Comhairle Contae Átha Cliath Theas
South Dublin County Council

Architectural Services Department

The conservation and essential repair of the Roman Arch

Building Dossier

1st November 2010

A view of the north-eastern façade The north-eastern façade to the public park, formerly the public side of the Arch which addressed the natural open space made by the valley around the Dodder river and the junction of the three roads shown in the map on pg. 8. Note the missing urn on the left side. (Photographed September 2009)

This project was assisted by the Department of the Environment, Heritage and Local Government under the 2009 & 2010 Civic Structures Conservation Grant Schemes

Introduction

In January 2009 the Architectural Services Department of South Dublin County Council was commissioned to inspect and advise on any necessary conservation works to the Roman Arch after a piece of stone fell from the entablature high on the north-eastern façade. The Arch is situated in a public park so there was a risk to members of the public should further pieces of stone fall. This report is a summary of the investigation of the structure with references to the relevant historical documentation and the conservation works carried out during the summer of 2010. These works have been completed recently.

The report is intended to be a record of the works which may be of use to the client or building owner, future conservators, the planning authority and possibly to the wider public who are interested in this structure. The report has been issued to the client and copies distributed to South Dublin County Council's Conservation Officer, the Irish Architectural Archive and the Local Studies Section of South Dublin Libraries in the Tallaght branch.

Feargal Ó Suilleabháin
Architectural Services Department
South Dublin County Council

1st November 2010

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Executive summary

The report is broadly structured in four parts: a brief history of the Arch and its context with reference to the relevant historical documentation, a summary of the examination and condition assessment of the Arch including the tests carried out and a summary of the conservation works carried out. The last part of the report considers the necessary regular maintenance and management of the Arch in the future. The dossier consists of this report, Appendix 1 (historical documentary research) and Appendix 2 (12 drawings, 9 of which show the interventions, 3 show the results of the cover metre survey). The report and the drawings cross-reference each other.

The Roman Arch, also known as Lord Ely's Gate, the Loftus Gate, the Loftus Arch, the Castle Lodge and the Dodder Lodge is situated just to the south of a bend in the river Dodder, at the junction of Dodder Road Lower, Dodder Park Road and Braemor Road, to the east of the villages of Terenure and Rathfarnham. The Arch is situated at the junction of these three heavily trafficked roads. To the north is a park which straddles the river Dodder and a footbridge which crosses over the river and to the south and west are the suburbs of Rathfarnham. The Arch is part of the village and town land of Rathfarnham and the former Barony of Rathdown. It is now part of South County Dublin and is beside the border with Dun Laoghaire Rathdown County Council to the east, and Dublin City Council to the north across the Dodder. The ordnance survey grid reference is 315321, 229509 and the sheet number is 3328-25.

The Arch is referred to in the Council's Record of Protected Structures, RPS (Map Ref. 201) under the County Development Plan 2004-2010-Schedule 2 Record of Protected Structures, referred to as "The Roman Arch, Dodder Road Lower". The structure is also listed under the National Inventory of Architectural Heritage as being of Regional Interest, Registry Number 11211012. The structure is not protected under the National Monuments Acts.

The Roman Arch was built around 1771 in the form of a Roman triumphal arch with flanking screen walls of calp limestone, which are faced with ashlar granite on one side. The central part of the structure is entirely faced with ashlar granite and decorated with engaged Doric columns, corner pilasters, engaged square columns, niches, full classical entablature and balustraded parapet surmounted by urns. The entablature is more enriched on the south-western façade than on the others. The central part of the north-eastern façade projects slightly beyond the main face and is framed by the engaged Doric columns. The central entrance arch or vault under the structure is closed by decorative wrought iron gates. Between each set of pilasters to either side of the central vault are round headed niches with circular recessed panels over. The keystone above the central vault of the south-western facade is decorated with an artificial stone mix known as “Coade” stone and bears an antique style head. Two former doorways on opposite sides under the central vault once led to the lodge keeper's accommodation; these have since been blocked up. The 4 windows, 2 on each of the short façades have similarly been blocked up. Excluding the flanking wings, the central block of the Arch is approximately 10 metres high, 12 metres wide and 5 metres deep.

The Arch was one of two entrances to the Rathfarnham estate. The history of the castle and its estate have been thoroughly researched and documented elsewhere and its importance is recognised; Rathfarnham castle is the only surviving, continuously roofed example of its type in Ireland. The quality of its internal decoration and the employment of architects such as Sir William Chambers and James (Athenian) Stuart during the eighteenth century give it an international context and relevance which is rare in Irish historical buildings. The Roman Arch as a piece of garden sculpture and as a gate lodge is considered to be one of the finest of its type in Ireland and is also remarkable for its very early use of structural iron, described later in this report.

Assessment of the Damage:

The Arch has been unoccupied and unused for over 30 years and in that time ownership and responsibility for its maintenance has changed several times. Consequently its importance has declined and this has negatively affected its physical condition. Before the works were undertaken, the following defects were identified.

1. The roof and rainwater goods had deteriorated to such an extent that rainwater was no longer being drained to the ground through the rainwater outlets as originally intended.
2. The masonry in the walls had been saturated and damaged by a combination of freeze-thaw action, salt mobilisation, organic colonisation and structural damage – the latter caused by corrosion of iron cramps and a bar embedded behind the façades of the Arch.
3. The deterioration of its physical condition had devalued of the Arch to such an extent that it was no longer properly maintained, was being vandalised and was considered dangerous.

Following removal of the vegetation and creeper growth a full structural examination was undertaken and the interiors were opened up. This confirmed that the primary decay mechanism was persistent rainwater penetration through the blocked and damaged rainwater goods and assisted by heavy progressive vegetation which had taken root within the structure. The symptoms of the decay were damaged roof slates, loose, dislodged, cracked and broken stone, large open mortar joints, eroded lime mortar, soluble salts and their destructive effects. A small number of original wrought iron cramps had corroded, expanded and cleaved the facing granite off in the south-western cornice. A wrought iron beam in the north-eastern entablature had corroded, expanded and cleaved the facing granite away from part of the strucrtue and caused extensive cracking elsewhere. It was noted that previous localised repairs in Portland cement seemed to be stable and had not of themselves contributed to the damage. Previous plastic mortar repairs were also left alone as they had not contributed to any damage.

Conservation philosophy and interventions:

Following the careful survey and examination of the building itself and researching its history in the relevant archives (refer to Appendix 1); the significance of the Roman Arch was better understood. The Arch is important by reason of its grandiose construction and architectural composition, its group value as a gate lodge, folly and garden ornamental structure, its association with one of the foremost houses in county Dublin, its technological early use of structural iron and because of its historic interest, commemorative and associative significance.

The conservation philosophy was drawn mainly from the International Charter for the Conservation and Restoration of Monuments and Sites 1964, a.k.a. The Venice Charter. The primary consideration was effective and honest repair. The works were guided by the principles of minimum intervention, repair rather than replace, honesty of repair, use of appropriate materials and methods and reversibility of alterations. For example the structural integrity of the iron tie bar was retained; its structural function was not negated by the works. Just enough proven, well understood traditional techniques (re-pointing of the mortar joints and reinforcement of the existing roof timbers) and modern technology (cathodic protection) were applied to repair and protect, not to restore. The interventions eliminated the primary source of breakdown of building fabric and stabilised the disturbed masonry. All interventions were recorded and are documented in Part 3 of this report. For budgetary reasons the wrought iron gates, the interiors and the flanking wing walls were not repaired; these could be repaired later at lesser expense and without a scaffold.

In summary the following conservation works were carried out to address the deterioration in its physical condition, mainly defects 1 & 2 above. The third defect is considered in greater detail in Section 4 of this report.

1. The roof was carefully stripped of its slate roof covering, most of the existing timbers were retained and were reinforced with new timber, the timber gutter boards and lead lining were replaced, the roof was recovered with most of the existing salvaged slate and some new slate, the rainwater down pipes were partly repaired and replaced, and a new soakaway was built in the ground beside the Arch.

2. The upper surfaces of the parapet walls, cornices and the sides of the blocking courses were dressed with lead set onto a new lime mortar fillet flaunching on the cornice. The creepers, ivy, mosses, algae, and some lichens were removed from the facades. Defective mortar joints were re-pointed. New stone indents were fixed into the building where sections had previously spalled or cleaved from the façade as a result of corrosion and expansion of corroded irons. Smaller isolated iron cramps which could be easily accessed were removed and replaced with new stainless steel cramps. Other localised ferrous pins and fixtures were removed from the more vulnerable parts of the façade. Embedded irons which were too inaccessible, too costly to remove and which removal would result in unnecessary loss of original material and reduce the authenticity of the technical design and artistic significance of the building, were protected from further corrosion by the installation of a cathodic protection system.

The defects and the conservation works outlined above are described in greater detail in Parts 2 & 3 of this report.

An aerial photograph of the Roman Arch from the north-east. The river Dodder is on the right side of the photo (The photograph was sourced from the website http://www.bingmaps.com)

Credits

Main contractor:	Bracegrade Ltd. Taney Hall, Eglinton Terrace, Dundrum, Dublin 14 Tel: (01) 2981621 Fax: (01) 2983402 Email: info@bracegrade.com Web: www.bracegrade.com
Specialist masonry repair contractor:	Inter-clean Ltd. 129 Clonliffe Road, Dublin 3 Tel: (01) 837 4114 Fax: (01) 837 0489 Email: info@interclean.ie Web: www.interclean.ie
Cathodic protection designer and installer:	Rowan Technologies Ltd. 216 Church Road, Urmston, Manchester M41 9DX, England Tel. / Fax. (0161) 7483644 E-mail: mail@rowantechnologies.co.uk Web: www.rowantecchnologies.co.uk
Architects:	Architectural Services Department South Dublin County Council County Hall, Tallaght, Dublin 24 Tel: (01) 4149000 Fax: (01) 4149209 Web: www.sdcc.ie
Engineers:	Dermot Nolan & Associates Claremount, Meath Road, Bray, Co. Wicklow Tel / Fax: (01) 2762626 Email: dnolanconservation@eircom.net Web: www. dermotnolan.com
Building owner & Project Sponsor:	Development & Parks Department South Dublin County Council County Hall, Tallaght, Dublin 24 Tel: (01) 4149000 Fax: (01) 4149209 Web: www.sdcc.ie

NDP

This project was assisted by the Department of the Environment, Heritage and Local Government under the 2009 & 2010 Civic Structures Conservation Grant Schemes

1. A brief history of the Roman Arch

The Roman Arch is built of a rubble core probably of calp limestone and brick, and is faced with ashlar granite, tightly bedded and jointed with very fine (2mm – 5mm) lime mortar joints. Many of the horizontal mortar joints are interspersed with small pieces of slate, a technique known as galletting, which may have served the purpose of protecting the mortar until it hardened as the building was gradually erected. The granite is medium to course grained, typical of other granites quarried in the south Dublin area, with a greyish - golden brown colour which indicates that it was quarried from an outcrop or boulders near the surface of the quarry which had partly oxidised over millions of years. The pitted surface of the granite shows that it has been cleaned and blasted with a too-hard abrasive at some time in the past. The calp limestone is clearly visible at the west side or back side of the flanking wing walls and was probably quarried locally. [1]

The Arch was built shortly after 1771 when Henry Loftus inherited the Rathfarnham estate from his nephew Nicholas who had died in his youth. The estate map prepared by Richard Frizzell [2] dated 1779 refers to the Arch as the "New Gate". Henry Loftus was a direct descendant of Adam Loftus who had been granted extensive lands at Rathfarnham and elsewhere and who had Rathfarnham castle built around 1580. In the interim period the castle had passed out of the Loftus family. It is plausible therefore that the Roman Arch was built as a ceremonial, second entrance to the estate, to signify the triumphal return of the estate and ancestral seat to the Loftus family. Like many other large gardens of the 18th century, the Arch was built as part of a vast landscape which included other structures such as a Roman temple (demolished 1989), an icehouse, a grotto, a dovecote, numerous statues and five bridges all arranged around a serpentine stream and several fish ponds laid out across the eastern part of the estate. Like Castletown, Co. Kildare the garden also referenced other structures beyond the estate, Hall's Barn a.k.a. the "Bottle Tower" to the east and the church spire in Rathfarnham village. This landscape was designed to look natural, to delight and stimulate the visitor to the estate and those who walked around it. The beautifully drawn, second edition ordnance survey map (published 1864) is perhaps the best map to describe the layout of the estate as conceived by its designer and the relationship between the Arch and the castle. Although the condition of the estate had declined by then, the lack of improvement may have preserved the original layout; certainly comparison of Frizell's map of 1779 and the 1864 map show little change in the intervening 85 years.

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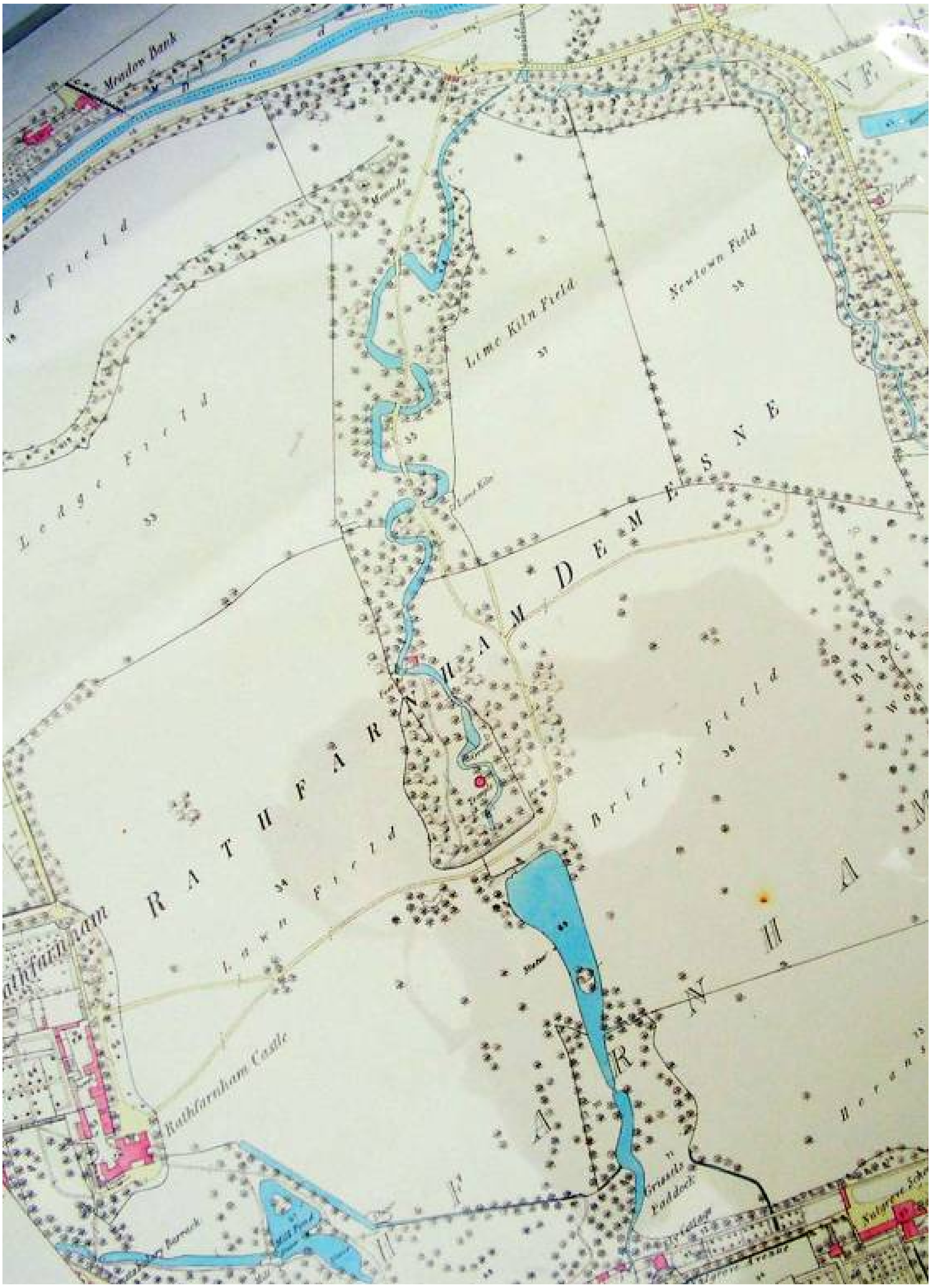
[1] A quarry once existed across the Dodder from where the Roman Arch is now; this is shown on the second edition ordnance survey map dated 1864. Also page 84 of "Stone, Brick and Mortar, Historical Use, Decay and Conservation of Building Materials in Ireland" by Pavia, Sara and Bolton, Jason (Wordwell, 2000) indicates that calp and "brown slate" were extracted from the banks of the Dodder at Rathfarnham.

[2] The estate map can be seen in the National Library of Ireland, Manuscripts Section by appointment. A reproduction is in the back of "Rathfarnham Roads" by Paddy Healy (South Dublin Libraries, 2005)



An extract from the second edition ordnance survey. “Ordnance survey. Parish of Rathfarnham Co. Dublin” (surveyed in 1864 by Captain Martin R.E. and zincographed in 1865 under the direction of Captain Wilkinson r.E. at the Ordnance Survey office). The Roman Arch is at the top of the map. The map has been rotated to that North is no longer up the page.

From the available documentary evidence it is known that the Arch was intermittedly occupied as a gate lodge until 1977 when it was acquired by Dublin Corporation and the last occupant was re-housed nearby. [3] Photographs taken during the 20th century show that its physical condition was gradually declining and that repairs were necessary; by 1969 part of the cornice of the south-western façade had already partially collapsed and the urn or final on top of the south-eastern corner was already missing. Photographs taken during the 1940's show that pieces of the wrought iron gates were missing and others damaged. [4] This gradual decline in the physical condition of the Arch can be attributed to several factors. First the Loftus family sold the estate in the early nineteenth century and moved back to other ancestral seats in counties Wexford and Fermanagh. Subsequent owners and lessors took varying degrees of interest in maintenance and improvement of the estate. By the mid nineteenth century the estate and castle had declined and was for a time vacant. [5] Secondly the acquisition and subsequent break-up of the estate in 1913 by property developers Bailey & Gibson resulted in the gradual and piecemeal re-development of the estate as a golf course and suburban housing and the Roman Arch was gradually cut off from what remained of the castle grounds. The castle and western part of the estate was acquired by the Society of Jesus who used it as a retreat centre and as a residence for Jesuit students. Thirdly the widening of the western end of Braemor Road and the construction of the new Dodder Valley Road in the 1970's right beside the Arch effectively isolated it and severed the former entrance avenue to the south-west of the Arch which had led to the castle, and latterly to the golf course since 1913. It is likely that the proximity of the roads made it increasingly uncomfortable to live there. The last occupant of the lodges of the Arch moved out in 1977. The Arch was isolated from its original estate and no longer had a use.

In 1981 Dublin Corporation blocked up the 4 window openings (2 on each of the short facades) and the two doorways (on either side of the central vault) following vandalism of the Arch and the two lodges within. The windows and doors were removed and the openings were filled with concrete blocks faced with smooth grey granite tiles. Therefore it was no longer possible to inspect or ventilate the interiors and further decline went unnoticed. During the 1990's Dublin County Council was broken up and ownership of the Arch was partially transferred to the new South Dublin County Council. The lack of access to the interiors, its isolated and awkward location at one corner of a park and three roads and at the junction of three local authority administrative areas devalued it and brought about a decline in its importance and its physical condition.

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[3] The occupancy of the Arch was traced by examination of Thom's directories "Thom's Irish almanac and official directory" (various years) (Dublin: Alexander Thom, various dates), Land Registry documentation and by examination of the Primary Valuation of Ireland, also known as the Griffith's Valuation, carried out between 1848 and 1864.

[4] The main sources of historical photographs are the Local Studies Section of South Dublin Libraries (many available online), those published in the Irish Georgian Society Records and those in the Irish Architectural Archive.

[5] Pages 7 & 8 of the "History of the county of Dublin" by d'Alton, John. (Cork: Tower Books, 1976. Originally published: Dublin: Hodgis & Smiths, 1838). Also the 1846 edition of Thom's Directory simply described the castle as "derelict".

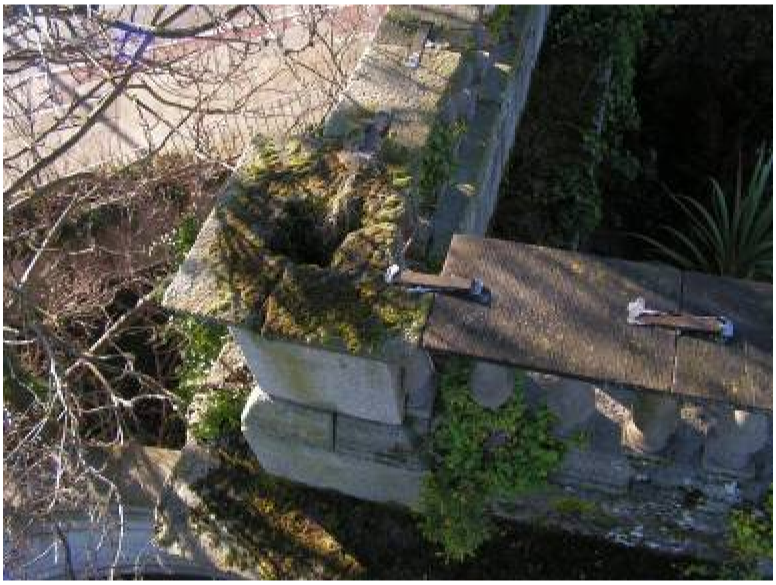
2. Examination and condition assessment

2.1 The inspections

In January 2009 the Arch was inspected by staff from the Architectural Services department of South Dublin County Council. The brief was to repair the visible structural damage to the entablatures which was considered dangerous. All sides of the Arch were inspected from ground level and later the north-eastern façade and roof were examined from a cherry picker. The inspection was hampered slightly by the low levels of natural light available in January, by ivy and creepers which covered much of the building and by the fact that the cherry picker could only be raised on the north-eastern side of the building because of nearby overhead electrical power lines. Also it was not possible to inspect the interiors of the two lodges since these had been blocked up in 1981. The creepers and ivy were cut at their base, defrilled and treated in January which made their removal later in the growing season much easier. Hazard signage and a temporary fence were erected in front of the north-eastern façade to prevent casual trespass by members of the public under the most dangerous parts of the Arch. The dead creeper tendrils were easily removed from the lower parts of the building later in the Summer of 2009, which allowed for a more thorough examination of the cleared facades in stronger daylight. The Arch was inspected again in June and July 2009. The 2 blocked up doorways on either side of the central vault were opened up and it was then possible to access the interiors of the lodges and to better assess the overall condition of the Arch. The opening up also allowed the structure to ventilate and partly dry out. The following condition assessment is organised according to the elements of the building in the following order, from top down and outside to inside, the parapet and balustrade, the roof and rainwater goods, the external walls, cornices and embedded irons, the wrought iron gates, the interiors, fittings and fixtures. The interventions made and the philosophies guiding them are described in the next part of the report.

2.2 The parapet, urns and balustrade

The upper part of the Arch consists of a parapet wall surmounted by a balustrade topped with urns or finials. The materials vary; the parapet wall is faced with granite, the cap stones are of limestone on the north-eastern façade and of granite on the three other sides. The joints between individual capstones were reinforced with wrought iron cramps set into chases and with lead poured over. Most of these had corroded, expanded and popped out of their joints. The capstones were generally in good condition otherwise with two exceptions: one part of the limestone cap stone half way along the north-eastern facade had decayed, probably as a result of the expansive action by the iron cramp. The granite cap stone below the missing urn at the south-eastern corner had also decayed and had multiple serious cracks. The latter was probably caused by weathering of the area around the exposed flue after the urn fell and possibly as a result of mechanical damage caused by the falling material. This suggestion is supported by the presence of a large crack in the cornice at the extreme right side of the south-eastern façade, directly below the missing urn.



The south-eastern corner. Note the damage around the flue and the popped iron cramps with the lead still visible on either side. Note also the granite cap stones of the south-eastern façade above and the limestone of the north-eastern façade to the right.

The urns or finials are of solid granite. One urn is missing from the south-eastern corner and has been missing for several decades; photographs of the Arch taken in 1969 show it missing then. This urn and that surviving on the north-eastern corner were also flues allowing smoke and gases from the fireplaces below to vent. One of the urns on the south-western face was badly cracked; a vertical crack over 25mm wide at its widest point ran down the inner face of the urn. The urn in the north-eastern corner had 2 smaller cracks. All the cracks were old and blackened. Generally the urns were otherwise sound; except for one urn on the south-western façade. They were plumb and no movement was noted when gentle manual pressure was applied.

Crack in the southernmost smaller urn on the south-western façade

Crack in the large flue-urn at the north-eastern corner

Old photographs show that the piers at either end of the flanking wing walls were each topped by a single spherical urn but these are now missing (photos from the 1980's show them in place). The sphere is missing from the northern wing wall and that on the southern wing wall is either missing or covered with ivy and organic growth; it is impossible to tell without cutting back some of the undergrowth. Fortunately during the course of the conservation works described in the next part, one of the missing urns was retrieved; it had been taken into care by a local resident after it fell from the pier and broke into three pieces.

Some of the limestone cap stones on the north-east façade. Note the mortar covering or protection over the iron cramps which reinforced the most of the joints between the cap stones. Note also the tooled lines on the cap stones

Some of the granite cap stones on the north-western façade. 3 of the 4 facades had granite capstones. Unusually this balustrade had only 2 iron cramps (visible at the far end) and the sectional profile was slightly thicker than elsewhere

A baluster in the north-eastern façade, near the north-east corner. Note the corroded wire mesh reinforcement wrapped around a central iron or mild steel core and spalled, cast masonry.

The balusters are made from a variety of materials: a few of the original, slim-profile limestone balusters remain on the southern end of the north-eastern façade (refer to the attached drawings). They are a grey limestone with small crinoids which suggests that they were quarried at Ardbracken, Co. Meath, a major supplier of limestone at the time but now closed. These balusters have elegant vertical tooled lines running down their sides. The majority of the other balusters on the north-eastern façade were cast replicas of the limestone balusters, a cementitious mix reinforced with a steel mesh and cast around a central, vertical iron or more likely a mild steel core bedded into the parapet wall below and into the cap stones above. The date of their installation is not known but similarly detailed balusters were erected elsewhere in Dublin in the early 20th century, roughly between the 1890's and 1930.

A general view of the roof taken from the north-western corner of the roof. Note the terracotta balusters of the south-western façade on the right and the limestone balusters on the far left.

The balusters on the 3 other elevations are all terracotta replacements, probably dating to the end of the nineteenth century when the use of this material reached its height. These are a pale cream colour (orange on the north-western facade) and have a fatter profile that the limestone balusters and their cementitious replicas in the north-eastern facade. They are hollow, made from two halves jointed together and the mould line is visible. Most have no reinforcing irons in them. 2 in the south-eastern facade were badly cracked and their long term cohesion was in doubt. Several of the others have small cracks but were otherwise in sound condition. Their long term condition should be monitored as part of the biannual inspection and cleaning of the gutters.

2.3 The roof and rainwater goods

The roof is a simple, coupled rafter roof covered with slates, supported by approximately 14 rafters which rest on two purlins, which in turn are supported by four vertical posts resting on the top of the wall. The slates were laid to a traditional pattern with a gradual decease in the size of the slates nearer the roof ridge. Many of the slates had slipped and cracked. Others had fallen out altogether and lay in the valleys below. Previous patch repairs in sand and cement were noted. The roof drains to two valley gutters, which are inside the parapet walls, along the short sides of the building. It is well known that internal valley gutter such as these fail occasionally unless they are regularly inspected and maintained. Both valleys are heavily colonised and blocked by extensive plant growth. The timber lining boards beneath the lead was soft and rotten where exposed. The vertical, internal faces of the parapet walls are clad with single-nailed slates set into a lime mortar haunching. The junction of the vertical slate cladding and the pitched roof slate covering was dressed with a lime mortar haunching to weather it better. Some of the vertical slates are missing. The roof covers three barrel-vaults, one larger central one over the main gateway and a smaller one on each side over the two lodges. The central vault is made from granite voussoirs with little or no fill above. The upper surface or extrados of the vault was visible from a large hole in the roof slate covering. The smaller vaults on either may be of granite or brick; they could not be seen properly from above and are plastered on their undersides. There is no attic or access to the roof from below.

As can be seen in the image above and those below the roof was in very poor condition. There was a large hole, about 350mm wide and 1200mm long on the eastern edge of the southern pitch of the slated roof which admitted water onto the upper surface of the central vault - big enough to admit a man. This had locally saturated the core rubble walls and the granite, causing plant and shrub growth and allowing birds and possibly bats to nest within the roof space. The bird manure may have promoted the plant growth and which in turn caused further damage to the stone and mortar joints with its roots and tendrils. In particular the damage to the iron tie bar in the façade was directly below this vulnerable area and is discussed later in this report. However most of the roof space, roof structure and the upper side of the central vault below the roof space were surprisingly dry when examined from the hole in the slate roof covering.

Biological colonisation of the northern gutter

The hole in the roof and shrubs growing from it

The gutter below each of the two roof pitches fall to a single outlet at the western end of each valley. The outlet fed into a cast iron rainwater down pipe which ran down the internal corner of each lodge; the cast iron pipes were probably installed in the 19th century to replace what was probably originally lead piping. Both downpipes curved outward through a hole near the base of the wall to drain to the ground on either side. Both pipes had corroded; the lower half of that in the southern lodge was missing and in the other lodge was badly pitted with holes. During one inspection it began to rain heavily but surprisingly little water was observed flowing through the pipes which meant they were blocked, probably with debris and dirt. After a few minutes the water began to drip through the vault above where it is intersected by another vault over the window ope. This was a cause for concern because the rain water was effectively draining into the core of the walls and saturating the structure from above with dire consequences.

The corroded rainwater down-pipe in the southern lodge. Note the hole at the top of the pipe. Note also the joist holes in the brickwork which one supported the floor. Note the springing of the vault above.

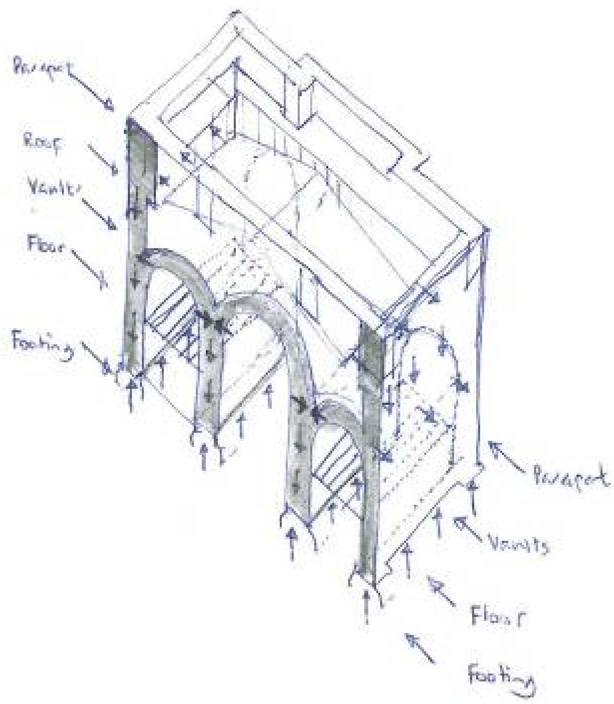
The rain-water outlet from the southern lodge, at the base of the south-eastern facade. Both outlet pipes had badly corroded within the stone opening causing localised damage in the area.

2.4 The external walls

As stated previously the walls of the Roman Arch are built with a loose rubble core faced with ashlar granite facing stone, a type of wall construction that became popular in the eighteenth century as the nature of composite structures was better understood. The granite blocks were jointed into the rubble core of calp limestone, brick and general debris with occasional through stones that extend back into the rubble core. Some of the more vulnerable blocks, such as those projecting at cornice level and the vertical, long stones of the pilasters were additionally secured with iron cramps, dowels and pins. Mortices, tenons, dovetails, joggles and dowels to joint stone were borrowed from timber jointing technology; although the masons relied on older, well-understood structural systems that usually relied on compression, the advantages of the fixings and joints appropriated from joinery were well understood since ancient times.

The granite has a distinctive sandy and pitted texture when touched and examined with a magnifying glass. This suggests that it has been cleaned in the past with a too strong abrasive. Several old photographs of the Arch show the rusticated bands on the east side of the flanking wings with clear, sharp arrises or corners, but these are now much softer and more rounded. Also the golden brown colour of much of the granite suggests that it was quarried from boulders or from the upper parts of the quarry. The colour is natural; the stone from the upper parts of a granite outcrop have been weathered over millions of years. The white feldspar crystals broke down as they were attacked by water, oxidised and gradually turned brown. Chemically the pyrites in Leinster granite form haemetite when oxidised, resulting in the distinctive golden brown colour. The clay which once covered the outcrop was gradually washed away leaving small clay pits. Therefore this granite is slightly more porous and tends to be less grey than granite taken from deep within a quarry. This could indicate that a defect was built into the building right from its construction.

The behaviour of the structure in principal is as follows; There are 3 vaults, the central one slightly bigger that the other 2, surmounted by a parapet wall and balustrade which effectively contained the outward thrust of the 2 smaller vaults and the roof along the shorter facades. The vaults are probably based on a simple footing foundation and were probably built slowly to allow for any differential settlement to occur gradually. Slate galletting was inserted regularly in the joints, probably to ensure even distribution of the loads and to avoid a concentration on one particular edge of stone which could then crack or spall; this was always a concern with ashlar masonry when the mortar joints were so thin. The drums of stone which make up the 2 columns in the north-eastern façade are probably separated with lead rings as well as lime mortar at their joints for the same reason (either this lead or some hidden ferrous metal was picked up during the cover metre survey described later). The parapet walls and balustrade also served the purpose of counterbalancing the uppermost stone course in the cornice and stopping them from rotating and falling from the edge of the building: examination of the joints from above (in planimetric view) showed that the stones between the individual corona stones of the cornice were not continuous with those of the stones on top of the parapet wall inside the blocking course. Therefore the blocking course was built on top of the junction of the corona stones and those on top of the parapet wall. Sketches in Appendix 2 of this report explain this construction and the interventions made in greater detail.



A sketch of the main structural forces acting on the Arch (sketch by the author)

The following defects were observed in the external walls:

1. Cracks, bulges and missing pieces of stone in the entablatures and elsewhere on the façade where the ferrous cramps had corroded, expanded and spalled or cleaved the covering stone away.
2. Stains resulting from carbon deposits, particularly in the more sheltered north-eastern façade under cornices and in corner areas. Stains resulting from iron oxides from the corroding iron.
3. Organic colonisation: lichens, algae, weeds growing from the façade and extensive creeper growth from the ground around and within the walls.
4. Salt damage: blistering and flaking granite was notable in the niches of the south-western façade. Soft friable granite on the upper part of the north-western façade where the gutter had blocked resulting in saturation of this area. White salt deposits were noticed on the underside of the central vault (NOTE The latter deposits increased noticeably after the very severe freezing weather of January and February 2010)
5. Vandalism: traces of old paint and graffiti were on the flanking wings and on the Arch itself. Recent, fresher marks were also visible. Although the paint won't damage the building its removal is a specialist operation and can cause damage.

The entablature on top of the north-eastern façade had a large horizontal crack along its underside and the outer part of the stone had sheared away. This defect was the generator of the project brief originally.

Pieces of masonry had fallen from the corner of the capital at the top of the column and from the front of the entablature. Dirt deposits were noted on the sheltered areas on this façade, below the cornice where they had been deposited as airborne dust or left as the rainwater evaporated, leaving hard black encrustations. The black, crust-like particulate soiling is worst on the undersides of the projections in the granite entablature. This black crust is caused by atmospheric pollution from car fumes and domestic heating which has been left on the sheltered areas after the rainwater has dripped away or evaporated or by dry airborne particles sticking to the surfaces of the north-east entablature which would be wetter for longer and more often as a result of their shaded, sheltered location. It should be noted that atmospheric pollution was particularly bad in Dublin before 1990 when a ban on combustion of certain fossil fuels was introduced. Motorised traffic continues to pollute the air. This black staining is aesthetically undesirable, and if allowed to thicken, it will chemically inter-react with the underlying stone. Green lichens were also notable which can indicate that the substrate is damp. Refer to the photo below.

A closer view of the front of the central part of the north-eastern façade before works began. Note the missing piece of stone and the damaged and missing balusters (photographed January 2009)

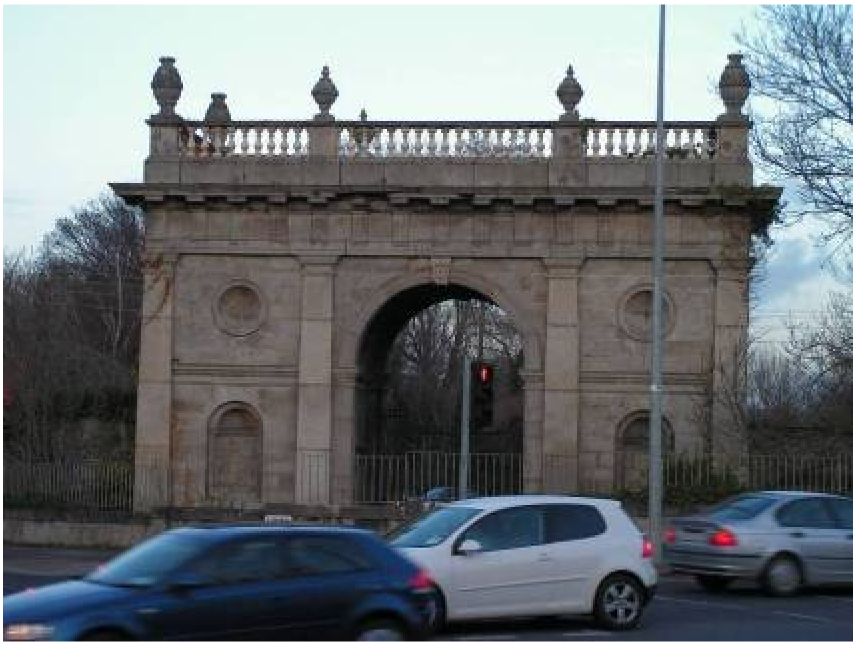
The damaged projecting entablature on the north-eastern façade viewed from below. Note the crack on the underside of the architrave of the entablature, the damaged capital & plant growth on the cornice on the left in the image. Note also the green lichens and black stains left by water run-off and residual dirt and salt staining.

The same architrave of the north-eastern entablature viewed from the north-east. Note the exposed iron tie bar.

The south-western façade was much more evenly weathered, as would be expected by its exposure to the prevailing winds and to wind-driven rain. This prevented the carbonate staining from forming as had happened on the more sheltered, far side of the building. The south-western façade has a more ornate frieze and entablature and the keystone is decorated with a Coade stone mask, probably representing a Roman god and the nearby river Dodder. [6] Closer examination of the façade showed that two parts of the dentil course or "mutele" had fallen and several cracks in the stone high up on the façade – see photos

[6] Such a motif was used elsewhere in the late 18th century, at Somerset House in London (William Chambers) and later at the Custom House, Dublin (James Gandon), the latter carved by Edward Smyth

below. Later when a scaffold was erected for the works a crack was also noted on the left side (northern end) of the frieze of the south-western façade and bulges were noted in the stone elsewhere along it. These defects were particularly hard to see from ground level and unfortunately were not noticed during the survey of the stone from ground level. The structural damage was caused by ferrous cramps which had corroded, expanded and ruptured the stone. Previous repairs and interventions were also visible, small mortar repairs dotted about, many of them only serving a visual or decorative purpose, such as that to the left of the Coade stone mask.



The south-western façade viewed from Dodder Valley Road (photographed January 2009)

A view of the central part of the south-western façade viewed from Dodder Valley Road – Braemor Road junction (photographed January 2009). Note the missing piece from the Coade stone mask and the two missing pieces of dentil course.

A closer view of one part of the damaged dentil course of the south-western façade. Note the small piece of cramp visible

Another part of the damaged dentil course of the south-western façade. Note the slightly jacked stone at the top of the cornice and the edge of an iron cramp at the back underneath. Half of another cramp is visible on the left. Note the iron oxide stains.

Trees and long grass had become established in the small open spaces between the Arch, its flanking wings and the modern public footpath and wall and railings along Braemor Road. In particular they had encroached on the south-eastern façade. It is possible that these trees had physically knocked against and damaged parts of the building as the bigger branches had swayed in storms and windy weather. It is also possible that the missing urn may have been knocked in such a manner.

Ivy and other creepers had colonised much of the back side of the flanking wings and the short (north-west and south-eastern) facades of the main body of the Arch. The ivy had penetrated mortar joints, loosened the rubble core fill and allowed wind-driven rainwater into the walls. In a small number of places mature, woody ivy tendrils had lifted entire stones by a few millimetres causing structural damage.

The upper part of the north-west façade photographed January 2009. The ivy has reached the very top of the structure. Note also the missing pieces of stone in the corners of both engaged pilasters, more damage caused by corrosion of embedded iron.

The corona stone of the cornice at the top of the corner pilaster at the south-eastern corner of the south-eastern façade. Note that the creepers had colonised the full height of the building in this area and had matured to such an extent that the strong, woody tendrils had penetrated the mortar joints and over time had lifted and dislodged one of the large corona stones.

As described previously the roof and rainwater goods of the Arch had deteriorated to such an extent that rain water was effectively trapped on the building and could only percolate gradually downward through the building. This action by rainwater saturated the rubble core and caused significant damage to the walls and the structure of the Arch. Rainwater was the primary destructive agent causing of most of the damage listed above. The effects of this continuous, gradual saturation are as follows:-

1. The lingering rainwater encouraged the development of plants, shrubs and mosses on and within the roof. The valleys were completely filled with plants to such an extent that the lead itself was not visible, and this was in January when most plant growth would have died back! This plant growth exacerbated the blockage and in this way was self perpetuating. The roots of these trees and shrubs penetrated the walls and roof causing instability, erosion of the mortar joints and further damage to the core rubble walls.

2. The lime binder in the mortar within the walls is soluble in water and if continuously washed in this manner can gradually leach out of the mortar leaving a mortar with aggregate but little binder, effectively reducing its strength. This action can also wash out the finer aggregates which reduces the mortar's flexural strength.

3. The rainwater saturated the rubble core and contributed to the corrosion of the embedded iron cramps and tie-bar which reinforced the ashlar granite face of the Arch, resulting in expansion of these irons and the catastrophic and potentially life endangering structural failure of the facing stone. This aspect of the damage was the most obvious and as stated previously was the generator of the project brief.

4. The saturated rubble core caused a combination of freeze-thaw cyclical damage to the walls (the winter of 2009 and 2010 was particularly severe) leading to a granular disintegration of stone surfaces where water ponded. This was most obvious on top of the cornice around the edge of the building which was unusually flat. Historically this detail was usually built elsewhere with a fall to allow rainwater to drain away and drip from the edges. It is possible that the cornice of the Arch was originally dressed with a sacrificial lime mortar flaunching fillet which would have made the necessary fall and that this had weathered away. The flat upper surface was wet to the touch and was covered with mosses and jelly-like algal scums in January 2009. When these were manually brushed away the surface of the stone below was sandy and pitted in texture.

5. The water moving through the saturated core of the walls gradually dissolved salts, mobilised them in very dilute solution and migrated to the surface of the stone as the water drained away and evaporated. The rainwater acted as very dilute acid bringing sulphates sourced from the by-products of fossil fuels in

contact with the slightly alkaline lime mortar and calp. This in turn caused two secondary forms of damage, dissolution and mobilisation of the salts through the granite weakened its mineralogical structure and caused its cement to break down, leaving the granite soft and crumbly. The build up and concentration of these salts near the surface of the granite also ruptured the stone as they were hydrated by rain, crystallised, expanded, dried out with the action of sun and wind and then wetted again in a continuous cycle. The combination of salts with the normal cycles of wetting and drying can break down the matrix of stone, even one as hard, dense and impermeable as granite. The last form of damage is not obvious until the affected areas are touched; the scaled granite of the north-western façade (below the blocked gutter inside the parapet wall) and the niches at ground level can be easily peeled away with a human fingernail. The repair of this damage is highly specialised and risky and was considered beyond the scope and budget of the recently completed works. It was considered more important to address the cause of the damage, which should allow the walls to gradually dry out over several years and to advise the client to assess the granular disintegration and scaling of the granite in several years time, if necessary.

The effects of the water ingress as a result of damaged rainwater goods and roof make this structure a textbook example of how bad the damage can be if these basic functional elements are not periodically inspected and maintained in good working order.

The upper surface of the cornice above the north-eastern façade. Note the extensive growth of mosses and weeds on the flat surface. (photographed January 2009)

The north-western façade: the granite around the window head has blistered and disintegrated as a result of salts washed into it over an extended period by water from the blocked gutter just behind and above this area.

2.5 The embedded iron and the mortar

To address the matter of corroding cramps, it was first necessary to identify and locate them. First all visible iron was identified where the stone had spalled from the façades and was indicated on a drawing. Then, after a scaffold had been erected the entire façade was surveyed with a cover metre - a hand held device, to locate the embedded irons, their direction, size and depth. The cover metre survey was hampered slightly by the presence of scaffold bars and lead within some joints (which were also sensed by the cover metre) and by the maximum range of the instrument; irons built beyond a depth of 300mm were not sensed. There are other means of surveying buildings for embedded irons but this was the most economical and practical for the time and budget available. The results were presented on a series of elevation drawings of each façade, enclosed in Appendix 2. Thirdly, all existing cracks and bulges in the stone were also noted. This was important because corroding irons buried more than 300mm in the façade could still exert a pressure and cause damage. Lastly the survey information was compared with the historic photographs; this gave an indication of how long ago the damage became apparent, and if the damage was recent or had progressively deteriorated. The drawing exercise was useful because a clear pattern of the placement and function of the embedded irons became evident, as follows:-

1. Most of the irons were concentrated in the elaborate cornice of the south-western façade, in a regular pattern at the top of the vertical joints between the blocks of the mutele course. From examination of photographs in the Irish Architectural Archive, the missing stone from the dentils was at least 50 years old and had not visibly deteriorated significantly in the interim period.

2. Another cluster of iron cramps were noted at the 4 corners of the building, on top of the cornice's corona course. The latter were often visible from above, unprotected and therefore very vulnerable. These iron cramps were irregular in their direction and location, each corner differed. No irons were detected in the 2 corners of the cornice where it protrudes slightly from the north-eastern façade.
3. Iron was recorded on the frieze of the south-western façade in 3 locations; in one of these the stone had already cracked (on the left side) and in the other (above the keystone) was bulging ominously.
4. The presence of iron (possibly a cramp or dowel) was recorded in the horizontal mortar joint between the uppermost large vertical block(s) of each pilaster and the one below. This would make sense because these long tall stones could be vulnerable to falling outward. The end of an iron cramp was visible on each of the two pilasters on the north-western façade where the stone had cleaved and fallen away. These are visible on the photograph on page 23 of this report.
5. A large wrought iron tie, 50mm X 50mm square in section was recorded in the entablature of the north-eastern façade, which extended from the top of one column to the other. The iron appears to have formed a composite beam with the stone above. From examination of a photograph in the South Dublin Libraries Local Studies Section, taken in 2001 the structural damage to the stone in the architrave had progressively and substantially deteriorated since.

It is possible that other iron existed elsewhere, but a balance had to be struck between what is measurable and reparable and what is unknown. For example it could be argued that a series of holes could have been drilled elsewhere in the frieze to check if other irons were present which had not been picked up by the cover metre but such drilling is of itself destructive and could further weaken the façade.

The crack at the south-eastern corner of the cornice, at the right side of the south-eastern façade. Note the large iron cramp. The crack could have been caused or assisted by the falling or removal of the flue-urn above at some time in the past as well as the expansive action of the corroding iron. Note that the iron was exposed to the elements and was not embedded or protected by stone. It is possible that the top of the cornice was originally dressed with a sacrificial lime mortar flaunching fillet.

Following erection of the scaffold it was also possible to closely examine the existing mortar joints. It was noted that the building has been re-pointed on several occasions in the past. Some parts of the building had been reported with a hard cementitious mortar. Elsewhere the mortar had deteriorated locally or had been eroded by weather or by creeper tendrils. A schedule of localised re-pointing was drawn up. Most of the existing joints were left alone, including the cementitious mortar where no damage to the joint or surrounding stone was evident. Some samples of what appeared to be an older mortar were taken and examined in the under a magnifying glass to see the range of aggregate size used previously.

Mortar sample raked out from a joint in the south-eastern façade

2.6 The wrought iron gates

This aspect of the structure is only briefly discussed because no works were done on them other than to protect them from damage by the conservation works. They were beyond the scope of works because of the client’s limited budget. The gates under the eastern end of the central vault are typical of the late eighteenth century with wrought iron bars and elaborate scrollwork. Remarkably the gates are still in place under the Arch after 240 years and they still work; they can still be opened, closed and secured with the anchor to a ready-made socket in the side walls of the main vault. The main deterioration is corrosion. They have also been damaged mechanically, some pieces are missing and others are loose. A small centrally positioned part of one of the gates had fallen to the ground and has been placed in storage in one of the lodges. Many of the brads and pins and other connections have corroded or come loose. It is difficult to precisely gauge their condition because of the layers of paint and laminated corrosion which obscure the detail. The upper hinges are secured into the granite on either side of the central vault and the stone has cracked at these points.

A general view of the gates from the north-east. No conservation works have been carried out.

2.7 The interiors of the lodges

The lodges on either side of the central vault are almost symmetrical; each consists of 2 rooms arranged one over the other, the upper room accessed via a steep stair ladder. The stair ladder was gone but its outline was still visible on the wall of each lodge. Each room had been lit with a single window before they were blocked up in 1981. Each lodge was surmounted by a solid vault of either brick or stone, slightly smaller than the central vault. The two lodges were not spatially connected.

A view of the ground floor southern lodge. A small early 20th century tiled fireplace is in the corner of each lodge; the flues ran up to the corner urns. Note the fragments of wallpaper on the walls; at least three separate papers were discernable, one has a decorative rose motif which probably dates from the early 20th century. Note the fragments of the timber floor on the walls.

The internal floors of the lodges at ground level are solid and finished with a rough textured, red terracotta floor tile. The floor construction beneath appears to be solid. The tiles could be important; in the eighteenth century floor tiles were made at a sand kiln in Smithfield and before that they were imported from Devon, England. If they are of more recent date there could be an older floor finish beneath.

The intermediate timber floors between ground and first floor levels had almost entirely collapsed and decomposed to a moist, brown compost strewn over the ground floor of each lodge. However their construction could be made out by examination of the existing fragments still adhering to the wall. The floor had been a simple arrangement of timber joists, laid for some reason in an east-west direction across the longer span of the room. The joists were approximately 8" (200mm) deep, the floor depth was $9_{1/4}$" (235mm) including the floor boards, and were laid at approximately 11" (280mm) centres. The three joists closest to the short external wall ran the full length of the room. All those beyond this were jointed into a trimmer which ran along the edge of the opening for the stair ladder. The joists were jointed into and supported by larger timber wall plates with joist holes built into their upper half. The wall plates are embedded into the surrounding masonry. Therefore these could also be functioning as a bonding timber, a common feature in eighteenth century buildings. All the joints in the floor construction appear to have been mortice and tenon joints, with some nails used as a supplement or as a later intervention. The rust stains from the nails can be seen in some places on the walls and the tenons are visible in the few fragments of timber that have survived.

The northern lodge. A fragment of the first floor structure, a trimmer joist at the edge of the ladder- stairs

The internal wall finishes are paint and wallpaper layers applied to a lime-based plaster on solid masonry. Because of the saturation of the walls these finishes are now in poor condition; the papers have peeled away from the wall surface in places and have split along their edges. The plaster has crumbled and fallen away in some places and is noticeably lose in others. The wall paint finishes are hard to identify because of the graffiti, the extent to which they have been covered with paper, staining caused by damp, years of neglect and accumulated dirt. There is no decorative plasterwork or finely carved joinery. Historically gate lodges tended to be simply furnished and decorated. No works were carried out to the interiors of the lodges because of the budget and client brief, except the replacement of parts of the cast iron, rainwater down pipes, as explained previously.

4. The conservation works

The interventions were prioritised and the philosophy for each proposed intervention was guided by the accepted principles and charters. The philosophy that respect for the whole monument should extend to its constituent parts was fundamental to the approach. The scope of works was established by prioritising the works and confining them to what was achievable within the available budget. The scope of works was also defined by the works which required specialist expertise (masonry repair, cathodic protection etc.) and a scaffold (working from a height) and those works which are of secondary importance which could be carried out by unskilled labour at a later date. Therefore the works were confined to the roof and external walls of the main body of the Arch; the flanking wings, iron gates and lodge interiors were deliberately excluded.

The first aim was to preserve the Arch, to stop the cause of the damage. Therefore the repair of the roof and rainwater goods so that rainwater would quickly drain away from the structure was the primary conservation intervention. A secondary intervention was the dressing and protecting of the vulnerable upper surfaces of the cornice and parapet walls with lead flashing on a lime flaunching fillet. Thirdly the damaged and eroded mortar joints would be re-pointed with a lime-based mortar after the creeper tendrils have been removed. These three interventions would limit further water ingress and the saturated walls could gradually dry out. Fourthly a series of holes were drilled into the concrete blocks along the lower edge of the upper (first floor) blocked-up windows so that the holes would not be visible and to help ventilation of the interiors.

Having assessed the condition of the Arch, diagnosed the causes of the damage and identified the appropriate interventions, the stabilisation of the structurally damaged facing stone and its irons was the next priority. Those parts of the façade where pieces of stone were missing, cracked, bulging or badly decayed were identified, cut out and new material was prepared. These included 2 parts of the cap stones on top of the balustrade over the north-eastern façade (granite in the corner and limestone half-way along), a lower part of the frieze at the northern end of the south-western façade, a part of each corner pilaster on the north-western façade (see photo on page 23), two parts of the mutele course or dentil course of the south-western façade and finally the entablature of the north-eastern façade. Several small pieces of mild steel were removed by drilling out the stone around them and filling the hole with a combination of granite dust and resin. The surface was tooled so that in dry weather the repair matches the surrounding stone. The last intervention were unblocking the 2 door openings and installing 4 slate vents in the roof covering.

The following detailed descriptions of each intervention are paragraphed and numbered to match the condition assessment for each element of the building in Part 3.

4.1 Protection of the significant parts of the Arch from damage during the conservation works.

The irreplaceable Coade stone mask was encased with a timber shutter to protect it from glancing blows and mechanical damage during the works and the important iron tie bar and its composite beam were shored with a structural scaffold while the area was carefully opened up. The wrought iron gates were kept in an open position to protect them form mechanical damage and falling debris during the works

Shoring of the structurally unsound but historic and significant north-eastern entablature

Protection of the Coade stone mask from damage during the works. A silicone cast was also taken of the mask to help reconstruct it should it be damaged during the course of the works

4.2 The parapet, urns and balustrade

The decayed granite capstone at the south-eastern corner was cut out and replaced with new Leinster granite, dowelled to the adjacent stone and the mortar joints made with new mortar. The top of the flue was capped with a cowl to prevent birds' nests and debris from blocking it. The decayed limestone capstone on top of the north-eastern façade was likewise replaced with new limestone indent. See photos below.

The south-eastern corner. New granite jointed with new stainless steel cramps.

New limestone indented above the balustrade on the north-eastern façade. Note also the new stainless steel cramps

The urns were left untouched except that on the south-western faced which was off plumb and had a severe crack. The crack was injected with resin and the surface was re-pointed with a lime mortar. The urn in the north-eastern corner was left untouched; although it has a crack at its base and another in its middle these were recorded. It would be prudent to monitor the condition of this urn as part of the maintenance of the roof. The spherical finial which once decorated the top of the pier at the northern flanking wing wall was recovered during the works; it had broken into 3 pieces and should be repaired and reinstated in the future. It is presently in storage in the northern lodge.

The iron cramps which jointed most of the cap stones have all been replaced with new stainless steel except 4 on the south-eastern balustrade which were still in good condition and had not caused any damage to the surrounding stone. The latter were covered with a sacrificial lime mortar to protect them from the weather and to prevent further corrosion with the alkalinity of the mortar.

Most of the damaged cementitious balusters on the north-eastern façade were replaced with new white cement balusters which have no ferrous reinforcement and rely on their own dead weight and on the mortar joint for stability. The particulars of replacements and repairs are indicated on the enclosed drawings in Appendix 2. Two badly damaged terracotta balusters on the south-eastern façade were also replaced with new white cement balusters. A small number of the existing cementitious balusters have been retained; their condition should be monitored as part of the annual maintenance of the roof.

Existing limestone half-baluster on the south-eastern façade which was repaired

Several slates were missing from the vertical clad, inner faces of the parapet walls. New slates were fixed to the parapet walls with a single nail as well as being bedded onto an NHL 3.5 lime mortar mixed in a ratio of 1:2 lime: sand. Refer to the drawings in Appendix 2 for the quantities.

4.3 The roof and rainwater goods

The roof was stripped of its slates and all trees, shrubs and mosses. The latter were also treated with biocide to prevent their re-establishment. The slates were tested for their soundness and those which “rang true” were salvaged for later reinstatement. The lead lining and timber boards of the 2 valley gutters were replaced entirely. Most of the existing roof timbers were retained. Badly decayed material was removed and some undersized or weakened timbers were reinforced with new timber screw fixed on either side. The following is a detailed schedule of the works.

4 rafters on the southern pitch of the roof (near the location of the former hole in the roof) were replaced entirely. 4 rafter ends at eaves level on the southern pitch of the roof were reinforced, and 4 others at ridge level. 2 rafters on the northern pitch of the roof (beside the south-western parapet wall) were replaced entirely. 4 rafter ends at eaves level on the northern pitch of the roof were reinforced and 4 others at ridge level. 4 metres of the timber wall-plate were replaced at the base of the northern roof pitch. The ridge board was entirely replaced with new plywood. The whole roof was then covered with breathable membrane.

The new timber was Pseudotsuga menziesii. (a.k.a. Douglas Fir & Oregon Pine) FSC certified and treated with “Protim” preservative. Most of the old slating battens were removed and replaced. Approximately two-thirds of the new / replacement slating battens are of Pseudotsuga menziesii (the specified timber) and the reminder will be pressure-treated white or red deal standard slating battens. The latter were used in the upper parts of the roof because of their inferior durability. 2 slate vents have been installed on each roof pitch (4 in total) to encourage cross ventilation of the roof space.

The new plywood gutter and valley boards. Note the reinforcement of existing timbers where they had rotted at the lower ends

The roof repairs underway, viewed from the north-west. Note the balustrade on the north-eastern façade had been mostly taken down

The repaired roof, viewed from the north-west. Note the darker, new vertical slate cladding. Note the lighter coloured slate on the 6 top courses of the roof slope and on the “small roofs” beside the valley.

The repaired roof viewed from the east. Note that some of the previous mortar patch repairs of the vertical slate cladding that were in good condition were left as they were. Note the new lead soaker dressed into the chase above the roof line and the new lead dressed over the top of the parapet wall. The inner side of the blocking course had yet to be dressed with a cover flashing

The historic detail of the mortar fillet at the junction of the vertical slate cladding and the sloping slate covered roof was not reinstated. The detail had broken down previously and let water into the roof space. It was considered more important to ensure that water was kept out of the building than to replicate the historic detail. Therefore a chase was cut with a mechanical saw into the vertical slate cladding, approximately 150mm above and parallel with the line of the roof, into which a Code 5 lead soaker was screwed and plugged and dressed down over the roof slope.

The rainwater down-pipes in both lodges were substantially replaced; the existing pipes were retained in the upper part of each lodge with new pipes caulked onto their ends. The 90 degree bend at the base where the pipe turns out through the external wall was made with black uPVC piping as was the short section of external rain water down-pipe. A soakaway (approximately 0.6m diameter and 1.5m deep) was made to the north-west of the Arch behind the northern flanking wing wall.

4.4 The external walls

After all creepers, plants and mosses had been removed from the walls, the joints and any remaining tendrils and roots were treated with biocide. The surfaces of the external walls were washed with a hose at mains pressure and brushed with a nylon bristle brush to remove any residue. The purpose of this cleaning was to clear the façade so it could be better inspected at close range. No attempt was made to remove any heavy carbonate stains or to address the salt damage. Wetting of the latter areas was kept to a minimum to limit further damage. No work was done to the flanking wing walls because of the limited budget and because this work could be done later without a scaffold.

Approximately 10 – 15% of the mortar joints were re-pointed with a 1:3 NHL 3.5 lime: sand mortar after the existing joints had been raked out with a hacksaw blade. The maximum aggregate size was 0.7mm, about one third of the size of the smallest joints. The sand's water absorbency tests indicated that a 1:3 binder; aggregate ration was most suitable. Most of the re-pointing was in the upper part of the structure around and underneath the entablatures. A new lime mortar flaunching fillet was put on top of the surface of the corona course of the cornice to provide a fall to the edge of the cornice so that rainwater would flow away, and also to make the surroundings of the exposed iron cramps at the upper corners slightly alkaline which would limit further corrosion.

The lime mortar flaunching fillet on the cornice, protected with dampened hessian after its application.

Pointing of cover flashings on the south-western blocking course with a lime mortar. Note the lead flashing built over the flaunching fillet and cornice as an additional protective measure.

4.5 The embedded iron

There are four categories of intervention to consider: (1) the iron tie bar in the north-eastern entablature, (2) the replacement of corroded iron clamps from the south-western entablature, (3) the cathodic protection of embedded irons and (4) the removal of isolated randomly arranged ferrous fixtures from the façade. Sketches of the construction of the entablature and cornice at three locations around the building are shown as found and with the completed interventions. It should be noted that the entablature was never taken down so some aspects of the actual construction remain unknown; the drawings are as accurate a representation as could be made from what could be observed and from what was opened up.

1. The wrought iron tie bar in the north-eastern entablature

The wrought iron tie bar in the north-eastern entablature is approximately 6 metres long, extending from the top of both columns. It is 50mm X 50mm square in section. A notch had been cut from the corner of each granite block at the bottom of the entablature to accommodate the bar. The lowest course appears to be cantilevered out from the body of the Arch behind. The bar appears to have functioned as part of a composite beam incorporating the stone above, an early form of reinforcement. The superior tensile strength of wrought iron over cast iron was understood at the time of its construction. The bar had corroded and expanded, probably as a result of the hole in the roof above. This expansive action had cleaved the facing stone off and cracked the soffit or underside of the beam. Refer to the photographs in Part 3.

1. As indicated previously, a structural scaffold was erected under the entablature to support it in case of structural failure or collapse.
2. As part of the works the facing stone was taken down to expose as much of the iron bar as possible to better assess its condition; much of this stone also had fine structural cracks and would have to be replaced anyway.
3. As much of the rust was blast cleaned from the iron as was possible; it was difficult to access the area behind the bar. The iron was treated with an anti-rust paint and primed.
4. A series of stainless steel shims were placed under and over the iron bar to more evenly distribute the load of the stone across the bar: this was important since the entire beam had deflected as a result of the corrosion.
5. New slips of facing granite were placed in front of the bar and were supported in the following way: several stainless steel plates, L-shaped in section, with a slot in the longer part were hooked over the bar, with the shorter part merely resting on it. From these a series of holes were drilled into the stone behind and a 12mm diameter bar, approx. 200mm long was inserted into the grouted hole.

6. The cracked lowest course of blocks were supported in the following way: several stainless steel plates, L-shaped in section, with a slot in the longer part were hooked over the bar, with the shorter part merely resting on it. From these a series of holes were drilled into the stone behind and a 12mm diameter bar, approx. 200mm long was inserted into the grouted hole.
7. New slips of facing granite were placed in front of the bar.
8. The cracked lowest course of blocks were additionally supported by with 12mm diameter dowel bars, approx. 400mm long, grouted into pre-drilled holes up and into the core behind, approximately 15 degrees off the horizontal. The direction of the holes was determined by the probable direction of the crack in the lowest course of the blocks. Small blocks were dowelled once, larger ones twice. Refer to the enclosed drawings
9. Two cables were secured to the southern end of the bar with self tapping screws to cathodically protect the bar. The cables were run out through a vertical mortar joint as indicated on the enclosed drawings.
10. The ensemble was then re-pointed.

No attempt was made to remove the deflection or to “straighten” the beam.

The north-eastern entablature: the exposed iron beam with the stainless steel L-sections bolted to the stone blocks below and hooked over the iron bar above. Note also the stainless steel shims or packers above and below the iron bar.

The north-eastern entablature: the completed repair. Note the new stone in front of the iron beam. The corner of the capital was not repaired because of budgetary constraints and because it was not an essential (photographed September 2010)

2. The replacement of corroded iron clamps from the south-western entablature

Three corroded iron cramps were partly removed from the mutele course of the cornice of the south-western façade. These irons reinforced the joints between the individual blocks.

1. The cramps were removed by carefully drilling out the stone around them and cutting them out as far as possible. The cramps could not all be completely removed.
2. Diagonal cracks in the adjacent blocks of the mutele course, on either side were repaired.
3. New sections of Leinster granite were prepared to match those which had fallen and been lost. These were built into the mutele course by being twice dowelled into the existing stones on either side and dowelled up into the existing corona course above.
4. A new stainless steel plate was inserted at the back of the horizontal joint above the mutele course to spread the load exerted by the corona course over the new and existing stone on either side of the new work.
5. The entire ensemble was re-pointed.
6. Because of the extensive fine cracks in the other dentils all the larger blocks of the mutele course were pre-drilled, grouted and dowelled with 650mm long dowels from the edge into the core behind.

The larger of two repairs in the mutele course of the south-western entablature. One cramp has been entirely removed and two halves remain on either side; one is just visible on the right side. Note the diagonal crack in the existing stone to the right. Note also the dowel hole drilled into the existing stone. The dowel joint was made as follows: The hole was drilled into the existing stone to a depth of 400mm. Grout was pumped into the hole. The 400mm long dowel bar was secured with a rope half way along its length and fully inserted into the hole. The new stone section was predrilled to match and erected. When in place, the rope was pulled until the dowel was 200mm in both the new and existing stone. This technology has remained the same for centuries.

The smaller repair in the mutele course of the south-western entablature. The crack in the adjacent block has been repaired. Note that the jacked corona stone above settled back naturally into its correct position after the rusted cramp had been removed.

The south-western entablature: the completed repairs (photographed September 2010)

3. The cathodic protection of embedded irons

Having identified the small number of embedded and exposed irons which could be removed, it was necessary to consider those embedded irons which were too inaccessible, too costly to remove or whose removal would result in massive costs, unnecessary loss of original material and would reduce the authenticity of the technical design and artistic significance of the building. The most appropriate intervention was to protect these irons from further corrosion by the application of cathodic protection. The principal is that by application of a low voltage current to each iron, this forces the iron to act as a cathode, which stops the exchange of electrons on the iron which causes corrosion. Over time the current also makes the surrounding area slightly alkaline which further mitigates against corrosion. There is no mains electrical supply to the Arch at present and obtaining one would require a metre box and other necessary equipment. Therefore it was decided to install 4 sacrificial magnesium anodes in the ground behind the northern flanking wing which would gradually corrode and generate a steady low voltage current, sufficient to cathodically protect the embedded irons. The magnesium anodes will last about 20 years. Their corrosion will eventually reduce the anodes to magnesium salts in the ground which are harmless to groundwater and wildlife. The sacrificial anodes will then need to be replaced.

Following identification of the irons to be protected, a design was prepared which involved running 2 cables up the north-western façade from the sacrificial anodes to 2 primary rings which were run in the horizontal mortar joist. Spurs were run from these rings to each iron. The cables were connected to each iron with 2 self-tapping screws. The maintenance of the cathodic protection is detailed elsewhere, so no further comment is necessary in this report. It is important to note that these cables are not cut or otherwise damaged during any future maintenance works, repointing or ground works near the buried anodes.

Drilling the cores at each joint in the corona course of the south-western cornice to each cramp behind to allow the cables to be attached to each cramp.

The south-western cornice: core hole drilled into the joint between the corona and mutele courses

The 4 magnesium anodes, approx. 700mm long before they were placed in the 4 holes behind the northern flanking wing wall

The north-western façade: chase cut into the mortar joints to accommodate the cable, part of which is visible.

The lower frieze of the south-western façade: the end of an iron cramp to which a cable has been connected. Note also the chasing of the stone and dowel hole which will act as a key for the mortar behind a new stone indent in this area.

The lower frieze of the south-western façade: the completed new granite indent.

4. The removal of isolated, randomly arranged ferrous fixtures from the façade

Several isolated pins, plates and other fixtures which were partly buried in the facades and whose precise function was not always known were removed as part of the works. 2 old electrical supply plates were removed from the south-eastern façade.

An old electrical supply point which was partly built into a mortar joint in the south-eastern façade.

The south-eastern façade: the repaired stone and re-pointed mortar joint after the steel plate had been drilled out.

The north-eastern façade: a close up view of the left-side, square recessed panel where a pin, approximately 200mm long, was drilled out of the stone. Note where the stone had been drilled out around the pin. The resultant cavity was filled with a mixture of granite dust and resin, into which a chase was made while still fresh aligning with the mortar joints. The resin-dust repair was then tooled to match the appearance of the surrounding stone during dry weather conditions.

The north-western façade: 2 repairs similar to that above, involving the removal of embedded irons which were close to the surface and relatively easy to remove

The last or fifth consideration was to do nothing. Those iron pins or dowels which reinforce the tops and bottoms of the stone balusters were left alone where no damage was notable – refer to the enclosed drawings. As mentioned previously 4 iron cramps which reinforced the joist between some of the capstones of the south-eastern façade which had not corroded were left in situ. Finally, those irons which were not detected by the cover metre, or which were detected but could not be physically located following test drills, but which undoubtedly exist were left undisturbed where no visible damage was noted on the surface. These may or may not cause damage in the future; only time will tell. The stone should be inspected for any new cracks or changes in appearance on an annual basis.

5. Future maintenance and the Conservation Plan

The interventions made in 2110 were essential repair and conservation works, which have secured and stabilised the masonry and have remedied the primary physical causes of the damage. It is imperative that the structure is now inspected and maintained on a regular basis to avoid reoccurrence of the damage. Such an inspection should include a check for any damage, cracks or further discolouration of the granite, any blockages or debris on the roofs and gutters, any damage to the slate roof covering or the lead flashings and dressings. The roof should be inspected twice a year, the other items once a year.

The flanking wing walls were excluded from the works because of budgetary constraints. They can be repaired by council staff without recourse to a scaffold; the ivy and creeper growth can be removed from the back or west sides of the wing walls and the split tree taken down from behind the southern, flanking wing wall. The joints should be re-pointed where the mortar has been damaged by creeper tendrils and missing stones or wide joints filled with smaller, thinner “pinning” stones. Localised grouting may be necessary if the calp limestone backing has become loose. The spherical finial which was returned by a local resident should be repaired and reinstated on the pier of the northern flanking wing wall.

In the longer term it is desirable that a sustainable use be found for the structure within the context of the park and the open space that it addresses. A viable use is the most effective way to ensure its survival in the future. If the structure were used, even occasionally, future leaks and other defects would be detected early and could be remedied inexpensively before they become a problem. A Conservation Plan should be prepared for the Roman Arch in consultation with the council’s Conservation Officer.

6. Conclusion

The Roman Arch was built for Henry Loftus, around or shortly after 1771 as part of a vast garden around Rathfarnham Castle, a statement of power and intent imprinted firmly on the landscape as well as providing elegant spaces in which to walk and approach his home. Although its garden setting is largely gone, the Arch is still one of the finest of its kind still existing today in Ireland and was possibly designed by one of the foremost architects of the day.

The Arch is situated at a prominent corner and road junction in south county Dublin. It is at the entrance to a major public park which adjoins the River Dodder and three local authority districts. It was created in a very different social and economic environment to that in which it exists today. The recent works to repair and to conserve are an important part of the solution and will facilitate the Roman Arch taking on a new role in its modern environment.

This report is a record of the recent works and may be of use to future conservators, the planning authority and to interested members of the public.

The Roman Arch viewed from the west, looking toward Braemor Road

Appendix 1. Historical documentation.

This Appendix lists those archives and sources where primary source historical documents were located while researching the Roman Arch. This does not preclude other documents being sourced elsewhere. Samples of the document types have been reproduced below and the sources acknowledged for their permission to do so. The known location of other documents is also listed below.

1. Maps

Maps were produced for several purposes. Privately commissioned maps such as that by Richard Frizell dated 1779 were commissioned by Lord Ely to assist in the measurement and management of his estate. Other maps such as those by John Rocque (1760), Taylor's Map of the Environs of Dublin (1816) and others were commissioned by multiple private clients. They are useful in tracing the development of the estate and the surrounding area. The first edition (1843) and second edition (1865) ordnance survey maps accurately describe the layout of the gardens. Maps were sourced in the National Library of Ireland, the Map Library of Trinity College Dublin and in the Local Studies Section of South Dublin Libraries, Tallaght branch.

Extract from "Map of the county of Dublin" by William Duncan, published in 1821. This map was commissioned by the Dublin Grand Juries for administrative and planning purposes. (reproduced courtesy of South Dublin Libraries)

2. Paintings, prints and drawings

The Roman Arch was a well known landmark and features in several contemporary engravings and paintings.

“A view of Rathfarnham Castle” by Thomas Walmsley (reproduced courtesy of the Castletown Foundation)

“Park Gate at Rathfarnham”, Fig.4, pg. 500, Gent Magazine, June 1789 (approx. 50% of the original size, reproduced courtesy of the National Library of Ireland)

"Lord Ely's Gate" an engraving published by Duggan & O'Neill, dated 1800 – 1900 (approx. 60% of original size, reproduced courtesy of National Library Ireland)

3. Photographs

Photos of the Arch, the gardens and other structures in Rathfarnham were sourced mainly in the Irish Architectural Archive and in the Local Studies Section of South Dublin Libraries. The latter can be searched online. The former has an extensive photographic collection of Rathfarnham castle which includes several of the Roman Arch.

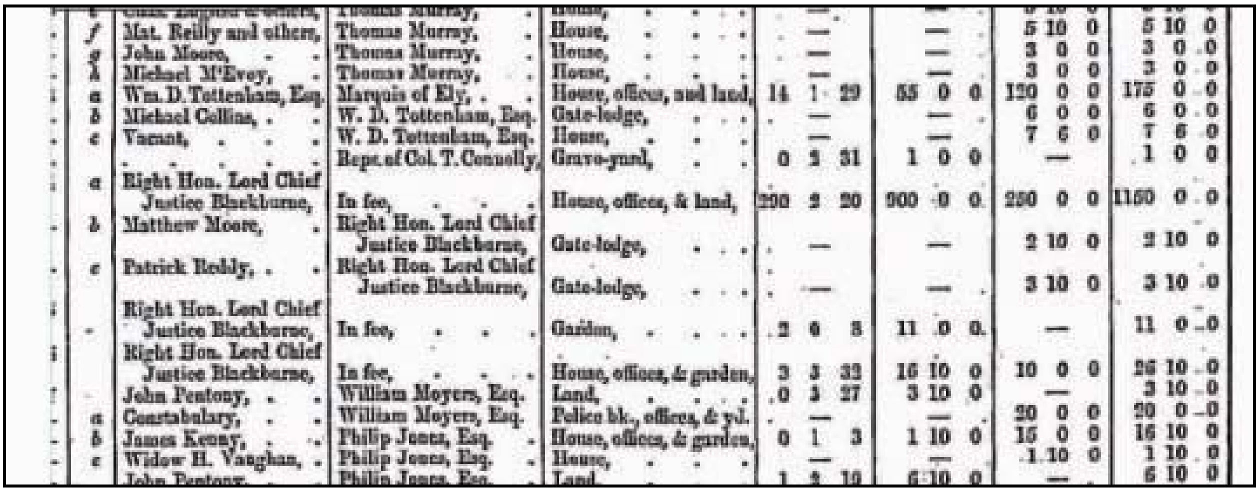
There are also images and photos of the Roman Arch in books and publications by the Irish Georgian Society Records and in private collections such as The Irish Picture Library and the Fr. FM Browne SJ Collection. The photos were useful in considering the condition of the Arch and how it has changed since the middle of the nineteenth century. They are also useful in describing the changes to its context over time.

The Roman Arch circa 1940 (reproduced courtesy of the Irish Architectural Archive)

The Roman Arch, late 19th century or early 20th century (reproduced courtesy of South Dublin Libraries)

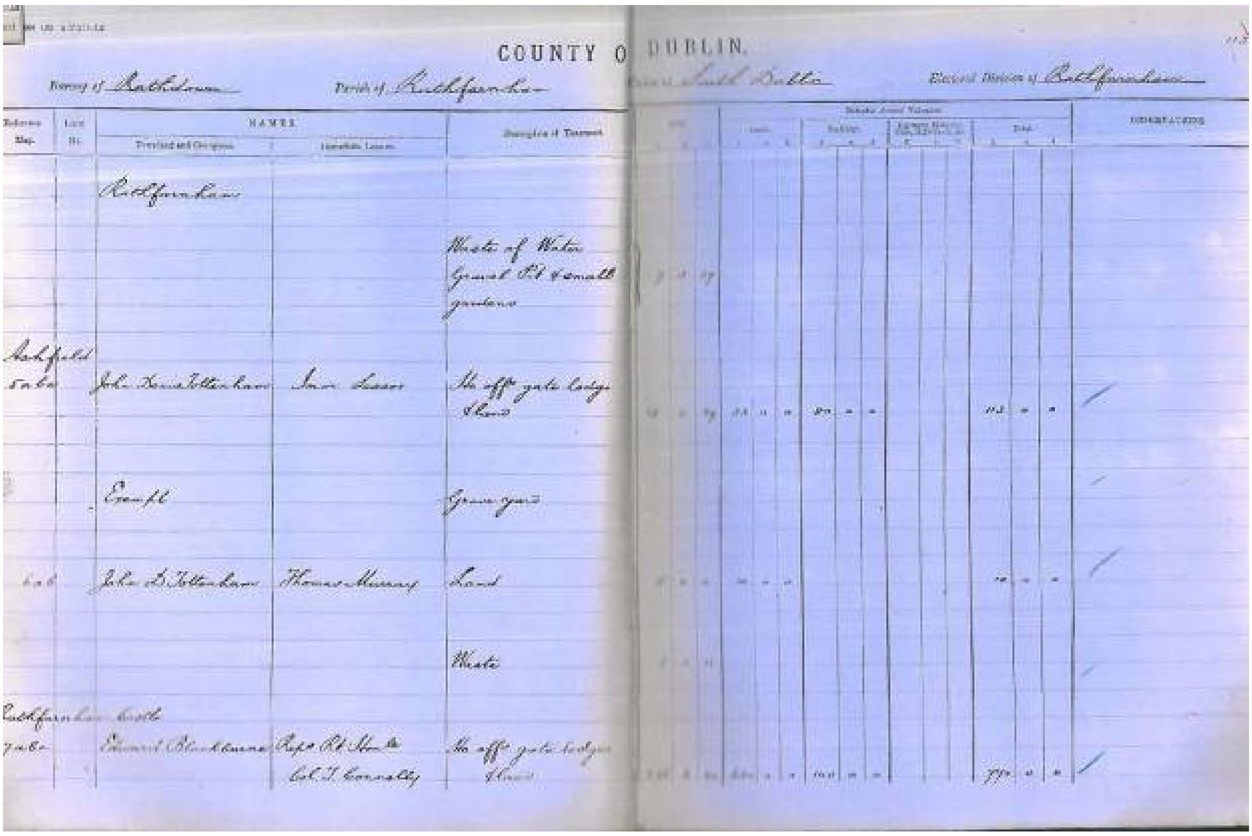
4. Valuations and occupancy

Three sources were used: The Primary Valuation of Ireland (a.k.a. the Griffith's Valuation) was the first national survey of the land holdings in the country and it is available online. The land valuation gives an indication of the condition of the structure and also usually lists the names of the occupants. Later national land valuations were sourced in the Valuations Office, some of which are copied below. Thirdly the annual "Thom's Irish almanac and official directory", a.k.a. Thom's Directories were also useful in tracing the occupancy and condition of the structure from the mid nineteenth century, though they are not as accurate.



f	Mat. Reilly and others,	Thomas Murray,	House,	—	—	5 10 0	5 10 0
g	John Moore,	Thomas Murray,	House,	—	—	3 0 0	3 0 0
h	Michael M'Evoy,	Thomas Murray,	House,	—	—	3 0 0	3 0 0
a	Wm. D. Tottenham, Esq.	Marquis of Ely,	House, offices, and land,	14 1 29	55 0 0	120 0 0	175 0 0
b	Michael Collins,	W. D. Tottenham, Esq.	Gate-lodge,	—	—	6 0 0	6 0 0
c	Vacant,	W. D. Tottenham, Esq.	House,	—	—	7 6 0	7 6 0
		Reps. of Col. T. Connolly,	Grave-yard,	0 2 31	1 0 0	—	1 0 0
a	Right Hon. Lord Chief Justice Blackburne,	In fee,	House, offices, & land,	200 2 20	900 0 0	250 0 0	1150 0 0
b	Matthew Moore,	Right Hon. Lord Chief Justice Blackburne,	Gate-lodge,	—	—	2 10 0	2 10 0
c	Patrick Reddy,	Right Hon. Lord Chief Justice Blackburne,	Gate-lodge,	—	—	3 10 0	3 10 0
-	Right Hon. Lord Chief Justice Blackburne,	In fee,	Garden,	2 0 8	11 0 0	—	11 0 0
	Right Hon. Lord Chief Justice Blackburne,	In fee,	House, offices, & garden,	3 3 32	16 10 0	10 0 0	26 10 0
	John Pentony,	William Moyers, Esq.	Land,	0 3 27	3 10 0	—	3 10 0
a	Constabulary,	William Moyers, Esq.	Police bk., offices, & yd.	—	—	20 0 0	20 0 0
b	James Kenny,	Philip Jones, Esq.	House, offices, & garden,	0 1 3	1 10 0	15 0 0	16 10 0
c	Widow H. Vaughan,	Philip Jones, Esq.	House,	—	—	1 10 0	1 10 0
	John Pentony,	Philip Jones, Esq.	Land,	1 2 10	6 10 0	—	6 10 0

Extract from the Primary Valuation of Ireland 1848-62 showing the occupant of the Roman Arch and the valuation applied to it in pounds (£), shillings and pence (sourced at website www.askaboutireland.ie/griffith-valuation/index.xml)



COUNTY OF DUBLIN

Barony of Rathdown Parish of Rathfarnham Electoral Division of Rathfarnham

Rathfarnham

Waste of Water Gravel Pit & small gardens

Ashfield 5abc

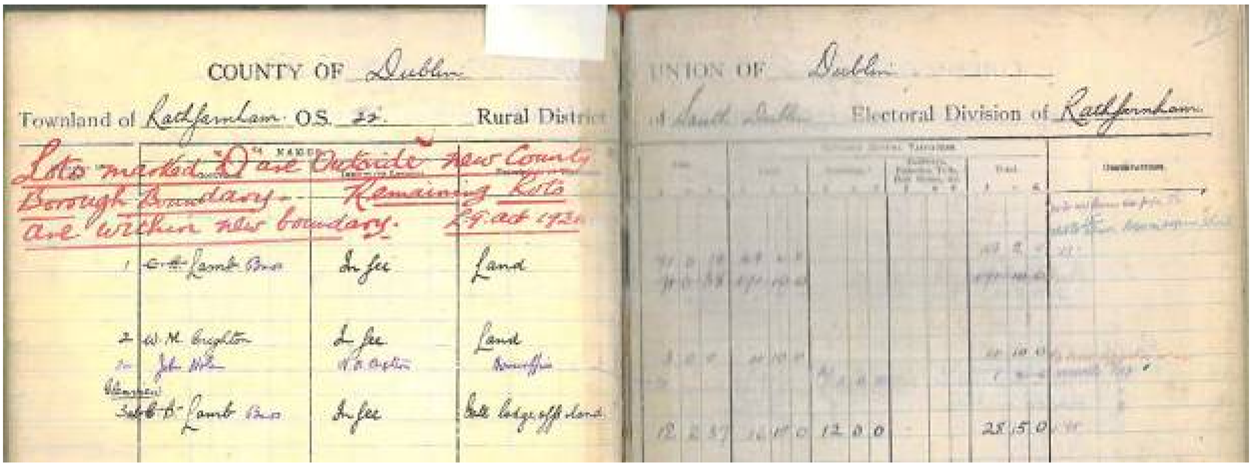
Temple Grave yard

6ab Thomas Murray Land

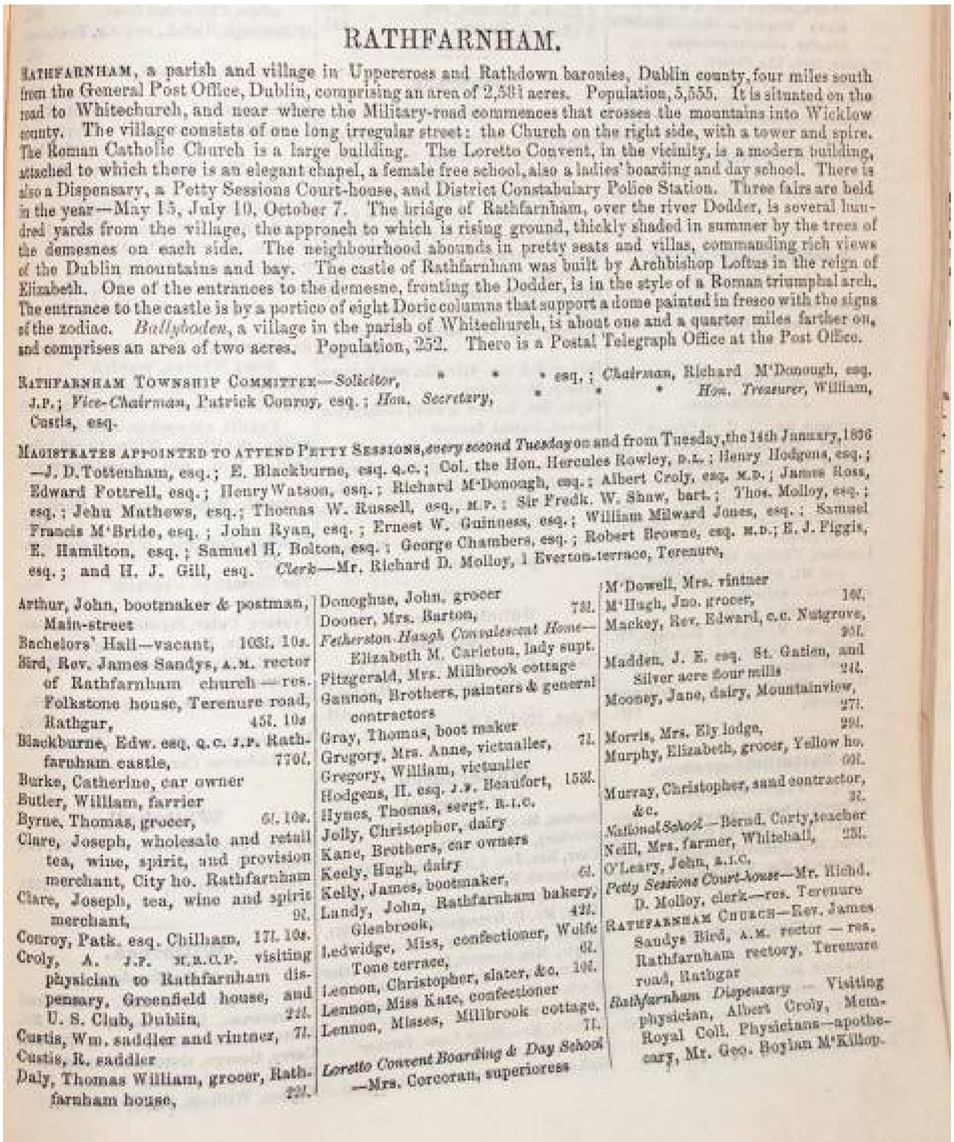
Waste

Rathfarnham Castle 7abc Edward Blackburne

An extract from the 1890 – 99 land valuation. Edward Blackburne was then the lessor of Rathfarnham castle in which the gate lodges were included (reproduced courtesy of the Valuation Commissioner & Valuation Office)



An extract from the 1909 - 47 land valuation. The estate had now been broken up and the Roman Arch and its lands were valued separately from Rathfarnham Castle (reproduced courtesy of the Valuation Commissioner & Valuation Office)



RATHFARNHAM.

RATHFARNHAM, a parish and village in Uppercross and Rathdown baronies, Dublin county, four miles south from the General Post Office, Dublin, comprising an area of 2,581 acres. Population, 5,555. It is situated on the road to Whitechurch, and near where the Military-road commences that crosses the mountains into Wicklow county. The village consists of one long irregular street: the Church on the right side, with a tower and spire. The Roman Catholic Church is a large building. The Loretto Convent, in the vicinity, is a modern building, attached to which there is an elegant chapel, a female free school, also a ladies' boarding and day school. There is also a Dispensary, a Petty Sessions Court-house, and District Constabulary Police Station. Three fairs are held in the year—May 15, July 10, October 7. The bridge of Rathfarnham, over the river Dodder, is several hundred yards from the village, the approach to which is rising ground, thickly shaded in summer by the trees of the demesnes on each side. The neighbourhood abounds in pretty seats and villas, commanding rich views of the Dublin mountains and bay. The castle of Rathfarnham was built by Archbishop Loftus in the reign of Elizabeth. One of the entrances to the demesne, fronting the Dodder, is in the style of a Roman triumphal arch. The entrance to the castle is by a portico of eight Doric columns that support a dome painted in fresco with the signs of the zodiac. *Ballyboden*, a village in the parish of Whitechurch, is about one and a quarter miles farther on, and comprises an area of two acres. Population, 252. There is a Postal Telegraph Office at the Post Office.

RATHFARNHAM TOWNSHIP COMMITTEE—*Solicitor*, * * * esq.; *Chairman*, Richard M'Donough, esq. J.P.; *Vice-Chairman*, Patrick Conroy, esq.; *Hon. Secretary*, * * * *Hon. Treasurer*, William, Custis, esq.

MAGISTRATES APPOINTED TO ATTEND PETTY SESSIONS, *every second Tuesday* on and from Tuesday, the 14th January, 1896 —J. D. Tottenham, esq.; E. Blackburne, esq. Q.C.; Col. the Hon. Hercules Rowley, D.L.; Henry Hodgens, esq.; Edward Fottrell, esq.; Henry Watson, esq.; Richard M'Donough, esq.; Albert Croly, esq. M.D.; James Ross, esq.; John Mathews, esq.; Thomas W. Russell, esq., M.P.; Sir Fredk. W. Shaw, bart.; Thos. Molloy, esq.; Francis M'Bride, esq.; John Ryan, esq.; Ernest W. Guinness, esq.; William Milward Jones, esq.; Samuel E. Hamilton, esq.; Samuel H. Bolton, esq.; George Chambers, esq.; Robert Browne, esq. M.D.; E. J. Figgis, esq.; and H. J. Gill, esq. *Clerk*—Mr. Richard D. Molloy, 1 Everton-terrace, Terenure,

Arthur, John, bootmaker & postman, Main-street
Bachelors' Hall—vacant, 103l. 10s.
Bird, Rev. James Sandys, A.M. rector of Rathfarnham church—res. Folkstone house, Terenure road, Rathgar, 45l. 10s
Blackburne, Edw. esq. Q.C. J.P. Rathfarnham castle, 770l.
Burke, Catherine, car owner
Butler, William, farrier
Byrne, Thomas, grocer, 6l. 10s.
Clare, Joseph, wholesale and retail tea, wine, spirit, and provision merchant, City ho. Rathfarnham
Clare, Joseph, tea, wine and spirit merchant, 9l.
Conroy, Patk. esq. Chilham, 17l. 10s.
Croly, A. J.P. M.R.C.P. visiting physician to Rathfarnham dispensary, Greenfield house, and U. S. Club, Dublin, 24l.
Custis, Wm. saddler and vintner, 7l.
Custis, R. saddler
Daly, Thomas William, grocer, Rathfarnham house, 22l.
Donoghue, John, grocer 73l.
Dooner, Mrs. Barton,
Fetherston-Haugh Convalescent Home—Elizabeth M. Carleton, lady supt.
Fitzgerald, Mrs. Millbrook cottage
Gannon, Brothers, painters & general contractors
Gray, Thomas, boot maker
Gregory, Mrs. Anne, victualler, 7l.
Gregory, William, victualler
Hodgens, H. esq. J.P. Beaufort, 158l.
Hynes, Thomas, sergt. R.I.C.
Jolly, Christopher, dairy
Kane, Brothers, car owners
Keely, Hugh, dairy
Kelly, James, bootmaker, 6l.
Lundy, John, Rathfarnham bakery, Glenbrook, 42l.
Ledwidge, Miss, confectioner, Wolfe Tone terrace, 6l.
Lennon, Christopher, slater, &c. 10l.
Lennon, Miss Kate, confectioner
Lennon, Misses, Millbrook cottage, 7l.
Loretto Convent Boarding & Day School—Mrs. Corcoran, superioress
M'Dowell, Mrs. vintner 16l.
M'Hugh, Jno. grocer,
Mackey, Rev. Edward, C.C. Nutgrove, 95l.
Madden, J. E. esq. St. Gatien, and Silver acre flour mills 24l.
Mooney, Jane, dairy, Mountainview, 27l.
Morris, Mrs. Ely lodge, 29l.
Murphy, Elizabeth, grocer, Yellow ho. 60l.
Murray, Christopher, sand contractor, &c. 3l.
National School—Bernd. Carty, teacher
Neill, Mrs. farmer, Whitehall, 23l.
O'Leary, John, R.I.C.
Petty Sessions Court-house—Mr. Richd. D. Molloy, clerk—res. Terenure
RATHFARNHAM CHURCH—Rev. James Sandys Bird, A.M. rector—res. Rathfarnham rectory, Terenure road, Rathgar
Rathfarnham Dispensary — Visiting physician, Albert Croly, Mem. Royal Coll. Physicians—apothecary, Mr. Geo. Boylan M'Killop.

An extract from the 1896 edition of Thom's Directory. The Roman Arch is referred to in the general introductory paragraph, Edward Blackburne is listed as the occupant of the castle and the valuation is the same that that above. The "castle lodge" is listed separately in later editions of the directory from the 1950's onward.

In addition to these primary sources, there are numerous secondary sources - books, magazine articles, pamphlets, theses and papers which consider the Rathfarnham area, the Castle and the Roman Arch

- "Historical Features and People of Interest at Rathfarnham" by Mel Ni Chearnaigh
- Rathfarnham Castle, County Dublin, by McParland, Edward. pp. 734-737, "Country Life", clxxii, no. 4438 (9th September 1982)
- The Irish Georgian Society Records, Volume 5, (1969, The Irish Georgian Society)
- Down the Dodder by Moriarty, Christopher (Wolfhound Press, Dublin, 1991)
- Rathfarnham Roads by Healy, Paddy (South Dublin Libraries, 2005)

General histories of the Dublin area which give good back ground information on the castle and which refer to the Roman Arch include

- A History of County Dublin. Vol.II by Ball, Francis Elrington (Gill & MacMillan, Dublin, 1979)
- The Neighbourhood of Dublin. Dublin by Joyce, Weston St. John. (Gill & MacMillan, Dublin, 1977) (Originally published 1912)
- History of the county of Dublin by d'Alton, John. (Cork: Tower Books, 1976. Originally published: Dublin: Hodgis & Smiths, 1838)
- The Shell Guide to Ireland by Killanin and Duignan, Michael V. (2nd edition, Ebury Press, London 1967)
- The Architecture of Ireland from the Earliest Times to 1880 by Craig M. (Lambay Books, Dublin 1997)
- Dublin 1660 - 1860 by Craig, Maurice (Alan Figgis & Co. Ltd., Dublin 1980, first published 1948)

Other texts of relevance are

- Sparkling Granite by Ryan, Nicholas M. (Stone Publishing, Dublin 1992)
- The Follies and Garden Buildings of Ireland, by Howley, James (Yale University Press, London and New Haven)

Appendix 2. As built drawings.

This appendix lists the 12 drawings enclosed herewith which describe the as-built condition and the cover metre survey of the embedded irons. The drawings are as follows:-

Drawing Number	Drawing Name
I10	As built drawing: ground floor plan
I11	As built drawing: roof plan
I25	As built drawing: south-west elevation
I26	As built drawing: north-east elevation
I27	As built drawing: south-east elevation
I28	As built drawing: north-west elevation
C25	Embedded iron survey: south-west elevation
C26	Embedded iron survey: north-east elevation
C27	Embedded iron survey: north-west and south-east elevations
I53	South-western cornice: as found and as repaired
I54	North-eastern cornice: as found and as repaired
I55	North-eastern cornice: as repaired – Detail A