THE INSTITUTE OF ADVANCED ARCHITECTURAL STUDIES

Director: ROBERT MACLEOD, B.Arch

The King's Manor

University of York
King's Manor, York

(York 24919)
THE INSTITUTE OF ADVANCED ARCHITECTURAL STUDIES is one of the post-graduate Institutes which was established in York by York Academic Trust. In 1961 the Institute was incorporated into the University of York when this was established. It has its origins in a summer school for architectural students, first held in 1949 to which residential courses for qualified architects, surveyors and builders were soon added. In 1966 it moved to its present premises in the King's Manor, a historic building situated in the centre of York and admirably suited for conversion to this new purpose.

PRESENT ACTIVITIES

The Institute of Advanced Architectural Studies forms a constituent part of the University of York and is concerned with post-graduate and further education for the professions allied to building, together with aspects of research development, and architectural practice, as outlined below. There is no undergraduate school of Architecture in the University.

(a) EDUCATION

A programme of short courses, varying in duration from one to ten days, and in organisation from seminar to conference, is held annually. These range widely in subject matter including aspects of human ecology, procedure and technology, and are intended for practitioners in the various fields concerned. A principal function of these courses is to bring together in an informed and critical context the skills and knowledge of existing research and development organisations, the needs of practice, and the experience of building users. An annual programme of courses is available from the Institute.

A limited number of research students are accepted to work for higher degrees, mainly M.Phil and PhD, principally in aspects of architectural and building history, practice and organisation. Those interested in undertaking post-graduate research work for higher degrees in the Institute should write to the Director indicating their specific area of interest.

(b) RESEARCH

Within the Institute a research section has recently been formed under its own Research Director. A first report on 'Architects and Information' was prepared for the Building Research Station and completed early in 1971; work now initiated includes a comparative study of housing conversions for student use and studies on the design of learning spaces. It is also hoped to develop a programme of research financed from outside sources around a central theme of upgrading of existing building stock.

(c) PRACTICE

The Institute has its own architectural practice, the Design Unit, which carries out commissions for the University itself and other clients. Work completed and in hand includes housing for university staff and students, for a local authority, and for housing societies.

The reference library and the slide and photographic collections are available for the use of architects, students and other persons with a bona fide interest.

Exhibitions on a wide variety of architectural subjects are held throughout the year.
FUTURE PLANS

As the result of increasing demand from the profession, the Institute has extended the range of its activities every year since it was established. This expansion is expected to continue for many years to come.

It is intended that a programme of year-long diploma/degree courses will commence in Autumn, 1972. These are specifically designed for experienced practitioners (at least four years post qualification experience) in the fields of architecture, quantity surveying, and engineering. An appropriate first degree and/or professional qualification will be required for entry to these courses, which will deal with conservation of buildings (from 1972) and design economics (from 1973). Details of these courses can be obtained on request from the Institute Secretary as they become available.

The Institute also intends to build residential accommodation on a site adjacent to its headquarters so that the members of its courses may live as well as study in collegiate surroundings.
The following societies and official bodies give the Institute their active support:

The Royal Institute of British Architects
The Royal Institution of Chartered Surveyors
The Town Planning Institute
Department of the Environment
Scottish Development Department
The Institute of Building
The Institute of Landscape Architects
The Incorporated Association of Architects and Surveyors
The Ancient Monuments Society
The Historic Churches Preservation Trust
The Council for the Care of Churches
The Institute of Civil Engineers
The Institution of Heating and Ventilating Engineers
The Institution of Municipal Engineers
The Building Centre

The Institute of Electrical Engineers
The Town and Country Planning Association
The Institute of Arbitrators
The Landscape Research Group
The Fire Protection Association
The Institute of Materials Handling
The Department of Education and Science
The National Playing Fields Association
The Institute of Registered Architects
The Institute of Quantity Surveyors
The Faculty of Architects and Surveyors
The Institute of Park Administration
The Institute of Wood Science
The National Trust
The Civic Trust
The Society for the Protection of Ancient Buildings

The Institution of Structural Engineers

Note: The photographs on the front and rear covers are Crown copyright and reproduced by permission of the Royal Commission on Historical Monuments (England).
DIPLOMA
AWARDED TO
Francois Le Blanc
At the ceremonies held 26 September 1973
THE KING'S MANOR, YORK
This certifies that the bearer has been exposed to a very intensive programme of examination, analysis and consolidation prior to return to his country of origin and is now believed to require careful personal restoration and preservation.

1973

INSTITUTE OF ADVANCED ARCHITECTURAL STUDIES
Institute of Advanced Architectural Studies

UNIVERSITY OF YORK
KING'S MANOR, YORK YO1 2EP

Diploma Course in Conservation Studies 1973-4

Director of Studies DR DEREK LINSTRUM DIPL. ARCH PH.D RIBA (Radcliffe Lecturer)
A DIPLOMA COURSE
IN CONSERVATION STUDIES

THE NATURE OF THE COURSE

The eminent suitability of York as a city in which to centre a course in conservation is self-evident. Within its boundaries is a collection, probably unrivalled in this country, of nationally important buildings and remains from the Roman period to the present century; it is, in itself, a complete case-study of the problems of urban blight and renewal, the conservation of historic buildings and townscapes, urban housing and transport, and the adaptation of an historic city to changing uses and needs. Within a radius of forty miles are fifteen ancient monuments in the guardianship of the Department of the Environment, important country houses dating from the 16th to the 19th centuries, four of the most notable 18th-century landscapes in the country, and a wide range of vernacular buildings. The city is located in the centre of the agricultural north and close to the industrial south of Yorkshire, and is in a good position to study the peculiar problems of conservation in industrial cities as well as the more obvious aspects of the subject.

Since the formation of the Institute of Advanced Architectural Studies at York in 1949, short courses on conservation have regularly been included in the annual programme, and a close acquaintance with practitioners in this field in this country and abroad has been steadily built up. A new appointment, the Radcliffe Lecturer in Conservation Studies was made in 1971, with the assistance of the Radcliffe Trust, in order to develop this study as a post-qualification mid-career course.

The need for such a course has been becoming increasingly apparent, and its initiation in 1972 received the support of all the professional bodies, learned societies and amenity groups concerned with conservation. The term conservation is used in its widest sense to imply the planned retention of a quality of life so far as it is affected by the built form. It is not used exclusively to mean the preservation and restoration of historic buildings, although this must inevitably be the core of a course based on architectural studies. The overall aim of the course is to attempt to co-ordinate the contributions of architects, planners, economists, historians, archaeologists and building craftsmen in analysing, preserving, adapting and replacing buildings in isolation or as part of an identifiable pattern. It is regarded as an advantage that the Institute intends to open a one year full-time graduate course in Building Economics in 1974 and the two courses will have several points of contact.

ASPECTS OF CONSERVATION WHICH WILL BE INCLUDED ARE:

*Architecture: restoration and preservation.* Current attitudes and practice; legislation; maintenance and use of historic buildings; economic considerations; specifications and job organization.

*Architectural history.* Development of building types; analysis and recording; sources of research; decoration and furniture.

*Construction.* Traditional materials, tools and craftsmanship; methods of building and contracting; faults and deterioration in construction and materials.

*Landscape.* History of landscape design; formation and planting; reclamation and maintenance.

*Townscape and conservation areas.* Historical development of communities; assessment of individual buildings and areas; legislation; economic considerations of retention or development; proposals for future development; detailed designs for conversions and replacements.
QUALIFICATIONS REQUIRED AND PROCEDURE FOR APPLICATION

Conservation work requires confidence and sound judgement, and a prospective student will be required to have had a minimum experience of four years after completing a recognized professional and/or academic education. He will be expected to produce evidence that he has a sympathetic knowledge of historic buildings and towns which he is capable of developing in his chosen specialization; although this is most likely to be in the architectural or planning field it could equally well be a specialization undertaken by an historian or archaeologist, an engineer, a surveyor or a landscape architect. The general pattern of the course will be sufficiently flexible to allow various emphases to suit the student's experience and requirements.

The course will commence in September and will consist of three academic terms. The syllabus is intended to achieve a balance of practical and theoretical work, and the student will be required to produce a dissertation or thesis as part of his submission for the University's Diploma in Conservation studies. Application forms may be obtained from the Secretary at the Institute and they should be returned by the end of January. It is expected that applicants will be interviewed in February, to enable those who are accepted to make arrangements with their employers for leave of absence. The course is full-time and students will be expected to reside in or near York for the three terms. Some residential accommodation will be available in the University Colleges. It is anticipated that a number of bursarships will be offered to students accepted for the course, and further information will be available at the interviews. (Fees for Students from the U.K. are £113.50 and for those from abroad £303.50.)

Further enquiries concerning the course should be made to the Secretary:
Institute of Advanced Architectural Studies,
King's Manor,
York, YO1 2EP.   Telephones: York (0904) 59861, Ext. 832. 24919.
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From the late 17th century the buildings went through a period of short leases to prominent York aldermen. In the early 18th century the Huntingdon block became a select girls’ boarding school and after 1813 it became a National School. From 1833-1956 the blind school occupied the premises and when they moved to new premises the Manor was bought by York Corporation.

In 1963 the City authorities leased the King’s Manor to the University of York. By October 1964 the reconstruction of the buildings (Feilden & Mawson, Architects) was complete and the Manor took on its present role as a centre of university teaching.

THE INSTITUTE OF ADVANCED ARCHITECTURAL STUDIES

THE KING’S MANOR, YORK, YO1 2EP (0904 24919)

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The Institute is responsible for the York University Design Unit which carries out architectural commissions and provides a practical background to the Institute’s teaching and research.

In addition the Institute is responsible for a small research unit.

H. Morley and Sons (York) Ltd., Petergate, York.
Institute of Advanced Architectural Studies

UNIVERSITY OF YORK
KING'S MANOR, YORK Y01 2EP

Programme of Short Courses 1973-4
Institute of Advanced Architectural Studies

September/November 1973

A Diploma Course in Conservation Studies
A one year course is mounted in addition to the short courses listed below. The course commences in September and consists of three academic terms. Details obtainable from the Secretary.

Conservation of Historic Structures 16–28 September
(open to overseas applicants only)
A course sponsored jointly with the British Council and concerned with the philosophy and techniques of building conservation.

Conservation: Analysis and Recording Techniques 8–12 October
A course co-ordinating the roles of each profession in the conservation process. It will include techniques such as photography and photogrammetry.

Design of Learning Environments SEMINAR 16–18 October
A discussion of the form of learning spaces together with those services, equipment and modes of operation which they require.

Design of Hotel Facilities 5–9 November
A survey designed to explore the special problems of the design of hotels. It will be planned to interest those concerned with management as well as design.

Maintenance of Buildings 19–23 November
Maintenance costs and costs in use; the implications of known failures in design and construction, maintenance, organisation and management. A course designed principally for project architects, building surveyors, maintenance officers and engineers.

November/March 1974

Structural Fire Precautions 26–30 November
An examination in conjunction with the Fire Protection Association of the effects and behaviour of materials in fires. It will also consider precautions necessary to minimise or prevent fire danger and means of escape. It will interest architects, surveyors and engineers.

Teaching Methods 1–10 January
A discussion planned jointly with the D.E.S. directed towards teachers in courses at degree level in the whole field of the Built Environment.

Maintenance of Historic Buildings 4–8 February
A study of materials normally encountered in Old Buildings. Traditional building crafts and materials will be discussed by those concerned in preservation and maintenance.

Student Housing SEMINAR 19–21 February
A short seminar to consider current developments in the housing of students. In addition this will be of interest to those concerned with housing for other single young persons.

Aspects of Urban Conservation 25 February–1 March
A review of the major considerations relating to old buildings in urban areas and particularly those affecting designated Conservation Areas and G.I.A.'s. The course will have wide appeal to planners and architects.

Management of the project 11–22 March
A survey of the handling of the architectural project from inception to completion; including planning, project information, financial control and the problem of communication between consultants.
Collaboration Exercise 22–24 March
The Institute will act as host to design groups who will determine a design and produce scheme drawings for a real project in a limited time.

The Design of Nursery School Buildings 15–20 April
An opportunity for teachers and architects to discuss the implications of educational changes etc., upon the design of these important school buildings.

SEMINAR on Aspects of Architectural Research
29 April–3 May
An opportunity for all concerned in directing or undertaking research in the Architectural field to exchange experience, ideas, procedures and skills.

Arbitration SEMINAR 17–21 May
A course held jointly with the Institute of Arbitrators and consisting of a series of monitored tutorials demonstrating arbitration procedure in a practical manner.

Design Economics 27–31 May
A study of predictive economic techniques applicable to building design. The content will include cost analysis of building elements and building form, management accountancy and cost benefit analysis.

Please tick the courses for which you would like to receive the prospectus and application form (normally circulated 2 to 3 months before the date of the course) and return this form to The Institute of Advanced Architectural Studies, The King’s Manor, York, Y01 2EP

Please note that this form does not itself constitute a reservation for any course. Reservations will be accepted on a provisional basis on request, but this is not binding until we have received and acknowledged a completed application slip and a deposit.

Name

Conservation of Historic Structures (overseas applicants only)
Analysis and Recording Techniques
Learning Environments Seminar
Design of Hotel Facilities
Maintenance of Buildings
Structural Fire Precautions
Teaching Methods
Maintenance of Historic Buildings
Student Housing Seminar
Aspects of Urban Conservation
Management of the Project
Collaboration Exercise
Nursery School Buildings
Architectural Research Seminar
Arbitration Seminar
Design Economics

Address
SOCIETIES AND OFFICIAL BODIES GIVING THEIR 
ACTIVE SUPPORT TO THE INSTITUTE

The Royal Institute of British Architects
The Royal Institution of Chartered Surveyors
The Town Planning Institute
The Department of the Environment
Scottish Development Department
The Institute of Building
The Institute of Landscape Architects
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NOTE FOR INDUSTRY

Many of the Institute’s courses are eligible for grant aid and enquiries should be made direct to the appropriate industrial training board. For the construction industry this would be to the CITB, Radnor House, London Road, Norbury, London, S.W.16.

NOTE FOR LOCAL AUTHORITIES

Attention is drawn to the current Grants Scheme operated by the Local Government Training Board. Details should be obtained through your Local Authority Training Officer.
UNIVERSITY OF YORK
INSTITUTE OF ADVANCED ARCHITECTURAL STUDIES
SHORT COURSE PROGRAMME 1972-73

Director ROBERT MACLEOD B ARCH
Assistant Director STUART SUTCLIFFE ARIBA
Secretary DAVID RYMER MA
### September-November

#### Conservation of Historic Structures
(open to overseas applicants only)
**17–29 September**

This course is jointly sponsored with the British Council and is open only to persons from overseas. It will be concerned with the philosophy and techniques of conservation.

A development of the course initiated here in 1971. The coordination of the contributions and research techniques of the architect, planner, surveyor, historian, archaeologist and geographer will be assessed, and there will be demonstrations of the use of photography and photogrammetry.

#### Building and the National Economy
**16–20 October**

A survey of the growth and relationship of the building industry with the nation, and a study of the economic implications upon the pattern and development of building design.

#### Seminar on Urban Archaeology
**28–30 October**

The Society for post Medieval Archaeology is organizing a seminar in conjunction with their Annual General Meeting and details can be obtained from the Secretary, c/o Portsmouth City Museums, Southsea Castle, Portsmouth.

#### The Design of Outpatient Departments and Community Health Centres
**30 October–3 November**

An examination directed towards management, medical practitioners, architects, surveyors and engineers of the planning and design of these important facilities including an assessment of the role of such buildings within the provision of social service and health facilities.

#### Structural Fire Precautions
**6–10 November**

An examination in conjunction with the Fire Protection Association of the effects of fire, behaviour of structure and materials and the precautions necessary to prevent or minimise fire danger in the light of recent legislation. It will be relevant to engineers, surveyors and educationalists in building schools as well as architects.

### November-February

#### The Performance of Timber in Building
**27 November–1 December**

New techniques in running the smaller office
**4–8 December**

1973 Aspects of School Building Design
**1–5 January**

The Maintenance of Historic Buildings
**29 January–2 February**

#### The Design of Learning Environments
**12–16 February**

Conservation and General Improvement Areas
**19–23 February**

A course designed to survey the role and performance of timber elements in building. It will include the selection and performance of various woods as materials. Assistance in planning this course has been given by the Building Research Establishment and the Timber Research and Development Association.

A course which will illustrate how new techniques can be utilised to assist in the day to day administration of the smaller offices both public and private. It will appeal primarily to architects from these smaller units which do not warrant large-scale equipment purchase.

An up-to-date analysis of factors influencing the design of educational buildings in the light of current teaching techniques and government policy. This course will be residential.

A study of the deterioration of structure and materials normally encountered in old buildings. Traditional building crafts and materials will be discussed by craftsmen and historians, and there will be contributions from practitioners actively concerned in maintenance and preservation.

A course concerned with the form of learning spaces together with those services, equipment and modes of operation which they require. In addition channels of communication between educational innovators, the clients and designers of learning environments will be considered.

A review of the major considerations affecting designated conservation areas and general improvement areas. Legislation, economics and the process of visual and historical assessment will be discussed. There will be contributions on obsolete buildings, uses for them and the role of the amenity societies in public inquiries. In addition, the techniques of upgrading housing stock and general environmental improvement will be covered.
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<td><strong>water in landscape design</strong>&lt;br&gt;7–11 May</td>
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<td><strong>management of the project</strong>&lt;br&gt;5–16 March</td>
<td><strong>building and government legislation</strong>&lt;br&gt;21–24 May</td>
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<td><strong>buildings for correction and detention</strong>&lt;br&gt;26–30 March</td>
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<td><strong>teaching techniques</strong>&lt;br&gt;9–13 April</td>
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<td><strong>resource allocation and management in design</strong>&lt;br&gt;30 April–4 May</td>
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<td><strong>the computer and the building professions</strong>&lt;br&gt;7–11 May</td>
<td><strong>planning: data collation and retrieval</strong>&lt;br&gt;2–6 July</td>
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<td><strong>energy provision for buildings</strong>&lt;br&gt;9–13 July</td>
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NOTE RESERVATIONS PROCEDURE OVERLEAF
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NOTE
Return of the tear-off slip does not constitute a reservation. Prospectus and application form for courses will be sent where signified on the tear-off slip 2-3 months prior to the date of the relevant course. Reservations are only accepted when we have received and acknowledged a completed form and a deposit.

H. Morley and Sons (York) Ltd., Petergate, York
SOCIETIES AND OFFICIAL BODIES GIVING THEIR ACTIVE SUPPORT TO THE INSTITUTE

The Royal Institute of British Architects
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The National Trust
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The Institute of Materials Handling
The British Computer Society
The Institute of Housing Managers
The Department of Education and Science

NOTE FOR INDUSTRY

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conservation of historic structures
(open to overseas applicants only)
analysis and recording techniques in existing buildings
building and the national economy
the design of outpatient departments and community health centres
structural fire precautions
the design of bar and catering facilities in public houses
the performance of timber in building
new techniques in running the smaller office
aspects of school building design
the maintenance of historic buildings
the design of learning environments
urban conservation and general improvement areas
open air museums
management of the project
buildings for correction and detention
the property market
techniques in education for the building professions
resource allocation and management in design
the computer and the building professions
water in landscape design
building and government legislation
designing for passenger travel
design collaboration exercise
planning: data collation and retrieval
energy provision for buildings
73/74 annual programme
institute general prospectus

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CONSERVATION OF HISTORIC STRUCTURES

Director of Short Course Programme
STUART SUTCLIFFE, RIBA
Secretary
DAVID RYMER

THE KING'S MANOR, YORK
CONSERVATION OF HISTORIC STRUCTURES
16 - 28 September 1973

CONTRIBUTORS

JOINT DIRECTORS OF STUDIES

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2 Marsham Street  London SW1P 3EB

R Gilyard-Beer OBE FSA  Assistant Chief Inspector of Ancient Monuments, Department of Environment
2 Marsham Street, London SW1P 3EB


LECTURERS

W T C Walker RIBA Dipl.Arch. Dip.TP, Deputy County Architect, W.R.C.C. Wakefield

R R Worskett, RIBA AMIP, Senior Planning Officer, Planning Service Division, Department of the Environment, 2 Marsham Street, London

Dr A J Taylor CBE  until recently Chief Inspector of Ancient Monuments Department of the Environment 2 Marsham Street London

Poul Beckmann MICE Ove Arup & Partners 13 Fitzroy Street London W1P 6BQ

B Feilden D.Univ. RIBA Feilden & Mawson Ferry Road Norwich NOR 18S (Surveyor of the Fabric to York Minster)

Miss J Hargreaves AMIP Assistant Planning Officer, City of York Corporation

D P Crease MA RIBA AMI.StructE  Chief Architect York University Design Unit

P E Curnow MA FSA  Inspector of Ancient Monuments Department of the Environment, London

J Ashurst D.Arch RIBA Professional and Technical Officer, Department of the Environment, London
CONSERVATION OF HISTORIC STRUCTURES
16 - 28 September 1973

COURSE MEMBERS

Five members of the I.A.A.S. One Year Diploma Course in Conservation Studies will participate throughout the course:

Mr Watson
Miss Findlay
Mr Sanchez
Mr Rennie
Dr. Neave

from TURKEY

Dr. O Bakirer
T Giritlioglu
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Netherlands Ministry of Housing and Physical Planning
CONSERVATION OF HISTORIC STRUCTURES
16 - 28 September 1973

PROGRAMME:

SUNDAY September 16th
1400-1600  Arrival and Registration at Fairfax House
1600-1630  Tea at Fairfax House
            WALK TO THE KING'S MANOR
1800-1900  Introductory talk
1930-2130  Buffet Reception

MONDAY September 17th
0815-0845  Breakfast at Fairfax House each day
0930-1100  Analysis of Historic Evidence by examination and Excavation 1
1130-1300  Analysis of Historic Evidence by examination and Excavation 2
1330       Lunch at King's Manor
1415-1545  Structural Analysis of movements in Historic Buildings
1615-1745  Structural Preservation of Historic Monuments and Sites 1
1830       Dinner at King's Manor
Evening Free

TUESDAY September 18th
0930       Coach leaves Fairfax House for Byland Abbey, Rievaulx Abbey and Duncombe Park
            (packed lunches)
1800       Return to King's Manor
1830       Dinner at King's Manor
Evening Free
WEDNESDAY September 19th
0930-1100 Analysis of Historic Evidence by Examination and Excavation 3  Gilyard-Beer
1130-1300 Discussion: Methods of Recording Historic Structures  Course Directors
1330 Lunch at King's Manor  Curnow
1415-1545 Use of Excavation within roofed structures  Gee
1615-1745 Holy Trinity Church, Goodramgate: Study of a Redundant Church  Curnow
1830 Dinner at King's Manor.  Gee
1930-2100 Structural Preservation of Historic Monuments and Sites 2  Faulkner

THURSDAY September 20th
0930-1100 Treatment of evidence in structures for presentation to the Public 1  Gilyard-Beer
1130-1300 Stone Preservation: Research into applied treatments  Ashurst
1330 Lunch at King's Manor
Afternoon Free
1830 Dinner at King's Manor  Ashurst
1930-2100 Treatment of evidence in structures for presentation to the Public 2  Gilyard-Beer

FRIDAY September 21st
0930 Coach departs Fairfax House for Richmond and Bowes Museum (packed lunches)
1800 Return to King's Manor
1830 Dinner at King's Manor

SATURDAY September 22nd
FREE ALL DAY
Lunch and dinner available on presentation of course badge at Alcuin College on the University Campus.
Lunch 12.15 - 2.30  Dinner 1800-1845
A D Saunders is replacing Dr A J Taylor on Wednesday, September 26th, and the title of his talk is "Co-ordination of Evidence - Documents, Fabric and Excavation".

SUNDAY September 23rd
0945 Coach departs Fairfax House for visit to Fountains Abbey and Studley Royal (packed lunches)
1800 Return to Fairfax House
1800-1845 Dinner at Alcuin College (as on Saturday)
Evening Free

MONDAY September 24th
0930-1100 Structural Preservation of Historic Monuments and Sites 3 Faulkner
1130-1300 Structural Preservation of Historic Monuments and Sites 4 Faulkner
1330 Lunch at King's Manor
1415-1545 Micklelegate and other work Crease
1615 Visit to Micklelegate if possible
1830 Dinner at King's Manor
1930-2100 Presentation by Course Participants 1

TUESDAY September 25th
0930 Coach leaves Fairfax House for Kirkham Priory, Castle Howard and Mausoleum (packed lunches) { from 1.30 p.m. only
1800 Return to King's Manor
1830 Dinner at King's Manor
1930-2100 Presentation by Course Participants 2

WEDNESDAY September 26th
0930-1100 Comparative Study of original documents and fabric Taylor
1130-1300 Structural Preservation of Historic Monuments and Sites 5 Faulkner
1330 Lunch at King's Manor
1415-1545 York Town Scheme 1 Hargreaves
1615-1745 York Town Scheme 2 Hargreaves
1830 Dinner at King's Manor
Evening Free
THURSDAY September 27th

0930-1100  Historic Town Centres 1
1130-1300  Historic Town Centres 2
1330  Lunch at King's Manor
1415-1545  Case Study: Creake Abbey
1615-1745  Structural Preservation of Historic Monuments and Sites 6
1830  Dinner at King's Manor
1930-2100  Discussion

Worskett  Worskett
Gilyard-Beer  Faulkner
Course Directors

FRIDAY September 28th

0930-1100  York Minster
1130-1300  Visit to York Minster
1330  Lunch at King's Manor

Feilden

COURSE ENDS

Rooms at Fairfax House must be vacated during the morning of September 28th unless prior agreement has been made for an extra overnight stay. Such agreement must be made directly with the Warden of Fairfax House and is NOT included in the Conference charges.

EXCURSION ARRANGEMENTS

N.B., All coaches will travel from Fairfax House via the King's Manor to pick up packed meals at 9.45. If it is more convenient members may join the coach at King's Manor but should inform the course directors in advance of their intentions.
CONSERVATION OF HISTORIC STRUCTURES
16 - 28 September 1973

York Town Scheme
by JUNE M HARGREAVES, Dip.TP MRTP
Assistant City Planning Officer - City of York

SYNOPSIS

Background to Town Schemes - enabling legislation
Evolution of the York Town Scheme
Operation of Scheme - conditions of grant aid and problems arising therefrom.
Administration of Town Scheme
Collection of materials for restoring old buildings
Suitable uses for historic buildings and relationship to planning process
Problems to be overcome in conversion of old buildings
The future of Town Schemes - Conservation areas and integration with overall planning policies

BIBLIOGRAPHY

Aspects of Conservation - H.M.S.O. No's. 1 and 2 (1971 and 1972)
A Guide to Historic Buildings Law - Cambridge and Isle of Ely
County Planning Department (1970)

CHS73/09/01
UNIVERSITY OF YORK

Heslington, York, YO1 5DD
0904 59861

Site and Neighbourhood Plans

How to reach the University

By Bus
There are three bus routes from York to Heslington: No. 3A (from Acomb) via the railway station, Rougier Street, Hull Road and University Road to Heslington Hall, No. 9A (from Clifton) via St. Leonard's (near King's Manor), Rougier Street, Hull Road and Windmill Lane to Heslington Hall and No. 17 via Rougier Street, Fulford Road and Heslington Lane, stopping at Heslington Hall.

By Car
Visitors arriving by car should take either the Selby Road to Fulford and turn east along Heslington Lane to Heslington Hall; or the Hull Road and turn south at the first traffic lights into Green Dykes Lane, whose extension is the University Road.
YORK—PLAN OF CENTRAL AREA
Structural analysis and recording of ancient buildings

Poul Beckmann


Introduction

Structural analysis and recording are aids to assessing the health of a building as it stands, and the possible effects of changes in its environment.

The two operations must go hand in hand as without records no meaningful analysis can be made, and, without analysis, records do not have any meaning.

For our purposes, structural records include any information describing the structure of the building in the three dimensions of space and the fourth of time. This therefore includes the state of the structure as it exists.

Structural analysis will include all methods by which the available data can be processed to produce an assessment of strength, stability and deformations, past, present or future.

If an ancient building appears in good repair and a visual inspection gives no cause for concern, one would only resort to structural analysis in order to assess the effects of a proposed change of environment such as may be caused by major construction or demolition works in the vicinity.

When an ancient building is visually in a poor state of preservation, the structural analysis can help in assessing

(a) the present structural safety, including the effects of any observed defects on this
(b) the possible cause of the observed defects
(c) the remedial works necessary, if any.

The record of the structure as found

The first requirement is a complete description of the structure as it stands ‘warts and all’. The most complete record is, of course, the building itself, but this is in most cases too big and too complicated to provide a picture which can be grasped as an entity. This is most important as it is in most cases impossible to arrive at a sound assessment of the causes and effects of defects observed in isolation. What is needed before a safe diagnosis can be made, is a complete pattern of symptoms. Hence drawings and models are essential. The drawings should be sections and elevations of small enough scale that the whole of the building can be shown on one sheet. On these should be superimposed all significant defects; cracks on two sides of a wall should be plotted on the same elevation with two different types of line so that one can distinguish between surface cracks on one face only and cracks showing on both faces, which are likely to go right through the wall.

In some instances it is necessary to have a three-dimensional picture of the structure with its cracks, and here a fairly crude Perspex model may be of assistance as the cracks can be drawn on the individual components of the model before assembly, and subsequently be assessed three-dimensionally in the completed model.

Whereas the graphical presentation of cracks is thus fairly straightforward, deformations are more difficult to depict in a clearly comprehensible manner. Relative levels can be shown under an elevation as a line diagram with exaggerated vertical scale. Out-of-plumbness can be shown with arrows indicating the direction with the magnitude at the level of the arrow superimposed in figures, and where the deformation of a particular line is of special interest, this can be plotted to exaggerated horizontal scale away from the main elevation.

Cracks are, on the face of it, easily observed, but it is important to ascertain, as far as possible, what the structural gap is, as this is often masked by past repairs so that what now appears as a 5 mm crack may in effect signify a structural gap of 25 mm concealed by pointing and/or stone replacement.

Measurement of past movements

As regards deformations which have taken place between the original date of construction and now, one can obviously only achieve a fairly low degree of precision in the measurements due to the inevitable inaccuracies in the original construction. For this reason, fairly crude methods of measurements suffice: an ordinary levelling instrument will do but it should have the best possible telescope to assist reading in poor light. As one may have to take levels in triforium galleries and other hard-to-get-at places, the instrument should be as light and as compact as possible. When taking and recording levels it should be remembered that any one section of the building which was built as an entity in one period would have been finished to within ±10–15 mm on horizontal features such as string courses, but anything built 50 years before or after may have been effected by intervening differential settlement. For plumbbing, simple plumb lines or theodolite-plumbing will be chosen on the basis of which is the easier to do, remembering that plumb lines are not easily fixed to great heights, and they require a calm day to be of any use externally.

Where there is more than one storey, and particularly where the work above a floor is of a different vintage from that below, fairly accurate (±25 mm) correlation of pier shapes are however necessary to ascertain possible eccentricities.

Having thus obtained our ‘description’ of the structure in three dimensions, at this particular point in time one can perform structural analyses to various degrees of refinement, about which more later.

Measurement of ongoing movements

It will, at times, be desirable to know whether cracks or deformations are still ‘live’, or, having resulted from some cause in the past, are now static and therefore require nothing but ‘cosmetic’ treatment. Likewise, one may have carried out structural repairs which are compromises for economic and other reasons and would like to know whether they have been effective in arresting movements. In this instance one is dealing with slow movement (250 mm settlement in 500 years averages 0.5 mm per year) and to get answers within a reasonable time, one must therefore employ measuring methods of high precision.
Level measurements should preferably be based on a deep datum bench mark which can be assumed to be unaffected by movement of the structure or the soil underneath it and likewise be independent of structures in the vicinity. Such a bench mark may take the form of a steel tube capped with a stainless steel dome, with its lower end grouted into the bottom of a bore-hole; sufficiently deep to ensure that no movement is likely at that depth, with the lining tube of the borehole left in place but terminated clear of the grout so that it can settle with the soil without dragging down the inner tube which forms the bench mark. The space between the two tubes should be filled with a rust-inhibiting compound.

The levelling instrument should be capable of reading 0.2 mm or perhaps even 0.05 mm. A self-levelling "automatic" instrument may have advantages because it is less likely to drift slightly out of adjustment than the very accurate bubble levels with opposed-screw adjustment. The levelling points should be either grouted-in sockets into which a removable ball-headed bolt can be fitted for supporting a precision levelling staff or be short lengths of non-tarnishing metal scale, permanently plugged and screwed to the fabric, preferably at re-entrant corners where they are unlikely to be damaged.

When checking variations in out-of-plumbness with the accuracy required, plumb bobs may have to be furnished with vanes and suspended in butts of oil or water to dampen oscillations, and measurements must be taken with a micrometer between the plumb wire and round metal studs permanently fixed in the masonry. Whilst cheaper in prime cost, this method is labour expensive when a number of points have to be checked and optical plumbing should be considered. Instruments are available which will read to an accuracy of 1 mm out-of-plumb in a 100 m height, but for the smaller heights in question here, the accuracy will be affected by the precision with which one can focus on the target. High level targets should be fixed by stout three-legged brackets out of reach of ordinary maintenance ladders. They should have graduated scales printed on glass and be capable of illumination from the ground. The low level bulls-eye target should be set below floor level, preferably in a pocket in a mass of concrete large enough to remain undisturbed by floor renovation, etc. For ease of operation it would be worth setting it to correspond to the centre of the high level target at the beginning of the exercise so that no zero corrections need be made to future readings. The alternate way of checking changes in slope would be to employ precision spirit levels with graduated tilting screws such as are used occasionally in mechanical engineering. These have plane machined bases which have to be placed on special machined reference plates fixed on brackets. This method will, however, only measure the change in slope at each reference plate position and the change in shape of the member will have to be re-constructed geometrically, thus losing a large degree of accuracy. The same applies to the more sophisticated electronic levels which, however, may be easier to read.

Linear dimensions can be checked with Invar tapes which are practically unaffected by temperature variation. It would be possible, if they were permanently installed on pulleys with tensioning weights, to read to an accuracy of say 0.2 mm with a vernier device. However, if they have to be taken down and re-hung every time, the inaccuracy of the measurements is likely to double.

The traditional way of checking movements at cracks has been the use of tell-tales which have taken the form of either glass slips cemented on either side of the crack, or specially 2-shaped pieces of pipe-clay with a wasted portion in the centre. Experience at York

![Fig. 1](image1) Section through nave and choir showing movements and cracks

![Fig. 2](image2) Principle of optical plumb

![Fig. 3](image3) Principle of Demec gauge

Minster indicates that failure of glass tell-tales often occurs where they are cemented to the structure and may in some instances be produced by shrinkage of the polyester cement. Even if the failure is due to structural movement there is no way of ascertaining the magnitude or the direction of any further movement with adequate accuracy. This applies also to the pipe-clay variety.

Where the main direction of a suspected movement can be foreseen, one can use a pair of small oblong brass plates which are placed with their long edges touching each other, and parallel to the expected movement. These plates are cemented or ravviplugged, one to either side of the crack. If a line is scored at right angles to the touching long edges, future movement of significant size can be directly measured from the off-set in the scribe line.

At St. Paul's a very ingenious system has been operated for the last 50 years: this entails the cementing in of two cylindrical metal studs either side of the crack and the use of a set of specially constructed micrometers (of which only one set is in existence) which will measure movement across the crack, at right angles to it, and out of plane movement of the structure either side of it to 0.001 mm. This hardware is highly sophisticated and in consequence very, very expensive.

At York Minster a demountable mechanical strain gauge is used to measure the variation in distance between three metal studs glued to the structure in the pattern of an isosceles triangle so that two studs are situated on one side of the crack and one on the other. If measurements are taken of the variations in distance between the single stud on the one side of the crack and the two on the other, a simple calculation can produce the movement parallel to, and at right angles to, the crack. The gauge length used is 100 mm and a setting template, which is part of the outfit, ensures that the studs are set at the correct centres. The instrument (trade name: Demec) is moderately expensive (about £80) but comparatively easy to use. A screw micrometer may be used in lieu of the Demec gauge but is much slower and more dependent on the operator's skill.

A somewhat cruder instrument would be a magnifying glass with a graduated reticule commonly sold as a 'crack microscope'. The reticule is available divided into tenths of mms. and provided that a sharp pencil line is drawn around the circular base of the instrument initially and the instrument is always applied, concentrically with the
marked circle, a fair degree of accuracy can be achieved.

There is always a possibility that movement will occur as a result of remedial measures being carried out. These movements may be indicative of certain unforeseen reactions of the fabric or the foundations to the building operations and should therefore be checked in a similar way to that described above. They do, however, tend to be more rapid and in consequence the instrumentation can be slightly cruder than that described for checking ongoing movement, but nevertheless considerably more accurate than that which suffices to establish what movement has taken place in the past.

Recording and Interpretation of Readings

It is essential that readings are recorded in books kept specifically for the purpose in such a way that a newcomer can, by studying the introductory notes in each book and the setting out of the results, immediately see what the figures represent. It is tempting to let ‘George’ maintain his own system of booking because ‘he knows what he is doing’, but George may walk under a bus tomorrow, and unless his hieroglyphics are decipherable, all his good work will be wasted.

Even the best kept note-book in the world is, however, useless on its own when it comes to interpreting the readings. Basically any series of readings should initially be plotted against time. Only this will enable one to distinguish between the three features which I will call, for convenience ‘noise’, ‘seasonal oscillation’, and ‘movement’. ‘Noise’ is the fine waviness of the plot due to unavoidable random inaccuracies in instrument reading inherent in the process employed. ‘Seasonal oscillation’ is the movement about a steady average position caused by changes in temperature and humidity. If one took hourly readings with a sufficiently fine instrument, one would plot the diurnal variations. If the readings were continued over a year one would see the diurnal variations superimposed on an annual movement, but over several years there would be no total movement in one direction or another from ‘seasonal oscillation’.

‘Movement’ is shown by a slope of the envelope for the seasonal oscillations which indicates that year after year there is a resultant movement in one direction.

‘Noise’ is common to all observations where an instrument permits readings which are more accurate than the measurement being taken. ‘Seasonal oscillation’ is mainly observed in widths of superstructure cracks. The level of both of these ‘confusing’ phenomena must be established before any significant ‘movement’ can be deduced from the readings.

Foundation Investigations

Foundation investigations occupy a middle position between recording and analysis in as much as the soil strata have to be identified and recorded and their properties ascertained by laboratory tests, but the real benefit of the exercise only becomes realized when combined with calculations of ground pressures and settlements.

The soil properties will usually be determined from laboratory tests on samples in the case of the fines and sieved soils and in situ tests, such as the Standard Penetration Test, in the case of granular soils. In both cases bore-holes are required in sufficient number and on such a pattern that reasonably reliable information can be deduced for the main parts of the building. Ground water levels are obviously of interest and for clay soils the pore pressure, as indicated by piezometers left in one or two bore-holes, is important. For sandy soils the density and presence of subterranean water flows should be checked.

The object of all this is to establish, once the size of the foundations and the loads are known, the safety of the existing foundations and their likely response to any change in their environment such as could be brought about by piling and/or heavy traffic consolidating loose sands, deep basements causing washing out of fines through pumping or, conversely, stopping subterranean flows of water. In some instances it may even be possible to get a rough idea of the past behaviour of the foundations of the building as one can, in processing the laboratory tests, back-pedal so as to study the behaviour of the soil strata at the time when the building was first constructed.

Structural analysis for assessment of safety

In the building industry today, structural analysis is normally used for calculating sizes of members in structures to be built or to check stresses against permissible stresses in existing structures. In ancient buildings the sizes are given and, when considering the safety of the structure, the stresses should be evaluated from first principles as the 'safe working' stresses laid down in codes and regulations are often determined from considerations other than those of safety, i.e. limiting initial and long-term deflection, preventing cracking, etc. In an old building one accepts the existing deflections, and there is therefore no need to limit one's stresses below what is necessary to maintain safety and limit further deterioration.

One should also approach with an open mind the problem of what constitutes failure and how it happens. In masonry, failure under compressive load will take the form of shearing, bursting, or splitting, but very rarely crushing of the stone. In fact, stresses in traditional masonry structures, including most Gothic slender flying buttresses, tend to be very low compared with the crushing strength of the stone.

As far as timber roof structures are concerned, one need very rarely concern oneself with the members as it will invariably be the joints that are the weak points.

Very few ancient buildings have 'text-book' structural frames and an accurate elastic analysis can therefore become very complicated, but for purposes of safety one can resort fairly simply to limit state assumptions. If equilibrium can be established between the external forces acting on a part of a structure and the internal forces in the structure, and if the internal forces can be mobilized without requiring an excessive stress level anywhere, then the structure will be safe regardless of whether or not the stress distribution assumed is in fact the correct elastic one.

Whilst lintel-and-post structures will therefore not pose any problems, timber trusses can be structurally highly indeterminate with a large number of 'redundant' members, but provided the joints are capable of a certain amount of 'give', one can assume that all parts which are capable of contributing to the load carrying capacity of the truss do in fact do so. (This may be the time to point out that there has been some myths about hammer-beam roofs, attributing to them some very special load-carrying characteristics which in truth they do not possess as they do not work without exerting an arching thrust against the supporting wall or by developing bending moments in the joints).

The analysis of simple masonry arches can often be carried out as a simple thrust-line construction. Due to the usually low stress levels all that is required for safety is to find a thrust-line which will balance the forces on the arch whilst remaining within a distance away from the boundary of the arch equal to between 5 and 10% of its thickness. The thrust-line is constructed as an inverted string polygonal force to the planes and the horizontal thrust exerted by the arch can be read off the diagram. One can in fact extend this exercise to construct the thrust-line extended from the arch down through pier and buttress right to

![Fig. 7](image_url)

East end. Diagram of thrusts and movements

![Fig. 8](image_url)

Cracking of arches
the foundation, and here of course the position of the thrust-line can become much more critical as few soil strata will allow much uneveness of ground pressure before they suffer differential settlement which will result in the foundation rotating with whatever it supports. The east end of York Minster is a prime example of this where high eccentricity of the load on the buttress foundations led to a rotation which in turn aggravated the eccentricity to the extent that the east wall is now about 0.6 m out-of-plumb.

Structural analysis as aid to explaining past defects

Heyman has postulated that if a masonry arch stands up for five minutes after the scaffolding has been removed, it will stand up for 500 years. In this statement, it is assumed that the supports for the arch in question are practically immovable in space and time and the foundation settlements are negligible.

In a less ideal world foundations do settle appreciably and differential settlements give rise to cracks, and so does the spreading of abutments of arches due to the horizontal thrust. But how does one distinguish between the effects of the two different causes?

There is a kind of structural analysis which can be done 'by inspection' which will indicate the likely causes of certain cracks. For instance, if there are cracks on the inside of the arch, near the crown in a symmetrical pattern, the supports are likely to have moved out horizontally. On the other hand, if there are 'anti-symmetrical' cracks at the quarter points, i.e. on the inside of the arch at one quarter point, and at the outside at the other, the cause is likely to be differential settlement of the supports. Similarly, if a wall leaning outwards is concave on the side of the lean, the cause is likely to be horizontal thrust from roof or vault, whilst if it is convex on the side of the lean, the mostly likely cause is an eccentric foundation which started rotating during construction. Another illustration of 'analysis by eye' is given at St. David's Cathedral where a very low-pitched roof 'truss' is supported on walls which lean out alarmingly. There is, however, no indication of movement between the horizontal tie beam of the roof truss and the walls. As a truss of this kind cannot exert any horizontal thrust, it must mean that the lean of the walls was caused by an earlier roof in conjunction with weak foundations and that with the replacement of the roof, the cause of lean has been eliminated and the movement arrested.

When one comes to multiple bay arcades, with triforium superimposed, where the spandrels over the arches contribute substantially to the strength and stiffness of the whole system, things are no longer simple enough for this kind of deduction. Even the determination of the stress pattern becomes difficult.

One might at this point consider the use of structural models and on the face of it, photo-elasticity is an attractive technique as it is possible to load a three-dimensional model in a heated chamber and let the model cool off whilst loaded. When this has been done, all strains are 'frozen' into the model which can then be cut into slices which can be analyzed on a photo-elastic bench. However elegant in principle, the making and loading of the model is a difficult and expensive task, and the actual photo-elastic analysis is a fairly lengthy mathematical procedure if quantitative results are required. If one could make a model of fairly soft rubber and coat it with a brittle lacquer one could get a very easy visual indication of regions of high stress, but there are great difficulties in simulating gravity loads on a model like this. On balance, therefore, the best choice is a mathematical model which can be analyzed with the aid of an electronic computer. For the particular example of arches with spandrel panels, the mathematical model can conveniently take the shape of a rigid frame with shear panels.

The objection may be raised that the loads and material properties are not known with an accuracy commensurate with that inherent in a computer analysis. It must however be remembered that, in this instance, the purpose of the computer is not to produce extreme numerical accuracy but to enable one to manipulate a large mass of data and as stress levels are not crucial, reasonably good, approximate figures for loads will be adequate for the purpose. Likewise, as one does not rely on the analysis to produce the exact magnitude of individual deformations as long as the pattern is in proportion, the elastic properties of the material need not be specified with very great precision.

The Central Tower complex at York Minster was treated this way as follows. A plane frame analysis was carried out for a structure consisting of the transect arcade and the Central Tower pier walls in that plane. Gravity loads were first considered and it was found that the calculated movements and stresses were inconsistent with the deformations and cracks observed in the fabric. A similar analysis was then carried out assuming that the Central Tower had settled relative to the rest (as was in fact observed). Here again it was found that the calculated results of such a settlement were in conflict with the observed and measured distortions of the fabric and one was therefore faced with the puzzle of how the transect piers had come to lean the way they did. It was only the 'rediscovery' of the existence of an early English tower built about 1250 and a casual reference to its fall in 1407 that presented the solution to this niddle.

There was still the remaining problem of the force in the cracks in the tower spandrels under the lantern and whilst analysis had shown small tensions under the windows due to gravity loads, the correlation was not satisfactory.

Fig. 9
Geometric thrust – line construction

Fig. 10
Mathematical model and calculated deflections from gravity loads

Fig. 11
Patterns of cracking

Re-examining the records of the measurements it was found that the north-west pier showed signs of having settled about 120 mm more than the remaining three at the level of the lowest string-course whilst the difference at gallery level was 100 mm.

A space frame model was now analyzed on the computer assuming these differential settlements within the tower, and this time the magnitude and disposition of tensile forces checked with the actual position and extent of the cracks.