

22-114**REPAIR METHODOLOGY – MANCHESTER OPERA HOUSE**

Timber window repair methodology to support LBC approval ref 126635/LO/2020 condition 3.

All repairs as itemised in approval drawings will be carried out as detailed on the drawings and under the method statement set out below.

Whilst the condition survey is recent it is possible that windows may have deteriorated further in the 3 years since it was carried out.

ASSESSMENT

Whilst internal surveys of the windows have been undertaken, external inspection will need to be undertaken by the contractor.

Although an inspection of the surfaces of a window may reveal much about its condition, probing vulnerable areas with a sharp instrument will be necessary to gauge extent of decay or rot present.

The contractor is to provide an assessment of condition and required repairs for any additional works required to those identified on the supplied drawings (those forming LBC approval). A photographic record marked up to show additional repair required will be provided for supply to Manchester City Council for their records.

EXAMPLE REPAIR

A single window will be removed for repair. This window selected should have suitable examples of most if not all repairs required. Principles and repair methods set out below should be followed. If deviation required approval should be sought. The example window will be made available for inspection by the conservation officer before works to other windows proceed.

GENERAL PRINCIPLES OF REPAIR

1. Where decayed timber is to be removed to form a splice repair, the minimum amount of existing timber should be removed as is necessary to allow an effective repair to be formed.
2. Always work new material to the line of the existing (rather than *vice versa*) and avoid unnecessary trimming of the original timber. Repairs should follow any existing deformities in the line of the window.
3. Generally, avoid mixing timber species between the new and the existing in a repair, as the joint between the two is likely to fail due to differential expansion and contraction during alternating dry and damp conditions.
4. When carrying out a repair, try to ensure that the structural integrity of the window is maintained and that the window continues to work as it was designed to do.
5. Wherever possible, spliced repairs should be designed to ensure that moisture is directed towards the outer face of the timber and that moisture does not lie on the repair joint.

6. The length of the splice is governed by the section of timber and the nature of the component being repaired and should be designed to ensure an effective bond between the new and the existing sections of timber.
7. Wherever possible, splice repairs should be designed which incorporate mechanical fixings (for example, timber pegs/dowels or non-ferrous screws/pins) as well as glue. Screw or pin fixings should ideally be inserted from the inner face of the window.
8. Well-seasoned timber should be used in forming a repair, with the line and density of the grain (number of growth rings) of the new timber matching the existing as closely as possible. As with all joinery work, timber with shakes, fissures, warping, heartwood, sapwood or numerous/large knots should be avoided for use in repair.
9. Avoid previous design faults when carrying out repairs. Consider modifying a method of construction (or a previous repair) where it is liable to lead to further decay.
10. If possible, repairs to window frames should be formed *in situ*, especially where the frame is built in and cannot be removed without damaging either the window or the surrounding wall. In general, casements/ sashes can be easily removed without damage, to be repaired on site or in a joiner's workshop.
11. Where windows are to be dismantled as part of the repair process, always mark and record the constituent parts before dismantling, especially where a significant number of windows are to be repaired. Similarly, always number glass panes/ quarries before removal.

TIMBER REPAIRS

12. For replacement of short sections of a glazing bar where only the outer tongue section is decayed. Care is to be taken, so this repair can be carried out without dismantling the sash or removing the glass.
13. Hardwood should be used for the new tongue, even where the existing glazing bar is softwood.
14. When replacing a moulded section of timber, a small section of the original moulding should be carefully stripped of any paint, revealing crisp, clean edges for an accurate mould to be taken. If the end section of the moulding cannot be drawn around, then an accurate moulding section can be obtained using a template former.
15. Where only small quantities of moulded section are required, it may be uneconomical for a cutter to be made for a spindle moulding machine. If this is the case, a combination of special purpose planes (moulding planes) and a steel scraper shaped to the required finished section can be used. New moulded sections should always be made very slightly over-sized, to allow for working back to the precise line of the existing timber in a repair, so avoiding the need to work the original material.
16. Where casements or sashes have loose joints due to the breakdown of glue and loose wedges. The wedges will often be easily removable and will probably be unsuitable for reuse. It may be necessary to remove some panes of glass for the joints to be pulled together successfully.

17. It should be possible to apply glue to the shoulders of the tenon. This can be achieved by working the glue down to the base of the tenon with a hacksaw blade or piece of card. Glue can then be applied to the voids left by the removal of the wedges from the mortice. The joint should then be pulled together and re-wedged.
18. Where opening of joints is combined with minor decay such that regluing alone will be inadequate, reinforcement of the timber at the joint can be achieved with a non-ferrous bracket.
19. If localised pockets of decay are detected in their early stages and the structural integrity of the window remains sound, the defective areas can be scraped out and the remaining, sound, timber treated, filled and, where appropriate, painted.
20. The treatment can take the form of a timber preservative when using standard modern paints but this is not suitable with all paint types. It is advisable to impregnate timber with raw linseed oil, for example, if using a linseed oil paint.
21. Larger voids should be filled with a combination of a timber patch (shaped to fill the void) and filler.
22. Traditional fillers (or 'stopping') were formed from a combination of white lead paste and ordinary linseed oil putty sometimes with the addition of chalk, sawdust etc, to give extra volume. Where linseed putty is used as a filler today, the lead is omitted to overcome toxicity concerns. Of the modern filler types, two-pack systems (for example, epoxy resin or polyurethane type) are generally more durable than ready-to-use fillers.

GLASS

23. Extreme care should be taken to avoid damage both during general building works (especially involving the erection of scaffolding) and in the repair of individual windows. When considering the method of repair, an assessment must be made beforehand as to the quality of the glass, whether or not it can be easily removed and whether the repairs can be carried out with the glass in situ.
24. If it is necessary to remove the glass for timber repairs, the putty may have deteriorated to such an extent that it can be removed by hand. Otherwise, an organic solvent paint stripper, soldering iron or bespoke infrared lamp can be used to soften the putty. Other methods of softening include the application of household bleach or a mixture of potassium carbonate and quicklime in a 1:3 ratio (by weight). In all cases, extreme care and patience are needed as numerous applications may be required to soften the putty adequately.
25. Replacement glass should be carefully chosen to be compatible with the original glass, but avoiding material which is too creamy (contains noticeable inclusions or inhomogeneous glass strings or layers) or over-distorted.
26. Few sources of new glass are satisfactory for replacement in historic windows. Handmade glass is, however, available from specialist suppliers and some stocks of discontinued glass are available from specialist merchants. Replacement glass will need approval of the conservation officer before bulk orders are placed.

27. Original glass, taken from a window which is decayed beyond repair, should always be kept for reuse in repair work elsewhere within the same building.

PUTTY

28. Reglazing in timber sashes/casements should be carried out in linseed oil putty. The glazing rebates should be primed before applying putty to the appropriate thickness and angle. Where metal fixing sprigs or pins are necessary, these should be fixed with a small gap between sprig and glass to avoid fracturing the thin, delicate glass. Putty should be decorated within a day or two after application to avoid it drying out/shrinking. The paint should be taken slightly over the border, between glass and putty covering about 1 mm of the glass, to form an effective seal against moisture penetration.
29. Putty thinned with a few drops of raw linseed oil or natural turpentine can be used to seal minor cracks in old putty, thereby extending its life for a few years.

NEW TIMBER TREATMENT

30. When used in repairs, any new timber without a high natural resistance to decay should be pre-treated by the supplier with a double- vacuum treatment using an organic solvent preservative.
31. Existing timber components removed from the window for repair can be immersed in a preservative (also organic solvent type), after all the repair cuts have been made. Where window components suffering from decay are to be repaired in situ, removal of the decayed areas of timber can be followed by brushing preservative in multiple applications or by smothering temporarily the affected area with an absorbent material (for instance, cotton wool) soaked in preservative and covered with polythene sheeting. In all cases, particular attention should be given to treating the end grain of timber.
32. The use of boron rods (which work by emitting anti-fungal boron when damp) must be avoided. Considerable damage (including possible weakening of the joints) is inflicted on the window by the insertion of the rods and they provide protection to only a small area of the wood for a limited period.

POINTING

33. The existing pointing material that fills the joint between a frame and the surrounding masonry should normally be matched (taking care not to inadvertently copy inappropriate repair work). The use of haired lime mortar and/or burnt sand mastic (baked sand and boiled linseed oil) is the traditional method for closing the window-to-wall gap. The void behind can be packed with rolled up newspaper, soaked with water before use.
34. Modern mastic sealants and foam fillers must be avoided as they can trap moisture and are disfiguring.

35. PAINTING

36. Only loose and defective areas of paint, putty, filler etc should be removed. Essential stripping of paint can be achieved successfully using an organic solvent stripper, although much patience is required, and care should be taken to clean the timber down thoroughly after stripping. Defective paint can also be burnt (flame or hot air stripper) but this method should be avoided on windows in situ (because of the dangers to the general building fabric) or where glass is still in place. Precautions should also be taken when burning off lead-based paint because of the toxic fumes. For the same reason, only wet abrasive paper should be used when rubbing down old paintwork.

STRIPPING

37. Under no circumstances should windows (or any other joinery) be stripped by immersion in caustic soda or similar 'acid bath' treatments, as this will deform the timber and weaken the joints.
38. Drips and anti-capillary grooves with accumulated paint layers should be cleared, and any further repairs carried out before priming.
39. Any reglazing should be carried out after painting, to minimise the risk of absorption by the timber of the binding oil from the window putty.
40. Following the removal of paint, all accessible surfaces of the window should be rubbed down (wet abrasive paper) with priming of exposed timber surfaces and application of a minimum of one undercoat and one finish coat. Concealed surfaces of timber (for example, underside of cill, interior of sash boxes) may be coated with primer and undercoat where they are made accessible during the course of repair. Some timber components are left unpainted, to allow the window to function properly (for instance, the junction of the sash window pulley stile/sash stile, which should be waxed to ensure an easy sliding action).
41. Alkyd paint systems are those most generally in use on external joinery. The elasticity required in paints applied to timber surfaces is initially good in alkyd-based paints, but this property deteriorates with age and generally results in the need for repainting much more frequently than with lead-based systems. Alkyd-based primers are not suitable for use on most hardwoods, where a metal-based primer should be used.

42. Final paint specification to be decided following paint analysis.

IRONMONGERY

43. Existing ironmongery is to be retained as indicated on drawings. Where to be cleaned or overhauled the hardware should be freed from the painted surface by cutting around the perimeter with a sharp blade.
44. Poultice material (peel away or similar) to be used to remove paint finish to ironmongery where required to reduce dust and issues with lead paint.
45. Before re fixing apply beeswax and buff with a soft cloth to protect ironmongery.