Jim Castle BSc(Hons) FRICS FHEA PgCLTHE

Building Pathology & Maintenance

For:

Argyll & Bute COUNCIL

GCU Glasgow Caledonian University

University for the Common Good

Introduction

- Definitions
- Marriage and the result …
- Pathology - questions
- Maintenance – questions
- Starting points (for pathology and maintenance)
- Pathology application

Definitions

- **Maintenance -** *the work needed to keep a building, road, machine, etc. in good condition*:

- **Pathology** – *the scientific study of disease*

(Cambridge Dictionaries Online, 2014)

But, who can combine these skills?

Need a marriage of building technology and pathology skills

Marriage!

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University

The result …..

A Chartered Building Surveyor

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Pathology

Questions

PATHOLOGY – the study of building “disease”

Examples of building “disease”

- Subsidence
- Dry rot
- Wet rot
- Dampness
- ASR
- Carbonation
- UV degradation
- Sulphate attack
- Cavernous erosion
- Et al – (literally thousands !!!!!!!)

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Pathology – questions

- What is the host material?
- What “disease” is the host material susceptible to?
- What factors are contributing to the “disease”?
- Which precise “disease” is affecting the host?
- What is its extent?
- How long has it been there?
- What is the resultant damage and its extent?
- Has the problem affected its neighbours (and how)?
- Is the “disease” active or inactive?
- Could activity return and what might cause its return?
- Does anything need to be done?
- If so, what and when?

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Maintenance

Questions

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MAINTENANCE - “Disease” prevention and eradication

Re-active – Fire fighting? Panic? Big money?

Pro-active - The clever answer?

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Pro-active Maintenance

“A stitch in time saves nine”?

Pro-active Maintenance

Planned Preventative Maintenance

(Planned Maintenance or Scheduled Maintenance)

Pro-active Maintenance

- Naval origins
- Regular inspection
- Intervals and timing to suit the case (pathology)
- Maintenance programme
- Pay now; save later
- Costs distributed more evenly
- No shocks!
- **But**, ongoing labour requirements and costs associated
- Over cautious approach may cost more
- **Optimum programme defined by pathology**

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B	C	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF
		Planned Preventive Maintenance schedule																				
Activity & Location	**Frequency**	**27-May**	**3-Jun**	**10-Jun**	**17-Jun**	**24-Jun**	**1-Jul**	**8-Jul**	**15-Jul**	**22-Jul**	**29-Jul**	**5-Aug**	**12-Aug**	**19-Aug**	**26-Aug**	**2-Sep**	**9-Sep**	**16-Sep**	**23-Sep**	**30-Sep**	**7-Oct**	**14-Oct**
In House	Week	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Inspection of Lightning Protection System	Y																					
NICEIC Fixing Wiring Inspection & Testing (Satisfactory)	5Y																					
Other																						
Inspect Car Parks	M																					
Inspect gates	M																					
clean food bins	T																					
clean leaves from gutters	T																					
Clean Gulley & drains	T																					
Inspect roofs (Visual)	T																					
Run H & C taps for 1 Minute	T																					
Walk/ test protected alarm areas	T																					
Check locks, catches & bolts	T																					
Test panic buttons	T																					
Inspect roof storage tanks	T																					
Ladder Checks	6M																					
Review Energy Conservation Practices	6M																					
Other Contracts																						
Lift Inspections & Services	M																					
Fire alarm service	3M																					
Air conditioning	3M																					
Boiler service	6M																					

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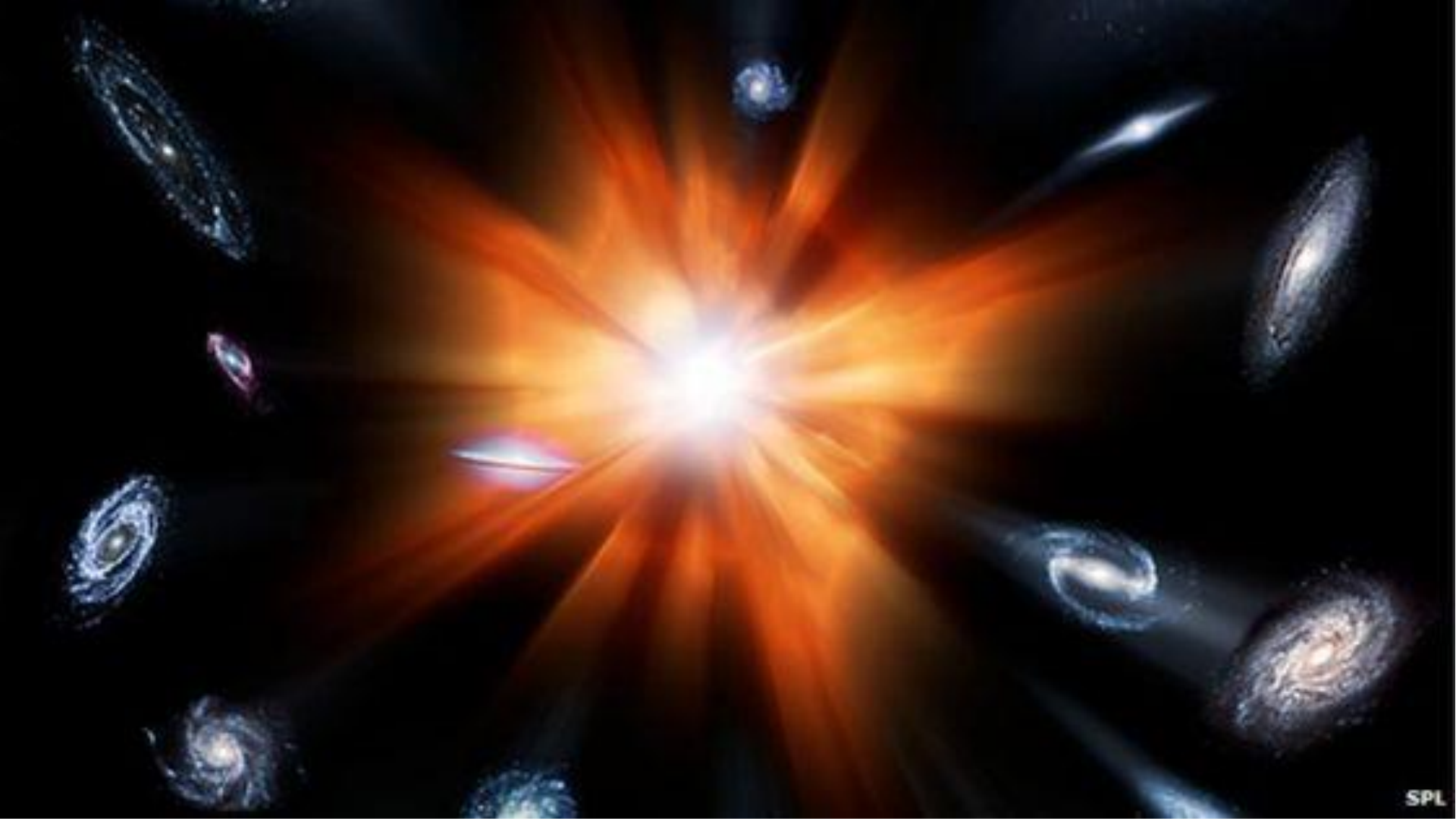
Pathology and maintenance

Starting points … *the Big Bang*



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Surveys …

Integral to maintenance …
Integral to pathology …

Know your buildings …

Asset register

- Age
- Quantity
- Condition
- Where does the building fit in your “plans”?

1.	Retain?	SURVEY
2.	Upgrade?	SURVEY
3.	Dispose?	SURVEY?

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Bute – Council Building

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Rosneath – shop unit

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Helensburgh – Clyde Street School

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Survey types …

- **Stock condition** (multiple) … Collect and record data
- **Condition** (individual) … Collect and record data
- **Measured Survey** … Collect and record data
- **Building Survey** … Collect, record and **analyse** data
- **Bespoke** … Collect, record and **analyse** data

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Horses for courses … (Survey choice)

Pro-active maintenance (PPM)

- Which survey type?
- Asset register & Measured survey (Quantum & typology)
- Stock/Individual Condition survey
- Building (whole) Survey (old and/or complex)
- Bespoke Survey (where a common theme)

Re-active maintenance

- Bespoke survey (identify cause and effect)
- Building Survey (where implications on other parts)

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Horses for courses … (Survey choice)

Pathology

- Which survey type?
    - **Building Surveys** (our focus)
    - **Bespoke surveys**

- Why?
    - Offers detailed examination
    - Opportunity to analyse
    - Facilitates defect pathology

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Building Surveys

- Pre-survey desk studies
- Qualified personnel
- On-site inspection
- Use of onsite sketching and photographs
- The written report

Pre-survey desk studies

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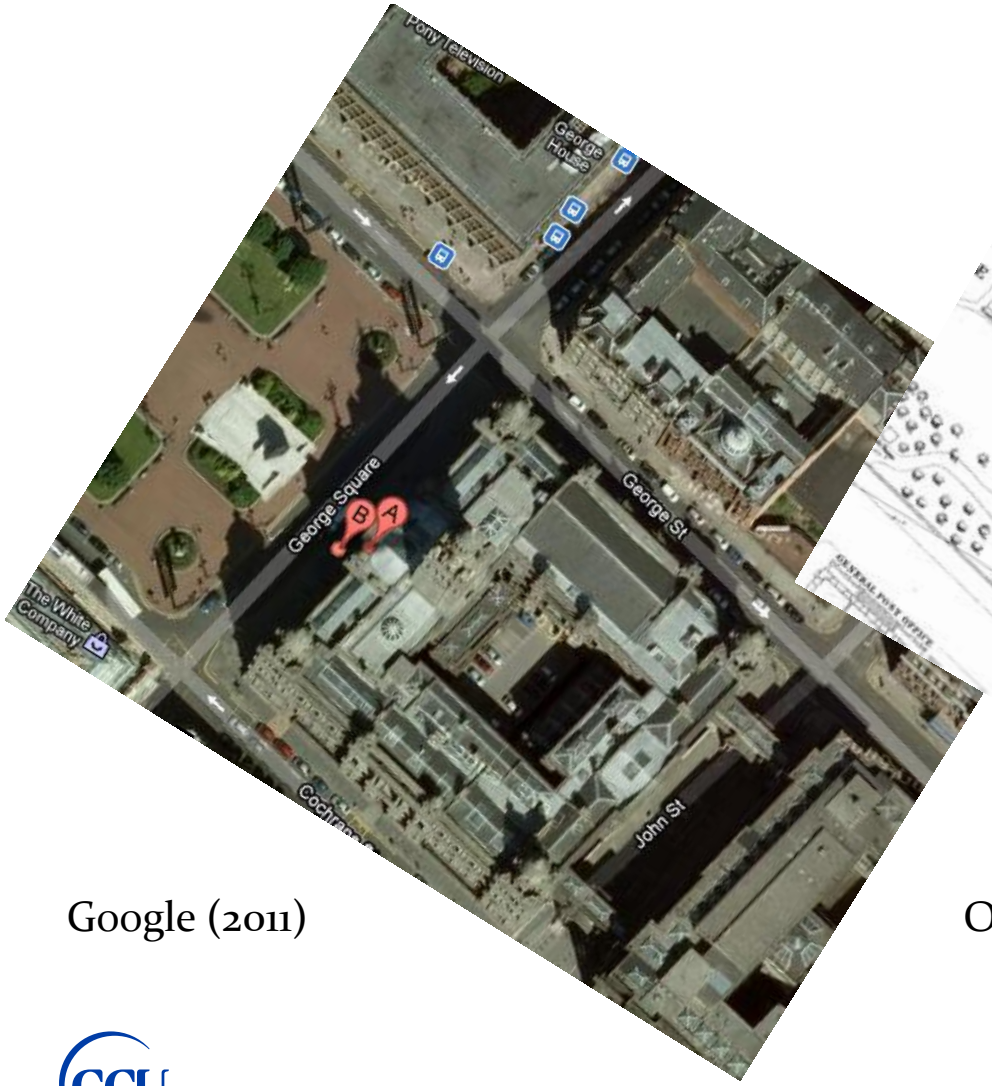
Old maps



Google (2011)

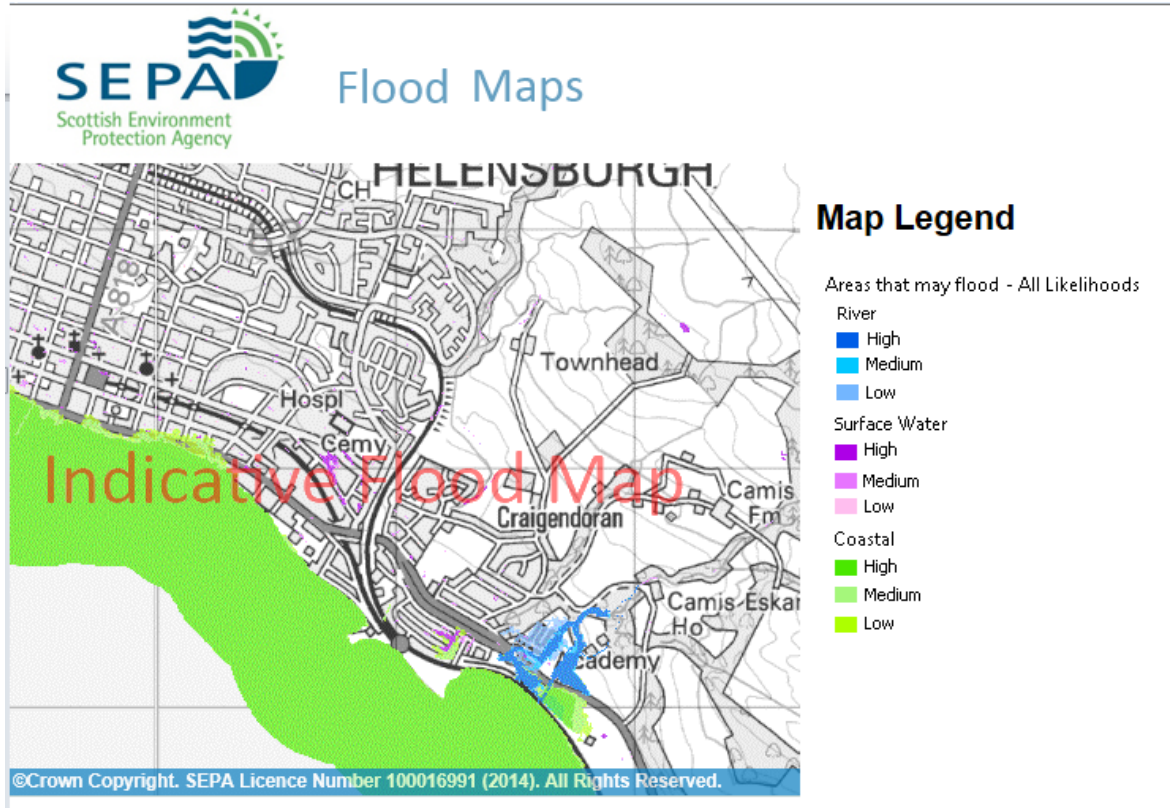
Old-maps (1859)

http://www.old-maps.co.uk/maps.html

Flooding

SEPA

http://map.sepa.org.uk/floodmap/map.htm



SEPA (2014)

Radon

- Naturally occurring radioactive gas
- HPA
- http://www.hps.scot.nhs.uk/
- *Indicative Atlas of Radon in Scotland*
- *HPA-CRCE-023* (2011)
- Radon Action Level – *recommended limit for activity concentration in UK homes*
- 200 Bq/m^3
- Becquerel – measures activity of a radionuclide
- 1 Bq = 1 transformation per second

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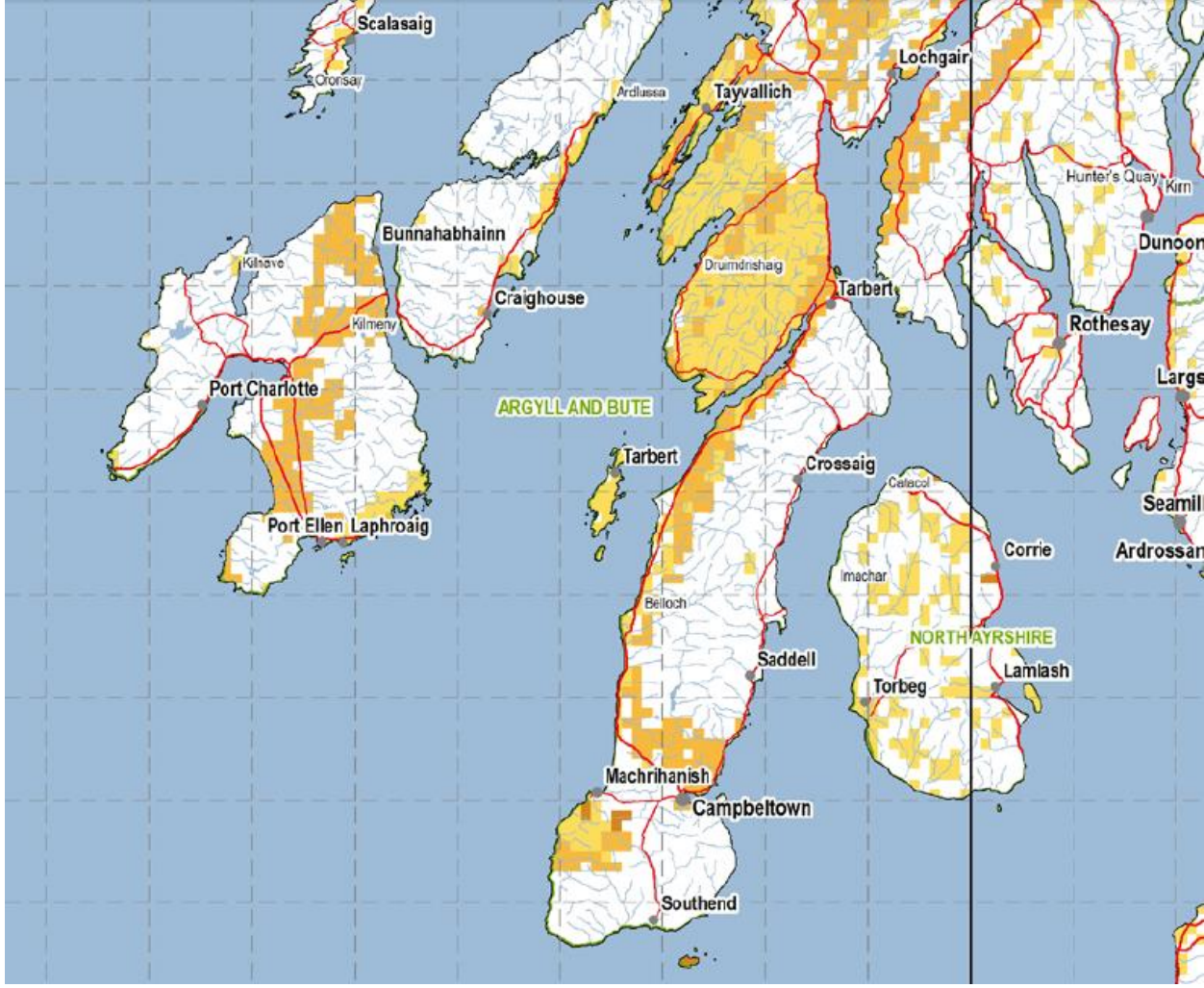
Percentage of homes at or above the Action Level	Radon probability area
0 - 1	Lower
1 - 3	
3 - 5	Intermediate
5 - 10	
10 - 30	Higher
Greater than 30	



HPA (2014)

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Risk and perspective

"People living all their lives at the Action Level run the risk of a few per cent of developing lung cancer. ..... about one in thirty people (3.3%) *exposed for a lifetime at the Action Level would be expected to develop lung cancer."*

HPA (2012)

15-20% of smokers develop lung cancer

Roy Castle Lung Cancer Foundation (2012)

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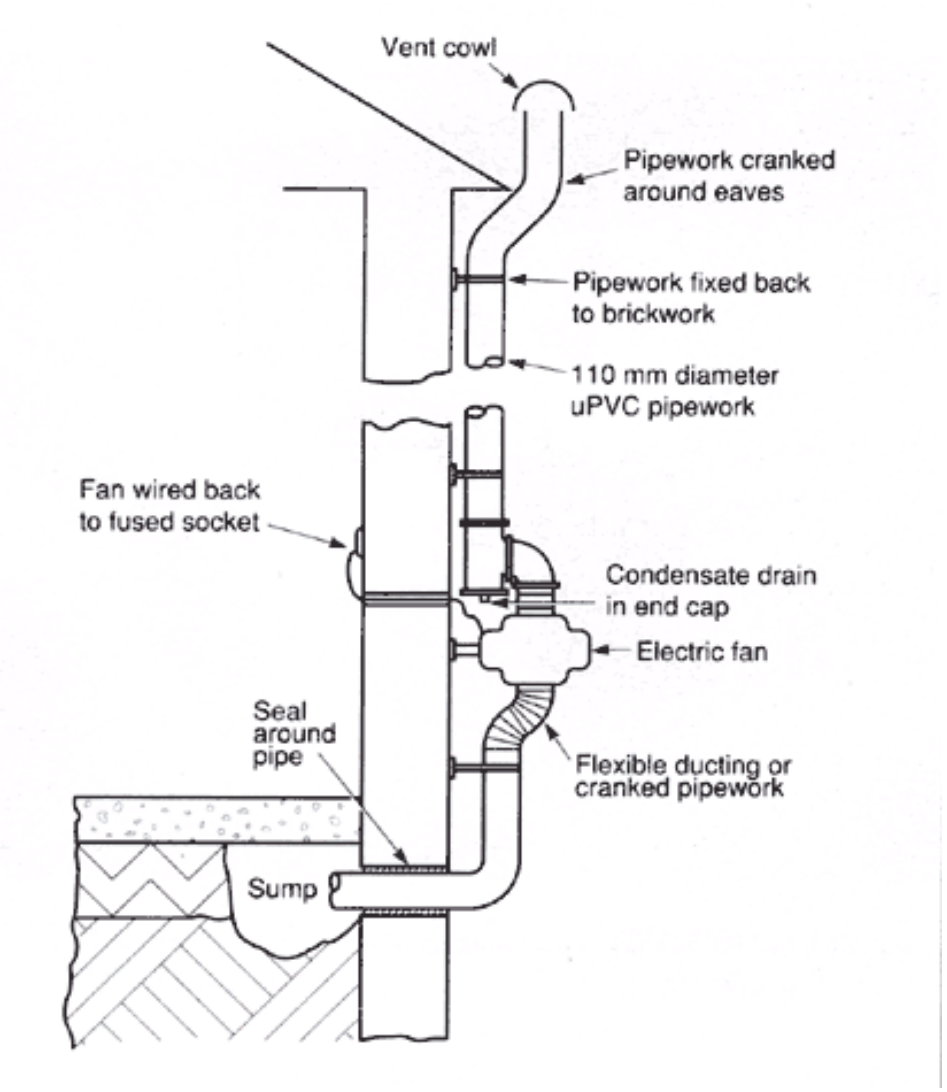
BRE



Radon sump

Mining

The Coal Mining History Resource Centre (Raley's Solicitors – Barnsley, Doncaster, Rotherham Wakefield)

http://www.cmhrc.co.uk/site/maps/scotland/index.html

Scottish Division

British Geological Survey

http://www.bgs.ac.uk/mineralsUK/mines/coal/home.html

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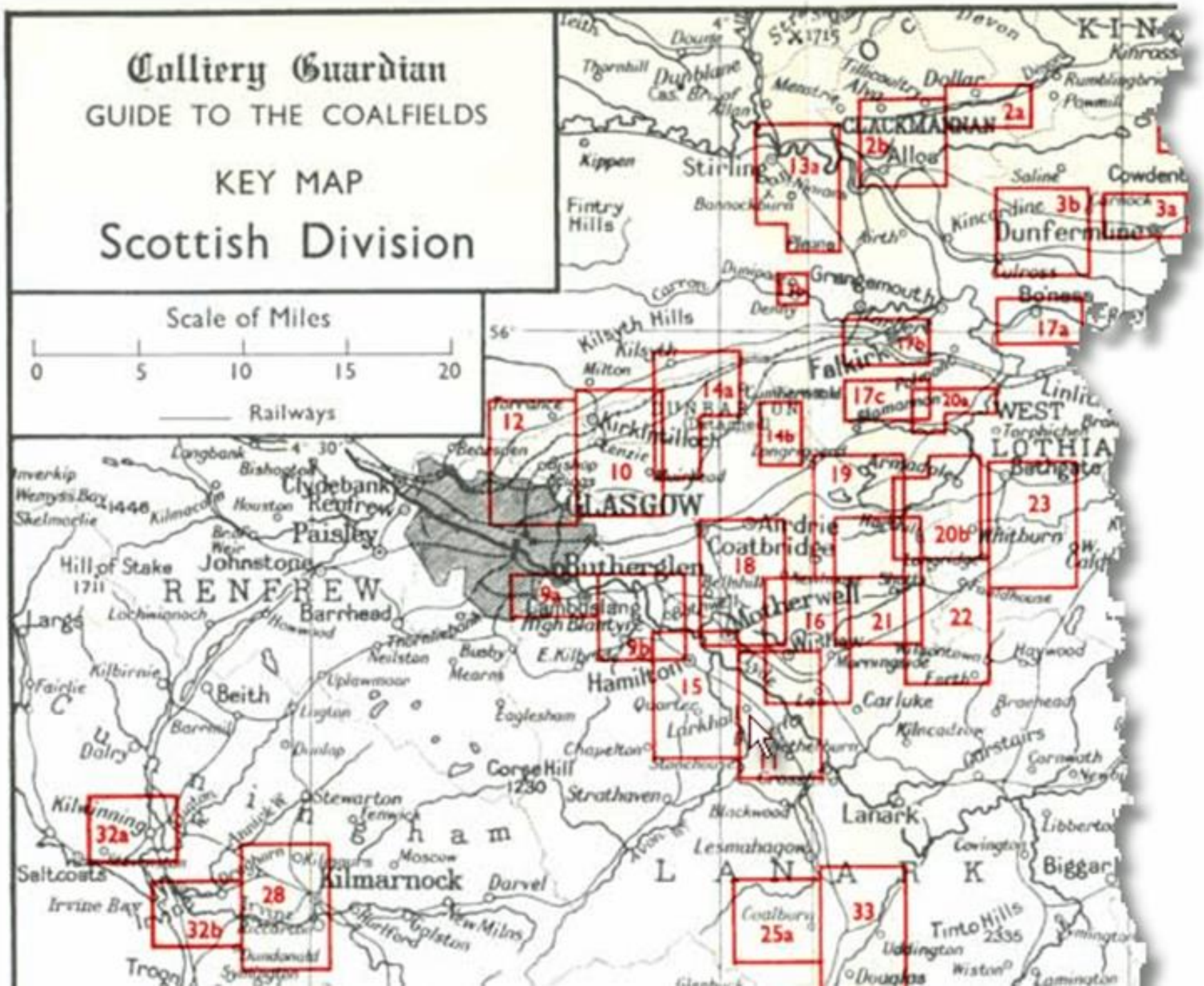
Colliery Guardian
GUIDE TO THE COALFIELDS
KEY MAP
Scottish Division
Scale of Miles
0 5 10 15 20
Railways
GLASGOW
RENFREW
LANARK
LOTHIAN
WEST
Stirling
Falkirk
Alloa
Dunfermline
Kilmarnock
Hamilton
Motherwell
Coatbridge
Airdrie
Whitburn
Bathgate
Lanark
Paisley
Clydebank
Renfrew
Johnstone
Barrhead
Beith
Ayr
Saltcoats
Irvine
Troon
Kilbirnie
Dalry
Stewarton
Darvel
Strathaven
Carluke
Larkhall
Coalburn
Douglas
Biggar
Tinto Hills 2335
Corse Hill 1230
Hill of Stake 1711
Fintry Hills
Kilsyth Hills
Dunblane
Doune
Dollar
Cowdenbeath
Grangemouth
Bonnybridge
Kirkintilloch
Bellshill
Wishaw
Carluke
Lesmahagow
Blackwood
Uddingston
Wiston
Lamington
Tillicoultry
Alva
Menstrie
Kinross
Rumbleton
Powmill
Saline
Kincardine
Culross
Torphichen
Armadale
Whitburn
Bathgate
Linlithgow
Kilsyth
Milton
Lenzie
Bishopbriggs
Bishopton
Langbank
Houston
Kilmacolm
Inverkip
Wemyss Bay
Skelmorlie
Lochwinnoch
Howwood
Neilston
Busby
Mearns
Uplawmoor
Eaglesham
Dunlop
Lugton
Barrmill
Stevenston
Ardrossan
Saltcoats
Irvine Bay
Kilwinning
Dreghorn
Moscow
Darvel
Newmilns
Galston
Hurlford
Kilmarnock
Troon
Chapelton
Strathaven
Blackwood
Lesmahagow
Douglas
Wiston
Lamington
Biggar
Libberton
Covington
Carnwath
Forth
Haywood
Braehead
Kilncadzow
Carstairs
Maryhill
Bishopbriggs
Milngavie
Bearsden
Clydebank
Renfrew
Paisley
Johnstone
Barrhead
Beith
Ayr
Saltcoats
Irvine
Troon
Kilmarnock
Darvel
Stewarton
Strathaven
Carluke
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Lanark
Biggar
Tinto Hills
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Hill of Stake
Fintry Hills
Kilsyth Hills
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Cowdenbeath
Grangemouth
Bonnybridge
Kirkintilloch
Bellshill
Wishaw
Motherwell
Coatbridge
Airdrie
Whitburn
Bathgate
Linlithgow
Falkirk
Stirling
Alloa
Dunfermline
Kilmarnock
Hamilton
Lanark
Paisley
Clydebank
Renfrew
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Barrhead
Beith
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Saltcoats
Irvine
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Grangemouth
Bonnybridge
Kirkintilloch
Bellshill
Wishaw
Motherwell
Coatbridge
Airdrie
Whitburn
Bathgate
Linlithgow
Falkirk
Stirling
Alloa
Dunfermline
Kilmarnock
Hamilton
Lanark
12
10
14a
14b
17a
17b
17c
20a
19
20b
23
18
9a
9b
16
21
22
15
25a
33
28
32a
32b
2a
2b
3a
3b
13a
9b

Scottish Division Map 32

Geology

British Geological Survey

http://mapapps.bgs.ac.uk/geologyofbritain/home.html

Maps of superficial deposits (“Drift Maps”) and “solid”

Geology of Britain viewer

More BGS map viewers

Go to Location

Switch Basemap

100% 0%

Geology Transparency

Grid Ref: 0, 0

North Sea

Dundee

Glasgow

Edinburgh

ULSTER

IRELAND

LEINSTER

Dublin

Liverpool

Manchester

Sheffield

Birmingham

Cardiff

London

Bruges

Dunkirk

Go to Location

Enter location as place name, postcode or grid reference e.g. 520000,180000

Helensburgh

Search for Location

DENMARK

Arhus

Copenhagen

Odense

Kiel

SCHLESWIG-HOLSTEIN

Schwerin

Bremerhaven

Hamburg

Bremen

Groningen

NETHERLANDS

NIEDERSACHSEN

Haarlem

Amsterdam

The Hague

Utrecht

Arnhem

Rotterdam

Hannover

Potsdam

Magdeburg

NORDRHEIN-WESTFALEN

Duisburg

Dortmund

Dusseldorf

Essen

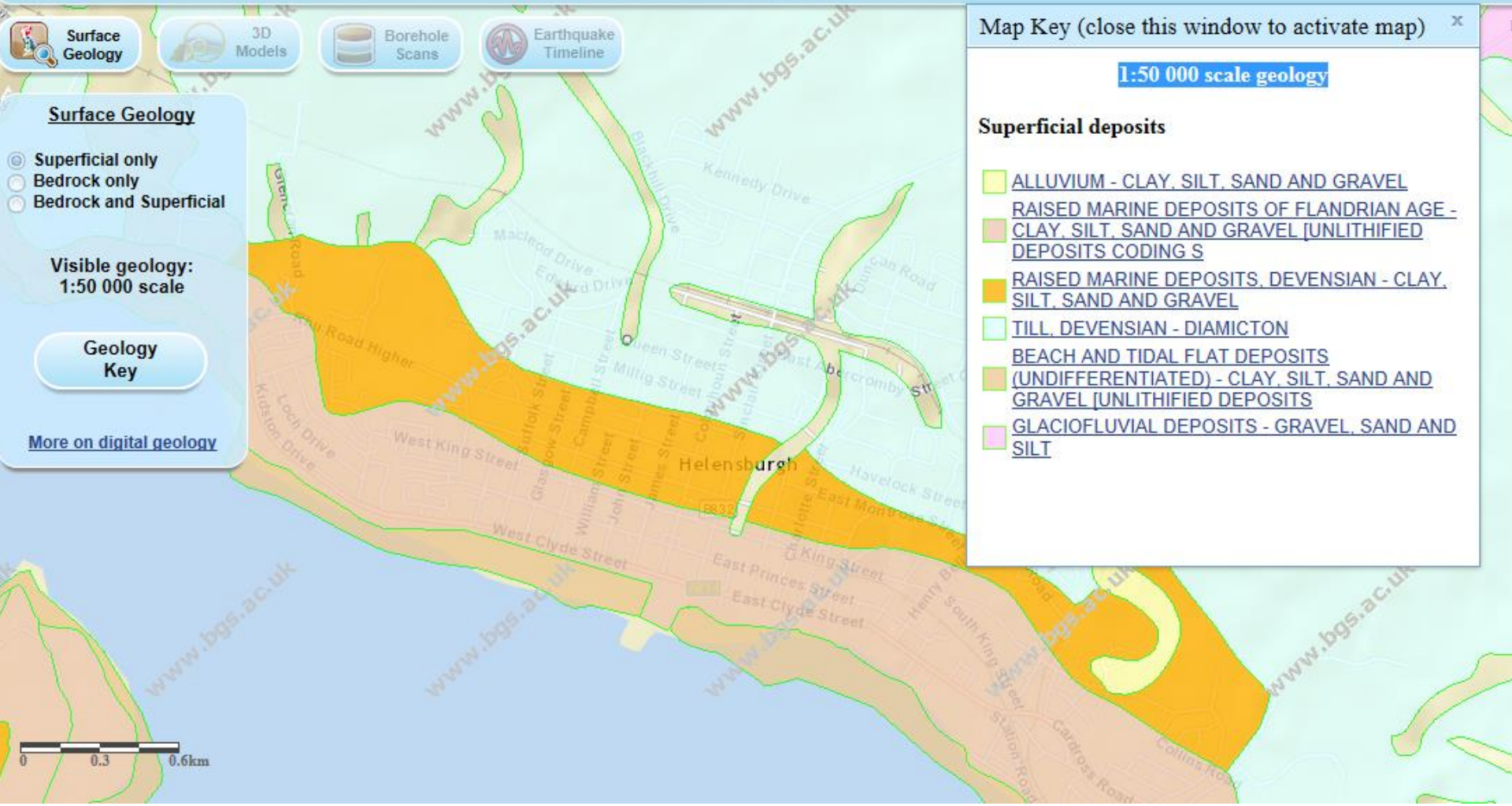
SACHSEN-ANHALT

GERMANY

Erfurt

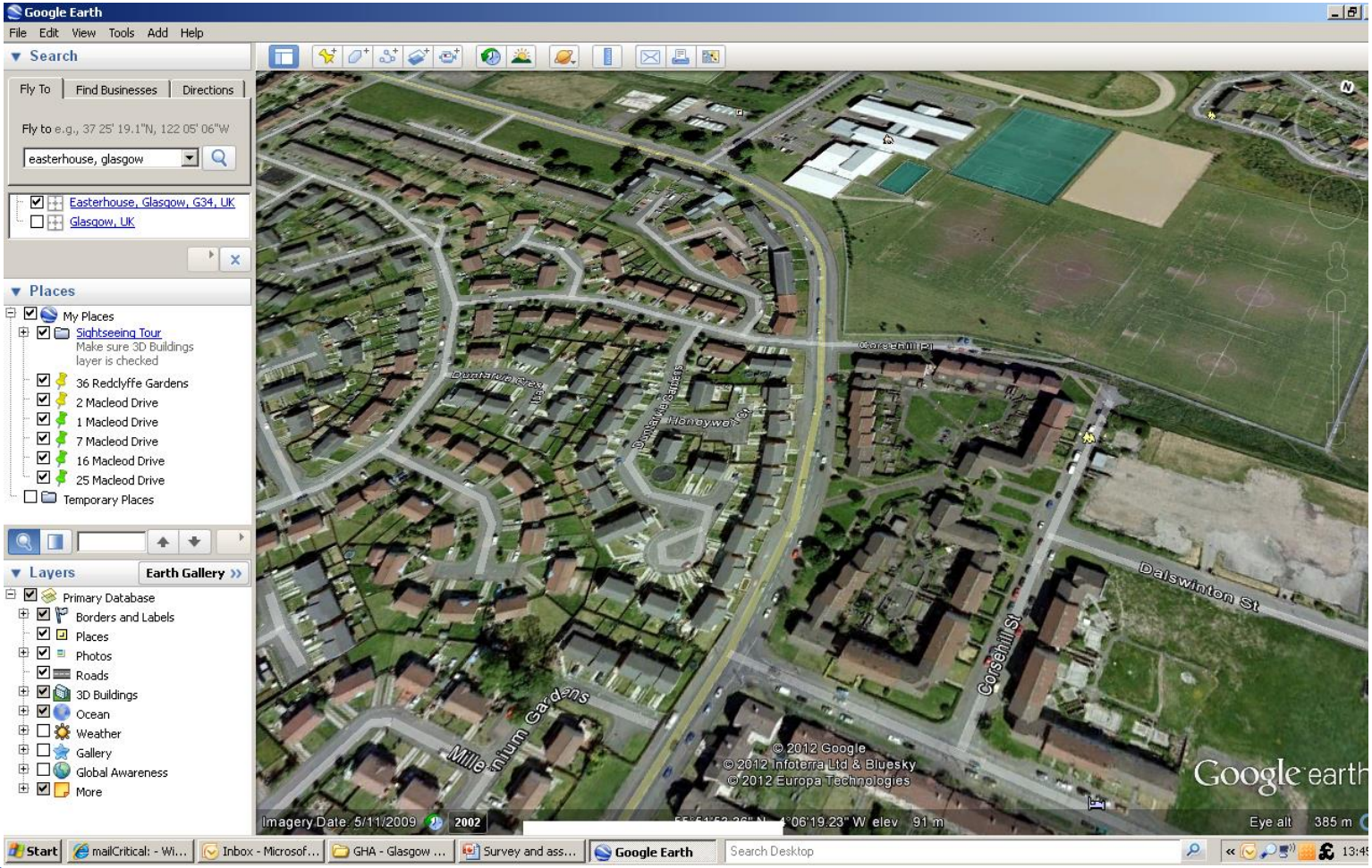
esri

Geology of Britain viewer



(BGS, 2016)

Google Earth



“Streetview” – Duntarvie Road, Easterhouse

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Qualified personnel

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Chartered Building Surveyors (RICS)

Experts in pathology (and technology) for whole building

Others may have speciality in certain areas

- Structural engineers (MIStrucE; ICE)
- Building Services engineers (CIBSE; MIMechE; MIEE; etc)

Others may have developed skills

- Chartered Surveyors (RICS GP division)
- Chartered Architects (RIBA; RIAS)
- Those with other technical background

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RICS governance and professional standards

Example (from Guidance Notes)

Surveyors are not required to follow the advice and recommendations contained in this guidance note. They should, however, note the following.

When an allegation of professional negligence is made .... the court is likely to take account of the contents of any relevant guidance notes published by RICS in deciding whether or not the surveyor has acted with reasonable competence.

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“Follow the trail of suspicion ...”

Roberts and another v J Hampson and Co

- Queens Bench Division 1988
- Mr Justice Ian Kennedy HELD that .... *He* (Hampson) *did not test the wood blocks of the floor and appeared to have ceased to follow the “trail of suspicion” in the skirtings because of the intervention of a piece of furniture ….*

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On-site inspection

- Talk to the occupier and/or owner
- Equipment
- Field sheets
- Note taking
- Sketches
- Photographs


BUSHNELL


Canon
EOS


FLIR SYSTEMS
B CAM SD


PROTIMETER
SURVEYMASTER


90° Tip


STANLEY 100 PLUS


C.K


STABILA


STANLEY
FatMax
BladeArmor
25'


NOKIA

Field sheets

- Prescriptive
- Non-prescriptive
- Semi-prescriptive

BUILDING SURVEY FIELD SHEETS

Surveyor:

Job No:

Have signed T & C been returned:

Details of others present during the inspection:

Vendor Enquiry Form completed and returned:

- *Use reverse of sheets, or insert blank sheets if additional "white space" is required*
- *Company and RICS safety policy to be adhered to at all times*

1. INTRODUCTION

1.01 Scope of Instructions:

1.02 Address of Property:

1.03 Client's Name and Details:

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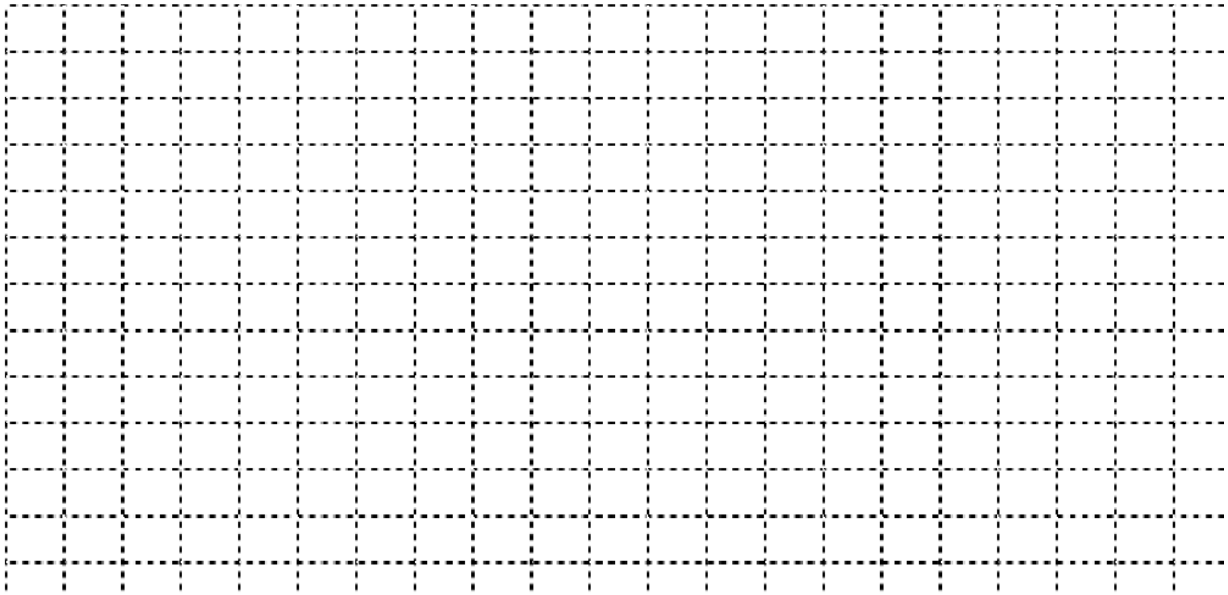
Sketching

SKETCH PLANS (external including building and site size)

External show:

- *Boundary, trees and large shrubs/hedges, manhole covers/septic tank/cess pit, paths,*
  pools, garages, conservatories, outbuildings, dimensions, slopes, retaining walls, etc.



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Detailed notes

Prompts

5.03 Main Roof

5.03.01 Structure *(Note: Collect other data whilst in void and transfer to appı*

- Unseen areas
- Accessibility
- Frame design
- Frame condition (shakes, joint separation, etc)
- Water penetration - general/ below valleys/ parapets
- Wood boring beetle
- Fungal decay
- Lining-type/ condition
- Torching/ nibs/ undersides of slates or tiles/ nail corrosion
- Daylight
- Alterations/ roof timbers/ upper floor walls removed
- Condensation
- Excessive loading
- Roof thrust
- Sagging timbers/ ineffective previous repairs
- Bracing/ straps
- Chimney breasts
- Party walls/ fire walls/ lack of
- Gable walls
- Birds/ bats/ vermin/ insects
- Asbestos
- Plumbing (see Section 6.03 and 6.05)
- Electrics (See Section 6.01)

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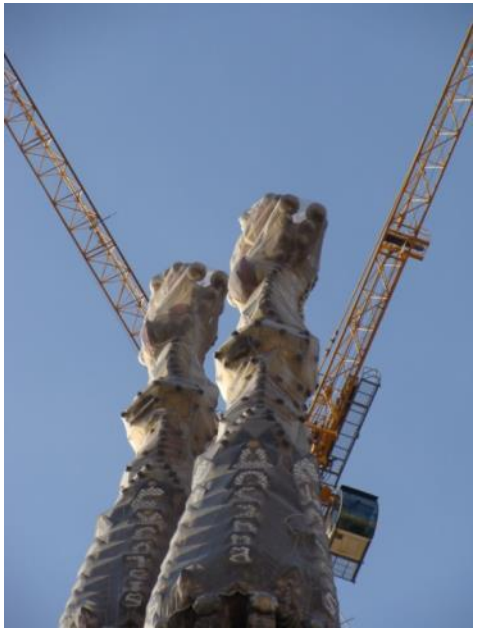
Photographs



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Pathology application

- Case studies
- A look at structural analysis

Case study 1

5.05 Chimneys

- Unseen areas
- Sole/shared use
- Damp proof course
- Height
- Access
- Lean
- Sulphate attack
- Bulge
- Brickwork
- Stonework
- Rendering
- Pointing
- Aerials/Satellite dish
- Chimney pots/sealed openings/vents/number
- Flaunching
- Flashings/soakers
- Flue terminals (boilers, fires etc)


SA54 KHO

Squat stacks *… height less than 4.5 times the width … only leaning slightly … limited mortar deterioration, … be repaired by repointing. If … loose or crumbling bricks, the stack should be dismantled to a point where it is stable and then rebuilt.*

Slender chimneys *… height more than 4.5 times width … leaning or showing signs of condensation damage … dismantled and rebuilt completely. … possible to rebuild them with a reduced height, provided their appearance is acceptable and no risk of smoking problems due to down-draughts*

(BRE GRG 15)

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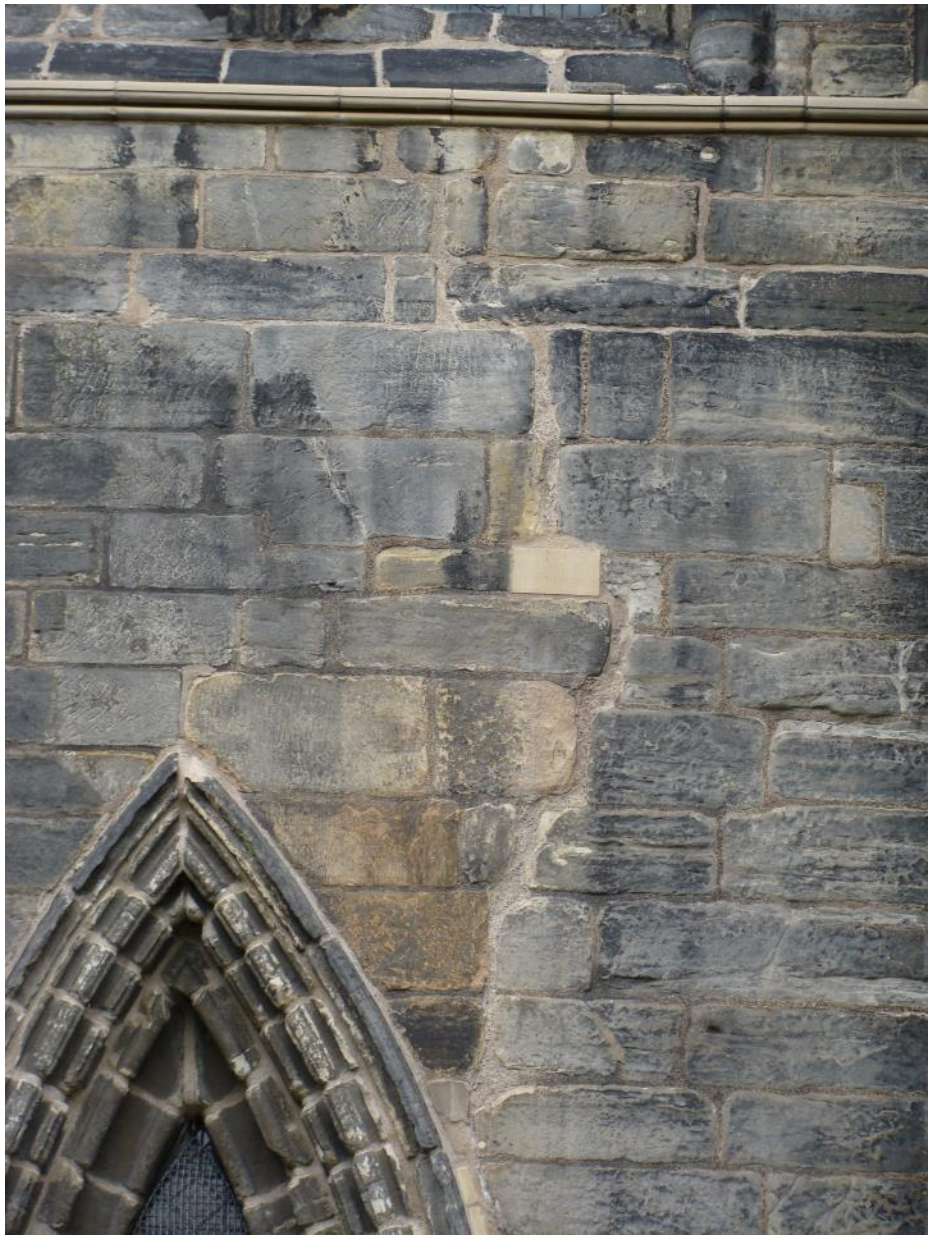
Case study 2



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Structural Analysis – a pathological approach

Influencing factors - considerations

Distortion surveys

Analysis and pathology

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Geology and hydrology

- Superficial deposits or bedrock?
- Cohesive or non-cohesive?
- Mining?
- Peat?
- Water table or groundwater level?

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Cracking

- Subsidence or something else?
- How can we diagnose; former or latter?
- If former, anything to indicate passive or active?
- Size
- Orientation
- Coincident with distortion (or not)

Bond?

Crack width?

Age?

Associated distortion?

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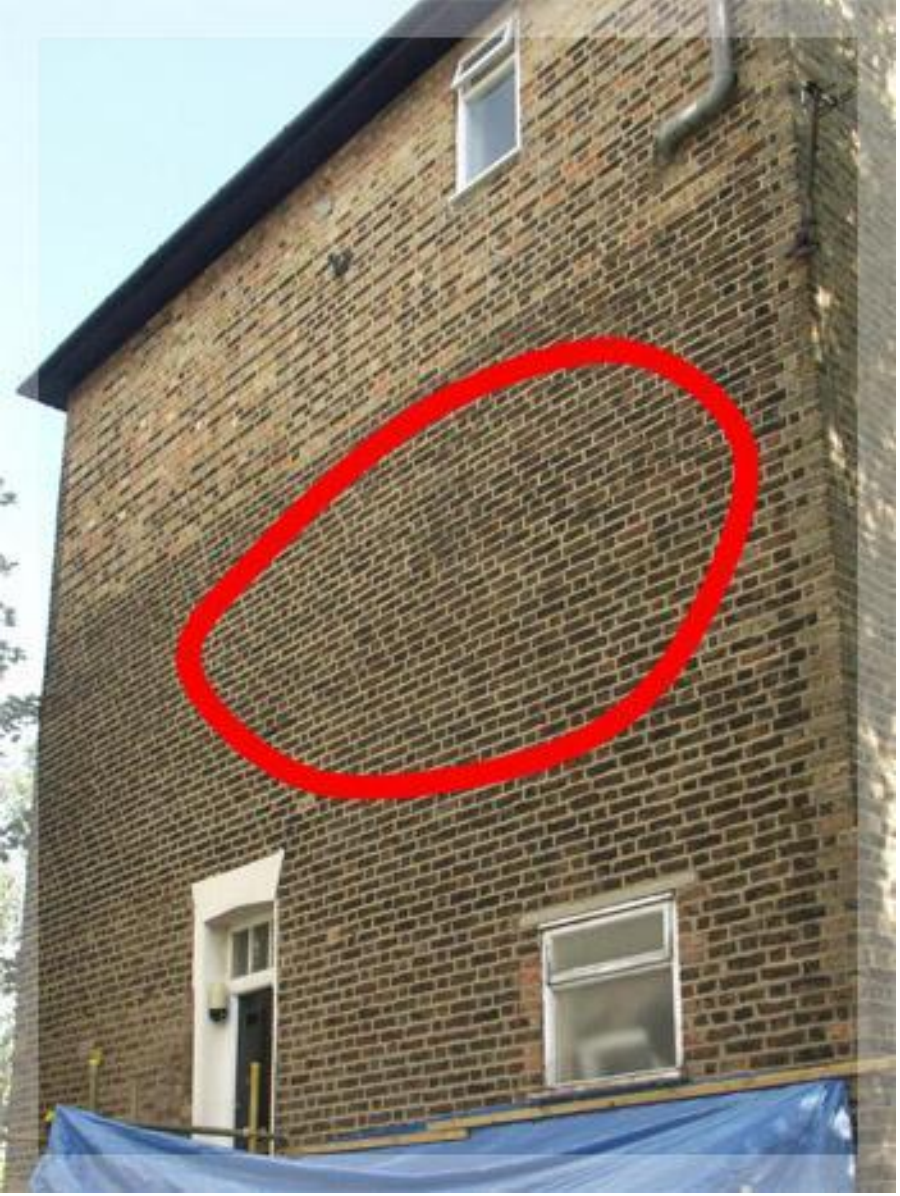
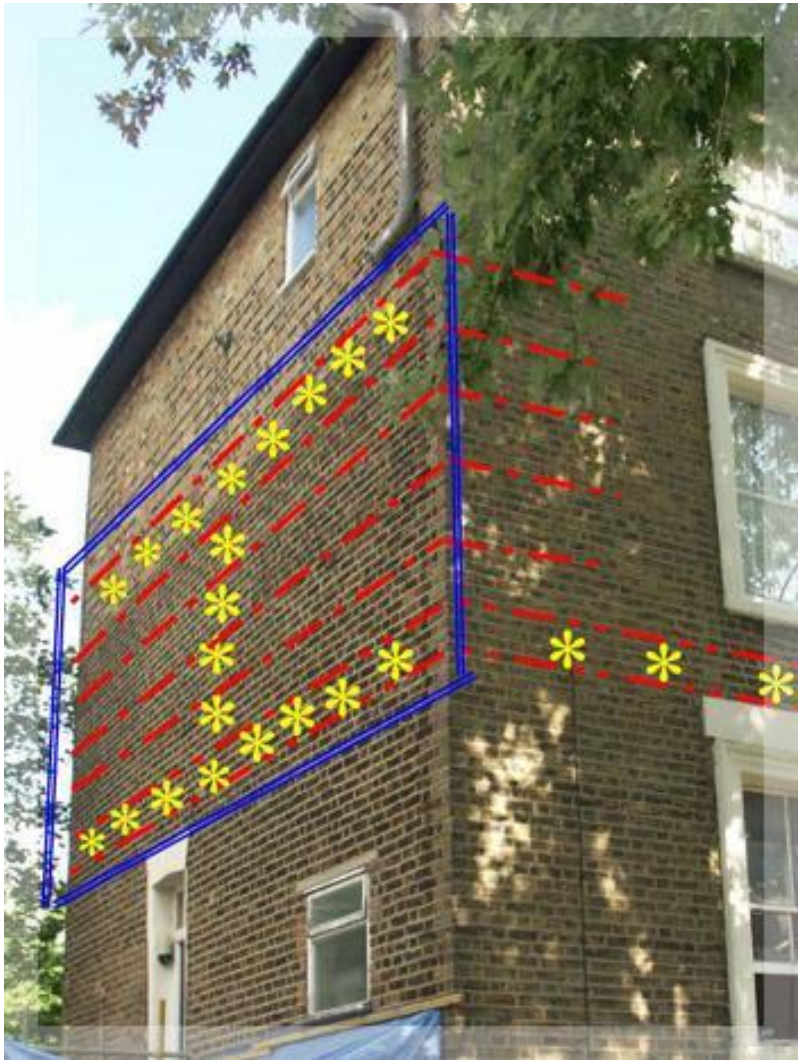
Distortion

- Vertical and horizontal plane
- Location - Ground level; wall head; intermediate
- Distortion survey



- Bed joint reinforcement (red)
- Lateral restraint strapping (yellow)
- Wall ties (blue)



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Action Wall Ties, (2012)

Drains

- Age?
- Type?
- Modes of failure?
- Associated ground and vegetation?

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Vegetation

- Trees
- Large shrubs
- Type; age; size now; size when mature; proximity
- Associated ground
- Proximity of drains

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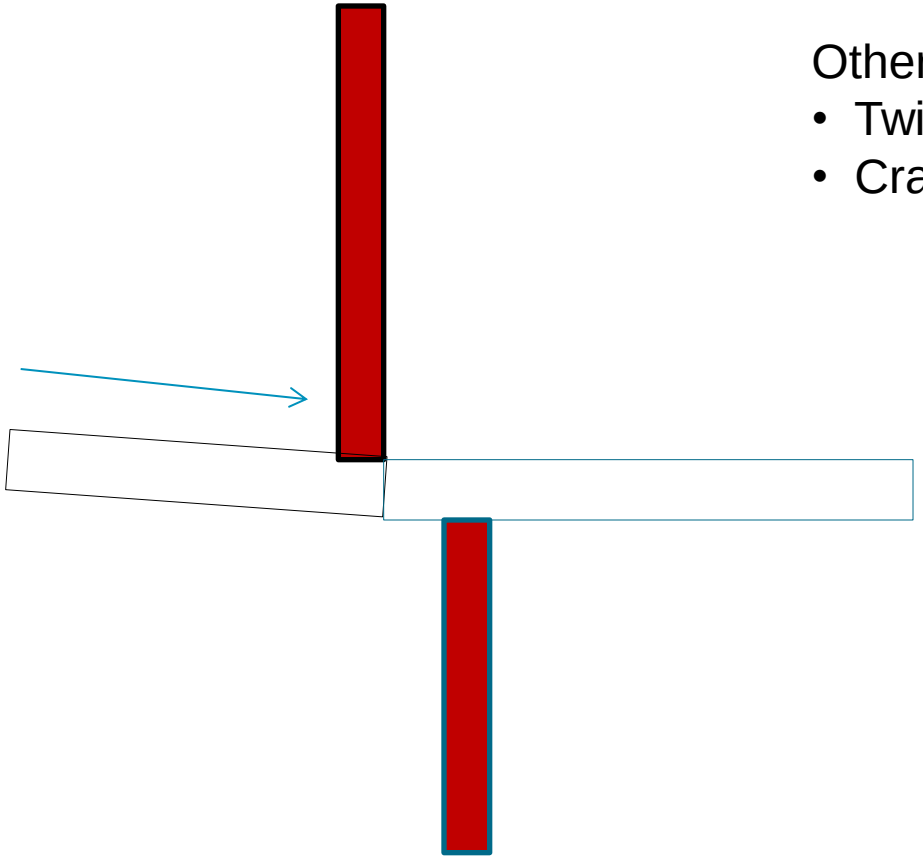
Construction

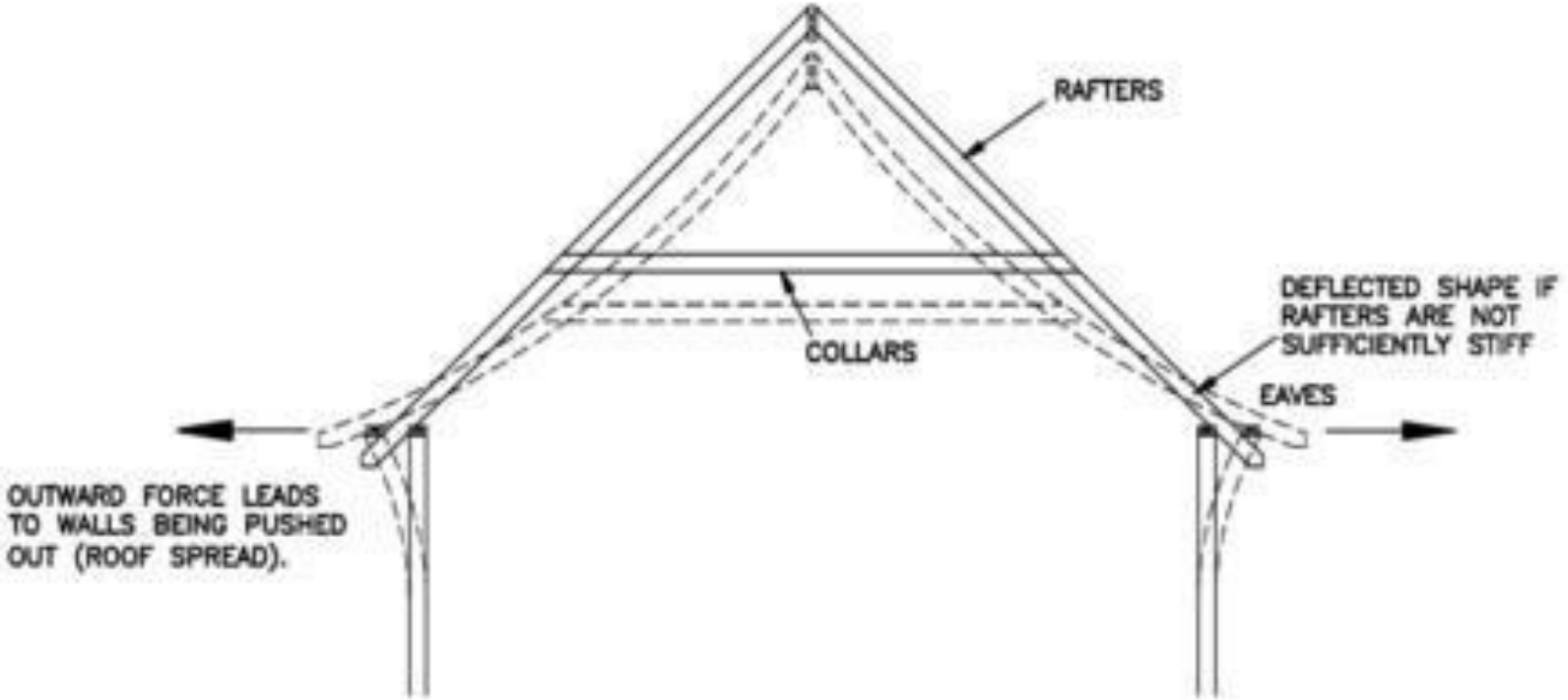
- Load distribution via foundation
- Soil bearing capacity
- Flexible
- Rigid
- Load paths
- Cavity or solid
- Lateral restraint

Eccentric partition loads



Other signs:

- Twisted door heads
- Cracking?



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Thank you – any questions?

james.castle@gcu.ac.uk