The safe removal of asbestos

– containing pointing from masonry facades – a fresh approach

The removal of asbestos-containing pointing (ACPs) from masonry facades is by no means a recent occurrence. However, to be carried out safely, effectively, economically, without unnecessary removal of non-asbestos-containing material and without impact on masonry of heritage significance, it is a process that requires the engagement of knowledgeable specialist consultant personnel and rigorous specification.

In the past, the need for such approach has not been fully understood by all parties, the consequences being that material in otherwise sound condition is needlessly removed and the building owner incurs unreasonable excessive costs. Stonemasonry consultant, Jasper Swann and Peter McKenzie, Director of Heritage Conservation at Jackson Teece Architecture, report on their development of a fresh approach incorporating procedures to effectively deal with the issue in the current façade conservation works on the Sydney Town Hall building.

Brief outline of the mining and uses of asbestos in Australia and throughout the world

Early uses of asbestos[1]

Evidence exists that at least 4500 years ago the inhabitants of east Finland used asbestos to strengthen earthenware pots and cooking utensils, but it is not until the mid-19th century that the asbestos industry proper emerged.

From the 1870s onward commercial asbestos mining commenced in Quebec, Russia, Italy, South Africa and USA.

By the late 19th century the use of asbestos was becoming increasingly widespread. Applications included fire retardant coatings, fireplace cement, fire resistant gaskets, pipe insulation, ceiling insulation, fireproof wall sheets, flooring, roofing, lawn furniture, and drywall joint compound.

The toxicity of asbestos was first recorded in the early 1900s by researchers in the UK who observed a large number of early deaths and lung problems in asbestos-mining towns. The first diagnosis of asbestosis was made in the UK in 1924.

1 The following summary is based upon information at http://en.wikipedia.org/wiki/Asbestos

Use of asbestos in Australia[2]

Before 1904	Small quantities of asbestos mineral were mined in Australia; however they were not of good quality and were more expensive than imported materials[3]
1904	Imported asbestos cement roofing slates sold by James Hardie
1906	Imported asbestos cement sheets sold by James Hardie
1916-17	New Wunderlich factory at Cabarita in Sydney
	New James Hardie factory at Camellia in Sydney
	Both factories produced asbestos cement sheet products, with some friction products such as linings for brake shoes
1919-1923	Woodsreef mine at Barraba NSW operated by James Hardie; produced small quantities of chrysotile
Before WW2	Immediately prior to World War 2 all asbestos used in Australia was imported from Canada [chrysotile] and South Africa [crocidolite], some 15,000 tons total per year
1943-1966	Wittenoom Gorge mine in WA operated initially by Lang Hancock and soon by CSR; the blue [crocidolite] asbestos was more expensive than imported material
1944-1979	Baryulgil mine in the Clarence River valley on NSW operated by James Hardie and Wunderlich; small quantities of chrysotile obtained
Post-WW2	Worldwide shortage of asbestos
	Importation of chrysotile from Canada resumed
1967	Use of crocidolite banned in Australia
2003	Use of chrysotile banned in Australia

2 The following summary is based upon information obtained from http://www.mileslewis.net/australian-building/pdf/07-cement-concrete/7.10-asbestos.pdf

3 That the "benefits" of asbestos were widely known in the latter years of the 19th century is demonstrated by an advertisement for "Eureka Asbestos Fireproof Paint" in the Morning Bulletin (Rockhampton, Qld.), 25 July 1892.

Through much of the 20th century, Australia was a major user of a great variety of asbestos products, a substantial proportion of which were imported from the United States, the United Kingdom, Germany and Japan. Imported asbestos-containing products included insulation, rope, yarn, fabric, friction materials, gaskets and millboard.[4]

Asbestos in caulks and putties

Caulk and putty

Prior to the commercial availability in the 1950s of elastomeric sealants such as polysulphides, urethanes and silicones, oil-based putties and caulks were used for weather-sealing of windows and joints. These were a mixture of whiting (finely ground chalk) and linseed oil, and had limited movement capacity.

Asbestos in caulk and putty

Asbestos was commonly added to caulking compounds and putties as filler because of its low price, chemical inertness, high strength characteristics, and its fibrous network that both prevents sagging in application and affords excellent viscosity control. Those caulking compounds that were applied with a caulking gun or putty knife typically contained 5 to 25 per cent asbestos.[5]

The availability and first use of asbestos-containing caulks in Australia has not been ascertained with any certainty; however, it is likely that they were first imported after World War I.

One such potential source was Johns-Manville, a company formed in the USA in 1901 as the result of the merger of two construction products manufacturers, H.W. Johns Manufacturing and Manville Covering Co.

From 1891 the H.W. Johns Asbestos Materials Catalog advertised a wide variety of asbestos products including roof coating, wood filler, fire-proof paint, building felt, etc.

In 1932 their US catalogue of building products comprised mostly asbestos related products, including:

> *ASBESTOS CAULKING PUTTY— A plastic asbestos waterproofing material which will not dry out. For setting wood and metal door frames, skylights, scuttles, copings, etc.; for pointing up cracks in masonry; and for miscellaneous caulking. Furnished in 5, 10, 25 and 50-lb. cans, and in 150-lb. drums.*[6]

Johns-Manville established operations in Australia and in the early 1920s advertised their asbestos cement roofing sheets, whilst in the 1930s they were advertising the use of their caulking compounds, for example for weather-sealing of the windows in the new Brisbane Women's Hospital.[7]

Also available in Australia was Nonporite Elastite Caulking Compound[8], an asbestos-containing caulk one of whose advertised uses was pointing of stonework. Nonporite products were marketed by McKinlay Fletcher Ltd at 277 Clarence Street, Sydney.

Another product that might have been imported into Australia was 3M Caulk, manufactured by Minnesota Mining and Manufacturing (3M) in the USA. This caulk contained asbestos and was available in the USA from 1935 until 1986.[9]

On the basis of this evidence, it is possible that the joints in any masonry facade erected or repaired from the 1920s to the1980s in Australia might contain putty or caulk that includes asbestos.

Occurrence of ACPs in Sydney

Examples of the occurrence of ACPs in Sydney include:

- Sydney Morning Herald building, constructed 1924-29 [now the Radisson Plaza Hotel] – Used as pointing for all joints in the sandstone facades. All pointing was removed as part of façade conservation works in 1990.
- Maritime Services Board building constructed 1949-52 – Used as pointing for the joints in the sandstone facades. Pointing was first removed from facades in 1990 when the building was adapted for its current use as the Museum of Contemporary Art and more recently in 2012, when all remaining ACPs were removed.

4 http://www.asbestos.com/mesothelioma/australia/asbestos.php

5 Survey of Primary and Secondary Processors of Asbestos Non-Roofing Adhesives, Sealants and Coatings, ICF Incorporated, Washington DC, 1986.

6 http://archive.org/stream/TheCatalogOfJohns-manvilleBuildingMaterials/TheCatalogOfJohns-manvilleBuildingMaterials_djvu.txt

7 Sunday Mail, 20 March 1938

8 The Nonporite Industrial and Technical Products Reference Booklet states:

ELASTITE CAULKING COMPOUND

(Knife Consistency)—a standard weather-sealing plastic caulking pointing and jointing compound which is the highest grade of its type obtainable. It is based on the non-drying, non-hardening properties of vulcanized tung (China Wood) oil with which are incorporated in-organic asbestos fillers such as pure Chrysotile fibre, etc.

Elastite Caulking must not be confused with so-called plastic putties, etc., none of which retain the elasticity and resiliency necessary to function as a permanent weather-proof seal or expansion joint between materials of different natures. Elastite Caulking Compound does not stain any surrounding work, and does not weep, flow, or shrink under any climatic conditions. It is available in a wide range of colours and several consistencies covering all types of applications. The standard colour is a neutral grey, and the knife consistency is always supplied unless otherwise specified.

USES: For caulking cracks in masonry work, sealing window frames (especially steel), expansion joints in concrete work, a waterproof seal around steel work in concrete, setting glass bricks, pointing stone and terra-cotta work; for bedding glass and metal work to eliminate vibration, etc., timber caulking, motor body caulking.

QUANTITY DATA: Packed in 7lb. 14lb. or 56lb. lever lid tins. Can be applied by knife or pointing trowel, tooled in by hand, or laid in preformed strips. One pound gives 20 lineal feet of 1/4in.x1/4in.joint.

(Soft Knife or Gun Consistency) – a specially designed form of soft Caulking Compound to be applied means of a hand-gun. It is particularly recommended for the weather-sealing and air-sealing of continuous sections where large runs of sealing or jointing are involved, such as beading, angle cracks and so on. Like the Standard Elastite Caulking Compound it is available in a wide range of colours.

Source: Nonporite Industrial and Technical Products Reference Booklet [no date, but 1930s] digital.slv.vic.gov.au/dtl_publish/pdf/marc/37/2069630.html

9 http://www.mesothelioma.com/asbestos-exposure/companies/minnesota-mining-manufacturing-3m.htm

- MLC building, constructed 1937, [now 44 Martin Place] – Used as pointing for the joints in the sandstone facades. Pointing was removed as part of façade conservation works in 2009.

In addition, numerous masonry buildings, structures and monuments – often of heritage significance and some dating back to the 1820s – which would originally have contained no asbestos-containing pointing, have been found to have been repointed in the past with ACPs, often sporadically.

Legislative framework

Under the existing legislation, it is not necessary to remove asbestos-containing pointing materials simply because they contain asbestos. Undisturbed, they generally present no measurable risk to public health and may remain untouched. Their retention, however, represents an undesirable legacy for the owner or future owners of the building. Therefore, when accessing a façade for other remedial works, a prudent step for the owner would be to consider the benefits of their removal whilst the opportunity presents itself.

However where repointing of masonry is required, or any other works likely to disturb the pointing, removal and disposal of ACPs must carried out in accordance with the Work Health & Safety Regulation 2011 [in New South Wales] and the 'Code of Practice: How to Safely Remove Asbestos', published by Safe Work Australia. An appropriately licensed asbestos removalist must undertake the works, and there are number of obligations relating to the removal and disposal of the material that must be met.

Past problems associated with identification and removal

In the past, however, the removal of ACPs has frequently taken on something of a wholesale approach. Pointing materials testing positive for asbestos, it has been stated, cannot be reliably distinguished from those testing negative on the same façade. The resultant outcome, somewhat predictably, involved treatment of the entire facade, as if all joints contained asbestos, with the consequent removal of all the pointing, and, of course, the repointing of all joints.

There have been three noteworthy but undesirable outcomes in taking this approach: i) the loss of original pointing which may have been of heritage significance; ii) the loss of non-asbestos-containing pointing which was still in good condition and adequately performing its function; and iii) a considerable and unwelcome additional cost to the building owner.

Further, it has frequently been the case that pointing materials containing asbestos have been misclassified as friable, when in fact they could almost invariably have been classified as non-friable (bonded). The additional costs arising from this have been significant, as the precautionary measures needed to safely remove the incorrectly classified pointing have been correspondingly, yet unnecessarily, burdensome.

Experiences with the current conservation works program on the sandstone facades of Sydney Town Hall have stimulated development of a practical and reliable methodology for avoiding the undesirable outcomes listed above.

Sydney Town Hall experiences

Sydney Town Hall was constructed in two principal stages:

1869-1880 Town Hall building;

1880-1889 Centennial Hall addition

The stonemasonry in both stages was pointed with 'mason's putty'[10]

For the recently completed Stage 1 conservation works on the southern portion of the George Street façades and the Clocktower, examination of the pointing materials on the various facades revealed that a considerable proportion of original 'mason's putty' remained, with different materials used for recent repointing of eroding joints, predominantly in areas exposed to weathering, for example cornices. Repointing materials included putties, various cementitious mortars and, unfortunately, an elastomeric sealant. Samples of pointing materials were taken prior to documentation of the works and tested for the presence of asbestos. The majority of the samples returned negative results but two samples showed the presence of Chrysotile (White Asbestos).

More comprehensive surveys and further testing during the construction phase confirmed the presence of asbestos in some of the pointing materials. For a combination of reasons, it was determined to remove most of the pointing from the facades, much of which – as was acknowledged by most parties – was considered unlikely to contain asbestos. Under the then prevailing circumstances, the desired outcome, namely asbestos-free façades, could be attained only through wholesale removal.

The adoption of wholesale removal and replacement measures in remediation works is the easiest, safest position to take; performance outcomes are assured and inexperience need not be highlighted. However, heritage conservation works in particular require a more tailored, rigorous and scientific approach. In addition, the containment of works, and therefore costs, to those that are necessary must be a high priority as a duty of care to the building owner.

For documentation of the Stage 2 works currently underway, namely conservation works on the north and south facades, it was determined that review and

10 The stonemasonry specification dated October 1872 required: Joints 1/8th of an inch to be …pointed with white lead putty combined with ordinary putty in the proportion of one (1) to eight (8).

Image 1. Sydney Town Hall. Image of an early 1870s-era joint in an area of the East façade completely shaded from sunlight and the effects of weathering; as part of the original work, the off-white 'masons putty' pointing was coloured on completion by application of an iron oxide pigment. The pointing displays only minor deterioration.It is imperative that original and intact fabric in such good condition be retained undisturbed in respect for its technical heritage significance. (Image: Peter McKenzie, 4 July 2012)

amplification of the requirements for removal of ACPs under the specification was a high priority. The principal objectives were:

- Minimisation of the loss of original fabric, a most important aim for a building of Exceptional heritage significance; and
- Avoidance of unnecessary, additional expenditure by the City of Sydney.

These objectives were achieved by close collaboration with an Occupational Hygienist, engaged by Council, who was able to provide specialised services arising from his knowledge and experience of asbestos in masonry, backed up by scientific research. His skilled input was crucial, during both the façade inspection phase and the works documentation phase.

The accessible portions of the façades were inspected from a cherry-picker. This had a positive advantage: it enabled hands-on dialogue between the stonemasonry experts – the conservation architect and stonemasonry consultant – and the Occupational Hygienist. Thus in the man-bucket, different pointing materials were identified, recorded and sampled for laboratory testing. The visual differences of the several pointing materials that were clearly evident to the expert conservation architect and stonemasonry consultant were not always evident to the, albeit experienced, Occupational Hygienist. However, the process of expert collaboration soon rectified this shortcoming.

A sampling and testing regime for the accessible portions of the facades was defined by the Occupational Hygienist. The conservation architect in collaboration with the stonemasonry consultant

Image 2. Sydney Town Hall: East Facade. The joints indicated by the arrows have been repointed with an off-white putty which laboratory testing showed contained asbestos. The crudeness of its application was one of the dominant visual clues allowing its consistent identification. Laboratory testing showed that the types of pointings evident in all other joints in the image did not contain asbestos. (Image: Peter McKenzie, 4 July 2012)

then closely inspected the joints and developed elevation drawings of the facades mapping the location and extent of the different types of pointing materials observed. Samples were taken for laboratory testing, the results of which were able to be correlated with specific, identifiable pointings. The correlation enabled ACPs to be distinguished from benign pointings.

Contractual advantages of the approach

The methodology developed for Sydney Town Hall has an additional benefit. Once the pointing types on the facades were mapped, the quantity of ACPs was readily derived and included in the tender documentation. The potential for subsequent cost variations for removal of ACPs was therefore substantially reduced. Whilst there were costs for inspection of facades, mapping pointing materials, and sampling and testing of pointings, these costs were small in comparison to the potential alternative costs of contract variations or wholesale removal and repointing of joints. The implications for future specification on other projects are clear.

Experience is essential

Whilst this process may seem straightforward, for a successful outcome it relies upon the expertise of the persons inspecting, sampling and documenting the pointing materials. Comprehensive knowledge of, and the skill to recognize the various types of pointing materials historically used in masonry facades can be gained only through experience in work of this specialist nature. In addition, the engagement of an experienced Occupational Hygienist, and his collaboration with the consultants, is crucial.

Undoubtedly, the success of the process depends on the knowledge, skills and experience of the observers.

The safe removal of non-friable (bonded) asbestos

A key aspect in developing the specification for safe removal of ACPs is whether the ACP to be removed is classified as non-friable (bonded) or friable.

Typically when repointing stone joints hand tools only are used to rake out deteriorated pointing material; indeed, for heritage conservation works the use of power tools, such as grinders, is expressly prohibited. The use of hand tools minimises the generation of dust and the potential release of airborne respirable asbestos fibres, to a level almost certainly within the legislated acceptable safety limits.

Therefore, an experienced Occupational Hygienist will classify ACPs as non-friable (bonded) only

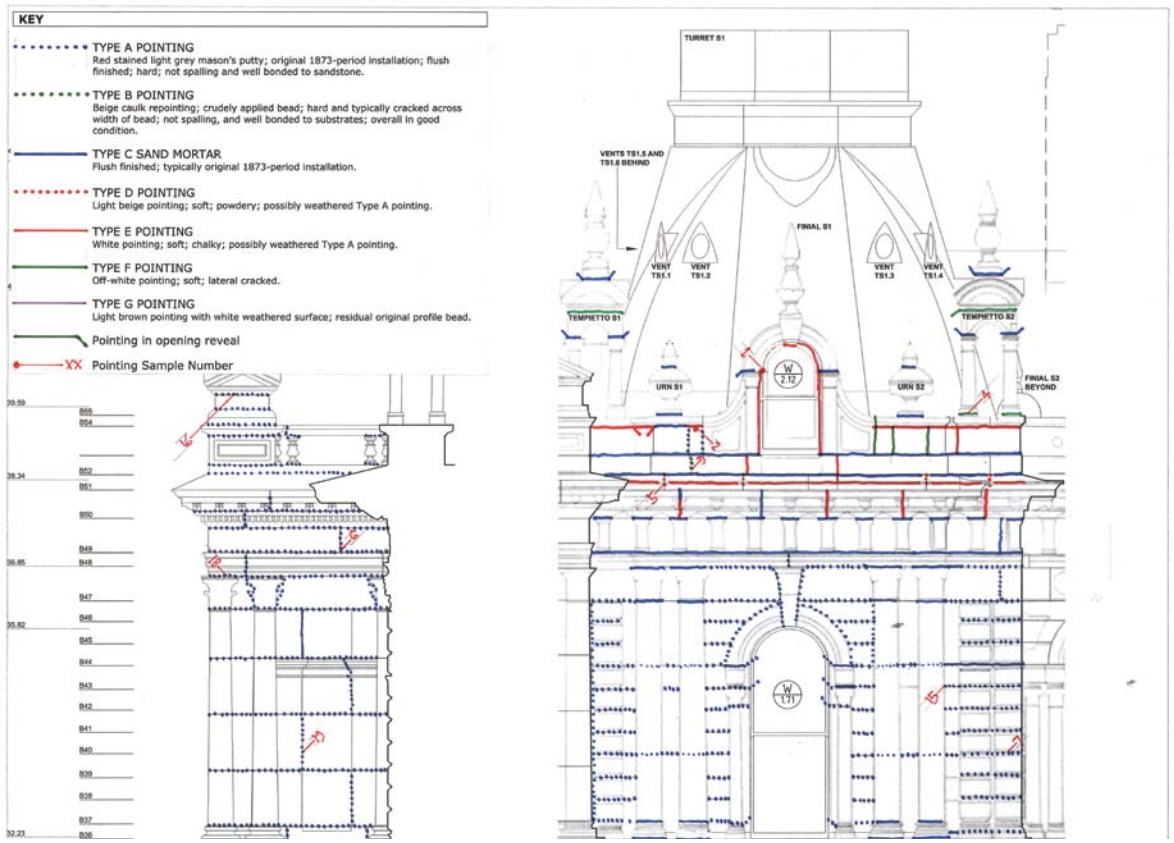

Figure 1. Sydney Town Hall – South Facade. Extract from a drawing of the façade recording the different types of pointings observed during inspection. The drawing was included as part of the tender documents for the Stage 2 conservation works. (Drawing: Jackson Teece Architecture, Peter McKenzie, 27 May 2013)

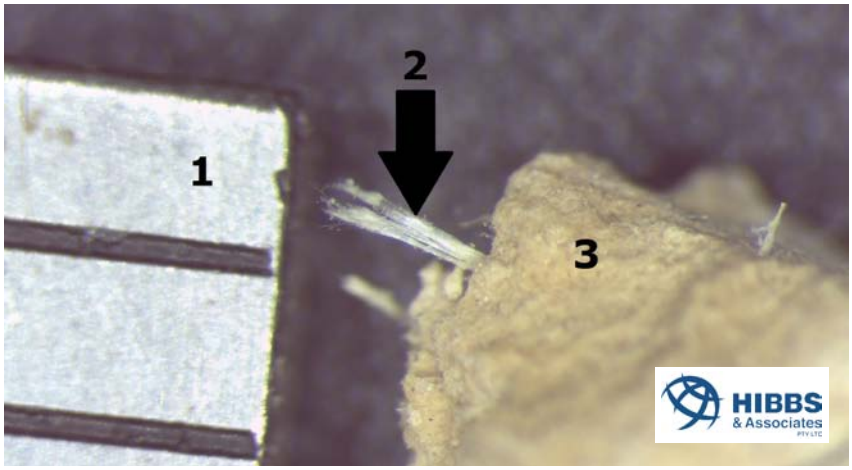

Image 3. Sydney Town Hall. Image of a sample of an ACP. 1. Scale rule with 1mm markers. 2. Asbestos fibre. 3. Pointing material. The Occupational Hygienist estimated that the samples of ACPs variably contained between 5 and 25 per cent asbestos fibres. (Image: Hibbs and Associates, Samantha O'Callaghan, 14 August 2014)

when the removal method generates minimal dust.

Classification of the ACP as non-friable (bonded) has substantial cost-saving implications arising from:

- the extent to which the immediate working environment needs to be enclosed; and
- the measures that need to be implemented to ensure safe removal of the material, within legislative requirements

When friable asbestos is removed, a comprehensive suite of strict enclosure, air-monitoring and decontamination measures must be employed. If an ACP is removed as a friable material, the design and installation of the airtight enclosure needs careful attention. Controls to be used in the removal of friable asbestos include the provision of (i) decontamination facilities, typically a number of shower cubicles, and (ii) negative pressure exhaust units used to maintain negative air pressure within the enclosed work area. A licensed asbestos assessor must test the encapsulated work area prior to the removal work commencing. A licensed asbestos assessor is also required to conduct extensive asbestos fibre air monitoring during the set up and removal of the enclosure and during all asbestos removal works.

For an ACP removed from facades as a friable material, these strict conditions are applied within a restricted scaffold work area and generally require construction of substantial, but temporary timber batten framework to affix and support the heavy duty plastic enclosure. Within the enclosure, consideration needs to be given to the probable need for lighting, increased air temperature for workers, and the impact on work quality arising from PPEs [full-face respirators, suits].

In removing non-friable (bonded) ACPs from a masonry facade, the installation of negative pressure exhaust units, wet-area decontamination chamber, and an airtight enclosure is not required. During the removal of non-friable (bonded) ACPs, surfaces are firstly wetted to minimise the potential release of dust during the works and only hand tools are used. The asbestos removalist must provide a dedicated area for the dry decontamination of tools and personnel at the entry point to the work area, and an adjoining personnel change area, and routine air monitoring is carried out for the duration of the works. Needless to say, operatives must be thorough in observing the specified processes for the safe removal and disposal of the asbestos-containing material.

In summary, the control measures needed for the safe removal of non-friable (bonded) ACPs are substantially less onerous, and less costly, than for the removal of asbestos classified as friable.

Comprehensive specification and tender documentation

For the methodology outlined above to work effectively, it must be prescriptively and unambiguously specified in the tender documentation. Tenderers must be required to:

- Nominate the licensed asbestos removalist.
- Describe their removal methodology in their tender in order to verify that the tenderer has understood, and importantly will apply, the specified removal methodology.
- Provide cost rates for removal of ACPs in excess of the quantity nominated in the specification.

A tender specifically excluding the cost for removal of ACPs carries the potential for substantial cost variation during the works, and therefore needs to be considered with healthy scepticism.

For the Stage 2 conservation works at Sydney Town Hall, all of the requirements for conducting safe removal of ACPs in accordance with the legislated Regulations and Code of Practice were developed by the conservation architect in collaboration with the Occupational Hygienist, and were included as part of the stonemasonry specification for tendering [and contract]. The specification included requirements that the contractor undertake:

- His own survey and recording of the pointings on the facades once access is in place, the survey to be undertaken jointly by an experienced contractor stonemason and Council's consultants [conserva-

tion architect, Occupational Hygienist, and stonemasonry consultant]

- Sampling and testing of pointings
- Preparation of an Asbestos Removal Control Plan

The use of stonemasons in removing ACPs

In the past, the removal of ACPs from masonry facades has mostly been carried out by personnel licensed for removal of asbestos, few of whom were stonemasons themselves. Because the careful and successful removal of pointing from masonry joints is in itself a skill, and one held by stonemasons alone, the issue of achieving the required removal without damage to the masonry has, in the past, been a significant one. In unskilled hands, the tools and techniques used to remove the pointing can, and frequently have damaged the face stonework. This aspect needs careful management, particularly on heritage conservation projects, and the engagement of a skilled stonemason to advise on and demonstrate techniques, and potentially distribute appropriate tools to the operatives charged with removal of the pointing is an invaluable measure prior to commencement of the removal operations.

Better still, and thankfully a development now gaining momentum, is the use of skilled stonemasons who have undergone training and certification in the safe removal and disposal of asbestos. This is an initiative that should be encouraged and rewarded in the assessment of tenders.

Conclusion

The applicability and feasibility of this newly developed approach has been proven in the recent experiences at two different work sites at Sydney Town Hall and the adjoining Town Hall House. For the Stage 2 conservation works program, the stonemasonry contractor, HBS Group, has successfully demonstrated that ACPs can be simply removed without risk to their workers, the staff and occupants of and many visitors to Sydney Town Hall, and the countless passers-by beneath the scaffolds. This outcome has been achieved without delay to the works program and without cost variation to Sydney City Council. Also, within Town Hall House, by adopting the same approach small areas of ACPs were similarly successfully removed by HBS Group for another contractor.

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