DEFINING A FUTURE REPAIR STRATEGY FOR THE

WELLINGTON MONUMENT –

CONCLUSIONS FROM THE 2008 INVESTIGATIONS

CONTENTS

A. History of Construction

B. Summary of Problems Since 1934

C. Reports Issued to Date

D. Objectives of 2008 Survey

E. Methodology for 2008 Survey

F. Findings of 2008 Survey

G. Conclusions

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A. History of Construction

The idea to erect a monument to Arthur Wellesley, Duke of Wellington, expressing his 'countrymen's gratitude and admiration' was first proposed publicly in June 1816. The approved design was for a stone-faced triangular pillar, 95 feet high, supported on a solid masonry plinth and surmounted by a massive cast iron statue of the Duke of Wellington, standing on a short circular pedestal that would house a viewing eye reached by an internal staircase. The whole structure was intended to be 140 feet tall. The shaft was originally planned to be 17 feet wide tapering to 11 feet wide at its head beneath the pedestal of the statue. The Monument's plinth was to be circumscribed by steps 8 feet high and 80 feet in diameter. The three rectangular ends of the plinth were to be enlivened by cannon fixed vertically to each quoin.

As far as can be gathered, the design had not changed in substance by the time that Lord Somerville addressed the foundation laying ceremony on site on 20th October 1817, except that the pillar was by then to be 20 feet wide where rising from the top of its base and 103 feet high (excluding the pedestal and statue) and the pedestal would be triangular not circular in section.

Funding shortages seem to have led to temporary suspension of building activity in a matter of months, by which time the pillar had reached a height of 45 feet above ground level. Construction eventually resumed and continued in fits and starts for a number of years. Public disinterest in the project (and the man it celebrated) resulted in reduction of the design to its absolute basics, with the shedding of all ornament and architectural élan.

Work ceased on the Monument entirely at some time in the 1820s. Previous commentators have made different assessments about the extent to which the pillar and, indeed, Lee's basic design had been completed by this time. Our investigations have shown – we believe with some certainty – that the pillar had essentially been built to its full height. Internally, the staircase formed of Ham stone steps rises to a 'hidden' landing roughly 120 feet above ground level. It seems probably that this landing is the remnant of the viewing platform which was to have stood at the head of the staircase within the pedestal, providing a view out through the observation window shown on Lee's original drawing. Holes cut into the stone newel and wall lining at this level most probably housed a barrier or other mechanism to close off the incomplete head of the Monument, which lacked its statue. The plinth we see today, although shorn of its intended cannon ornament, is recognisably the same plinth illustrated on Lee's design, once the cavetto cornice – presumed to be a later embellishment – is removed. This would suggest that this largely independent structure had also been partly completed by the end of the Monument's extended first phase of construction.

It is important to appreciate that, in its first phase, the Wellington Monument was neither conceived nor built as an obelisk. It was to be a tall pillar acting as a

statue base, no different in concept than, say, the circular pillar of Nelson's Column in London.

With the termination of building work in the 1820's, the triangular pillar stood largely complete, but anonymous – without dedicatory inscriptions or a crowning statue of the man whose military triumphs were being celebrated. Most pertinently, it seems probable that the Monument was also left without a satisfactory capping, perhaps in the expectation that the financial situation would improve rapidly, thus permitting the commissioning of the massive cast iron statue. However, public indifference to Wellington in the 1820's turned to outright hostility in the early 1830's. Despite gradual rehabilitation of his public image towards the end of the 1830's and into the 1840's, it seems that the Wellington Monument remained untouched and ignored until Wellington's death in 1852.

A lightning strike in 1846 and possibly another in 1850/51 are said to have caused serious structural damage to the pillar. Charles Giles, a local architect appointed to report upon the repair of the Monument in 1853, a few months after Wellington's death, declared the Monument a public danger, its shaft (which he termed 'truncated') having "fallen into grievous disrepair, the summit being quite open and apparently unfinished". He reported that one of the blades of the shaft had been rent by lightning and, in several locations, stones were displaced or missing.

The reconstituted Monument Committee instructed Giles to prepare a scheme for the repair and consummation of the incomplete Monument. The approved scheme involved a dramatic change of concept. Despite the recency of Wellington's death, there seems to have been no intent any longer to use the Monument to celebrate his life and achievements. The Committee eschewed any thought of completing the implementation of the original proposals – abandoning the chosen dedicatory inscriptions and the cast iron statue of the Duke. Instead, Giles set out to transform the Monument from statue-bearing pillar into the tallest obelisk in Britain (whether by design or accident). His design was strongly influenced by standard ancient Egyptian motifs and elements, but, of necessity, utilised the triangular form and other constraints of the existing pillar. The plinth's earlier pylon-dominated Egyptian character was strengthened by the addition (or so it is assumed) of the cavetto cornice and the south west doorway, with its pylon surround and winged scarab ornamental over-panel. Giles had intended that the plinth should be surmounted by three stone lions, but these were excised from the implemented scheme to reduce costs. The shaft was repaired and extended to 170 feet (51.81m), 5 feet lower than the obelisk we see today. Internally the existing staircase was retained and the flight was extended off the existing Ham stone viewing platform with new Lias steps.

As built, Lee's pillar seems to have been somewhere between 17 feet (5.18m) and 20 feet (6.10m) wide at its base, and it was intended to have been 11 feet (3.35m) at its head. Basic geometry demonstrates that it is not possible to

extend a pillar of this shape upward by some 50 feet without the head of the new obelisk tapering away excessively. Indeed, today the head of the body of the shaft (measured across the centre of the viewing eye) is 13 feet (3.94m) wide – rather broader than the intended width of the top of Lee's pillar almost 32 feet (9.75m) below. The implication would seem to be that the shaft was widened and refaced during implementation of Giles's design in 1853-54. The plinth appears to have been refaced at the same time.

By 1892, the obelisk has fallen into disrepair to the extent that the uppermost 20 feet (6.10m) were rebuilt and the shaft was extended upwards by 5 feet (1.52m). This means that today's pyramidion belongs to that third and final stage of construction. One modern day description suggests that, until then, Giles's obelisk had a conical cap, although the source for this information cannot be found and its veracity must remain in doubt.

Thus, be the end of the 19th century, the Monument had taken on the appearance that we see today. Thereafter, it has been subjected to repeated repair works of a major nature, but its character and concept have remained unchanged.

B. Summary of Problems Since 1934

Since 1934 the National Trust has had to bear the cost of repeated major repair programmes which occur cyclically on average every 10 to 15 years. To our knowledge, these have occurred in 1948, 1952, 1955-56, 1961-62, the early 1970's (little is known about this phase), and 1987-89. These repair programmes have all attempted to rectify the same reoccurring problems in the ashlar stone cladding of the shaft and plinth of the Monument.

C. Reports Issued to Date

Prior to the writing of this report the following documents have been prepared and issued to the National Trust by TFT Cultural Heritage:

- 2005 Condition Survey
- 2006 Conservation Statement
- 2006 Repair Options Report

D. Objectives of 2008 Survey

1. Selective removal of individual pieces of ashlar at all levels on shaft to ascertain distribution of very thin and deeper pyramid shaped cladding.

2. During (1) sampling of bedding mortars and core material to develop understanding of developmental history of shaft and its facing.

3. Close examination of bulging panels of ashlar, especially where previously tied back with dowels, to verify interpretation of problems set out in 2006 Repair Options Report and to assess success of past conservative repair.

4. As (3) close inspection to investigate reappearance of long vertical fractures near blades of shaft.

5. To develop understanding of issues that might be involved if option to entirely reclad shaft were to be implemented – as but one example, recladding with say 150mm thick ashlar to improve performance will involve cutting back the monument's core. The practicality of this needs to be explored.

6. To investigate impact of repair to bulging ashlar reportedly carried out in 1948-56 which involved inserting reinforced concrete anchors in place of quoins and adjacent ashlar and pouring concrete into the voids, behind the bulged ashlar panels. Information on this repair work only came to light when a missing National Trust file was retrieved after the Repair Options Report was finalised. The presence of reinforcement and mass poured concrete behind ashlar has potential to impact detrimentally on the long-term condition of the monument but may also have considerable ramifications on the practicality and economics of certain repair options now.

E. Methodology for 2008 Survey

Construction of the scaffold commenced in June 2008, with phase 1 of the investigation works commencing for one week on 28 July 2008. At the end of phase 1 an inspection was undertaken, accompanied by the structural engineer, and approval was given to extend the scaffold to 42 metres. Phase 2 inspections lasted for 2 weeks commencing 1 September 2008.

The summer 2008 survey work offered close up inspection of the ashlar from a scaffold and limited 'opening-up' of the stonework at various points up the shaft. In particular it helped to better understand:-

- The nature/size of the shaft and construction
- The way it had been fixed to the inner core of the structure
- The impact and effectiveness of the past repair techniques
- The condition of the chert and mortar core revealed behind

A detailed technical report has been produced of the investigation works undertaken in 2008. This paper provides a summary of its findings and makes recommendations on the way forwards to achieving a more durable repair to the Monument.

F. Findings of 2008 Survey

The investigation work in 2008 has revealed that:

- The lower one third of the shaft above the plinth is constructed to a better standard than the remainder. The bottom 50 courses (approximately) of ashlar are more substantial, better jointed and continue to adhere to the core behind. In the main, they are very difficult to loosen and remove. Relatively few repairs have been undertaken to this section of the shaft since it was constructed. Structurally it appears to perform as a unified monolithic entity. There are few defects evident superficially in this part of the shaft.
- Evidence of past repair to the shaft commences around 50 courses of ashlar above the head of the plinth. From this point upwards, almost continuous historic repairs can be seen to all three blades of the shaft, with very few individual stones left untouched in one way or another on the blades themselves. Today, long vertical fractures – identical to those which have been repaired repeatedly in the past – commence at this level on all three blades and run upwards for the greater part of the height of the shaft.
- Removal of individual stones from the backing core becomes increasingly easier from course 50 upwards. The ashlar becomes smaller in all dimensions and the bedding and jointing mortars increasingly eroded with height.
- Whenever the core of the Monument was exposed by removal of ashlar, it was found to be extremely solid and robust, being formed of large quantities of chert bound in lime mortar. However, removal of individual stones and clusters of ashlar between courses 50 and the top of the Monument revealed numerous long 'conduits' formed by the percolation of water down between the rear of the ashlar skin and the dense core material, eroding the soft lime mortar bedding (but not the core itself). This has considerably weakened the bond between the ashlar face and the core.
- Moving upwards from course 50 towards the upper horizontal lightning conductor band (at course 122) it is evident that the degree of past intervention and repair increases markedly, so that between roughly course 90 and course 140, no stones have been left untouched.
- Today extensive defects exist in this same area. Most notably these include marked displacement of the ashlar, sometimes for many courses at a time, alongside each blade. This is associated with the reappearance

of long, vertical fractures beside the blades and bulging of panels of ashlar on the faces of the shaft. Often this damage is occurring to sections of ashlar which were re-fixed to the backing core in the last major repair phase in 1988-90. In other words, these repairs have not been successful.

- Where re-fixed ashlar was selected for opening up (removal), it was found that in more than 50% of instances resin bonding of stainless steel dowels (or pins) drilled into the core had failed, allowing the repaired ashlar to be removed with ease. In a number of instances the length of dowel proved inadequate to provide a robust fixing into the core in any case.
- As has been noted above, the ashlar used to face the Monument seems to have become smaller with height (perhaps as a cost saving measure). By course 122, the thickness of the ashlar skin is seriously inadequate with some pieces of stone being no more than 25mm thick compared to stones of 200mm-300mm in thickness in the bottom 50 courses of the shaft. This has contributed greatly to the permeability of the ashlar face at this height and it was no surprise to find that the water eroded conduits behind the face increased in number and size at this level.
- Historic repair programmes as well as present day defects have concentrated on this section of the Monument. Extensive concrete repairs were carried out in the 1940's and 1950's. Opening up revealed that the reinforced concrete had been cast in situ once pockets had been hacked out of the backing core. Thus, where concrete repairs exist, they are slightly deeper than the surrounding ashlar face.
- Of all past repair techniques, in one sense, the use of concrete has proven the most successful in that it has remained in place and has not been fractured subsequently or otherwise become deformed or displaced. However, the effect of these repairs has been to drive the fracturing and displacement in the surrounding ashlar away from the blades towards the centre of the faces of the shaft. As a result the concrete repairs have had a detrimental impact on the 'health' of the shaft despite proving robust in themselves.
- Preliminary analysis suggests that the Monument's problems result from a combination of *bending*, caused by the wind in this exposed location, and the *inadequate properties* of the ashlar cladding.

The 2008 investigation work has proven extremely valuable in expanding our knowledge of the defects affecting the shaft and the impact and shortcomings of past repair work. This was not possible by visual inspection alone, since much has been learnt through the process of opening up of sections of the ashlar facing to the shaft.

G. Conclusions

From what has been learnt to date it would seem that the bottom one third of the obelisk is performing well as a unified structure and, for the moment, it is believed that little repair or strengthening will be required at this level. This is not to lose sight of the need for substantial repairs to the plinth itself.

Above course 50, it is clear that significant long-term problems with the ashlar cladding to the shaft have reappeared. There have been many attempts to rectify these using different repair solutions, since the National Trust took over management responsibility for Wellington Monument in 1934. In one way or another all such repair techniques have failed, proven inadequate or have been to the greater detriment of the fabric of the shaft.

The problems affecting the shaft appear to be the result of a combination of structural bending and the inadequate characteristics and performance of its ashlar stone facing. In places these problems have been further exacerbated by the indirect impact of past interventions and repair.

It is important to stress that so far no specific repair technique has proven universally effective. A satisfactory future repair strategy will need to overcome or address:

- The thinness and lack of dimensional substance of the ashlar at higher level
- Persistent penetration of the ashlar face by large quantities of wind driven water and the consequential erosion of bedding and jointing mortar
- The lack of bond between the ashlar cladding and solid core that results from massive water ingress
- The compound detrimental effect of various past repair techniques including unyielding mass reinforced concrete insertions and widespread drilling of the core for dowelling which has created channels for water passage through the interior of the Monument
- The effects of structural bending above the monolithic bottom one third of the shaft.

In the light of the foregoing, it seems possible that there is no one simple repair solution that will tackle satisfactorily all these issues. An effective repair strategy for the Monument to provide long term durability will need to encompass a range of interventions which will most likely include renewal of over thin and otherwise deficient sections of ashlar, the provision of strengthening in very specific locations to reintegrate the upper structure and fabric in order to achieve greater resistance to the effects of bending, removal of particularly aggressive or otherwise detrimental past repairs, and the introduction of resistance to water ingress through the cladding and mortar joints.

Further analysis of the compound cumulative effects of these problems and specifically, of the structural mechanisms involved in bending needs to be undertaken. However, at this stage, it seems certain that major intervention will be required into the upper two thirds of the structure and fabric of the shaft. Leaving these problems unaddressed is not an option as past history and observed evidence from the 2008 investigation work indicate strongly that collapse of parts of the ashlar cladding will occur in the coming years. Major intervention is likely to involve the removal of a significant percentage of the upper ashlar to implement this comprehensive repair strategy, Prior to the 2008 investigation programme, it had been envisaged that effective repair to achieve long-term durability might cost in the region of £3-£5M, With our improved, though so far not perfect, understanding following these investigations, it seems probable that a comprehensive repair programme will take at least two years to implement and, depending upon the final scope and combination of works, costs could well be at the higher end of the range previously considered.

The next step should be to instigate the further analysis defined above. This will enable comprehensive specification of the combined repair approaches that need to be implemented. A provisional budget in the region of £50,000 needs to be provided to fund this further analysis. It is hoped that grant aid will be made available as a contribution to this work by English Heritage. If this further preparatory stage can be undertaken in the next 12 to 18 months, it is recommended that, dependent upon the availability of the funding, repairs could and should be commenced in 2012. There remains the risk of loss of stone from the upper levels of the shaft until that time and it is stressed that the effects of ongoing deterioration on the ashlar should not be underestimated.

Essential repairs to the plinth could be brought forward for specification and implementation at an earlier date, since this structure is independent of the shaft and does not suffer the effects of bending in the same way.