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Fooling the Eye: Investigation of Finishes at the Boyd House II

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Proceedings of:

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1.0 BACKGROUND

1.1 Brief

The author was engaged to undertake an analysis of the external and internal finishes of Robin Boyd's former home at 290 Walsh Street, South Yarra, for its current owner, the Robin Boyd Foundation.

The brief was to document the history of the finishes used on the exterior and interior of the house and courtyard. This included, among other tasks, determining:

- Which elements retain their original finish, and had not been recoated since;
- The chemical composition of these still exposed original finishes;
- Whether the 'natural' timber cladding and other elements have a clear coating;
- The original colours of finishes applied as well as the sequence of subsequent colours, to the present day.

This relied, in part, on XRF and FTIR testing carried out in association with conservation chemist Petronella Nel at the Centre for the Conservation of Cultural Materials, University of Melbourne.

1.2 The place

The house was designed in 1958 by architect, architectural writer and critic, Robin Boyd, for his family. To temper the effect of open-plan living on family life, Boyd divided adults and children into two separate zones, separated by a central courtyard. The side and front walls are of cavity brick, with window walls of heavy Oregon timbers facing the courtyard. Some internal walls and the suspended catenary roof are lined with jarrah boards. Joinery is of limed mountain ash.

After Robin's death in 1971, his widow Patricia continued to live at the house, until it was sold in 2004 to the Robin Boyd Foundation.

The house is of State architectural and historical significance. It is described as ‘one of the most innovative houses built in Victoria in the post war decades and as one of the most important houses designed by … Boyd’. It is listed on the Victorian Heritage Register as H2105 (Heritage Victoria nd.).

1.3 Historical resources

The Boyd House II has been well recorded by early photos taken during and after its construction, particularly by photographers Mark Strizic and Peter Wille. Many of them are held by the State Library of Victoria. Wille’s colour slides are of particular interest when comparing the appearance of finishes today and when the house was first built.

Strizic’s photos are reproduced in the classic book by Robin Boyd, *Living in Australia*, 1970. The book contains a description of materials used in the living-dining room of the house:

> … *the background is dark brick and the foreground is dark red (jarrah) and off-white (mountain ash) timber, with brass fittings.* (p. 36)

Tony Lee, Executive Director of the Robin Boyd Foundation, provided two documents from the foundation’s archives that were thought to provide insight into the type of finish on the courtyard mullions (the posts that hold large panes of glass on the north and south sides of the courtyard), which are rough-sawn timber with a silvery grey colour.

The first is a letter to Robin Boyd from Hickson’s Timber Impregnation Co. (Aust.) Pty. Ltd (18 April 1958). It notes that Boyd was interested in the appearance of rough-sawn Oregon timber vacuum-impregnated with Tanalith C wood preservative, which was said to colour ‘the surfaces of light coloured timbers’. The letter went on to note the difficulties inherent in treating Oregon, as opposed to other timbers such as Pinus Radiata, resulting in ‘limited penetration’ due to its ‘very refractory’ nature. In addition, a letter from Robin Boyd to Stegbar Windowalls Pty Ltd

ordering window-wall frames for the house notes: ‘I want to leave the frames unpainted and I understand you have a preservative treatment. Would you please apply it to all these frames’ (1 Aug. 1958).

Tanalith C is a preservative product based on chromated copper arsenate (CCA), providing an initial pale green colour on light timbers, but slowly weathers to a warm honey brown colour and in the longer term, silver grey. It was posited that the current appearance of the courtyard mullions was the result of a CCA preservative, but that they were otherwise uncoated.

1.4 Methodology

In-situ investigation of painted finishes and removal of samples for further analysis took place in January 2014. A 1.8-3.6 m step ladder was used to provide access to higher elements, and advantage was taken of the courtyard balcony to access the first floor of the front wing’s rear (east) elevation. In addition, as part of repair works prior to a programme of external painting, a number of deteriorated timber elements had been removed and replaced with new, allowing sampling from otherwise difficult to access elements including:

- A window mullion (internal and external faces) and the north end coverstrap of the clerestory windows to the street façade;
- A window mullion from the window wall of the rear (east) elevation of the rear wing;
- The base of one of the courtyard mullions (NB: while not a difficult element to access, this allowed removal of a larger sample than usual for instrumental analyses).

Most buildings on which finishes analyses are carried out display a long and multi-layered history of coatings, which vary in type and colour over time. In such a case, it is useful to make small dished cuts with a microscalpel (‘cratering’) which are then examined and compared with each other using a field microscope (30-60x magnification). Samples are only removed for

further investigation where unique colour chronologies (or stratigraphies) are found, preventing duplication of effort.

In the case of the Boyd House II, in places where multiple finish layers could be perceived through cratering, they were all of the same colour, or similar shades of a single colour. In such a case, little can be learned from on-site micro-examination, and it is more productive to mount and cross-section a sample from each type of element found on each elevation. This sampling was also guided by visual comparisons, so, for example, only one location of the rear glazed wall of the front wing was sampled, as the mullions at ground-floor and first-floor level appeared to have identical coatings.

When sampling, a small amount of the substrate is removed along with the coatings if possible. Care was taken to choose sampling locations that were both unlikely to be noticed (e.g., next to door hinges, at ground level or above eye level) and/or adjacent to an existing defect (chip, split, etc.) that would have to be fixed anyway.

A total of 58 samples were removed by scalpel from the painted elements of exterior and interior of the front and rear wings and courtyard. Of the total samples taken, 33 were mounted in acrylic resin, cross-sectioned and polished. They were then examined under a Nikon SMZ800 binocular microscope (magnification up to 63x) under a fibre-optic light source (Microlight 150). This allowed the layering, or seriation, of successive finish applications to be examined.

Microphotographs were taken, at a range of magnifications. Microphotographs provide useful information in regard to the relative colour values, number, thickness and soiling of coating layers, and the condition of the substrate. They are not especially useful, however, for matching finish colours.

Where possible, samples which contained exposed early paint layers were taken, to allow accurate matching to colour charts. The charts used were Dulux and Munsell colour standards. The Munsell standards are commonly used in conservation work as they are a permanent system of colour notation that can be referred to in the future. Their disadvantage is the limited palette which often provides a poor colour match. On the other hand, paint manufacturers such as Dulux frequently rename or discontinue their colours, so such a specification has a limited lifespan. One partial way around this is to record the RGB (Red Green Blue) coordinates for a commercial paint colour, as a more permanent record.

A number of unmounted samples were also subjected to instrumental analyses to learn more about the make-up of their coatings (if any). The most useful of these was found to be x-ray fluorescence (XRF) analysis, to determine the elemental make-up of coatings. This was carried out by Petronella Nel of CCMC on 30 January with a Bruker Tracer III-SD Hand-held XRF (which has a rhodium x-ray tube). Whole samples of coating on timber were analysed, as XRF machines operating in the open air only detect elements heavier than calcium or potassium in crystalline compounds. The carbon, oxygen and hydrogen that wood is composed of are too light to be detected and thus do not interfere with the reading. For the same reason, however, XRF cannot detect organic binders which are made up of polymers of lightweight elements, such as drying oils and resins which comprise carbon, oxygen, nitrogen and hydrogen.

As the XRF only indicates which chemical elements are found in the coating, and not which compounds they comprise, the results must be interpreted in light of the coatings available since the house was built in 1958.

XRF analysis was followed by Fourier transform infrared transmittance (FTIR) analysis by Petronella Nel of CCMC, using a Bruker Alpha-P FTIR machine. Infrared spectroscopy is a

favoured method for identifying binding materials, such as oils and resins, but works best with unpigmented or slightly pigmented samples (such as a tinted varnish). With heavily pigmented samples, such as typical paints, there can be interference from the pigment spectra. There is also interference from the organic compounds which comprise the timber substrate. These two problems can often be overcome by extraction of the binder from the coating so it can be tested on its own. This proved very difficult with the aged coating samples found on the Boyd House II, however, and produced little in the way of conclusive information. A next step in this process would be to try the more time-consuming (and expensive) method of gas chromatography.

2.0 RESULTS

2.1 Answers to key questions

As noted in section 1.1, there were a number of specific questions the Boyd Foundation wished to have answered by the finishes investigation, apart from the overall chronology of finishes applied to the house. They are addressed below, with the overall scheme and its evolution discussed in the next section of this report.

2.1.1 Elements which retain their original finish

Based on the on-site and laboratory investigations, the following elements are believed to retain their original (1958) finishes intact (i.e., exposed).

Original external finishes of west (front) wing & courtyard

- Stringer to front steps; Door to balcony; Rough-sawn Oregon components of courtyard (east) elevation, including window mullions, balcony floor beams and joists; Rough-sawn Oregon components of courtyard ‘walls’ on north and south sides – all have a very sheer grey coating

Original internal finishes of west (front) wing

- Built-in cabinets to kitchen/dining and upstairs living room/bedroom and bathroom – multilayered, limed finish
  The mountain ash joinery was finished in situ, leaving exposed timber where it abuts a structural post (see Figure 1). A white paint was applied and then mostly rubbed away (as shown by the cross-section, Figure 2). This was followed by a pale varnish.

Figure 1. Left to right: Rough-sawn Oregon post with silver-grey coating; ash joinery with unfinished strip, edge of limed finish showing white undercoat, and with varnished top coat (N Schmeder, 2014).

Figure 2. Limed finish of an internal door in the rear (children's wing), as seen in a cross-section under a reflected light microscope (63x). The large brown area is timber, with small amounts of white paint visible in indentations on the surface, beneath a layer of transparent varnish. (N Schmeder, 2014)

- Rough-sawn Oregon floor beams and joist (exposed above the dining room), also some of the Oregon posts around the staircase; Mullions of east clerestory windows; Mullions of west windows to balcony; Door to balcony – sheer grey coating
- Stramit ceiling to dining room – high-gloss off-white paint
- Jarrah tongue-and-groove panelling to east wall of upstairs living room/bedroom, in vestibule and bathroom – coated with a drying oil, such as linseed
- Ceiling lining boards to upper level – uncoated

Original external finishes of east (rear) wing

- None identified

Original internal finishes of east (rear) wing

- North wall of Bedroom 1 – deep purple-grey on bagged brick
- Mullions to west window wall of Bedroom 1 and Study; Rough-sawn Oregon roof beams in Bedroom 2 and Bedroom 3 – sheer grey coating
- Doors to Laundry, Bathroom, Bedroom 2, Bedroom 3 and built-in furniture – multilayered limed finish
- Jarrah tongue-and-groove panelling to walls in Bedroom 2, Bedroom 3 and Laundry – coated with a drying oil, such as linseed
- Ceiling lining boards to all rooms in rear wing – uncoated

2.1.2 Finish of 'natural' timber elements

Jarrah tongue-and-groove boards were used extensively in the interiors as well as the exteriors. Externally, they were used for the front door and its surround, the balcony floor, and the north and south walls of the rear wing. Only the external walls of the rear wing appear to have had a pigmented coating originally, with the same sheer grey seen on many other elements.

The front door and surround have obviously been coated several times with a drying oil, as build-up is visible at the edge. FTIR testing indicated the presence of an organic coating (oil or resin) whose spectrum most closely matched that of linseed oil.

Results for the jarrah lining boards on the walls of the front and rear wings had less conclusive results, but FTIR analysis suggested they had been coated just once with a drying oil such as linseed oil. It appears that the softwood boards used to form the soffit of the catenary roof which covers both wings and the edges of the courtyard were left entirely uncoated.

The second timber element with a 'natural' finish is the timber boards used to form the soffit of the catenary roof which covers both wings and the edges of the courtyard. One sample – from inside the rear wing – was tested with FTIR. There was no indication of any organic coating, so it is likely that these boards have never been coated.

2.1.3 Chemical composition of original finishes

As discussed in the introduction, there was a theory that the translucent grey colour of the massive rough-sawn Oregon timbers used as mullions for the glazing that enclose the courtyard on the north and south sides, and perhaps those used to construct the walls of the two elevations facing onto the courtyard, was the result of aged chromated copper arsenate (CCA) preservative treatment. With this in mind, samples from these elements were tested with XRF.

The results showed two different types of coatings used to create this finish, which is similar to the natural silver-grey of aged wood. While trace amounts of arsenic and copper (and possibly chromate) were detected in one case (on the courtyard mullions), this was clearly not the primary source of colour.

Courtyard mullions

One finish was found exclusively on the mullions of the courtyard walls (north and south sides). It included a large amount of calcium, zinc, a bit of titanium, a bit of iron, and a tiny amount of copper and arsenic.

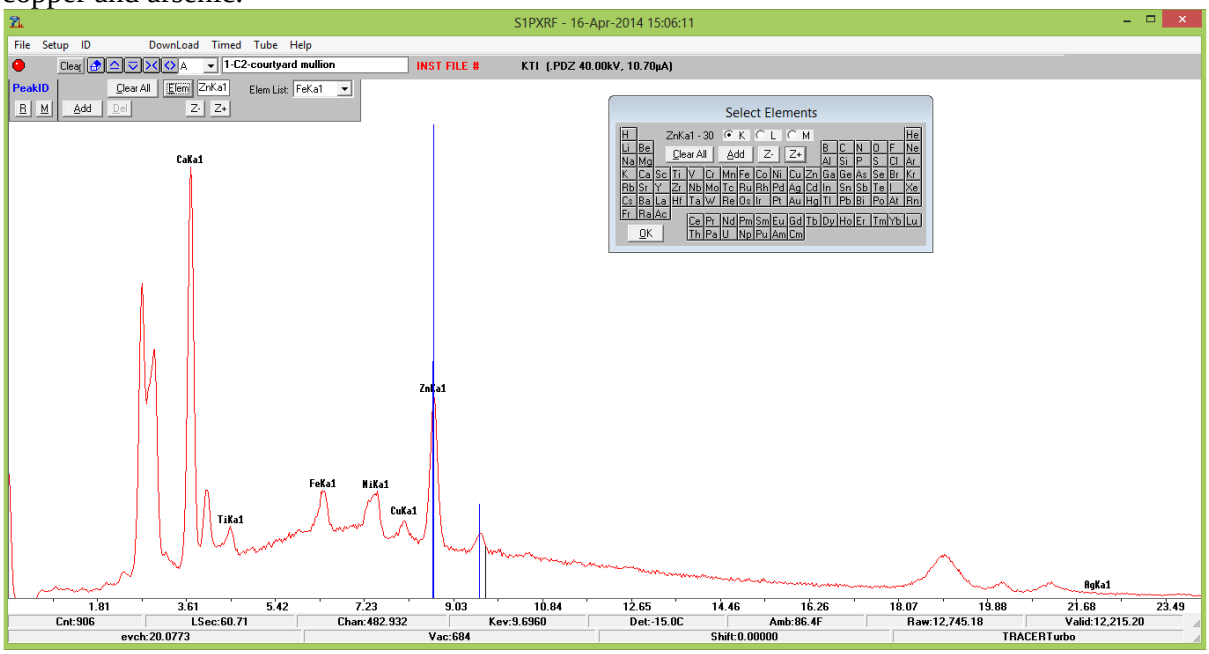

Figure 3. XRF spectrum for a courtyard mullion. It has a very strong peak for calcium (left), and strong for zinc (right), with small peaks in between for titanium, iron, nickel and copper. The blue line to the right of the zinc peak indicates the presence of a small amount of arsenic. (CCMC, 2014)

There are two types of external architectural coatings based on calcium (specifically, calcium carbonate) as a binder or filler: limewash and powdered casein paint. Limewash is one of the oldest architectural finishes, and has been used in Australia since the early days of settlement, prepared on site using lime putty. Casein is a protein precipitated from milk when treated with dilute acid. Milk-based paints have also been used since ancient times, but gained in popularity in the late nineteenth-century when they began to be mass produced in the United States. Casein paint was one of the most popular internal and external house paints in 1930s America, particularly the paste variety. Powdered casein paint – the type that contained calcium in the form of whiting or chalk – was still being manufactured (Standeven 2011:47-49). It is not known

how popular casein paints were in Australia in the 1930s or later. Miles Lewis only mentions the early variant of adding milk curds (casein) to limewash, but not any manufactured varieties (Lewis nd:11.3a). No articles about 'casein paint' or 'milk paint' in Australia could be located in an electronic journal search. Finally, only one mention of it could be found online in Australian newspapers of the 1950s in a general article about milk by-products, while there were many contemporary mentions of the new 'plastic' (PVA) paints and cement powdered paints.

In summary, it appears to be far more likely that the paint found on the courtyard mullions was based on limewash. Certainly lime was used on the building site, in the cement-lime mix for the bagging on the bricks, and it appears that limewash was used directly on the bricks prior to applying the bagging.

The sheer silvery-grey colour and the presence of other inorganic elements detected by XRF indicate that the limewash was supplemented by other white (and black) pigments, to provide a greater degree of coverage and as a colourant. The zinc and titanium detected are believed to be from white pigments: zinc oxide and titanium dioxide, both common in the 20th century. The presence of iron may indicate the use of Mars Black (Fe_3O_4), a strong black pigment developed in the 20th century. It is likely that these three pigments were introduced into the mix in the form of a pre-mixed grey paint (probably a waterborne emulsion paint, available since the late 1940s, that would be miscible with limewash). The trace amounts of copper and arsenic correspond to the initial CCA preservative treatment.

West and east wings

A second coating type was found on all the internal and external rough-sawn Oregon timbers used to construct the two wings of the house, as well as the smooth-sawn mullions to the west (front) clerestory window. In some cases, the silver-grey coating is so sheer that it is hard to

determine by eye whether the timber is in fact coated or just aged. XRF analysis, however, confirms that all the greyed-off timbers did, in fact, obtain this appearance via an applied, semi-opaque coating.

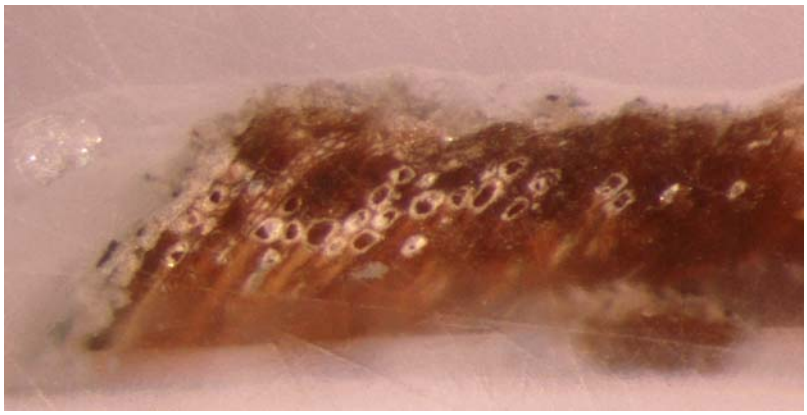

Figure 4. Microphotograph (40x) of a sample taken from the outer face of the balcony door (east elevation of front wing). The large brown object is the timber, with a very thin coating of grey paint on its upper and left-hand edge. (N Schmeder, 2014)

The elements tested were the following:

- Front wing – internal face of the west clerestory window mullion; reveal of the southern ground-floor door off the courtyard; ceiling beams over dining room
- Rear wing – ceiling beams over Bedroom 3; external face of window wall mullion, west elevation

In all cases, the chemical elements detected were, in order of quantity, the most zinc, less lead, less titanium, and a tiny bit of iron. As in the case of the courtyard mullions, it is believed that the zinc and titanium are white pigments in the form of oxides, and the iron is from Mars Black – creating the pale grey colour. Lead is believed to be lead white, the most important white pigment since ancient times, used for house paint until 1970. For architectural uses, it was most commonly mixed with linseed oil, as it acted both as a pigment and drying agent, making an opaque, fast-drying and durable coating.

It is interesting to note that this same lead paint was re-applied when repainting the west window wall of the rear wing, as there are multiple coating layers visible, all of the same chemical composition. This means that its last repainting was likely prior to 1970, when lead paints were removed from the Australian market.

These results make sense comparing photos from when the Oregon frame was being erected in 1958, with those taken a year or two later. The pale yellow wood seen in 1958 had already changed colour dramatically to the same silver-grey we see today. CCA on its own would not have greyed off that quickly, nor would bare wood have weathered that fast.

Figure 5. Courtyard elevation of the Boyd House while under construction in 1958. Note the fresh yellow Oregon timbers. (Peter Wille, Collection of architectural slides, State Library of Victoria)

Figure 6. Courtyard elevation of the Boyd House c1959. Note the greyed off timbers of the front wing and the courtyard mullions. (Peter Wille, Collection of architectural slides, State Library of Victoria)

Summary

The coating on the courtyard mullions appears to be a limewash mixed with a light grey waterborne emulsion paint (containing zinc white, titanium white and Mars black pigments) to give it greater coverage and a pale-grey colour.

The coating to the rough-sawn Oregon timbers to the exterior and interior of the two wings, as well as smooth-sawn elements such as the clerestory window mullions (and likely the doors), were painted with a white lead and linseed oil paint, which included zinc white, titanium white and Mars black pigments. Considering the sheer nature of the original areas of coating, it is likely the paint was diluted with extra turpentine or another solvent before application.

2.2 Colour and finishes scheme

2.2.1 Original scheme (1958-59)

When first completed, the Robin Boyd House II had rustic textured external finishes with applied pale to medium grey paints on them. The paint layer applied to the external timber elements was

unusually sheer, comprising more of a wash that gave the effect of natural weathering. This was combined with the natural greys of the lead window cames, and some areas of vertical jarrah boarding. The jarrah was just oiled around the sheltered entrances of the west (front elevation), but painted in the sheer grey wash on the north and south elevations of the rear wing. The brick walls were bagged and painted in a warm mid grey.

Internally, narrow jarrah boards (which appear to be tongue and groove floorboards) continued as a strong theme on ‘feature walls’, combined with bagged brick walls in a darker and cooler grey than seen outside. Red bricks provided a suitably rustic floor finish to the downstairs level of the front wing. Another finish was introduced to both wings: a pale, two-coat limed finish which left the timber grain visible but washed out the natural warm yellow tone of the ash joinery. This combination of materials, finishes and colours was used consistently throughout the two wings, though there were two brightly painted elements in the rear children’s wing. These are hardboard panels set behind the sink in Bedroom 2 and the built-in desk in Bedroom 3. The panel in Bedroom 2 was painted a deep blue. The one in Bedroom 3 was painted or sponged in mottled dabs of coppery colours.

2.2.2 Changes up to 2014

There has been very little overall change in the colour and finishes scheme of the house over the last 55 years. An unusually large number of elements have never been recoated and retain their original finish layers.

Others have been repainted one or more times in a variety of greys. In some cases, such as the window mullions of the west wall of the rear wing, the colour match and paint type has been identical. In most, however, there has been a gradual shift in the original grey tones, in some cases darker or cooler, but these changes are not consistent. One of the biggest changes in

appearance, though not colour, is the recoating of elements that originally had the sheer silver-grey wash. In places where repainting was required, the successive paint layers have obscured the timber grain (particularly where acrylic paint has been used), and obliterating the original delicate and “natural” appearance.

One other element whose appearance has notably changed since the house was built is the railing to the internal stairs in the front wing. The timber railing originally had a limed finish similar to that of the joinery, but has since been covered with a cream-coloured acrylic paint.

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