
ATTACHMENT M

Stone Report 1 – Stone Replacement
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AUSTRALIAN WAR MEMORIAL

NEW SOUTHERN ENTRANCE REDEVELOPMENT PROJECT



FEASIBILITY REPORT ON DISMANTLING AND REUSE OF EXISTING STONE ELEMENTS

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INDEX

1.0	Purpose of Report	3
2.0	Author Identification	3
3.0	Details of Inspection	3
4.0	Summary of Stone Salvage Proposal	3
5.0	Documentation	4
6.0	Condition of Existing Stonework and Potential for Reuse ...	4
6.1	Granite Paving and Steps	4
6.1.1	Potential Re-Use of the Pavers	8
6.1.2	Potential Re-Use of the Steps Treads	8
6.2	Sandstone Bastion Wing Walls to Main Entrance Steps	9
6.2.1	Demolition of Plant Room Stonework and Potential for Reuse	16
6.2.2	Supply of New Wondabyne Sandstone	16
6.3	Sandstone Paving to Parade Ground Forecourt.....	17
6.4	Sandstone Steps to Parade Ground Lower Tiers ...	20
6.5	Stone of Remembrance	21
7.0	Summary & Conclusion	25

1.0 Purpose of Report

The purpose of this report is to provide:

- i) An assessment of the current condition of certain elements of the external stonework and paving;
- ii) An assessment of the feasibility of dismantling certain elements of the existing stonework and paving and re-using the material in the redevelopment.
- iii) Outline methodologies for dismantling the stonework.

All photographs in this report are taken by Jasper Swann.

2.0 Author Identification

Jasper Swann has 30 years experience in the construction, conservation and care of sandstone buildings and structures. He holds a BSc(Hons) Degree, a City & Guilds London Institute Craft Certificate in Stonemasonry, a Diploma in Lettercutting & Carving and a Masters Degree in Heritage Conservation. He is a former member of the NSW Heritage Council's Technical Advisory Group and former lecturer in the conservation of sandstone structures in the Masters of Heritage Conservation Program at the University of Sydney. He has been a regular article contributor to the Australian Stone Advisory Association's (ASAA) industry magazine, *Discovering Stone*. A full CV is available at <http://www.jasperswann.com.au/cv>

3.0 Details of Inspection

The stonework and paving was inspected by Jasper Swann on 12 February 2020. Conditions at the time were dry and overcast.

4.0 Summary of Stone Salvage Proposal

It is proposed that a number of existing stone elements will be dismantled and set aside for potential reuse in the redevelopment. The stone elements identified for such re-use are as follows:

- Granite paving to Parade Ground forecourt
- Granite steps to Main Entrance
- Sandstone bastion wing walls to Main Entrance steps
- Sandstone paving to Parade Ground forecourt
- Sandstone steps to Parade Ground lower tiers
- Marble Stone of Remembrance
- Sandstone retaining walls and copings to front lawns

5.0 Documentation

The following documentation has been perused:

Scott Carver drawings:

AWM-0274-SD-A-052

AWM-0274-SD-A-051

AWM-0274-SD-A-100

AWM-0274-SD-A-103

AWM-0274-SD-A-101

AWM-0274-CD-A-111

AWM-0274-CD-A-303

AWM-0274-CD-A-507

Underpinning Methodology Pp.6, 7, & 8

Main Ceremonial Stair Reinstatement p.9

6.0 Condition of Existing Stonework and Potential for Reuse

6.1 Granite Paving and Steps



Figure 1 Granite paving to the forecourt. (Photo: Jasper Swann, 12 February 2020)

The existing paving to the forecourt consists of 450mm x 300mm 'Christmas Bush' granite pavers, (Fig.2). The thickness of the pavers is understood, from previous internal AWM investigation, to be 65mm.

A relatively small number of the pavers are 450mm x 450mm, with a scored grid pattern cut into them, (Fig.3).

The majority of the pavers are in good condition. A very small number of the pavers exhibit cracking, (Fig.4).

The steps to the Main Entrance are of the same Christmas Bush granite. The treads are solid and range in length from less than a metre to approximately 2.7m. The majority of the treads are in good condition. Two of the treads have cracked across their full tread width, (Figs.5 & 6). A small number of pavers on the landings of the front steps have also cracked.



Figure 2 450mm x 300mm granite pavers to forecourt. (Photo: Jasper Swann, 12 February 2020)



Figure 3 450mm x 450mm grid-scored granite paver to forecourt. (Photo: Jasper Swann, 12 February 2020)



Figure 4 One of several cracked granite pavers to forecourt. (Photo: Jasper Swann, 12 February 2020)



Figure 5 Cracked granite step tread to forecourt steps. (Photo: Jasper Swann, 12 February 2020)



Figure 6 Cracked granite step tread to forecourt steps. (Photo: Jasper Swann, 12 February 2020)

6.1.1 Potential Re-Use of the Pavers

The pavers are known to have been laid on a wet cement bed in order to be able to resist cracking under the load of heavy vehicles. They are therefore likely to be particularly well-adhered to the concrete substrate, with no voids. In addition, they have been laid with relatively tight joints that have been pointed using a hard cementitious mortar.

Lifting the pavers with the intention of salvage and reuse would be likely to be a labour-intensive process and potentially one that would not yield a satisfactory outcome. My expectation would be that significant loss of pavers through breakage would occur. In addition, because of the tight and cement-pointed joints, it could be reasonably anticipated that even those pavers that might come away from the substrate without breaking would be likely to incur some degree of spalling to the arrises.

Lawrence Fraser, of the Australian War Memorial staff, present at the inspection, described how a recent attempt to manually raise approximately 4 sq m of the granite pavers from the forecourt had taken a full day and that approximately 1.5 sq m of the pavers were salvaged during the exercise, the remainder being damaged beyond reuse. It is therefore probably reasonable to conclude that any attempt to raise the existing granite pavers and salvage for potential reuse would result in a significant loss of the pavers – perhaps 60-70% — and also be a time-consuming and thus costly undertaking. It was also noted that the pavers only have the flamed surface finish applied to one side, so they cannot be flipped over for reuse.

An additional consideration is the pigmentation of the existing granite. Having been exposed to weathering for around 40 years, some depth of pigmentation in the granite is likely to have been lost due to the effects of UV- light and general weathering. This point was made by Mr Damian Morris, of Marble Craft, also present at the inspection, and I would concur with his view on this. Up to 50% of the granite's original colour may have been lost. The salvage and reuse of the granite paving might be compromised by the effects of this, in which newly extracted Christmas Bush granite pavers supplied to supplement the salvaged material might be notably more colourful and appear quite distinct from the salvaged material. This may have design implications. The provision of samples would be required to test the acceptability of reuse of the existing paving alongside new.

6.1.2 Potential Re-Use of the Steps Treads

The majority of the step treads would likely be able to be raised without significant damage, subject to skilled masons undertaking the dismantling. However, the issue of faded pigmentation as described above may present aesthetic design implications if they were to be reused in the redevelopment. Given that at least two of the existing treads are cracked, some new material would be required to complete the reinstallation in its existing configuration,

and it is possible that these would appear visually distinct from the existing. The colour match of the old and new would need to be tested for acceptability, by provision of samples.

6.2 Sandstone Bastion Wing Walls to Main Entrance Steps

The bastion wing walls consist of what is presumed to be a concrete core, clad in Wondabyne sandstone, (Figs. 7 & 8). Large sandstone copings of approximately 3.5m length span the walls. The face stonework is consistent in detail with the stonework at the same level on the adjoining facades of the main building.

The stonework is generally in fair condition, with the exception of the western elevations of each bastion, where the stone has been deleteriously affected by the western sun. On these elevations, the stonework has suffered extensive cracking and exfoliation. A significant number of stones are beyond repair and would need to be replaced with new in any reconstruction. It is likely that dismantling of the stonework will lead to the loss of corners and arrises where cracking and micro-cracking exists. These instances of damage would best be repaired with reinforced mortar repairs, especially on the very large copings, whose replacement with new would not be considered necessary or good conservation practice. The extent of such mortar repairs could be quite significant. Figures 9-12 show examples of stones that would need to be replaced. Figures 13-19 show examples of existing damage requiring repair.

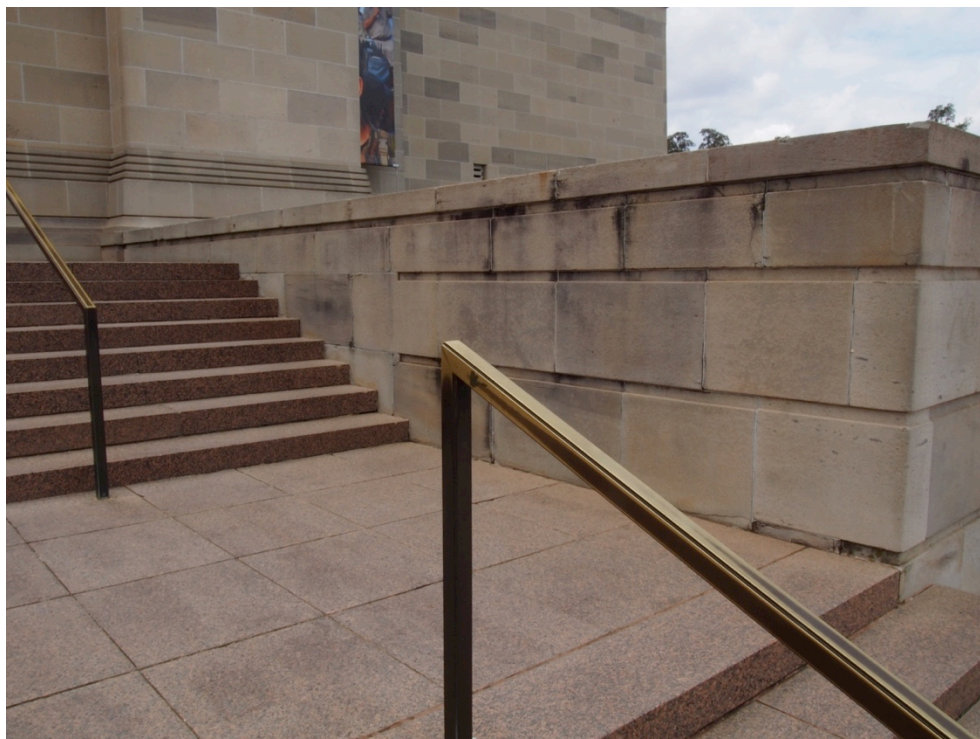


Figure 7 Eastern bastion wing wall, western elevation. (Photo: Jasper Swann, 12 February 2020)



Figure 8 Eastern bastion wing wall, east elevation. (Photo: Jasper Swann, 12 February 2020)



Figure 9 Stone in west elevation of eastern wing wall in poor condition. This stone will require replacement on reconstruction. (Photo: Jasper Swann, 12 February 2020)



Figure 10 Stone in west elevation of eastern wing wall in poor condition. This stone will require replacement on reconstruction. (Photo: Jasper Swann, 12 February 2020)



Figure 11 Stone in west elevation of western wing wall in poor condition. This stone will require replacement on reconstruction. (Photo: Jasper Swann, 12 February 2020)



Figure 12 Stone in west elevation of western wing wall in poor condition. This stone will require replacement on reconstruction. (Photo: Jasper Swann, 12 February 2020)



Figure 13 Cracking to external mitre of coping on the eastern bastion wall. This type of deterioration will not withstand dismantling and will require repair, either with mortar repair or hairline indent on reconstruction. (Photo: Jasper Swann, 12 February 2020)



Figure 14 Cracking at edge of ashlar on the eastern bastion wall. This type of deterioration will not withstand dismantling and will require repair, either with mortar repair or hairline indent on reconstruction. (Photo: Jasper Swann, 12 February 2020)



Figure 15 Cracking at edge of ashlar on the western bastion wall. This type of deterioration will not withstand dismantling and will require repair, either with mortar repair or hairline indent on reconstruction. (Photo: Jasper Swann, 12 February 2020)



Figure 16 Cracking at edge of copings on the western bastion wall. This type of deterioration will not withstand dismantling and will require repair, either with mortar repair or hairline indent on reconstruction. (Photo: Jasper Swann, 12 February 2020)



Figure 17 Localised exfoliation to ashlar at the abutment of the granite steps.
Replacement or repair of the sandstone will be required on reconstruction of the bastion wing walls. (Photo: Jasper Swann, 12 February 2020)



Figure 18 Localised exfoliation to ashlar at the abutment of the granite steps.
Replacement or repair of the sandstone will be required on reconstruction of the bastion wing walls. (Photo: Jasper Swann, 12 February 2020)



Figure 19 Significant cracking in upper course to western bastion wing wall. This type of cracking will not withstand dismantling and will require repair using mortar repair or hairline indent on reconstruction. (Photo: Jasper Swann, 12 February 2020)

6.2.1 Demolition of Plant Room Stonework and Potential for Reuse.

I understand that the stonework surrounding the existing plant room at the northeast corner of the building is to be demolished as part of forthcoming works, (Fig.20). An option for replacing the worst stones in the bastion walls at the front (southern) entrance would be to salvage the stonework from the plant room walls and reuse it where possible in the reconstructed bastion walls. Dismantling of the plant room walls, setting aside for reuse, and protection of the stonework would need to be undertaken by skilled masons. It is likely that there would be sufficient quantity to undertake the necessary replacement using this approach. Mortar repairs to smaller areas of damage would still be required.



Figure 20 The lower walls around the plant room are to be partially demolished. Careful dismantling and salvage of the sandstone in these walls is recommended, as there is potential for reuse in the reconstruction of the bastion wing walls at the front entrance. (Photo: Jasper Swann, 12 February 2020)

6.2.2 Supply of New Wondabyne Sandstone

Wondabyne sandstone is available from Gosford Quarries. The quarry is located on the Hawkesbury River. Blocks extracted from the quarry are transported by barge, but must first clear the railway which runs between the quarry and the riverbank. Permission from, and coordination with, State Rail is therefore required. Historically this has not been an issue, but it can have implications for the time-line for supply.

Wondabyne sandstone exhibits significant variation in colour. Observation of the existing facades provides the best indication of the likely range and variation in colour. The variegated appearance of the stonework in the facades of the Australian War Memorial means that any colour variation within any new sandstone supply could be reasonably anticipated to be absorbed.

6.3 Sandstone Paving to Parade Ground Forecourt



Figure 21 Sandstone paving to forecourt. (Photo: Jasper Swann, 12 February 2020)



Figure 22 Sandstone paving extending to the east, mirrored by the same paving extending to the west (not shown). (Photo: Jasper Swann, 12 February 2020)

There are several areas of sandstone paving located across the parade ground and forecourt. The paving is in generally good condition, with localised exceptions, (see Figs. 21 -24). The stone is Wondabyne sandstone.

Joints are quite tight and pointed with a cementitious mortar.

It is likely that the sandstone pavers were laid on a wet cement bed, as per the adjacent granite paving. This being the case, it is also likely that an attempt to raise and salvage the paving may prove to be an exercise that yields a low return of reusable paving. It is recommended that a trial be conducted to attempt careful removal of the sandstone pavers over an area of, say, 2 sq m, to assist in evaluation as to whether the material can be successfully reused in the redevelopment. These works should be undertaken by skilled masons.



Figure 23 600mm x 420mm Wondabyne sandstone paving to the forecourt. (Photo: Jasper Swann, 12 February 2020)



Figure 24 Localised damage to sandstone paving. The majority, however, is in good condition. (Photo: Jasper Swann, 12 February 2020)

6.4 Sandstone Steps to Parade Ground Lower Tiers

The steps are of Wondabyne sandstone and comprise solid treads. There are three flights of sandstone steps leading to the lower tiers of the parade ground: One straight flight, (Fig.25), and two curved-on-plan, (Fig.26). The sandstone treads in the curved-on-plan steps are not worked to a curvature but are in fact straight units.

The condition of the step treads is generally good and with care, I would expect that they could be successfully lifted and salvaged for reuse in the redevelopment. The works would need to be undertaken by skilled masons.



Figure 25 Wondabyne sandstone step treads to lower forecourt. Steps are in good condition. (Photo: Jasper Swann, 12 February 2020)



Figure 26 Three tiers of Wondabyne sandstone steps (seen behind the Stone of Remembrance), all in good condition. (Photo: Jasper Swann, 12 February 2020)

6.5 Stone of Remembrance

The Stone of Remembrance consists of three broad tiers of marble steps and a central monolithic stone of the same marble, (Fig.27). The marble is generally in good condition. There are several cracks in the steps that would be likely to open up during dismantling, (Figs 28-31). Great care would be required to successfully dismantle the structure to minimise damage. Repair works to broken step treads would need to be undertaken in a workshop environment. The dismantling and repair works would need to be undertaken by skilled masons.



Figure 27 The Stone of Remembrance. (Photo: Jasper Swann, 12 February 2020)



Figure 28 Cracking in marble step (top left corner), likely to break when dismantling. (Photo: Jasper Swann, 12 February 2020)



Figure 29 Cracking either side of joint in marble step course. (Photo: Jasper Swann, 12 February 2020)



Figure 30 Cracking to leading edge of marble step requiring glue repair prior to dismantling. (Photo: Jasper Swann, 12 February 2020)



Figure 31 Cracking in marble step likely to break during dismantling. (Photo: Jasper Swann, 12 February 2020)

7.0 Summary & Conclusion

The table below summarizes the findings and conclusions of the stonework inspection:

Stone Element	Likelihood of Successful Salvage for Reuse	Issues	Recommended Action	Outline Methodology for Dismantling
Christmas Bush Granite Paving	Low	Up to 70% loss on removal. Noticeable colour mismatch of new and salvaged material.	Consider all new supply of granite paving	By hand if attempting to salvage, or otherwise demolish by mechanical means.
Christmas Bush Granite Steps	High	Need for small quantity of replacement with new. Noticeable colour mismatch of new and salvaged material.	Engage skilled masons to dismantle and set aside for reuse. Procure samples of new Christmas Bush granite for replacement elements.	By hand. Use of diamond blades to relieve joints. Use of soft slings for lifting. Treads to be numbered and joint configuration recorded prior to dismantling.
Sandstone cladding and copings to Main Entrance Bastion Wing Walls	High	Heritage requirement to conserve as much of the original material as possible. Significant number of stones will need to be replaced TME, potentially using	Develop scope of works for conservation and repair on reinstatement.	By hand. Skilled masons only to undertake the works. Stones to be numbered and joint configuration recorded prior to dismantling.

		salvaged stone from Plant Room walls, or otherwise new Wondabyne stone. Also many stones will need to be locally repaired once reinstated, either by mortar repair or hairline indent		
Sandstone paving to Parade Ground forecourt	Unknown	Adherence to substrate is untested.	Carefully attempt to raise and salvage 2 sq m	By hand. Diamond blades to relieve joints.
Sandstone steps to Parade Ground forecourt	High	None	Carefully attempt to raise and salvage 4 lin m	By hand. Use of diamond blades to relieve joints. Use of soft slings for lifting.
Stone of Remembrance	High	Localised cracking likely to cause some breakage of steps during dismantling	Skilled masons to repair broken stones in workshop prior to reinstallation.	By hand. Use of diamond blades to relieve joints.

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