved and developed. The Canal & River Trust is keen to give local people and communities the chance to come together and look after a section of a canal or waterways - to 'take up and make one's own'.



This guide aims to enable volunteers to carry out minor (and some more major) repairs to canal bridges in desperate need of restoration.

Is this guide for you?

Yes, if you are a volunteer, an organisation such as a community group or charity, or a local business wanting to adopt a local canal bridge and help restore it to its former glory.

This guide addresses many of the main issues to be aware of when organising and carrying out restoration work, but does not include everything that needs to be considered. In partnership with your local Canal & River Trust Volunteer Coordinator you will plan and deliver work in accordance with the necessary legislation and good practice relating to safety, heritage, environment and volunteering.



What can you do?

- ✓ repointing
- ✓ painting
- ✓ brickwork repairs

Getting organised

Volunteers are your most valuable resource!

Identify a bridge in need of help!

Step 1 - The first step is to identify a bridge in need of restoration or repair*. This could be a bridge you pass whilst walking your dog, one you drive past every day or even one you've cruised past on your boat! The bridge might need repointing; repainting; reconstruction ...or it could just be in need of a bit of TLC. Intervention now could save the need for more major repairs at a later date. All of this can be done by volunteers with the appropriate level of skills, experience and with supervision in place! It may be necessary for volunteers to undergo training with the Canal & River Trust before starting restoration work on a bridge.

Step 2 - Once you have identified a project that your volunteer or community group would like to get involved with, the second step is to contact your local Canal & River Trust Volunteer Coordinator. There will be a lot of things to consider and your local Volunteer Coordinator is your link to the rest of the Trust. They will be able to liaise with all the experts and everyone involved with a bridge repair. The Volunteer Coordinator will be able to confirm if there is a budget in place for the repairs and if volunteers can carry out the work. In some cases the bridge will be of heritage value, and may require certain types of consent before work can start.

Step 3 - The Volunteer Coordinator will then help you coordinate a site meeting with all the interested parties to discuss the project in more detail.

Helpful tips

What to discuss at the site meeting

- ✓ Agree on the main jobs and discuss how long it will take [**Hint:** Take little steps. It is better to start small and build up to bigger jobs.]
- ✓ Agree a provisional timetable to start work
- ✓ Discuss volunteers abilities for the job – skills, interests, time, availability
- ✓ When to carry out the work and discuss budgets
- ✓ Decide on what materials are required/ who will supply them
- ✓ Welfare arrangements (eg. toilets)
- ✓ Agree who is supervising the project
- ✓ Consider what skills you might need and if training is required
- ✓ Health and Safety issues/ Permission to work
- ✓ Discuss access, parking and requirements for scaffolding



* Not all waterway bridges are owned by Canal & River Trust, please check.

“Quote.....

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- Richard Parry, Chief Executive, Canal & River Trust

Contact Canal & River Trust
About Building Bridges

t: 0303 040 4040

e: volunteer@canalrivertrust.org.uk



Put an action plan together

To ensure the restoration or repair work is a safe and enjoyable experience for all involved it is essential that the work is adequately planned, organised and supervised. **Your method statements and risk assessment will need to be approved by the Canal & River Trust before work can proceed.**

Planning and Health and Safety

Risk Assessments: A Risk Assessment is an important tool in protecting volunteers, staff and members of the public as well as complying with the law. It helps you focus on the risks that really matter on your site – the ones with the potential to cause harm.

Conducting a risk assessment is not difficult or demanding. It is just a case of looking at the activity and identifying the hazards (anything that has the potential to do harm) associated with it. By gauging the likelihood that the hazard will do harm, and the severity of the harm caused, a risk rating can be calculated. If the risk rating is low, the activity can proceed; if it is medium more control measures might need to be considered, and if it is high more control measures are likely to be required to reduce the risk to an acceptable level.

More guidance regarding risk assessments can be found on the HSE website <http://www.hse.gov.uk/pubns/indg163.pdf>

Method Statements: Clear, step by step guidance on how to carry out the work so that everyone has an agreed reference point. The method statement

should take into account the heritage implications of the project and ensure clear and concise information is available to all volunteers.

Specialist Access: Volunteers will be working on and around the bridge structure for the duration of a project – to ensure volunteers are not exposed to the risk of working at height specialist access may be used to access some areas of the bridge.

Canal & River Trust will be responsible for organising the installation, modification and maintenance of the agreed access arrangements and carrying out daily or weekly inspections. Requirements for access should be discussed at the initial site meeting with the Canal & River Trust.

Personal Protective Equipment: The Canal & River Trust will provide personal protective equipment (PPE) to all volunteers working on the project. PPE should be used when all other measures are deemed inadequate to control exposure to health and safety risks whilst carrying out a task. PPE can include items such as safety helmets and hard hats, gloves, eye protection, high-visibility clothing, and safety footwear. To make sure the right type of PPE is chosen, consider the different hazards in the workplace and identify the PPE that will provide adequate protection against them; this may be different for each job.

Useful information can be found on the HSE website <http://www.hse.gov.uk/coshh/basics/ppe.htm> and <http://www.hse.gov.uk/pubns/indg174.pdf>

Publicity:

Think what you want to achieve with the restoration project and who you want to get involved.

- ✓ Advertise for volunteers well in advance.
- ✓ Posters on notice boards in libraries, on site, and other community venues (with permission).
- ✓ Press Release/contact local newspaper and radio stations about the work and invite them along to see you in action!
- ✓ Make the local community aware of your plans and look at ways to create partnerships with other existing groups (e.g. community groups, Scouts) to support the work and create a really diverse volunteering experience which benefits the community.
- ✓ Volunteering can also offer opportunities for people to develop learn own skills and interests.

Insurance:

Make sure your group has public liability insurance in place, or the activity is covered by the Canal & River Trust insurance policy.

Equipment:

Here is a suggested list of equipment:

- ✓ Safety Equipment – hard hats, gloves, safety specs
- ✓ First Aid Kit
- ✓ Hand tools
- ✓ Lifejackets or throw lines if working near the waters edge
- ✓ Mixer for mortar
- ✓ Materials – sand, lime mortar, bricks
...plus tea, coffee and biscuits!



50% of the population live within five miles of one of the Canal & River Trust's canals or rivers

Getting started

Introduction to Lime Mortar

Lime was used before the introduction of cement, (which was not introduced until 1824 and even then it probably wasn't used because of the cost) so many of the canals built before this date were built using only sand and lime. Lime is produced from either chalk or limestone. When these materials are burnt at a very high temperature they turn into quicklime. The quicklime is not suitable for building with, so water is added to it, and this is called slaking. Slaked limes come in three categories – Hydraulic, Non-Hydraulic limes and Hydrated lime. In the second half of the 20th century there was shift to using mortar with higher cement content (Ordinary Portland Cement) which reduced the breathability and restrained the natural movements of the bridge causing problems. In recent years there has been a shift back to lime-based mortars.

Hydraulic lime is produced from a limestone which contains clay-based materials and is commonly used for external work as it can withstand more aggressive conditions that buildings are exposed to. Natural Hydraulic Lime is available with different clay contents and degrees of 'hydraulicity'. Strengths are divided into eminently hydraulic (NHL5), moderately hydraulic (NHL3.5) and feebly hydraulic (NHL2).

Type of Lime to Use

- ✓ NHL 5 For exposed and wet areas e.g. some lock chambers, bridge abutments.
- ✓ NHL 3.5 For less exposed areas e.g. bridge faces and parapets and for repointing work.

... carrying out the work

Things to consider when mixing Lime Mortar*

- ✓ Choose a mix with an appropriate type of lime for the work
- ✓ Use a well graded aggregate including coarser grit
- ✓ Ensure materials for the mix are accurately measured – a bucket can be used as an accurate gauge for this.
- ✓ Ensure materials are thoroughly mixed just before use.
- ✓ The mix should not be made too wet, use only enough water to achieve workability.

* Canal & River Trust will provide advice and guidance on Lime Mortar before you start working.

Safety Warning:

Care must be taken at all times when handling lime. Contact with wet mortar may cause irritation, dermatitis or burns. Wash the mortar off your skin immediately. Contact between mortar and body fluids (e.g. sweat and eye fluids) may also cause irritation, dermatitis or burns. If the mortar comes into contact with eyes, wash immediately with plenty of clean water and seek medical advice.



Repointing

Why repoint?

Mortar, being softer than the building materials around it, often erodes over time due to the effects of the weather. If the mortar 'fails' or falls away there is nothing to protect the bridge from the elements and water is able to penetrate the bridge and erode its structure. By repointing the bridge you will help slow the deterioration of the structure. This activity should be carried out under the supervision of an individual who has experience using Lime Mortar.

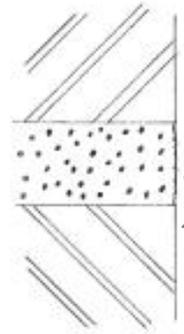
Lime mortar repointing work should not be carried out during periods of heavy rainfall or cold/frosty conditions (under 5°C and falling). The ideal time to carry out work is from late March – end of September.

Preparation

To prepare your bridge for repointing you must:

- ✓ Clear out joints of old mortar to an approximate depth of 25mm or twice the joint height, taking care to avoid damaging or scratching the brick. **Note:** Cutting out using powered tools is not usually permitted.

Repointing is the process of taking out and replacing mortar from the face of a joint



Flush joint

- ✓ All joints should be brushed and flushed out with water to remove dust and loose materials.

Repointing the joints

- ✓ Prior to repointing, sufficient water should be applied to the bricks/stone to ensure that water is not drawn out of the new mortar too quickly.
- ✓ The standard mix for repointing mortar is Natural Hydraulic Lime (NHL) 3.5 Hanson or St Astier at 1:2.5 with well graded 'sharp' sand.
- ✓ 0.5 soft sand might be required to get the right colour mortar.
- ✓ Working from a hawk, fill damaged joints using a heritage pointing tool.
- ✓ Deep joints should be repointed in two stages with a drier mortar being used to 'pack out' the back of the joint before returning to the standard repointing mix.
- ✓ Fill the joints with mortar until it is flush with the face of the stone or bricks.
- ✓ After filling the joints the mortar should be 'beaten' with a churn brush to expose the aggregate, compact the surface and remove excess mortar.

- ✓ Protect new mortar from the elements by covering your work with damp hessian and plastic sheeting.

Tools and materials:

- ✓ Chisel, Lump hammer (or similar)
- ✓ Mixer for mortar, Shovel
- ✓ Pointing trowel, Heritage pointing tool, Hawks
- ✓ Churn and wire brush
- ✓ Lime, sand, clean water (all of which should be protected from rain/damp)
- ✓ Hessian and plastic sheeting
- ✓ Bucket for accurately measuring quantities of sand and lime
- ✓ Personal Protective Equipment – Gloves and Safety Spectacles plus a dust mask for mixing the mortar.



heritage pointing tool

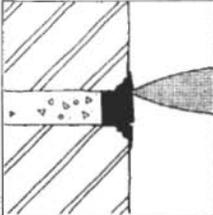
hawk

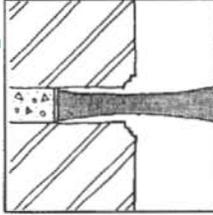
chisel

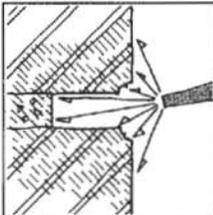


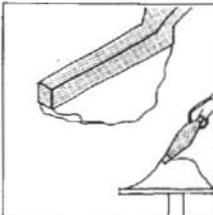
Repointing

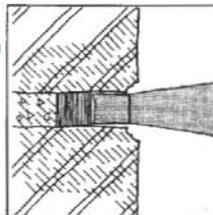
Step-by-step guide

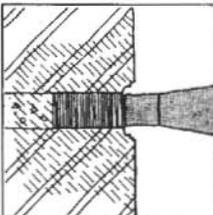
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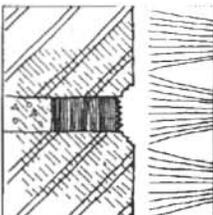
1. When removing small areas of cement rich mortar which has covered the edges of the bricks, the mortar edges need to be weakened by striking along the line of the original joint before chasing out.
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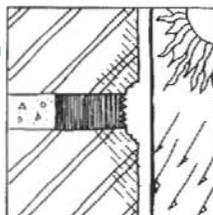
2. Cut out mortar using a chisel, which will not wedge in the joint. Remove the mortar to a depth of at least twice the width of the joint back to sound backing mortar (Deep tamping may be necessary to fill any large voids).
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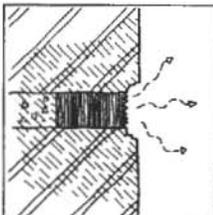
3. Cutting is complete when all joints are clear of debris with a square face at the old backing mortar and no old mortar sticking to the bricks. Flush the joint with clean water until it runs clear, working from top to bottom on the wall as repointing proceeds. Effective repointing needs damp joints, but not running with water.
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4. Keep ready mixed lime mortar in a sealed container until needed. Lime mortars should be 'beaten' to the correct consistency before use. The mortar should have a consistency of modelling clay and should hang from a pointing tool.
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5. The mortar should be placed into the prepared damp joint without touching the face of the brickwork and pressed in hard using the pointing tool.
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6. On old brickwork the finished face of the joint should be slightly recessed never extending beyond the original joint width.
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7. Once the joint is filled it should be given a rough texture by striking or stippling with a churn brush to expose the aggregate. The mortar needs to be still green but stiff – too early and the texture is too extreme and the bricks become stained; too late and no impression will be made.
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8. Ideally work should be carried out between March and September. In hot or windy weather the finished work should be kept damp for 7-14 days and protected from direct sunlight. When working in the winter months mortars should always be protected from exposure to frost.
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9. New condition. Moisture evaporating through joints.

Brickwork repairs



Britain's canals relied heavily on brick as their principal building material. A lot of the softer bricks were prone to frost damage due to the damp nature of the canal environment and as a consequence many bridges are in desperate need of repair with large cracks, crumbling bricks and whole sections missing. Some bridges have also been exposed to excessive movement, invasive vegetation growth, and water penetration from poor pointing – all of which can cause brickwork to fail or crack.

Preparation

To prepare your bridge for repair to brickwork you must:

- ✓ Clear bridge wall of any loose debris/ brickwork and assess how much other damaged brickwork must be removed.
- ✓ Remove damaged brickwork along the line of crack, back to solid brickwork using hand tools.
- ✓ Where possible reclaim and clean bricks so that they can be used in the rebuilding process.
- ✓ Clear brickwork of loose debris in preparation for the rebuilding.

Brickwork repairs

- ✓ Working to a plan agreed by Canal & River Trust and using WRG's Practical Restoration Handbook – Brickwork section https://www.waterways.org.uk/wrg/wrg_documents/practical_restoration_handbook/prh_brickwork and CRT's Approved Process: Heritage Works (available from your Volunteer Coordinator) as a guide start your brickwork repairs.

- ✓ Lime mortar for brickwork repairs needs to be of a firmer / thicker consistency (as usually used for pointing) and the bricks will need to effectively be 'shaken' into position. A thinner mix (normal brick laying consistency) will increase susceptibility to frost damage.
- ✓ All new work should be temporarily covered with hessian and polythene to prevent damage from environmental conditions.
- ✓ It is important to repair brickwork sympathetically especially when working on bridge parapets. Brickwork bonding pattern and courses must be maintained.
- ✓ Ensure you have an experienced bricklayer to 3 to 4 novices on site.

Major Brickwork Repairs

- ✓ Major brickwork repairs should only be carried out by experienced bricklayers, due to the technical nature of the work.
- ✓ Major brickwork repairs may become notifiable under Construction, Design and Management Regulations if the planned work is going to last longer than 30 days or involves 500 person days of work.

Important Information:

Replacement bricks need to be a good match in colour, texture and size with originals. New bricks must be approved by the Canal & River Trust before use.

Brickwork repairs (cont.)

Replacing whole bricks

Cutting out, usually of whole bricks, is best done by hand with a hammer and chisel taking great care not to damage adjacent sound bricks. Use of powered chisels and cutting tools should generally be avoided. Wedge shaped jointing chisels should not be used as they can damage the brick edges or arises. Replacement bricks should then be placed on a mortar bed, the side and top joints should then be packed solid with mortar and pointed up. Where the replacements form a patch of several bricks, temporary supports or wedges may be needed to prevent the masonry from collapsing.

Tools and Materials Required

- ✓ Plugging Chisel and Bolster
- ✓ Lump hammer (or similar)
- ✓ Mixer for mortar, Shovel
- ✓ Repointing tools
- ✓ Hawk, Brick Trowel
- ✓ Brick line and pins, Spirit level
- ✓ Soft and wire brush
- ✓ Materials for mortar mix (lime, sand, clean water)
- ✓ Hessian and plastic sheeting
- ✓ Bucket for accurately measuring quantities of sand and lime
- ✓ Personal Protective Equipment – Gloves and Safety Spectacles plus a dust mask for mixing the mortar.
- ✓ ...and lots of bricks!

Rebuilding

Where structural damage such as excessive cracking, bulging or settlement has occurred, it may be necessary to demolish a section of a wall and rebuild it. Depending on the size and shape of the rebuild, and the probability of further movement, the new work may be reinforced brick ties (see diagram). It is important to extend the repair well beyond the immediate vicinity of the defect and to use a flexible mortar. This will help to disperse stresses as the new work 'settles in' with the old.

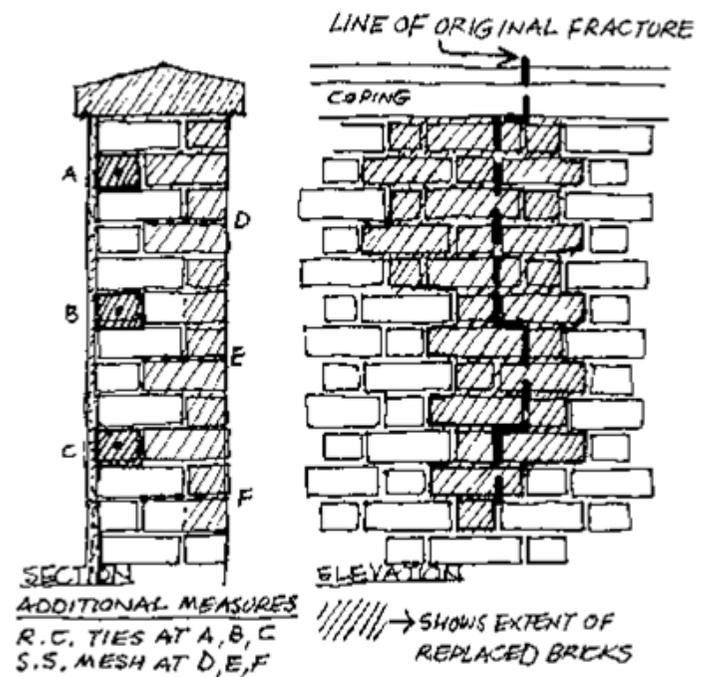


Diagram © Canal & River Trust

Repainting

Many canal bridges were painted white as a warning to boats for decorative purposes or as an attempt to protect the brickwork and now form a significant element in the heritage value of the structure. Over the years paintwork can become defective and start to flake, blister, peel or crack exposing the brickwork underneath. Volunteers can easily get involved in the repainting of these bridges.

There are numerous types of paints that can be used for this type of conservation work. Your local Canal & River Trust Heritage Advisor will specify the type of paint and application methods to be used. The main factor to consider when choosing paint is its ability to allow water to escape out of the structure as it is near impossible to make it completely waterproof.

Preparation

All work to remove paint must comply with the Approved Process: Heritage Works for Cleaning Historic Fabric and due to the use of chemicals this work will often be carried out by contractors.

Painting

- ✓ Before starting to paint ensure the surface is dry and any loose materials are removed by brushing. Mould growth, moss and lichen should be removed by brushing and scraping.
- ✓ Using either a brush or roller, paint should be applied and worked well into all surfaces

- ✓ The painting process may involve several coats so ensure you have taken into this account in your planning. Each coat should be done in one session to avoid patching.
- ✓ Ensure that there is adequate protection from the elements, such as moisture or excessively high/low temperatures, whilst carrying out the work. Where necessary, finished work should be protected from adverse conditions until it has cured.

Tools and materials required:

- ✓ Paint
- ✓ Paint brushes/rollers
- ✓ Hand brush
- ✓ Plastic sheeting
- ✓ Cleaning materials for removing paint from brushes
- ✓ Personal Protective Equipment – gloves and safety spectacles
- ✓ Warning signs for the public



Useful links

WRG Health & Safety Booklet

To help keep you safe on site, this booklet contains initial Health and Safety Information that new volunteers need to know. http://issuu.com/waterwaysassoc/docs/health_and_safety_guide_131115

WRG Health & Safety Video

WRG's Health & Safety Video contains important Health & Safety information that all volunteers need to know. https://www.waterways.org.uk/wrg/health_safety/wrg_health_safety_video

Practical Restoration Handbook

The purpose of the handbook is very simple – to give guidance on practical restoration work carried out by volunteers. The authors of the chapters come from a range of organisations and from professional and experienced people within the waterways restoration movement.

https://www.waterways.org.uk/wrg/health_safety/practical_restoration_handbook

CRT Approved Processes - Heritage Works

This document describes 'best practice' standards for works of repair to heritage assets (i.e. historic waterway buildings and structures). The purpose of these standards is to ensure a consistent, approved approach to practical heritage conservation. (contact your local CRT Volunteers Coordinator)

