

State of the Art of Conservation in Ireland

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2. The Faculty of the Built Environment of the Dublin Institute of Technology.

The Dublin Institute of Technology is the largest educational institution in Ireland. It has an enrolment of nearly 10,000 third-level students pursuing some 85 different programmes at certificate, diploma, degree and postgraduate level as well as 7,000 part-time students and 4,000 apprentices. The Dublin Institute of Technology has 1,500 full-time and 1,000 part-time staff. It is divided into 6 Faculties (Faculty of Arts and Music, Faculty of Science, Faculty of the Built Environment, Faculty of Engineering, etc...).

The Faculty of the Built Environment is divided into four Schools: School of Construction, School of Architecture, School of Environmental Planning and Management and School of Real State and Building Economics

Faculty's Research on Conservation and the Environment: Main areas.

- Conservation Materials Science,
- Assessment of Traditional Building Structures and Techniques,
- Application of Digital technologies to heritage and conservation,
- Heritage Skills,
- Sustainable Design and Construction,
- Environmental Management.

The main areas of scientific conservation research in the Faculty are as follows:

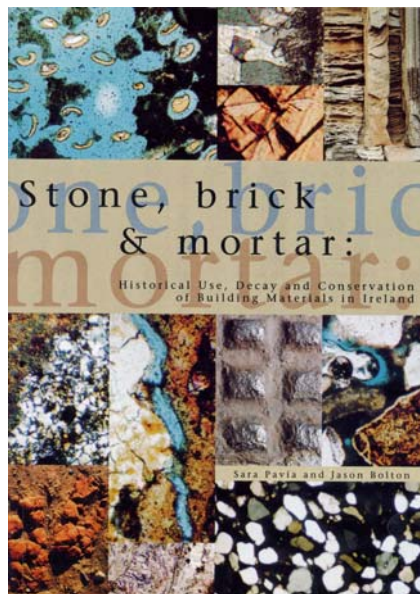
- Petrology of building stone.
- Petrography of building ceramics and mortar.
- Stone, brick, mortar weathering.
- Conservation treatments for building materials.

- Physical properties, durability and sources of building materials - Rock mechanics and durability testing.
- Clay mineralogy.
- Mortar technology- replication of historic mortars, types and properties of building limes.
- Mineral coatings on monumental stone.

Methods and Techniques: Conventional fieldwork techniques, polarised-light microscopy, stereomicroscopy, X-Ray powder diffractometry, X-Ray fluorescence, SEM / EDAX, engineering testing (densities, porosity, compressive strength), clay extraction and X-Ray diffraction analysis, geochemistry.

Latest Publications: We have recently made a relevant contribution to the conservation field in the form of two academic / professional books.

- Stone, Brick and Mortar.



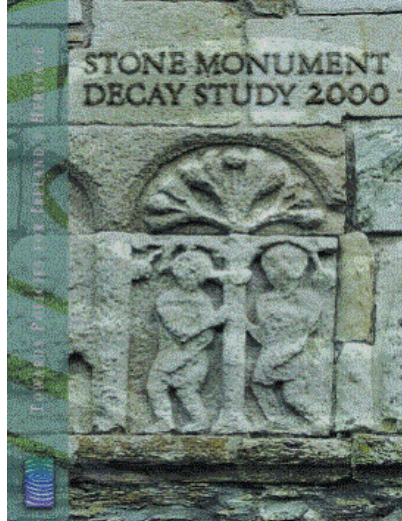
By S. Pavia and J. Bolton (2000). The objective of this book is to illustrate types, origin, sources, uses, properties, historical evolution, decay and conservation of stone, brick and mortar. It attempts to be a working tool for architects, archaeologists, stonemasons, civil engineers, building technicians and others with an interest in building materials; it can be used as a text book for students in the aforementioned areas and a source of information for any curious reader. It contains a mixture of ancient history and tradition with modern scientific research. It applies mainly to Ireland but refers to other places in Europe and the Mediterranean such as Spain, Egypt and Britain.

It begins by briefly introducing the different types of building materials and techniques from the Stone Age to the 20th century. Chapters are dedicated to vernacular architecture, quarrying and stone masonry both past and present. Different types of rocks and where they are found in Ireland are described, together with stone decay in natural outcrops and in urban areas; the indicators of stone decay at buildings and the processes leading to damage. Bricks and mortars are also an important part of the contents. The historical development of brick making; the properties and composition of the raw clay and the baked bricks; the types of raw clay for brick manufacturing and the decay and defects of the fired brick are also found in later chapters. Also included are types of mortars and their uses; historical evolution of mortar composition; properties of mortars relevant to construction and the effect of mortar

on stone decay. Finally, the book contains a compilation of methods and techniques of stone cleaning and conservation, with reference to their characteristics and suitability.

This publication intends to communicate science and tradition. It includes historical references of building materials as well as conclusions obtained from direct observation; experimental work at sites and laboratory testing. Some information is based on testing carried out in real case studies.

- Stone Monuments Decay Study 2000.



By S. Pavia and J. Bolton (2001). Published by The Heritage Council. This investigation provides a concise, accurate account of the current condition of over a hundred stone monuments, and sets a standard for the methodical analytical recording of standing stone archaeological monuments. The study identified and quantified the causes and mechanisms of stone decay of Irish monuments.

A wide range of monuments, dating from the Neolithic to the 19th century were examined including megalithic tombs, castles, tower houses, post-medieval buildings, churches, abbeys, round towers and other ecclesiastical remains. The project based its investigations on the analysis of the decay of some of the most important stone types in Ireland – limestone, sandstone, granite and a number of metamorphic rocks. A standard methodological approach, including fieldwork tasks and laboratory techniques, was applied. The methodology was designed for its' applicability to any stone monument, of any stone type, of any period.

3. Conservation areas in Ireland / Other national centres and partner institutions.

3.1 Policy and Administration:

- –Dúchas-, Department of Arts, Culture, The Gaeltacht and the Islands. State body responsible for the formulation of national policy relating to Arts and Culture and for the support and development of the Cultural Institutions – such as the National Museum, and the formulation and implementation of national policy in relation to Heritage.

The National Inventory of Architectural Heritage: Dúchas Section which aims to compile an evaluated record of the post 1700 structures comprising of the architectural heritage of the twenty six counties of Ireland. This inventory should assist local authorities to make informed planning decisions. See funding section.

- National Museum of Ireland. The National Museum of Ireland was established by the Science and Art Museums Act, 1877. It was the result of the merging together of several Irish Collections. The Museum contains artefacts and masterpieces dating from 2000 B.C. to the 20th century. The role of the museum is to preserve and make accessible the portable natural and cultural material heritage of Ireland, and communicate to the people of Ireland and visitors to Ireland a vision and understanding of that heritage, and act as a major educational resource and deepen cultural ties with other countries.
- Office of Public Works; For over 160 years the Office of Public Works has provided the Government and the public sector with high quality, cost effective services in the areas of property, construction and procurement. The Office of Public Works is a Government Office responsible for providing and maintaining buildings and property used by Government Departments, designing and supervising the construction of new buildings and maintaining and restoring historical buildings.
- The Heritage Council; The Heritage Council was established as a statutory body under the Heritage act 1995. Its role is to propose policies and priorities for the identification, protection, preservation and enhancement of Ireland's national heritage. National Heritage is defined as including monuments, archaeological objects, heritage objects such as art and industrial works, documents and genealogical records, architectural heritage, flora, fauna, wildlife habitats, landscapes, seascapes, wrecks, geology, heritage gardens, parks and inland waterways. The Council has a particular responsibility to promote interest, education, knowledge and pride in the national heritage.
- Local Authorities – Conservation and Heritage Officers-. Recently appointed by the Heritage Council, conservation officers have responsibility for protecting national heritage at a local level.

3.2 Architectural History and Archaeology:

- Department of Art History –Trinity College Dublin-;
- Faculty of the Built Environment –Dublin Institute of Technology-.

3.3 Conservation Science and Technology:

- Faculty of the Built Environment –Dublin Institute of Technology-. Research – See sections : Current conservation research projects and Main areas of scientific conservation research in the Faculty.

Also: School of Construction. Alternative methods of treating diseases in wood – without chemicals- particularly dry rot. Sustainable construction: Solar energy, water economy, ecological materials.

- National Museum of Ireland. Energy efficient buildings to achieve stability on environmental conditions for artefacts in museums.
- The State Laboratory, Abbotstown, Castleknock. Chemistry of weathering. Commercial and research basis.
- Trinity College Dublin. Director of Buildings. Energy Conservation: Sustainability concerning energy production and use in buildings. Computer simulation on decay mechanisms based on known scientific principles. Coordinative role. Dept. of Civil Engineering. The preservation of historic engineering structures constructed of concrete and stone, especially early concrete buildings and masonry bridges. Diagnosis and treatment of porous building materials. Cathodic protection of steel and iron in masonry structures.

3.4 Education and Training

- Master in Urban and Building Conservation (MUBC), School of Architecture – University College Dublin. Master degree established in 1986. Directed towards professionals and postgraduates working in the conservation field. Primarily concerned with building conservation also involved with conservation of urban areas. Draws upon multidisciplinary expertise of specialists from several university departments, the building industry and other institutions.
- Module on Building Conservation. Architecture degree. School of Architecture – University College Dublin-.
- Construction Industry Federation (CIF): Historic Site Managers Training Project – EU funded programme Leonardo, see previous section on research project background-.
- Dublin Civic Trust – Educational trust with charitable status. The objective of the trust is the recognition and protection of Dublin’s architectural heritage. They carry out building inventory and recording, seminars and training for postgraduate students and professionals, permanent exhibitions and publications.
- Module on Building Conservation. Architecture degree. School of Architecture, Faculty of the Built Environment, Dublin Institute of Technology.
- Traditional technologies. Training on crafts and apprenticeships –plastering, carpentry- School of Building, Faculty of the Built Environment, Dublin Institute of Technology.
- Traditional technologies. Dúchas-, Department of Arts, Culture, The Gaeltacht and the Islands. Workshops for training stonemasons.

3.5 Other roles/areas.

- The Irish Georgian Society. The Georgian Society is Ireland's Architectural Heritage Society. The Irish Georgian Society was founded in for the protection of buildings of architectural merit in Ireland. The Society aims to encourage an interest in and to promote the conservation of distinguished examples of architecture and the allied arts of all periods in Ireland. These aims are achieved by education and grants, planning participation, membership and fund raising.

4. Ireland’s Research Background - EU projects to date -

4.1 Euroform 1991 – 1993

Conservation of traditional built environment.

4.2 Force 1997

Qualification Study – Preliminary survey of national monuments and heritage skills-. Portugal, UK, Ireland.

4.3 Leonardo Da Vinci 1996 to present-

Directorate General : Education and Science.

Status in progress.

Ireland, Spain, UK, Portugal, France, Germany, Italy, Denmark, Finland, Hungary and Rumania.

Council of Europe (COE) –Cultural Heritage Division- and European Foundation for Heritage Skills (EFHS). EFHS was established by COE as a body to promote architectural heritage skills and enhance research and training in order to preserve heritage skills.

Specific projects:

- Historic Site Managers Training Project – CIF – Construction Industry Federation- It is the only employer organisation for the construction industry in Ireland. It has a membership of over 2,500. It provides information and advice on matters affecting the construction business including contractual matters, planning, building legislation, tendering, health and safety regulations, insurance etc. It also provides training.
- Beta – Development of CD Rom for training in conservation-
- Caravella – Promotion of Architectural Heritage Skills-
- Transfusion – Dissemination of projects to new members: Finland, Hungary, Romania-

4.4 ADAPT/ TREAT – Training in restoration and Environmentally Adapted Techniques-

Ireland, Portugal, Denmark, Holland, Belgium.

Status: Finished. It has been re-structured into a new programme (EQUAL) which will begin soon. It will overlap issues of ADAPT incorporating new elements.

4.5 Raphael 1997 –1999

Application of new technology in conservation: CD Rom, Internet and Virtual Reality VRML.

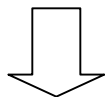
Ireland, Council of Europe, Portugal and UK.

Status: Finished. It has been completely re-structured into a new programme (CULTURE) which will overlap issues of ADAPT incorporating new elements.

Small size programme, a good programme for a small institution to start.

Specific project:

- Mayglass Project – 1999-2001- Ireland, Portugal, Denmark and UK. Traditional architecture and new technology-. A practical case study involving the restoration of a mud thached cottage in south east Ireland.



HEREIN – Telematics- project : **Development of technologies to disseminate conservation and cultural heritage.** Directorate General XII: Science, Research and Development. Fifth Framework 1999 to present.

1. Development of a database
2. Each partner country to contribute to the database- most EU countries are involved, there are different levels of involvement-
3. National Monuments is the Irish representative.
4. Telematic companies are involved –the largest is probably the French company Bull-

STEP- Conservation of Historic Buildings, Monuments and Associated Cultural Property. Directorate General XII: Science, Research and Development. 1992-1996. Completed 1997.

Participants: Dublin, Germany, UK, Italy, Greece, Belgium, Spain, Norway.

The aim of this programme was to built on previous experience to determine the major factors involved in the decay of monuments and to produce guidelines for planning and implementing appropriate conservation measures. Exposure studies and laboratory experiments were carried out using limestone, sandstone and marble.

5. State of the Art of Conservation in Ireland: Current Research Projects.

5.1 Stone Monument Decay Study 2000 – An assessment of the degree of erosion and degradation of stone monuments in the Republic of Ireland.

Faculty of the Built Environment, Dublin Institute of Technology.

This project is explained in detail in the last section of this paper: Vulnerability of Irish Historical and Archaeological Heritage. Under the headings Case study 1 - illustrates a threat/risk to heritage and Case study 2 - illustrates a solution/initiative which has been developed to counteract such a threat/risk.

5.2 Decay of Irish Coastal Archaeological Stone Monuments.

Faculty of the Built Environment, Dublin Institute of Technology.

The Faculty is continuing research into detecting threats posed to built structures by coastal erosion and marine environments. This work -which has been in progress since 1998 – has included the testing of passive sampling devices for the detection of coastal erosion rates and processes.

The overall aim of this research is to assess the level of risk impacting on Irish coastal stone structures. More specific objectives include the identification of the range and variety of archaeological monuments occurring on the Irish coast; the study of the nature and origin of their building materials; the examination of the level of threat to stone monuments posed by coastal erosion; the evaluation of evidenced stone decay on the Irish coast and the evaluation of coastal stone decay through experimental means.

5.3 Materials' Audits for Building Conservation

Faculty of the Built Environment, Dublin Institute of Technology.

A number of Irish Castles dating from the 15th to the 18th centuries were appointed by National Monuments, Duchas, Department of Arts, Heritage, The Gaeltacht and the Islands as subjects for this research programme.

This project involves the assessment of the composition, origin and current condition of the building materials comprising these monuments. The project embraces extensive petrography of building stone, brick and mortar; rock mechanics; durability testing. The location of sources of raw materials for brickmaking and archaeometry studies (mineralogical changes during firing, estimation of ancient firing temperatures and estimation of ancient ceramic production technologies) are also main subjects within this research project.

5.4 Development of non-destructive methodologies for recording and monitoring decay of historical and archaeological fabrics.

Faculty of the Built Environment, Dublin Institute of Technology.

This research project is concerned with the assessment of measurement techniques for recording and monitoring decay of historical stone buildings and archaeological structures. The ultimate aim of the project is to develop a feasible methodology for recording and monitoring the decay of historical buildings and archaeological sites. This will involve the assessment of measurement techniques for recording and monitoring the progressive surface and textural variations. The project will be based in the combination of recording surveying technology with scientific research on building materials. The research will build upon previous research work on close range photogrammetry and stone weathering completed in the Faculty's Dept. of Geomatics. The research will also define limits for the recording and

monitoring ability of the different systems assessed - close range photogrammetry, photography, control survey, production of three-dimensional surface models, interferometry.

5.5 Building Conservation Economics.

Faculty of the Built Environment, Dublin Institute of Technology.

The Faculty is also engaged with research to provide authoritative evidence of exemplar practice which can best meet the objective of securing economic viability and long term preservation of historic buildings in Europe. This research will identify and assess comparative practice and legal provisions adopted in Europe and North America, regarding the use and reuse of historic buildings, with a view to putting forward operational and legislative solutions which will support the long term preservation of the built heritage.

The objective of this study is to analyze tax subsidies, grant aid and other financial instruments employed to support the preservation of buildings of architectural or historic merit. The research study will identify and assess comparative practice and legal provisions adopted in European and North American Countries, regarding the use and reuse of historic buildings, with a view to putting forward operational and legislative solutions which will support the long term preservation of the built heritage. The study will take a global approach by investigating the situation in the developed world: specifically in Europe and North America. It will review the situation in a number of countries within Europe, particularly those that have been recognised by the Council of Europe as having developed innovative techniques in funding conservation works (UK, Netherlands, Denmark, France, Germany, Ireland).

6. Funding

Most of our local funding has been sourced from Europe, either directly or indirectly. Funding sources are as follows:

1. Private enterprise sector:

Industrial partners include quarry developers, lime suppliers, multimedia companies and building and conservation contractors.

2. Public sector -Government Institutions-:

- Higher Education Authority (HEA). Programme for research in third level Institutions (PRTL). Under the National development plan, the Government provides funding for research to third level Institutions. The Higher Education Authority is the planning and development body for
- higher education in Ireland. It was set up in 1968, and was given statutory powers in the Higher Education Authority Act 1971. Among the principal functions of the HEA are: to further the development of higher education; to assist in the coordination of state investment in higher education and to allocate research grants among universities and designated institutions.
- Science Foundation Ireland (SFI). The National Foundation for Excellence in Scientific Research, has been launched by the Government to establish Ireland as a centre of research excellence in strategic areas relevant to economic development, particularly Biotechnology and Information and Communications Technologies (ICT). A major fund (established by the Government) to develop Ireland as a centre for world class research excellence in strategic niches of Biotechnology and ICT. As part of its response, the Government has approved a Technology Foresight Fund of over £500 million (635m, US\$600m) for investment in research in the years 2000-2006.

- National Monuments, Duchas, Dept of Arts, Heritage, the Gaeltacht and the Islands. The Department of the Gaeltacht was established in 1956. In January 1993 the Department of the Gaeltacht was replaced by the Department of Arts, Culture and the Gaeltacht. The new Department is also responsible for the formulation of national policy relating to Arts and Culture and for the support and development of the Cultural Institutions – such as the National Museum, and the formulation and implementation of national policy in relation to Heritage, including Inland Waterways, National Parks and Wildlife as well as National Monuments and Historic Properties. In July 1997, the Department was re-named the Department of Arts, Heritage, Gaeltacht and the Islands, and was given new responsibilities in relation to the development of offshore islands, both inside and outside the Gaeltacht.
- The Heritage Council –Lottery Funds-. As mentioned in previous section (Conservation areas / Other national centres and partner institutions). The Heritage's Council role is to propose policies and priorities for the identification, protection, preservation and enhancement of the national heritage.

3. European Programmes.

3.1. Directorate General XII : Science, Research and Development. Fifth European Union Framework Programme of research, technological development (RTD) and demonstration. 1998-2002.

Activity 1: Energy, Environment and Sustainable Development.

Key action the city of tomorrow and cultural heritage.

Specific programmes of the 5th framework:

- CRAFT Co-operative Research Action For Technology: Allows research and development challenged SMEs to form transnational consortia and use third parties to carry out technical research with 50% of EU funding.
- INCO 2 Focuses on specific research and technology actions which are relevant to developing countries. One of the deliverables of this programme included technologies for conservation of cultural heritage.

3.2. Directorate General :

- Education and Science.LEONARDO DA VINCI Education and training programme. Large projects 300,000 Ecus average. Leonardo Da Vinci 1996 to present-. See section Ireland's Research Background - EU projects to date –
- EQUAL follows up from ADAPT/ TREAT – Training in restoration and Environmentally Adapted Techniques-. Adapt has been re-structured into a new programme which will begin soon and will overlap issues of ADAPT incorporating new elements. See section Ireland's Research Background - EU projects to date –
- CULTURE follows up from Raphael (1997 –1999)- Application of new technology in conservation: CD Rom, Internet and Virtual Reality VRML. Raphael has been completely re-structured into this new programme. See section Ireland's Research Background - EU projects to date –

7. Vulnerability of Irish Historical and Archaeological Heritage. Stone Monuments Decay Study 2000.

7.1 Risks for Ireland's Archaeological Heritage

Since 1996 the Heritage Council has commissioned a series of reports on inter-related topics to obtain baseline data on the state of Irish archaeological heritage and a number of reports commissioned by the Heritage Policy Division of the Department of Arts, Heritage, Gaeltacht and the Islands have also become available. These reports detail a heritage resource that is under greater pressure than at any time in history.

Up to 34% of the State's identified archaeological monuments have now been levelled and the rate of destruction has increased to an unprecedented 10% per decade. According to these sources, this material is being destroyed at an alarming rate of about 1500 sites per year, without any attempt to rescue the data being lost. Planning authorities and land and building owners and occupiers have not been adequately informed of the legislation and there is no adequate guidance for them to comply with its provisions.

The statutory Record of Monuments mainly deals with upstanding, or previously known monuments. There has been little systematic aerial survey carried out and by and large the evidence of artefact find spots has not been included, even where they may indicate prehistoric sites or monuments. These low visibility sites can be destroyed without record.

Of the sites that are receiving attention, which are mostly in urban areas, there is still no co-ordination of activity between the planning authorities. Few local authorities have access to professional heritage advice and this puts an additional burden on Dúchas. There are no Guidelines for minimum standards of Environmental Impact Assessment, and these need to be put in place as a matter of priority.

Pre-development archaeological work is compulsory in Ireland. However, despite the massive rate of afforestation there is still no pre-afforestation archaeological survey. More than 900 pre-development archaeological reports are now produced annually. In general the quality of the work being carried out is variable. The quality of the written reports is also variable. There are no guidelines for the organisation or contents of excavation reports and very few are produced with eventual publication in mind.

Associated with these reports are hundreds of thousands of artefacts, the majority of which have never been conserved, as there are not enough facilities to deal with newly excavated material. Dúchas alone is estimated to have a backlog of some 250,000 unconserved artefacts, some of which have been stored for over 20 years. The National Museum may have a backlog of over a million unconserved acquisitions. Despite this situation, policy remains to continue to allow the excavation of this material under current conditions, despite the likelihood that part of it will eventually decay without being studied.

Geophysical investigation has now become a standard practice in Archaeological Assessment as well as an accompaniment of archaeological excavation, yet there are currently no standards for the production, dissemination or archiving of geophysical data.

7.2 Case study 1 - illustrates a threat/risk to heritage

In 1999, a nation-wide Stone Monument's study was commissioned by the Heritage Council. The study was carried out by Dr. Sara Pavia and Jason Bolton, Faculty of the Built Environment, Dublin Institute of Technology. The aim of this research was to gather information on the degree of degradation and erosion of stone monuments in the Republic of Ireland. The output from this study was to provide the Heritage Council with objective and up-to-date factual data gathered through fieldwork and laboratory analysis in order to assist the Council to identify policies and priorities for the preservation of monuments, and to prioritise its limited resources. A wide range of monuments, dating from the Neolithic to the 19th century were examined including megalithic tombs, castles, tower houses, post-medieval buildings, churches, abbeys, round towers and other ecclesiastical remains. The project

based its investigations on the analysis of the decay of some of the most important stone types in Ireland:

- limestone,
- sandstone,
- granite and
- a number of metamorphic rocks.

A standard methodological approach, including fieldwork tasks and laboratory techniques, was applied. The methodology was designed for its' applicability to any stone monument, of any stone type, of any period.

All monuments studied showed some form of decay. The intensity of decay does not increase with the age of the monument, but is primarily determined by the type and origin of the stone, and the stress it has undergone through the years. A total of 112 monuments were assessed:

- 12.5% of the monuments suffered structural damage, involving a danger of collapse
- 22% exhibit intensive stone decay
- 27% showed mild structural damage
- 33.3% displayed significant loss of carved detail
- Biological colonisation was found on 97% of examined sites
- 32.5% were re pointed with modern Portland cement mortars; reacting chemically with the original masonry and inducing damage in 46% of these cases
- 4.5% exhibit mild vandalism

7.3 Case study 2 - illustrates a solution/initiative which has been developed to counteract such a threat/risk

The solution to counteract the threats and risks identified during the investigation is the study itself. This wide-ranging study provides the necessary factual baseline data with which to base any decisions regarding the future of and any potential interventions to Irish stone monuments.

The study identifies the causes of the decay of a monument. It analyses the causes of harm, decay or loss, to stone monuments providing fundamental baseline data in order to discern suitable conservation strategies. The study identified and quantified the causes and mechanisms of stone decay of Irish monuments. It also determined the degree of structural damage, vandalism and maintenance problems. This investigation provides a concise, accurate account of the current condition of the studied monuments, and sets a standard for the methodical analytical recording of standing stone archaeological monuments.

This programme laid the foundation and the methodology to identify the current condition, potential threats and conservation solutions for the monumental stone heritage of Ireland. In an ideal situation, the existing Irish Sites and Monument Record (SMR database) should hold information on monumental fabrics, type of stone, stone decay and current condition for all recorded monuments in the Republic of Ireland. Currently, large sections of the country, and important stone types remain unexamined. However, a continued assessment as established in this study would enable control over monumental sites and the careful management of our standing stone heritage.