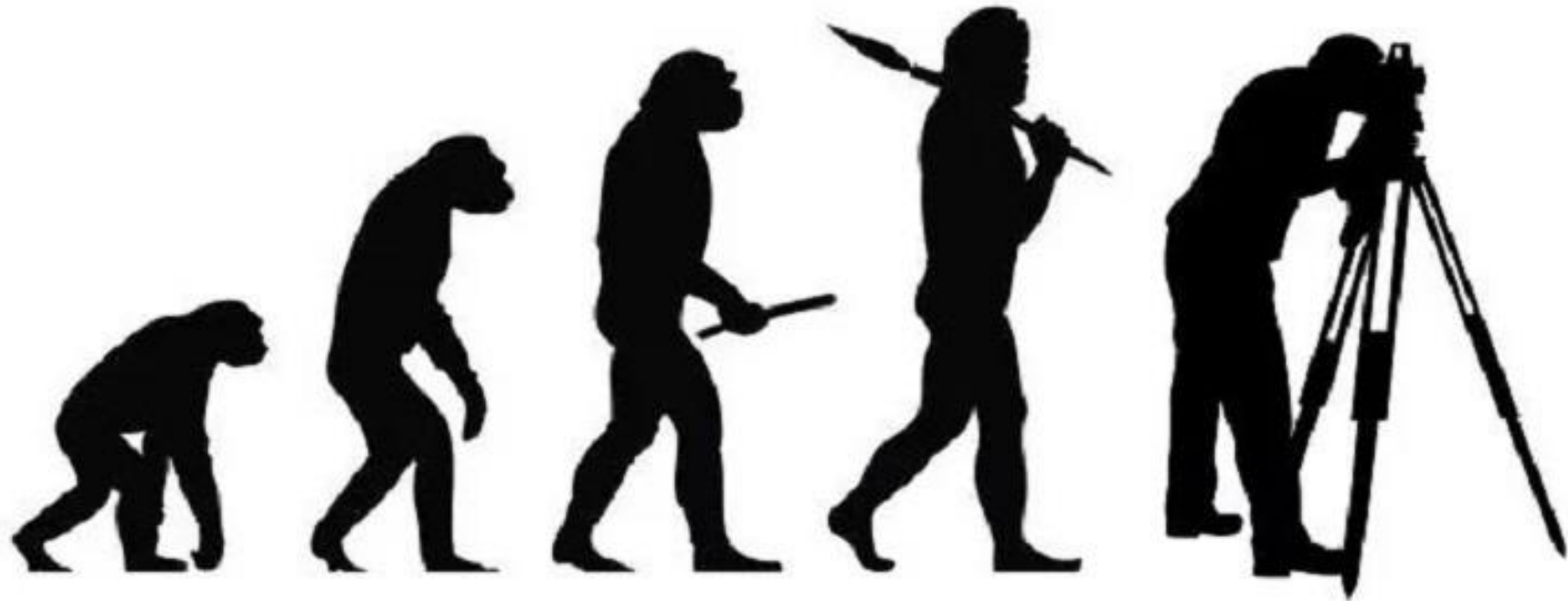


Lecture 4: Digital Surveying



<https://www.satpalda.com/blogs/evolution-in-surveying-techniques>



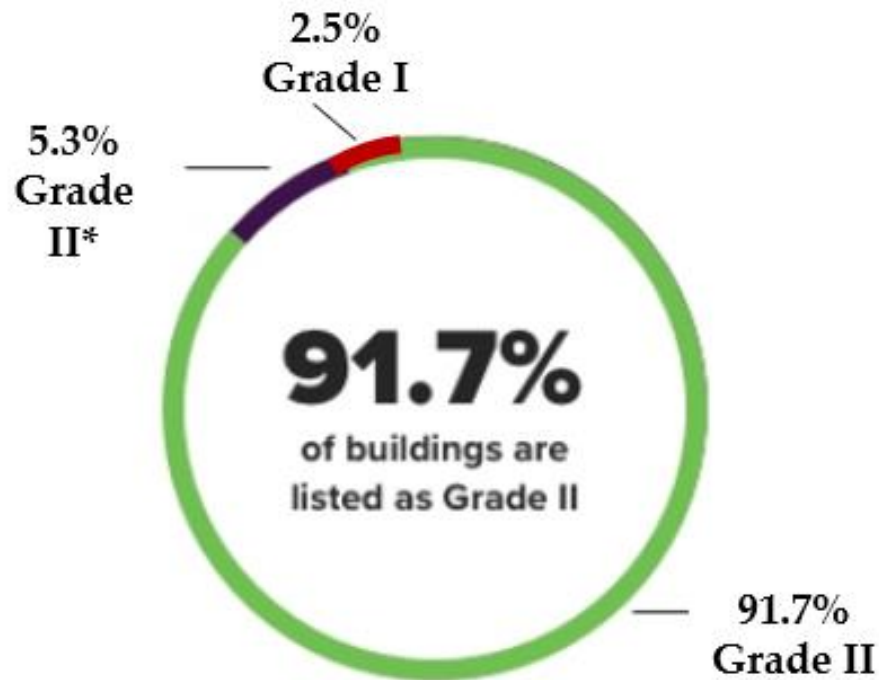


Survey of Listed Building

The Palace Theatre, Swansea

Listed Building Survey

Definition: survey of older buildings, some of which are of such historical or architectural importance that they're listed and therefore maintain a certain level of protection.



Classification (by Historic England)

Reason for building survey

Detailed building plan/elevation

As-existing conditions

Retrofit/renovation plan

Fulfilment of building legislation

Listed Buildings in Wales

By Administrative County

- Blaenau Gwent (53 buildings)
- Bridgend (375 buildings)
- Caerphilly (378 buildings)
- Cardiff (862 buildings)
- Carmarthenshire (1,850 buildings)
- Ceredigion (1,897 buildings)
- Conwy (1,744 buildings)
- Denbighshire (1,813 buildings)
- Flintshire (1,027 buildings)
- Gwynedd (4,168 buildings)
- Isle of Anglesey (1,123 buildings)
- Merthyr Tydfil (234 buildings)
- Monmouthshire (2,426 buildings)
- Neath Port Talbot (397 buildings)
- Newport (437 buildings)
- Pembrokeshire (2,876 buildings)
- Powys (5,487 buildings)
- Rhondda, Cynon, Taff (371 buildings)
- Swansea (521 buildings)
- Torfaen (259 buildings)
- Vale of Glamorgan (739 buildings)
- Wrexham (1,051 buildings)

Source: <https://britishlistedbuildings.co.uk/wales#.YCe-rzJxdPY>

Listed Buildings in Swansea

- Birchgrove (2 buildings)
- Bishopston (8 buildings)
- Bonymaen (6 buildings)
- Castle (125 buildings)
- Clydach (10 buildings)
- Cockett (3 buildings)
- Cwmbwrla (7 buildings)
- Dunvant (1 buildings)
- Gorseinon (3 buildings)
- Gowerton (3 buildings)
- Grovesend and Waungron (1 buildings)
- Ilston (18 buildings)
- Killay (5 buildings)
- Landore (25 buildings)
- Llangennith, Llanmadoc and Cheriton (21 buildings)
- Llangyfelach (7 buildings)
- Llanrhidian Higher (5 buildings)
- Llanrhidian Lower (7 buildings)
- Llansamlet (10 buildings)
- Llchwyr (8 buildings)
- Mawr (8 buildings)
- Morriston (10 buildings)
- Mumbles (39 buildings)
- Mynyddbach (1 buildings)
- Penderry (1 buildings)
- Penllergaer (5 buildings)
- Pennard (12 buildings)
- Penrice (22 buildings)
- Pontardulais (5 buildings)
- Pontlliw and Tircoed (6 buildings)
- Port Eynon (6 buildings)
- Reynoldston (5 buildings)
- Rhossili (7 buildings)
- Sketty (22 buildings)
- St. Thomas (7 buildings)
- Three Crosses (5 buildings)
- Uplands (84 buildings)
- Upper Killay (1 buildings)

Source: <https://britishlistedbuildings.co.uk/wales#.YCe-rzJxdPY>

Listed Buildings in Swansea



*All Saints Church, Queens Road, Ryde
Condition: Satisfactory Repair*



Vivian Engine House, Yorkshire Imperial Metal Works - condition: Extreme Risk



Canteen building (Power House), Yorkshire Imperial Metal Works - condition: Extreme Risk



Morfa Bridge (also known as the Bascule Bridge), Normandy Road, Bonymaen - condition: Extreme Risk



Survey of Listed Building: Tools and Process

Tools: The Basics

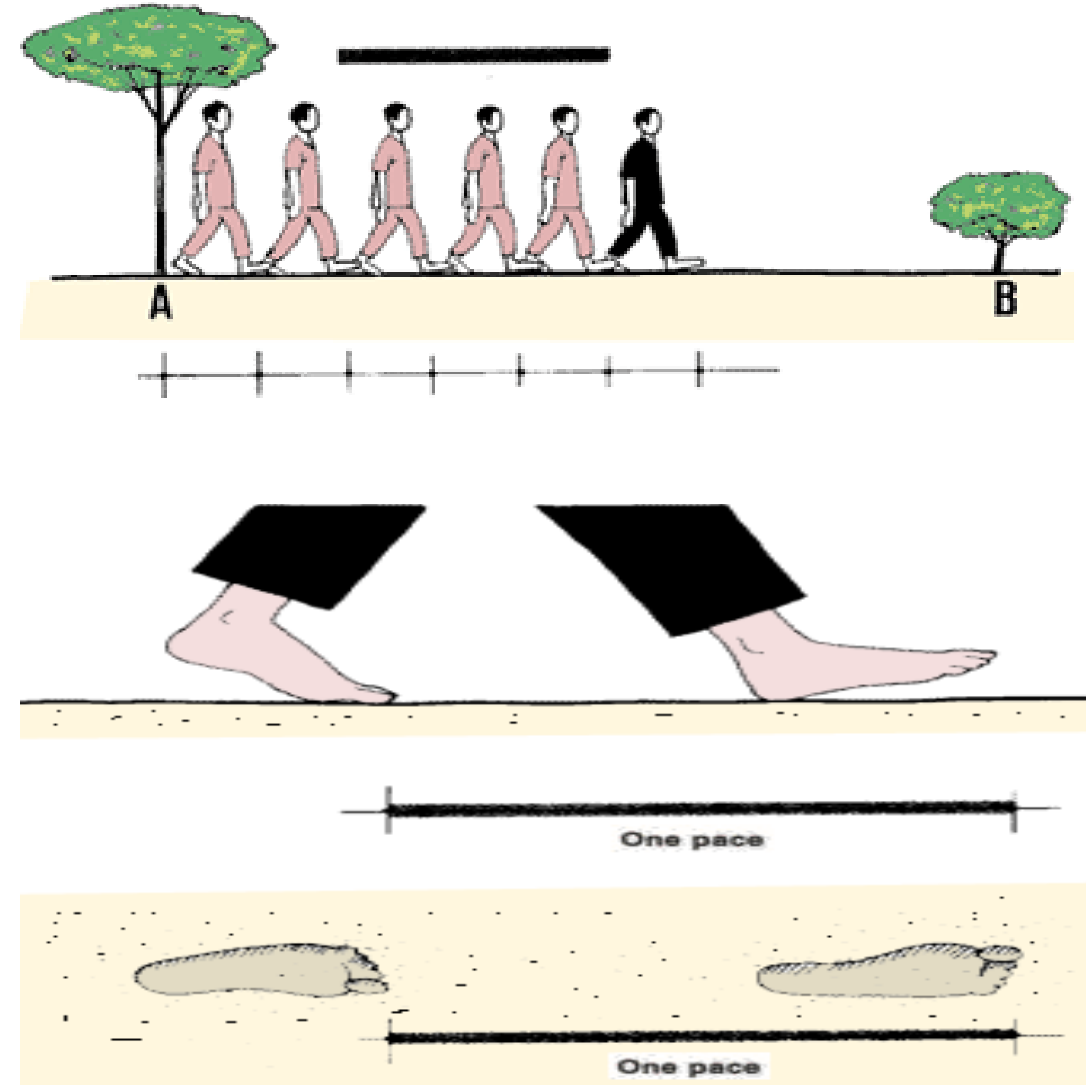


Building Surveying: Linear Measurement - Pacing

Pacing: The ability to pace distance is very useful

A person can determine their pace by counting the number of paces necessary to walk a distance that has been previously measured. The natural pace of each individual normally varies from 700 – 950mm.

- A pace is defined as one step
- A stride is consider two steps



Building Surveying: Linear Measurement

Surveying tapes are available in lengths up to 100m, but a 30m tape is the most common length in use. Two types of tapes are commonly used:

Steel Tapes

- All steel tapes are manufactured so that they measure their normal length at a specific temperature and under a certain pull, which is generally 20°C and 50N.
- With care it is possible to take measurements using a steel tape with an accuracy of 1 in 10,000 (or 3mm for a 30m distance)

Fibreglass Tapes

- Fibreglass tapes are manufactured from fibreglass strands embedded in PVC.
- Compared to steel tapes they are lighter, more flexible and less likely to break.
- They are also rust free.
- They stretch more when pulled
- The accuracy of a fibreglass tape is lower at 1 in 1000 (i.e. a precision of 30mm in a 30m length).

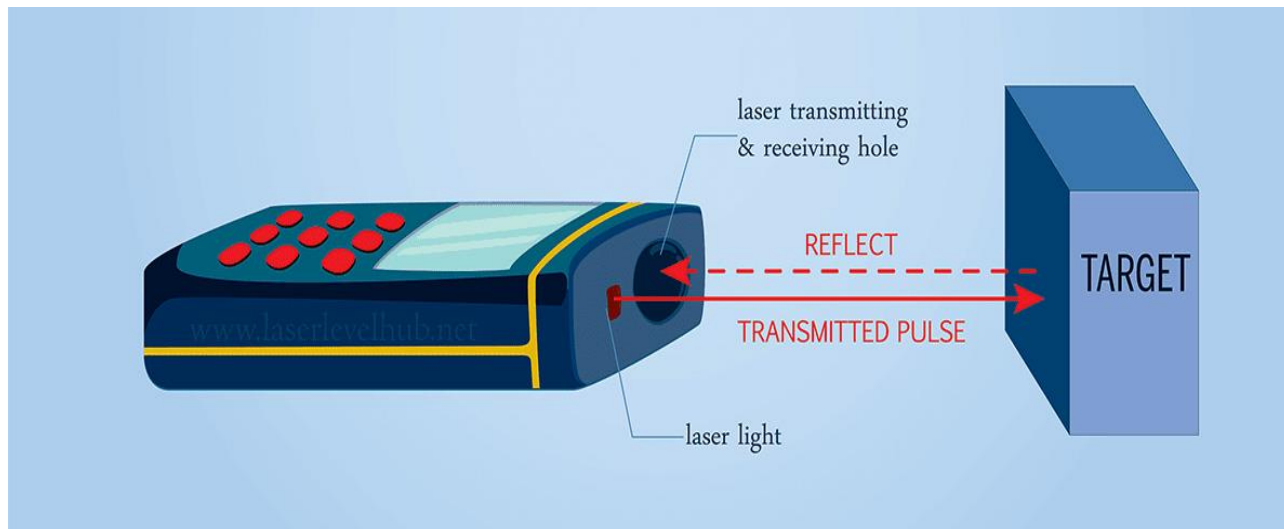


Building Surveying: Linear Measurement

Disto / Laser measuring

Typically used in building surveys. Hand held disto equipment use laser beam. Modern versions can calculate room areas, volumes and angled slopes.

- Accuracy = $\pm 3\text{mm}$; Range = 200m; Single Operator; useful when
- not possible to use inaccessible heights/points etc
- Errors: requires baseline calibration; errors due to weather
- Safety: Lasers must NOT be pointed in the eye



Building Surveying: Other Linear Measurement



Measuring Wheels and Rods can be used to supplement other equipment.

Building Surveying: Other Measurement

In Building Surveying you will also be looking at other factors especially when assessing existing buildings.

Thermal Camera

Thermal bridging / heat loss detecting areas of poor detailing, damage or construction defects.

Moisture Meter / Protimeter

Areas of damp / water ingress detecting both moisture (damp) and humidity levels.



Building Surveying: Measurement where Access is Limited



Telescopic inspection camera: mounted at the top of featherweight with telescopic, self locking pole. It is perfect for taking pictures and videos of **roofs, gutters**.



Optical distance measurement: for geometric survey to measure distance to produce building **plan and drawings**.



Protimeter survey master: this will be used to check **wall dampness** within the building.

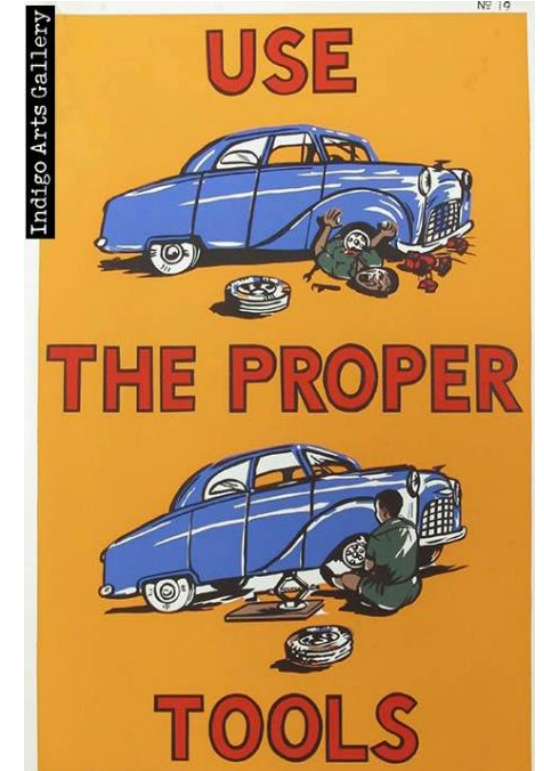


Digital camera: high quality digital camera will be used to ensure small details are captured for the **technical report**.

What are the Importance of Correct Use of Equipment in Building Survey?

This will ensure;

- That the equipment is suitable for the intended use
(e.g. limited access within building)
- Safety of the personnel
- Capturing of adequate information
- No missing data (internal data storage)
- Systematic and instrumental error are minimised
- Full and informed decision is made on the next stage
(i.e. restoration or conservation)



Building Surveying - Process

- Planning: Research, analysis, and decision making.
- Field work: Data acquisition, site measurement and observation
- Computing: Data processing and calculation
- Mapping: Data representation, sketches and drawing
- Report

PLANNING

Research, analysis, and decision making.

What Existing Information is Available ?

- As built drawings
- Building File / O&M Manuals
- Original Property deeds
- Previous planning applications / building regulation work
- Fire plans
- Asbestos register plans
- OS Data / Historic Maps / Topography



Assess the Risk

Health and safety at work: criminal and civil law

1. Overview
2. [Health and Safety at Work Act](#)
3. [Criminal and civil law](#)

1. Overview

There are 2 parts to the law – civil and criminal. They're not the same.

As an employer, you must protect your workers and others from getting hurt or ill through work.

If you don't:

- a regulator such as the Health and Safety Executive or local authority may take action against you under [criminal law](#)
- the person affected may make a claim for compensation against you under [civil law](#)

Neither the Health and Safety Executive nor local authorities enforce civil law or set the rules for the conduct of civil cases.

<http://www.hse.gov.uk>

2. The Health and Safety at Work Act

The Health and Safety at Work etc Act 1974 is the main legislation covering occupational health and safety in Great Britain.

It's sometimes called HSWA, the HSW Act, the 1974 Act or HASAWA.

You can read the act in full on the [legislation.gov.uk](https://www.legislation.gov.uk) website

The objectives of the act include:

- securing the health, safety and welfare of people at work
- protecting others against risks to health or safety relating to the activities of people at work
- controlling the keeping and use of dangerous substances

Other acts cover specific industries and activities.

Regulations

Regulations are law, approved by Parliament which are made under an act.

Certain industries and work have specific regulations, such as:

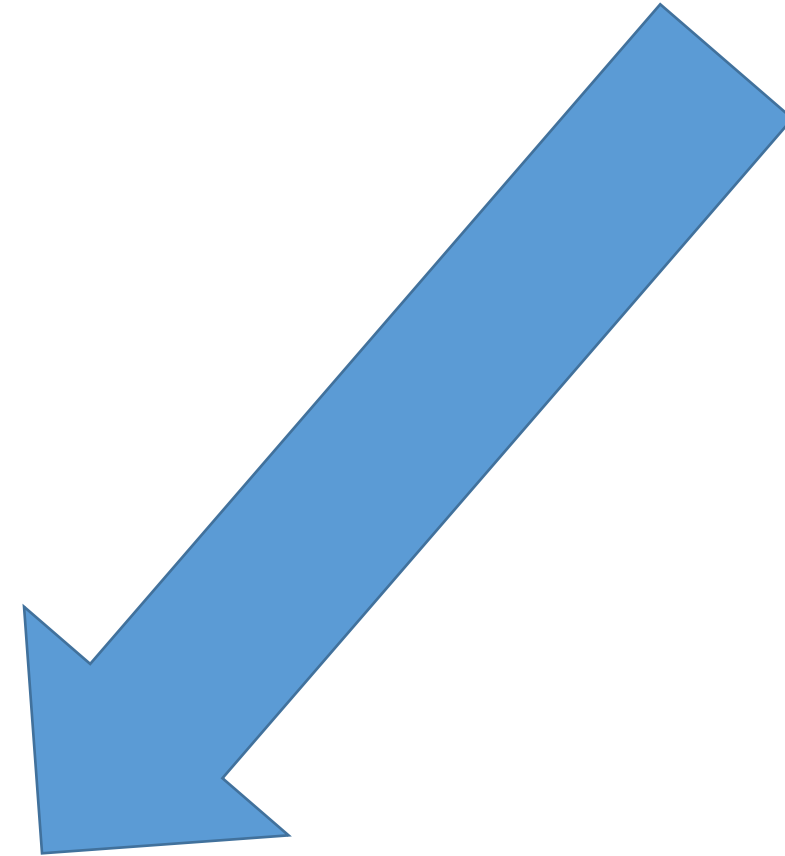
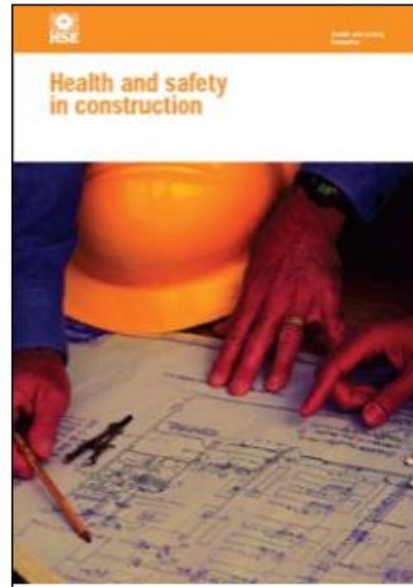
- managing health and safety in construction
- manual handling
- managing and working with asbestos

In practice, to comply with the act and regulations, you must control the risks in your workplace and keep on top of how you do it. For basic information on how to do this, go to [Health and safety made simple](#).

The Construction (Design and Management) Regulations 2015 (CDM 2015) came into force on 6 April 2015, replacing CDM 2007



L153
Published 2015



<http://www.hse.gov.uk/construction/index.htm>





[http://1.bp.blogspot.com/-dNI0LVAIWqU/VSOvUR-fvPI/AAAAAABaHM/rfcPgX8J8cc/s1600/Constructing%2Bthe%2BEmpire%2BState%2BBuilding%2C%2B1930s%2B\(2\).jpg](http://1.bp.blogspot.com/-dNI0LVAIWqU/VSOvUR-fvPI/AAAAAABaHM/rfcPgX8J8cc/s1600/Constructing%2Bthe%2BEmpire%2BState%2BBuilding%2C%2B1930s%2B(2).jpg)





PLANNING

Research, analysis,
and decision making.

List groups or people especially at risk from the significant hazards which you have identified:	RISK	List existing controls here – or note where the information may be found:	Describe the action needed to improve matters where it is reasonably practicable to do more to control risks. Specify also the target date for action and the person to action.	Residual Risk
Office staff	Med	Staff required to observe corporate policy on use of ladders. Code of Guidance on use of Ladders Existing rules to be observed when using ladders for surveys:- - Ladders to be used in low risk situations for a short duration of time <u>is</u> not exceeding 30mins and for access only. - Avoid use if practicable, consider use of alternatives e.g towers, scaffolding, Mobile elevating work platforms (MEWPs). - Ladders to be prevented from use by unauthorised people e.g in particular care should be taken when using ladders in school environments. - Minimum of two people to undertake survey that involves use of ladder. - Ladders to be lashed whenever possible, if not, then ladder to be footed / restrained at all times. - Ladders not to be used in windy, icy or inclement weather. - Ensure surfaces are level and non slip. - Do not impose any side loading on ladder. - Ladder should be erected at an angle of 1 : 4. - Ladder shall extend 1.075m above the exit level. - Use rucksack/shoulder bag, <u>Do</u> not carry anything in hands when climbing ladder. - Staff attention drawn to HSE guidance available at: http://www.hse.gov.uk/pubns/indg455.pdf	Staff awareness training required. Action by management team by May 2019 In house ladders maintained by the structural section to be periodically checked by structural section. Record findings of inspection. May 2019	low
Use of ladders by young or inexperienced staff	High	Work experience school pupils are not permitted to use ladders. Inexperienced staff to be supervised by responsible person at all times.	Responsible person in charge of supervising young or inexperienced staff shall ensure that they are aware of the requirements in the code of guidance and Work Instruction 3.PDD.DC.03	low

FIELD WORK

What do you need to capture
as part of a survey?

Building surveys; Survey document preliminaries

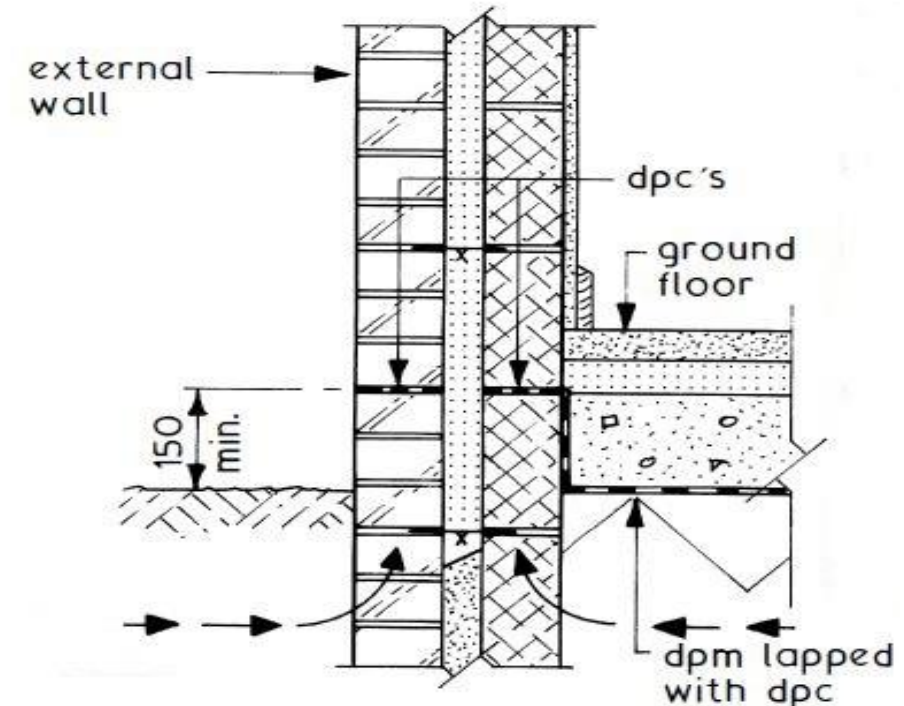
- Title and address of property
- Client's name, address and contacts
- Survey date and time
- Property status freehold, leasehold or common hold
- Occupancy occupied or vacant. If vacant, source of keys
- **Extent of survey, e.g. full structural services reports**
- Specialists in attendance, e.g. electrician, heating engineer, etc.
- Age of property (approx. if very dated or no records)
- Disposition of rooms, i.e. number of bedrooms, etc.
- Floor plans and elevations if available
- Elevation (flooding potential) and orientation (solar effect)
- Estate/garden area and disposition if appropriate
- Means of access roads, pedestrian only, rights of way
- Drainage Positions



SCOPE

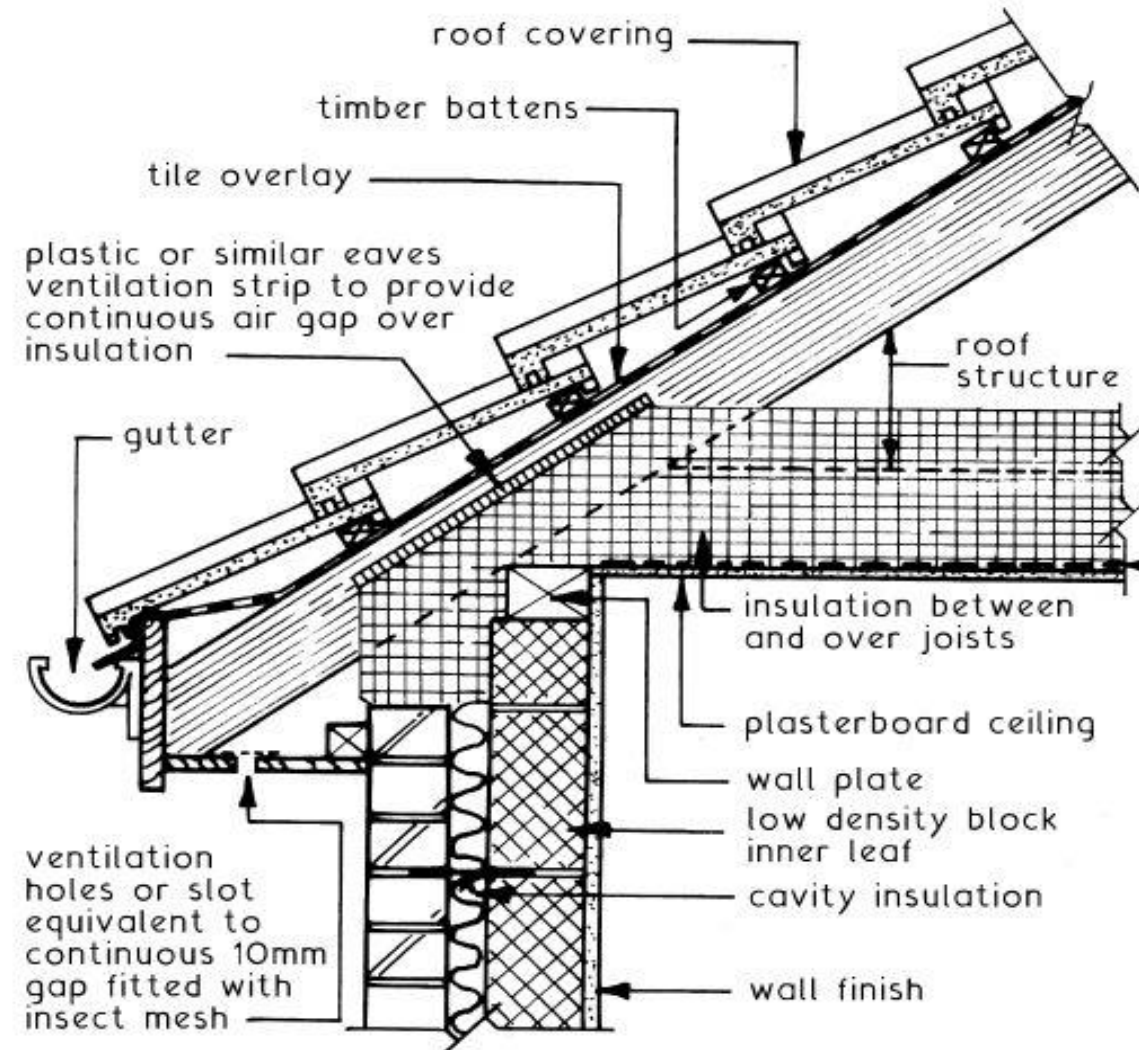
Level of Details for Walls

- Materials type of brick, rendering, cladding, etc., condition and evidence of repairs
- Solid or cavity construction, if cavity extent of insulation and type pointing of masonry, painting of rendering and cladding
- Air brick location, function and suitability
- DPC, material and condition, position relative to ground level
- Windows and doors, material, signs of rot or damage, original or replacement, frame seal
- Settlement signs of cracking, distortion of window and door frames specialist report



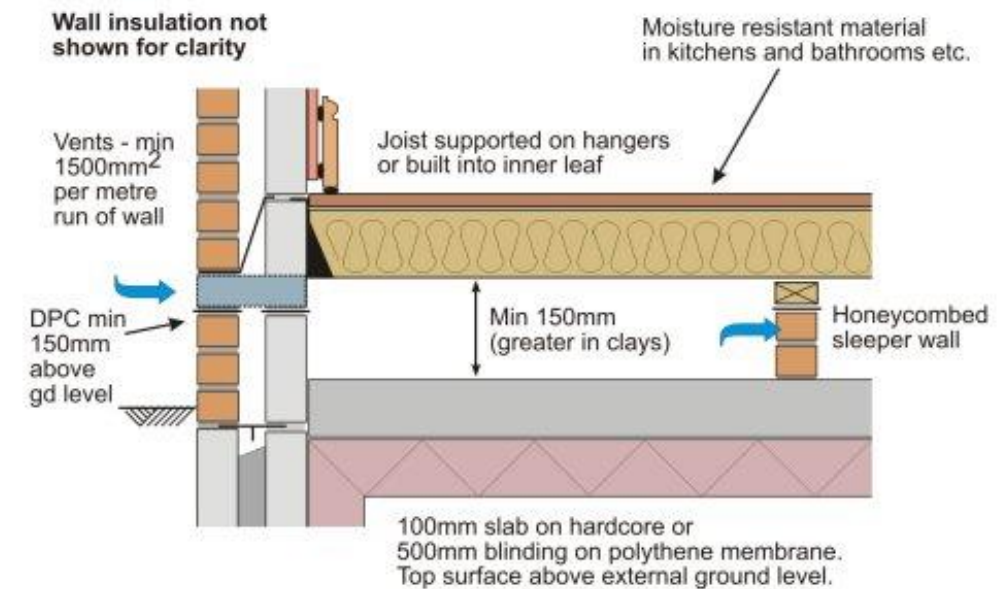
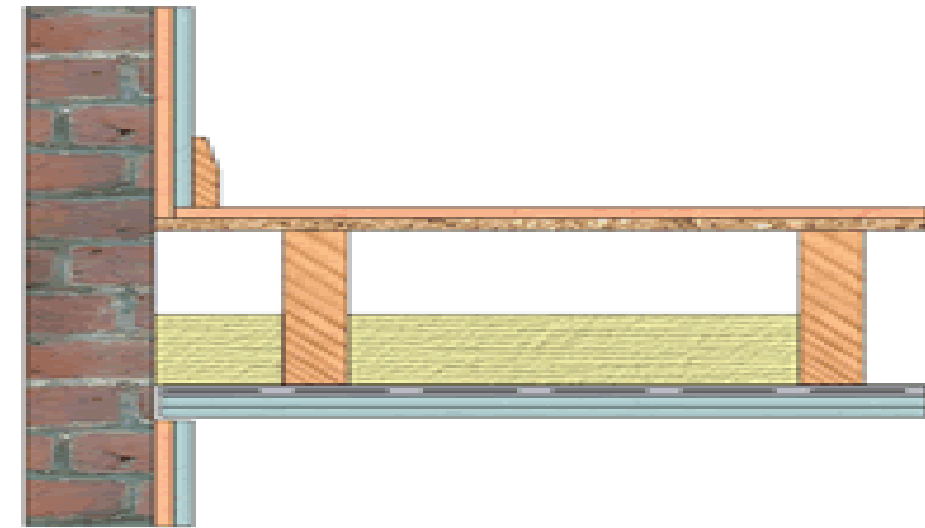
Level of detail for roofs

- Tile type, treatment at ridge, hips, verge and valleys
- Age of covering, repairs, replacements, renewals, general condition, defects and growths
- Eaves finish, type and condition
- Gutters material, size, condition, evidence of leakage
- Rainwater downpipes as above
- Chimney dpcs, flashings, flaunching, pointing, signs of movement
- Flat roofs materials, repairs, abutments, flashings and drainage



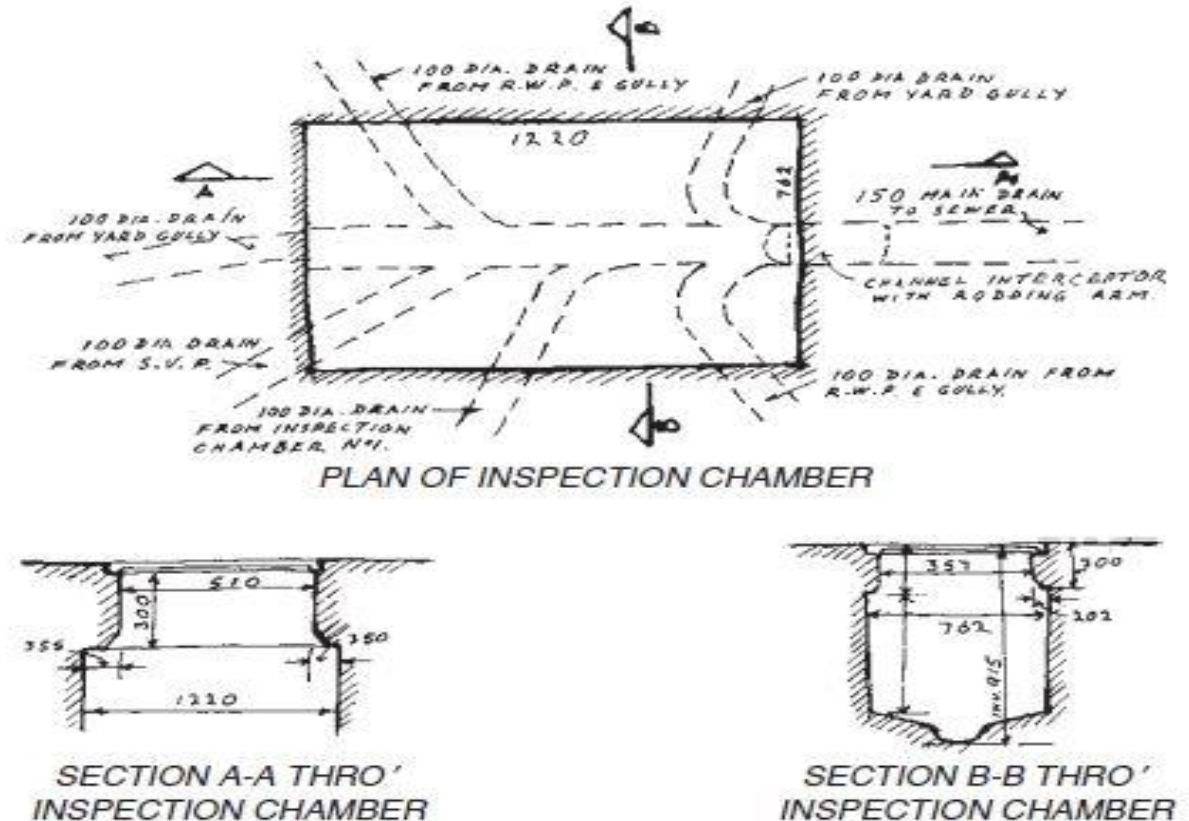
Level of Detail for Floors

- Materials type of timber, in-situ concrete, precast concrete, condition and evidence of repairs. Direction of span.
- Wall fixing, hung, built in, suspended etc.
- Air brick location, function and suitability in suspended ground floors
- DPC under suspended ground floors, material and condition, position relative to external ground level



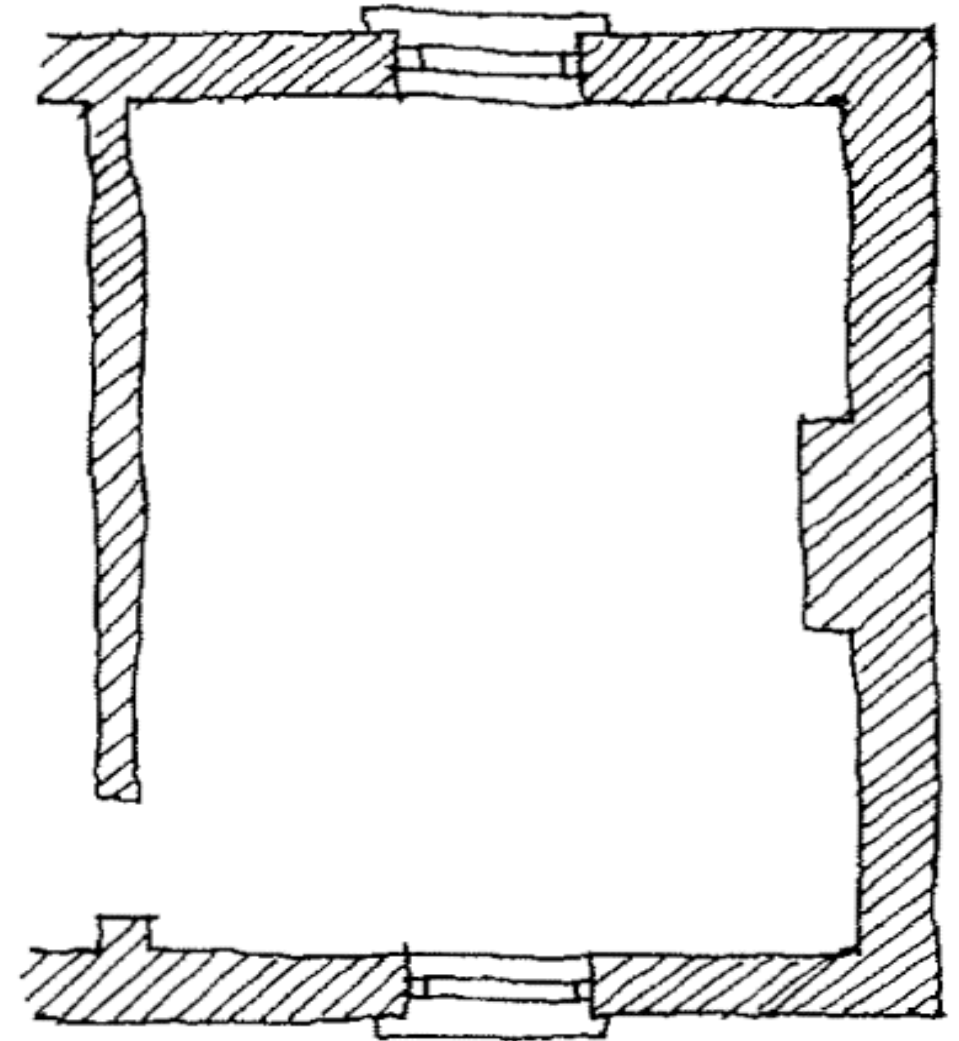
Level of Detail for Drain Surveys

- A building surveyor may provide a general report on the condition of the drainage and sanitation installation. However, a full test for leakage and determination of self-cleansing and flow conditions to include fibre-optic scope examination is undertaken as a specialist survey.
- Details should include
 - Drain diameter
 - Materials i.e. Clay, plastic.
 - Manhole/catch pit details
 - Falls between manholes and catch pits.
 - Direction of Flow
- Differentiate between foul and surface water drainage systems



Measuring Internal Detail

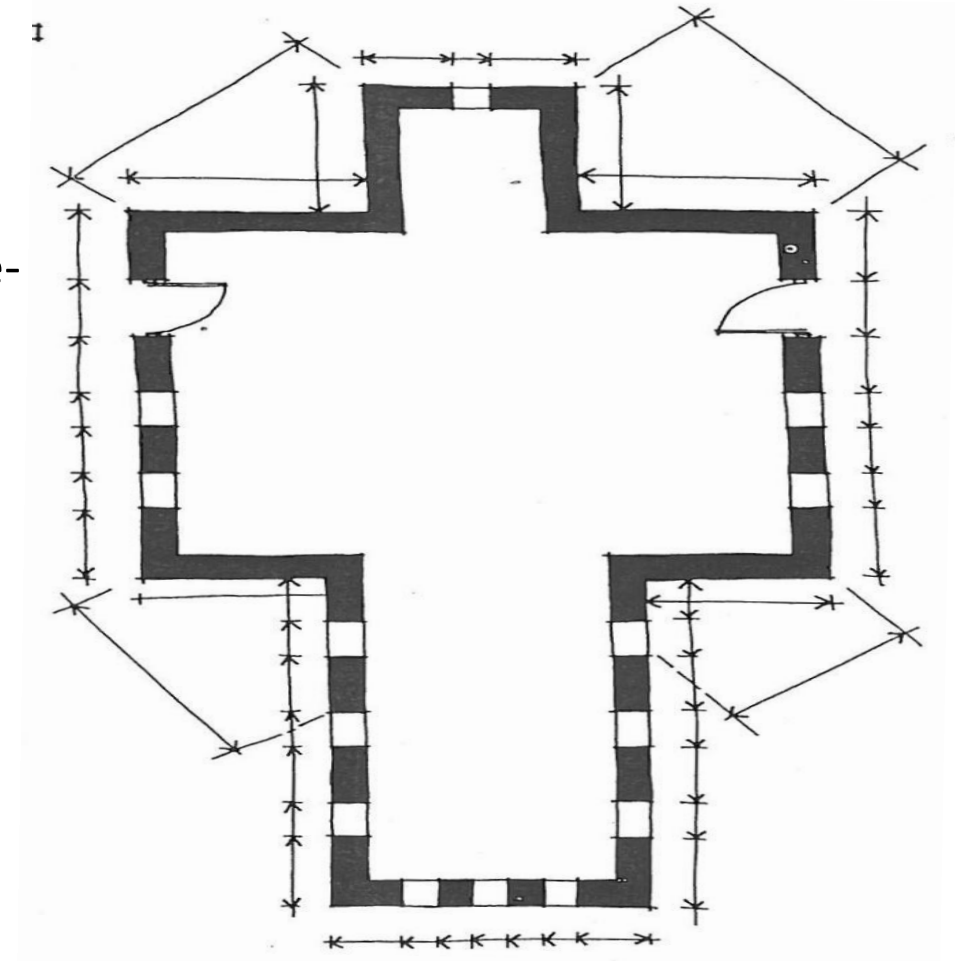
- First, have a good look around. Then draw a rough plan of the room.
- Do this as carefully as you can, noting the shape of the room and the approximate position and width of doors, windows, recesses and any other major features.
- You will be recording your measurements on this drawing later.
- Make it as big as you can so that you will have plenty of room to write.
- Start by measuring the length and width of the room. Draw dimension lines on your plan to show where the measurements were taken.
- Write each measurement beside its dimension line.



Draw a rough plan of the room

Measuring Externally

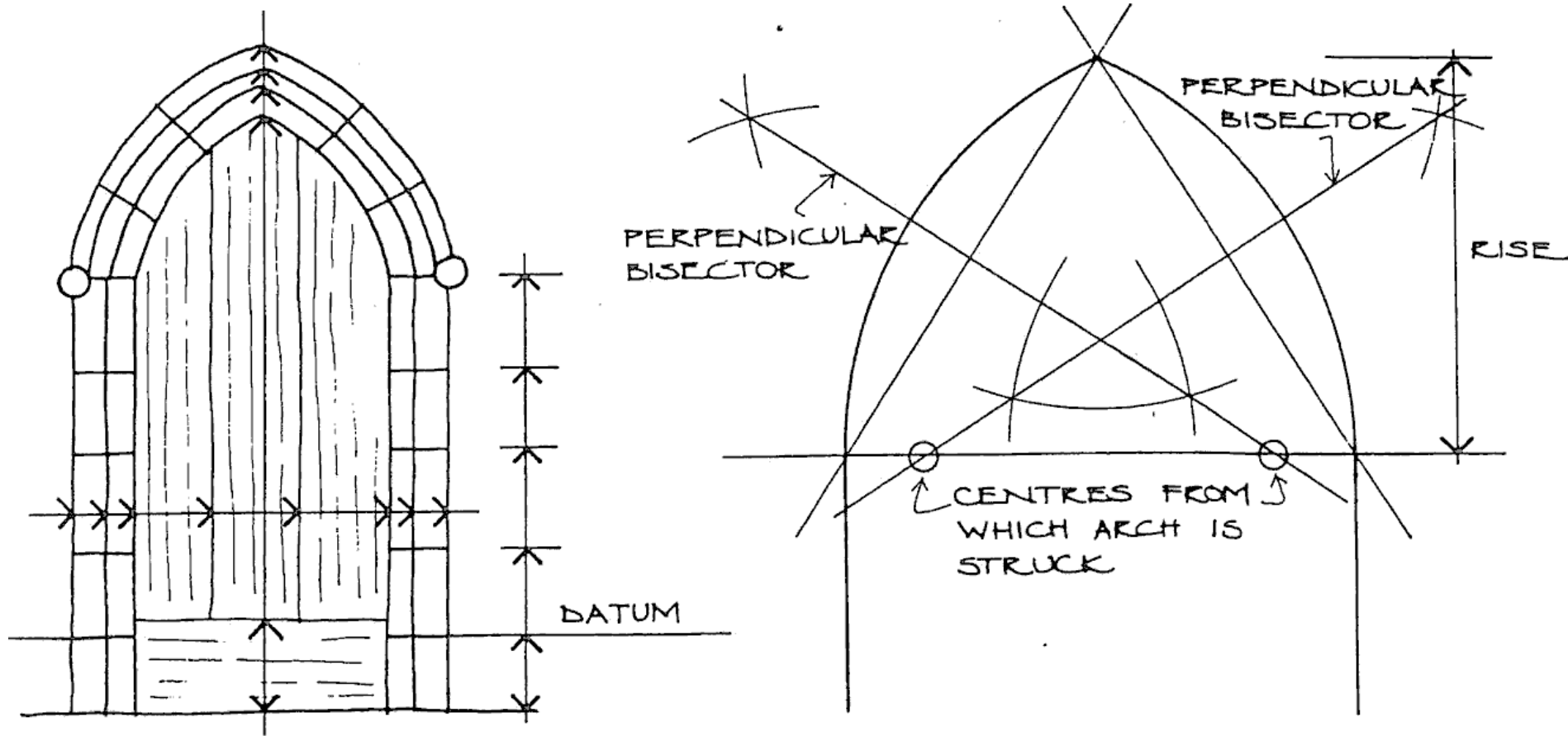
- Pick up all features at ground floor level.
- Take sufficient dimensions to tie in wings or extensions and re-entrant features
- Use running measurements
- Tie external survey to internal survey through doorways and window openings



Gothic Arch Details

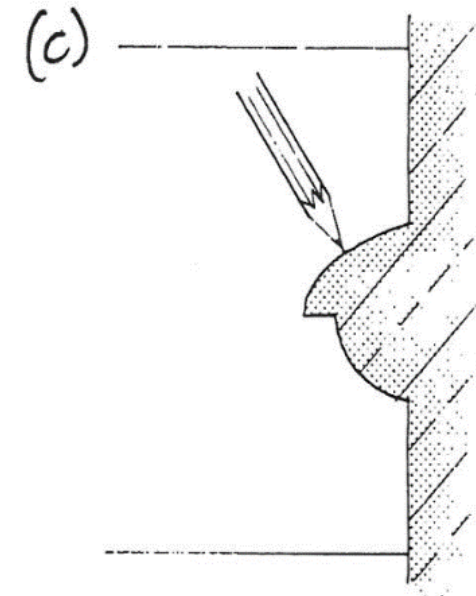
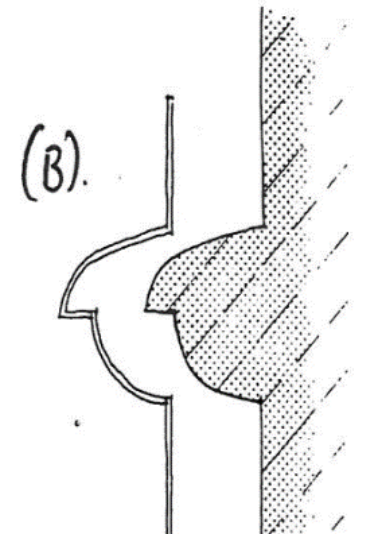
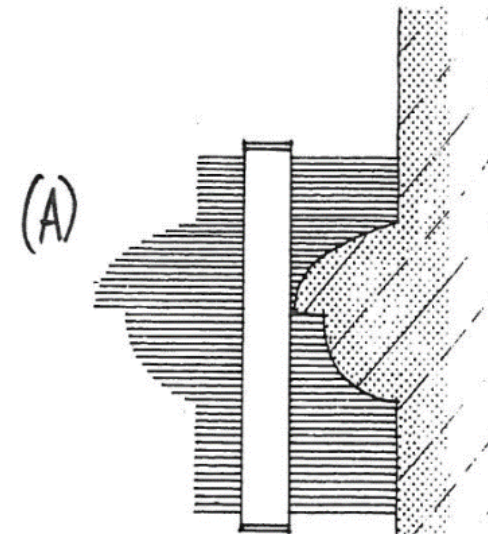
- Measure from datum to the underside and top of arch, and any additional features
- Measure from the datum to the springing point of the arch on both sides estimate point at which the arch was struck.

Note the number of masonry blocks or bricks used

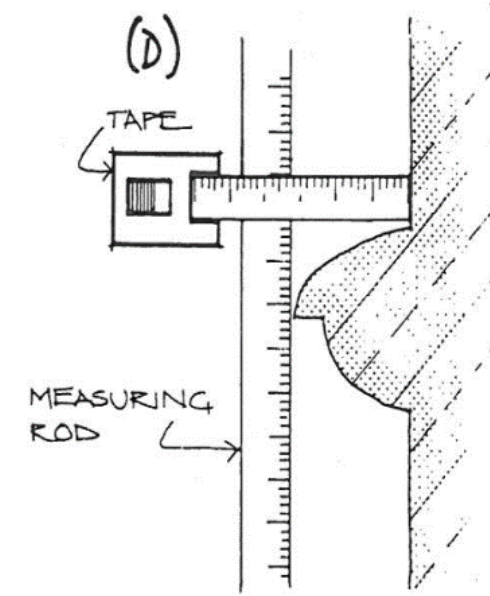


Measuring Mouldings

- Mimic instant taper, a device with 165 identical steel needles are held against the moulding
- A strip of lead dressed around the moulding
- At an open joint (between stones) Insert card/tracing paper and trace around moulding
- Take offsets from straight edge



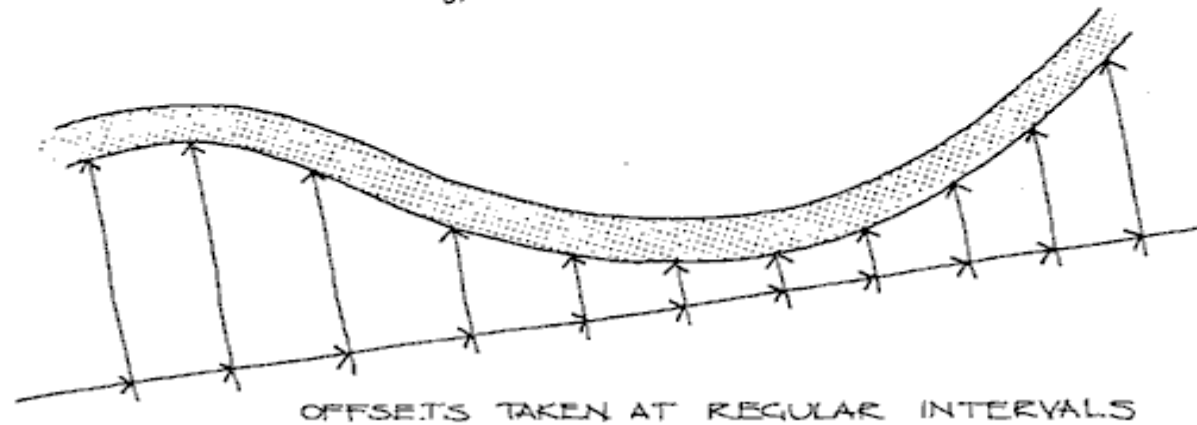
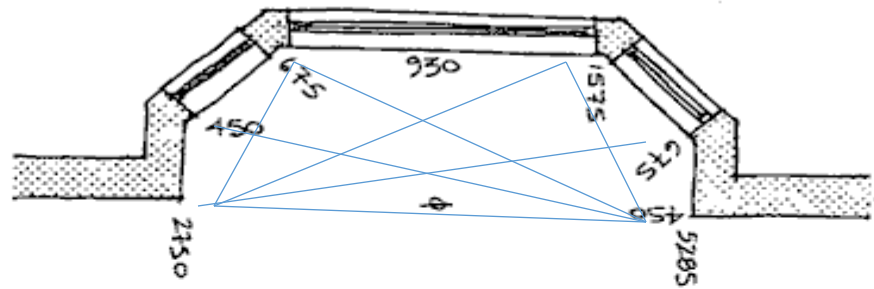
TRACING ONTO PAPER



USING OFFSETS

Measuring Bay and Meandering Walls

- Measure all internal distance within the bay
- Then tie all measurements in from the reveal on either side of the window



DATA PROCESSING & REPRESENTATION

Data / Information from the Survey

History

- History and development of the building (desk study)

Construction

- Original construction principle of the building (As-built survey)

Condition

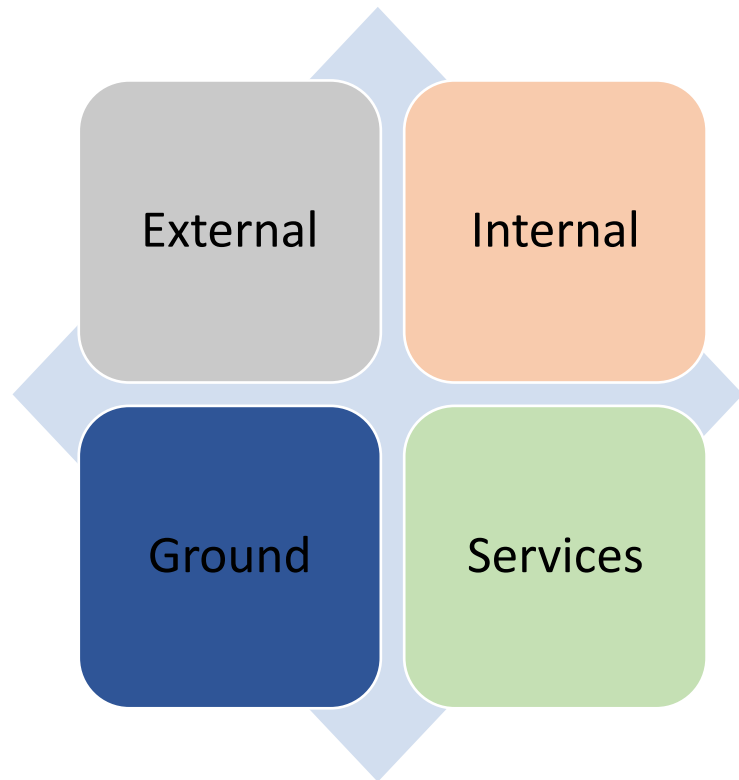
- As- existing condition of the building (**Initial Assessment/survey**)

Defect / Strength

- Major and minor defects and what they could mean (**Full Assessment**)

Initial Assessment

Q1) Assess the condition of the main building elements (roof, wall, ceiling, stair, pipes etc) as good, fair, poor, very bad or not inspected.



Good	Structurally sound; weathertight; no significant repairs needed.
Fair	Structurally sound; in need of minor repair; showing signs of a lack of general maintenance.
Poor	Defects that need repairing or replacing but are not considered to be either serious or urgent. The property must be maintained.
Very bad	Defects that are serious and/or need to be repaired, replaced or investigated urgently.
Not inspected	Not inspected (further investigation required)

Initial Assessment (contd)

Q2) Overall condition: Taking into consideration the evidence collected, assess the condition of the building as a whole as good, fair, or poor.

Good (1)	Satisfactory Repair: Considered to be in an acceptable state of repair and condition taking into account the age of the property. No repair is required.
Fair (2)	Maintenance Required: Considered by the surveyor to be in a generally acceptable condition but requires some routine maintenance and repair which is considered normal for a property of this age and character.
Poor (3)	Urgent Repair or Further Investigation Needed: Defects or shortcomings that are an actual or developing threat to the fabric of the building or to personal safety. Repair or further investigation is required immediately.

Initial Assessment (contd)

Q3) Occupancy condition: Report the options to best describe how the building is used: **Occupied**, **Partly occupied**, **Vacant or Unknown**.

Q4: Photograph: Photographs of building should be taken to show its condition. Photos should be of a high enough resolution to be able to be reproduced in publications. Digital photos should ideally be taken on the highest setting and Jpegs should be at least 3mb when open.

Q5) Site visit: The date of the site visit/ assessment should be recorded in the following format: dd/mm/yyyy. Photo date should also be recorded

Full Assessment

A Full assessment / building survey looks at certain aspects of a building and gives details of its condition and any potential concerns. (Usually carried out by building retrofit expert to know the strength of the building).



SURVEY REPORT

Technical Survey Report

Definition: This is a process of presenting the survey data collected to non-specialist audiences in an **A**ccurate, **B**rief and **C**lear format (i.e. easily understandable form).

Importance of technical survey report :

- ❖ provide detailed advice on the condition of the building
- ❖ describe the identifiable risk of potential or hidden defects
- ❖ make recommendations for any further special inspection
- ❖ help you make a reasoned and informed decision when purchasing or planning for repairs, maintenance or upgrading of the property
- ❖ where practicable, provide an estimate of costs for identified repairs

Planning Technical Survey Report

- Survey data collection
- Accurate record of survey data
- Creative planning phases
- Use technical sources such as:
 - English Heritage Methodology and Guidance for Surveying
 - **Royal Institution of Chartered Surveyors Guidance**
- Structuring the report
- Writing the first draft
- Revise the draft
- Finalising the report



Structure of Survey Report

Section	Details
Title page	Must include the title of the report, property address, name of the owner/client and date of inspection. It is also desirable to put the photograph of the property
Summary	A summary of the whole report including the brief overall assessment, important features, and the overall condition rating of the building
Contents	Numbers and lists of all sections, subsection headings and appendixes with page numbers
Introduction/ Instruction	This section will contains the scope of the assessment carried out on the building. The report should be prepared in accordance with the signed terms and conditions of engagement
Body	Divided into numbered and headed sections. These sections separate the different main ideas in a logical order constructional principles & structural risks, exterior, interior, services and grounds.
Conclusions	A short, logical summing up of the theme(s) developed in the main text
Appendices	Any further material which is essential for full understanding of the report (e.g. drawings, photos, general advice, house illustration, glossary of building terms, general maintenance notes and guidance

Body of Survey Report

constructional principles & structural risks

- Description
- Principle of construction
- Occupancy details
- Trees
- Structural movement

Exterior

- Chimney stacks
- Roof coverings
- Rainwater pipes & gutters
- Main walls
- Window
- Doors
- Joinery & finishes

Interior

- Roof structure
- Ceilings
- Walls & partitions
- Floors, stair
- Chimney & fireplaces
- Built-in- fittings
- Woodwork
- Toilets fittings

Service

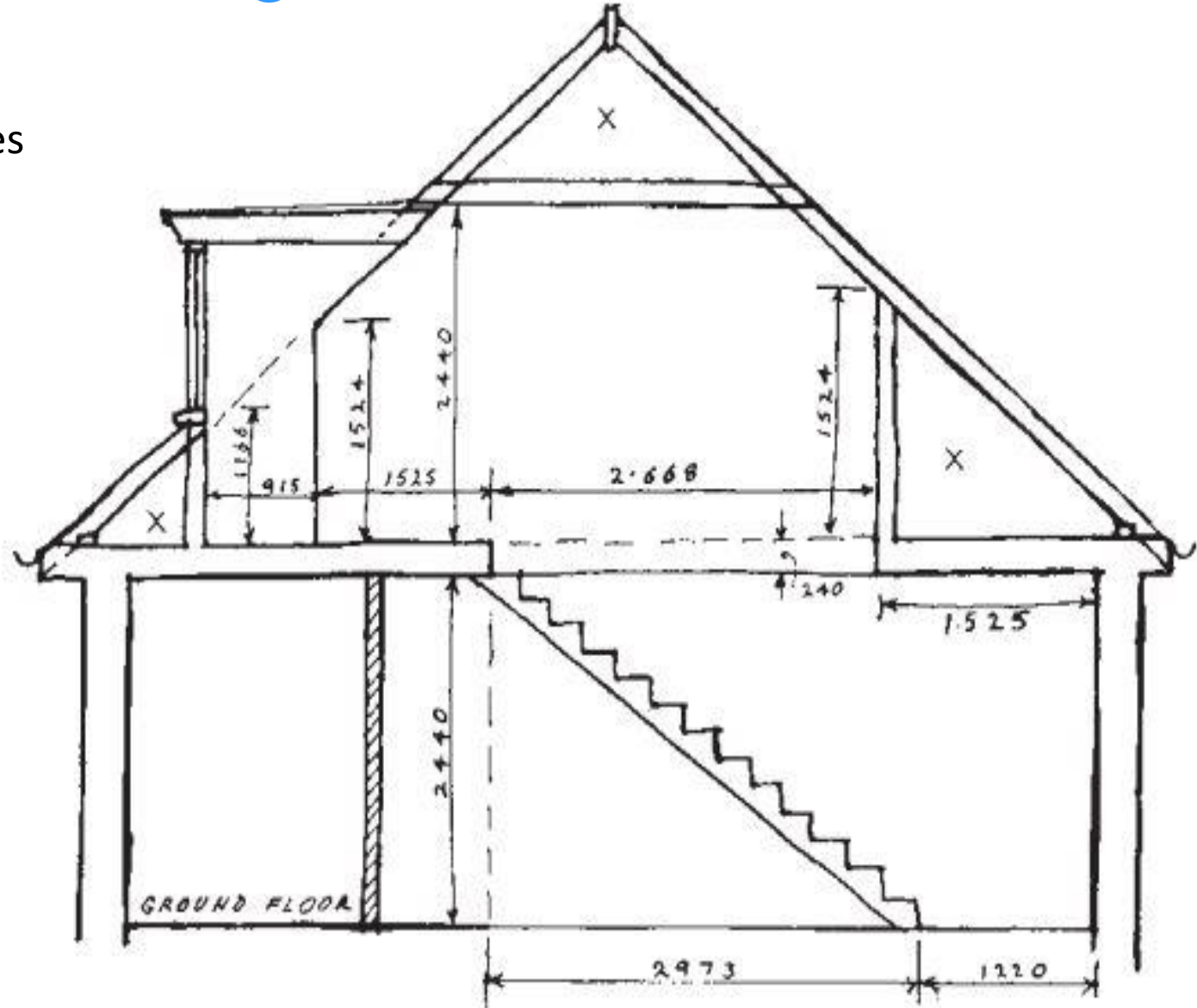
- Electricity
- Gas
- Water
- Heating
- Drainage
- Common services

Ground

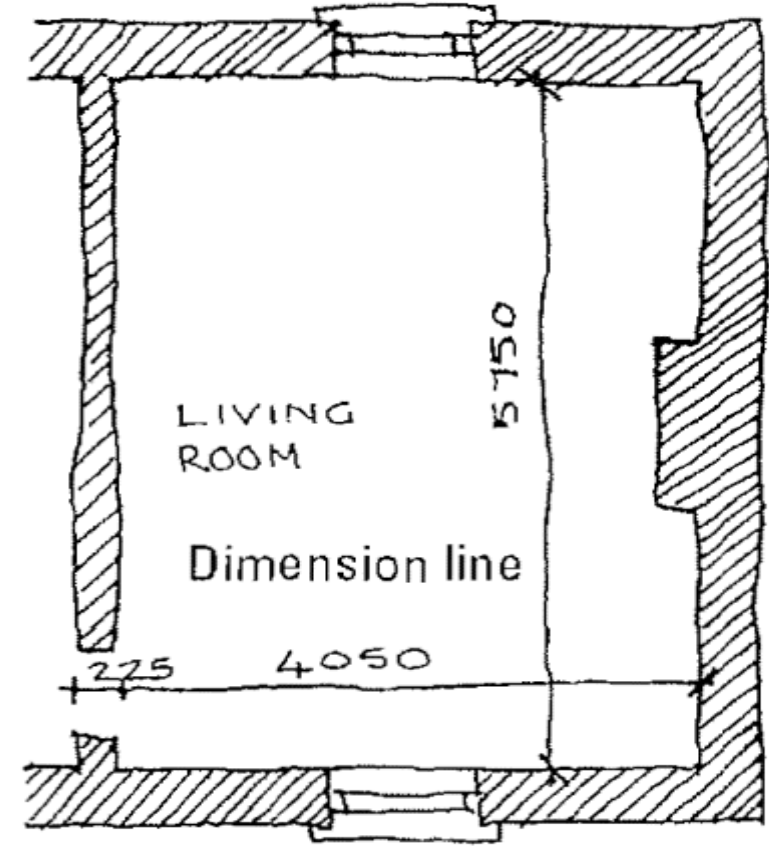
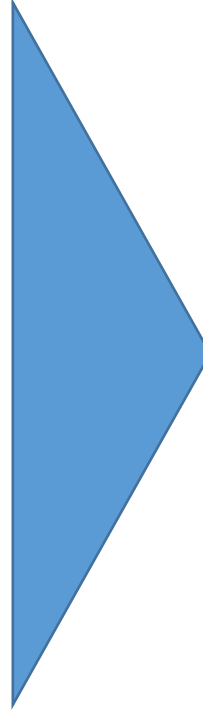
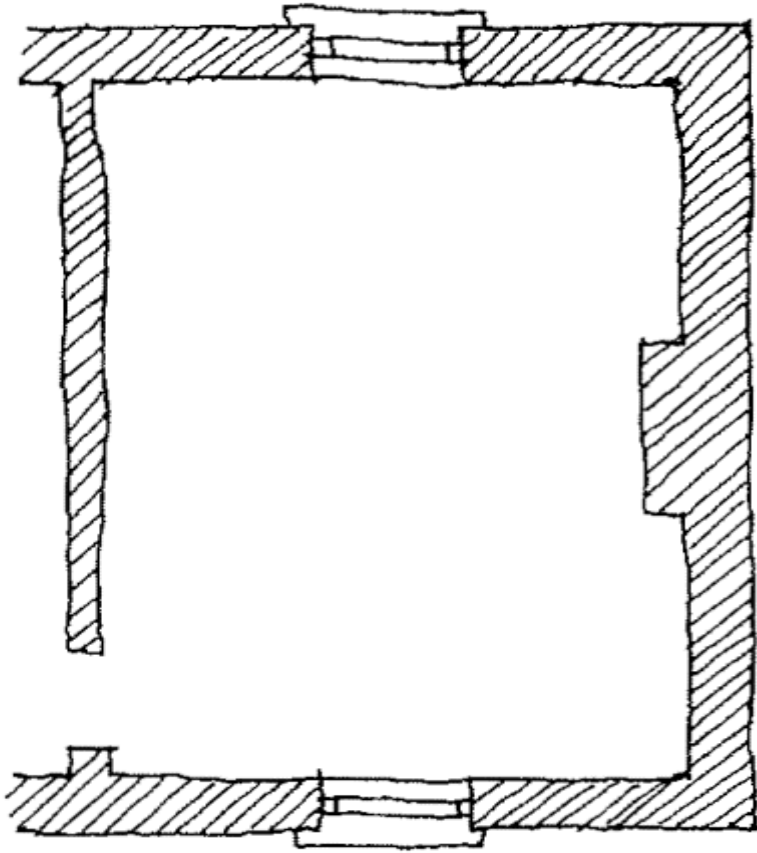
- Garage
- Permanent out buildings
- Other structures
- Boundaries & fence

Appendices: Section through Sketch

- Section through building can show similar details as floor plan sketches acting as a check
- Mark all voids that cannot be measured such as roof spaces
- Establish wall thickness at window and door openings

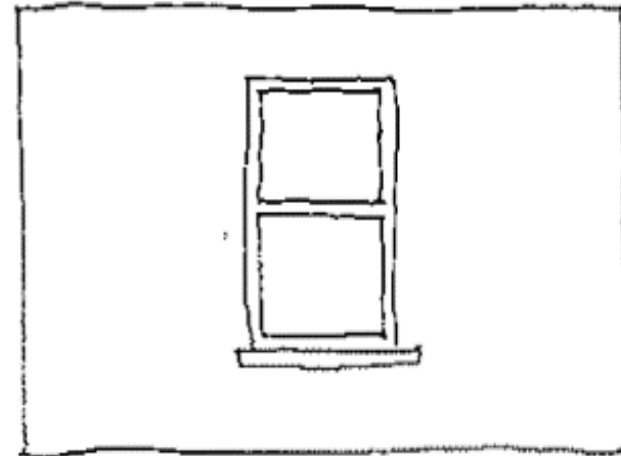
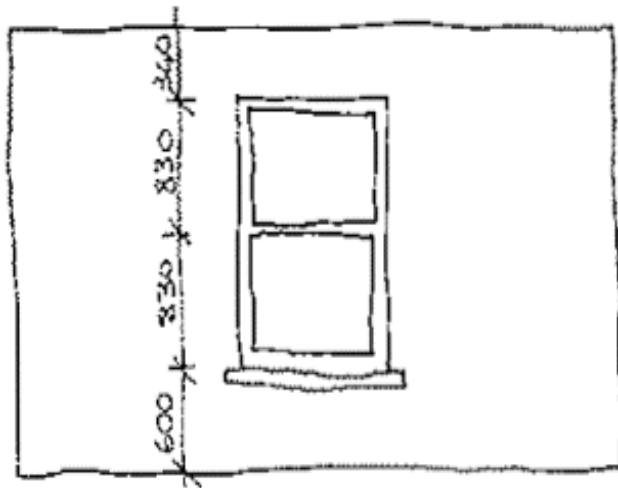
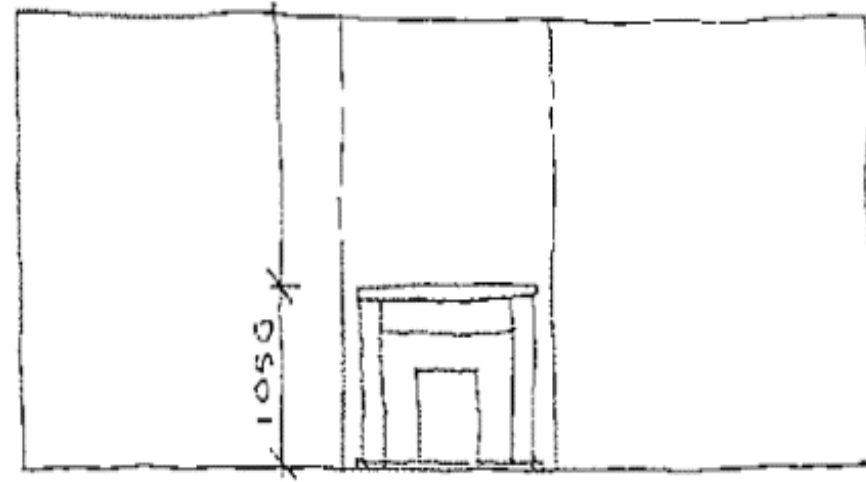
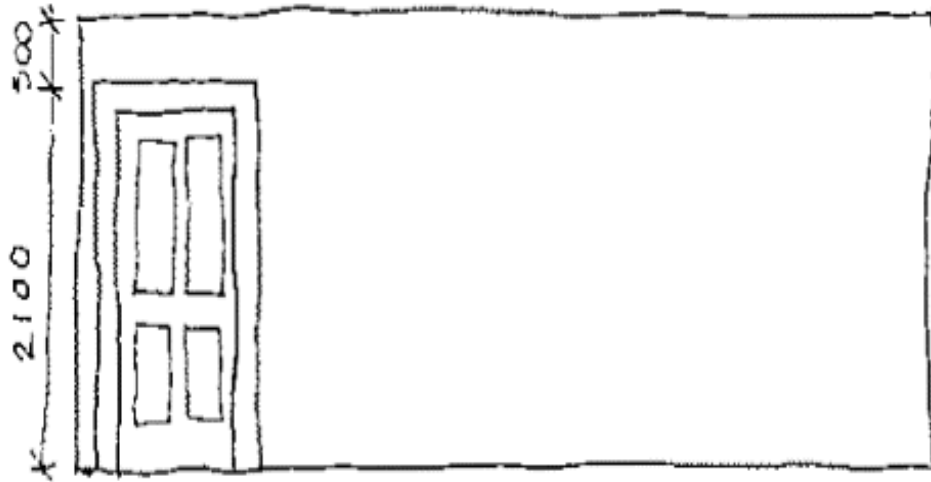


Sketch Drawings



Internal Elevations

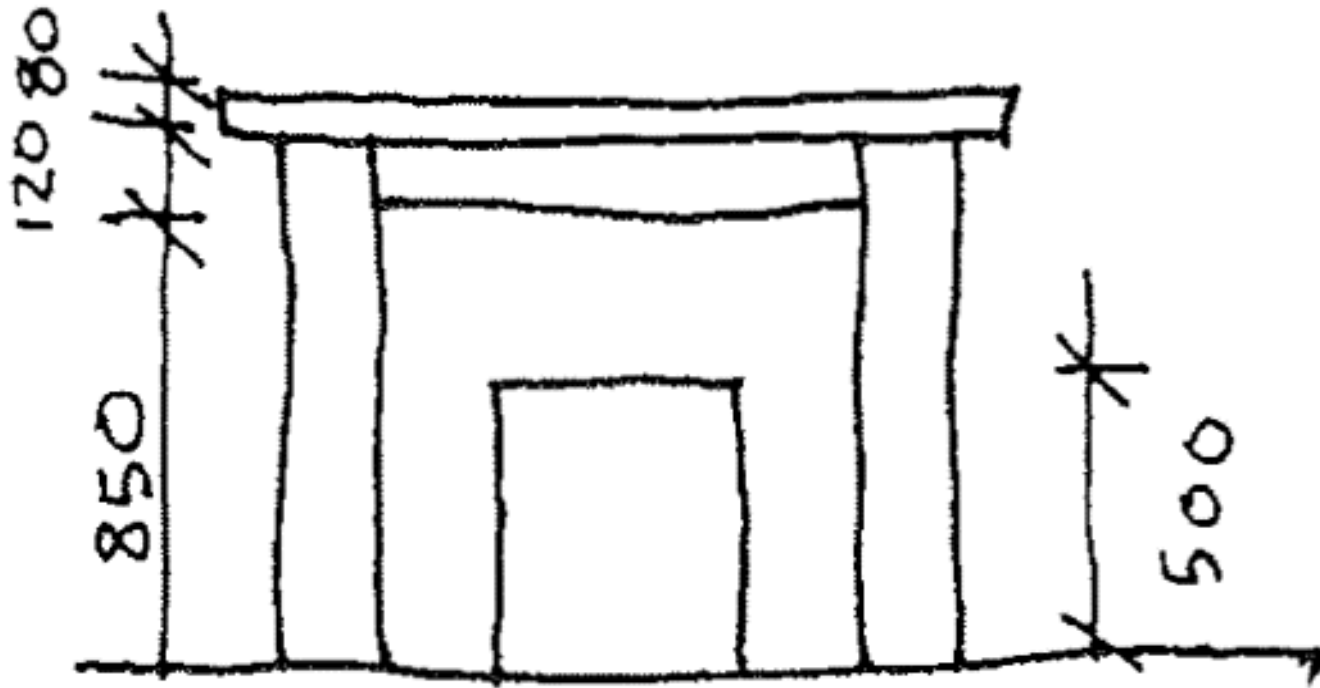
Draw a rough elevation of each wall of the room. Then measure the heights of ceilings, doors, windows, cupboards etc. Note the measurements on your elevations, using dimension lines just as you did on plan.



Additional Detail

If you come across something you want to measure in detail - an interesting fireplace or window, for example - make a separate sketch of it at a larger scale. For detailed features, take photographs

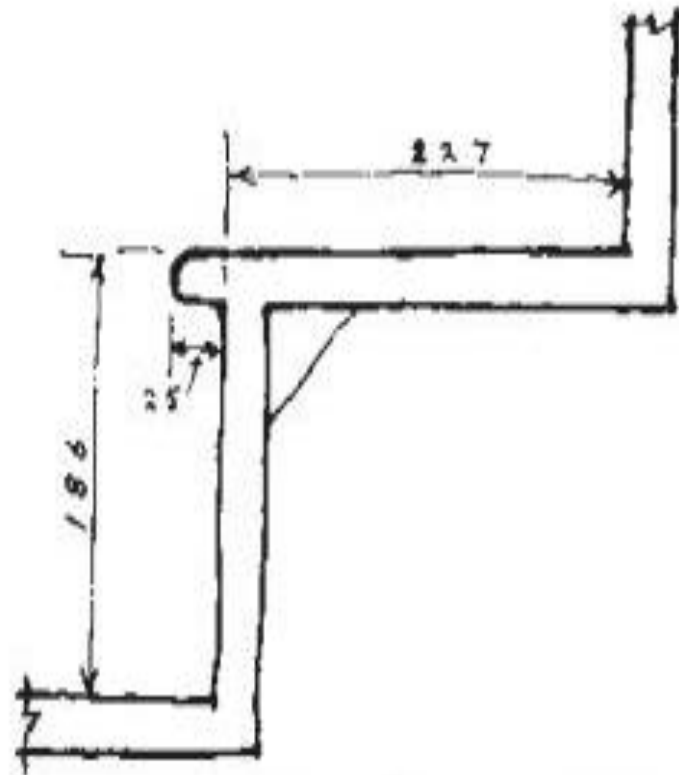
Use another sheet of paper, if necessary. This will mean that your main drawing does not get too crowded.



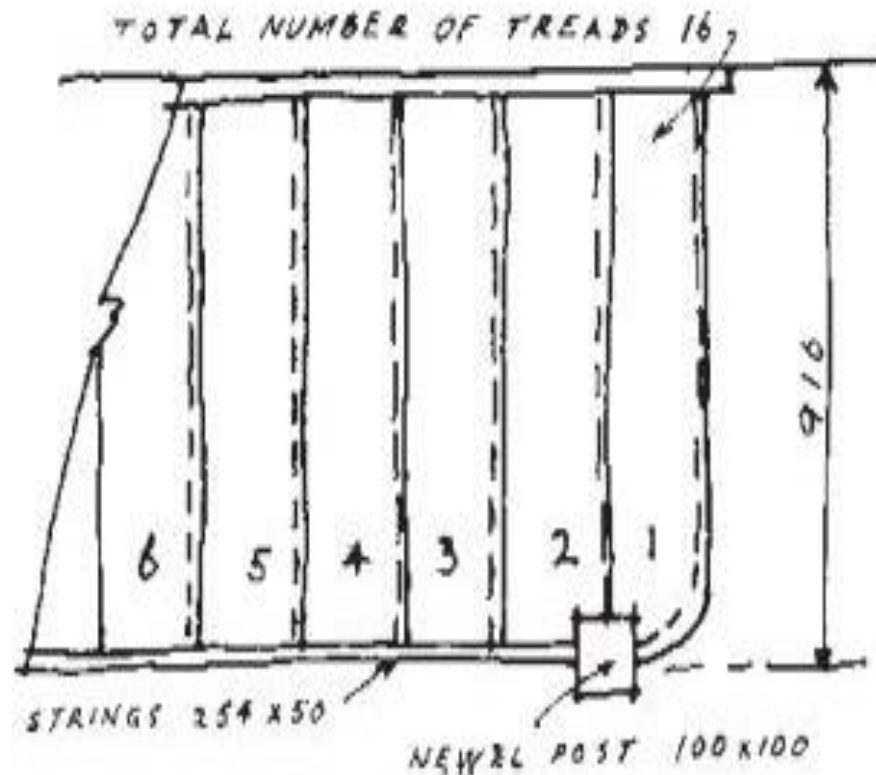
Stairway Detail Sketches

Height between lower and upper floors can be determined by measuring the tread rise and multiplying by the number of risers.

Overall stairway going can be determined by measuring the tread and multiplying the number of treads.



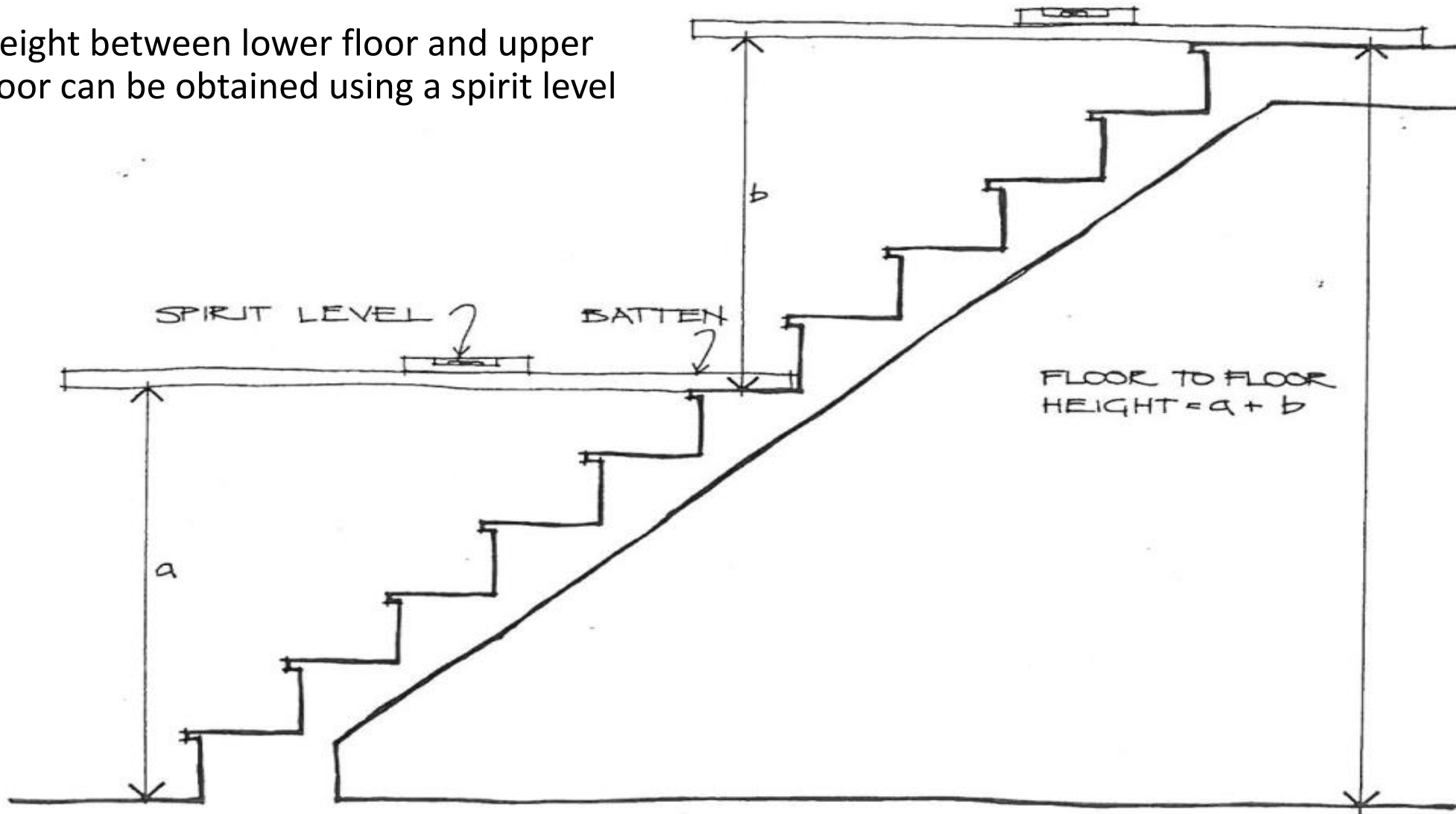
SECTION THRO' TREAD & RISER



PART PLAN OF STAIR

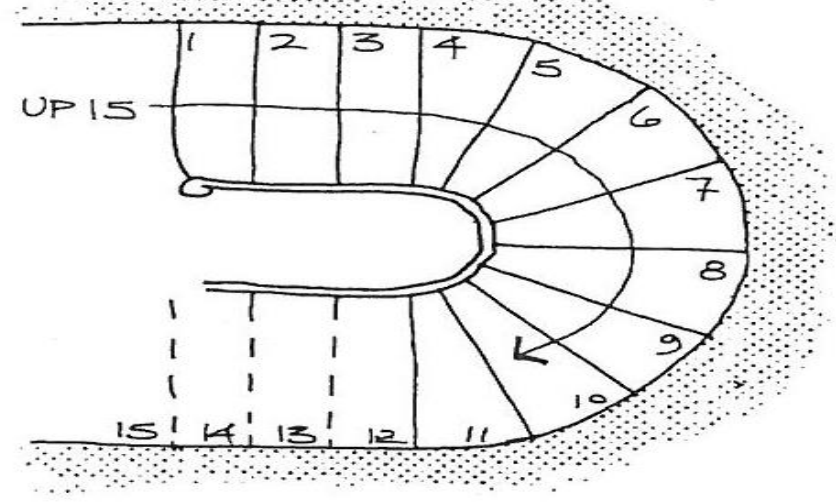
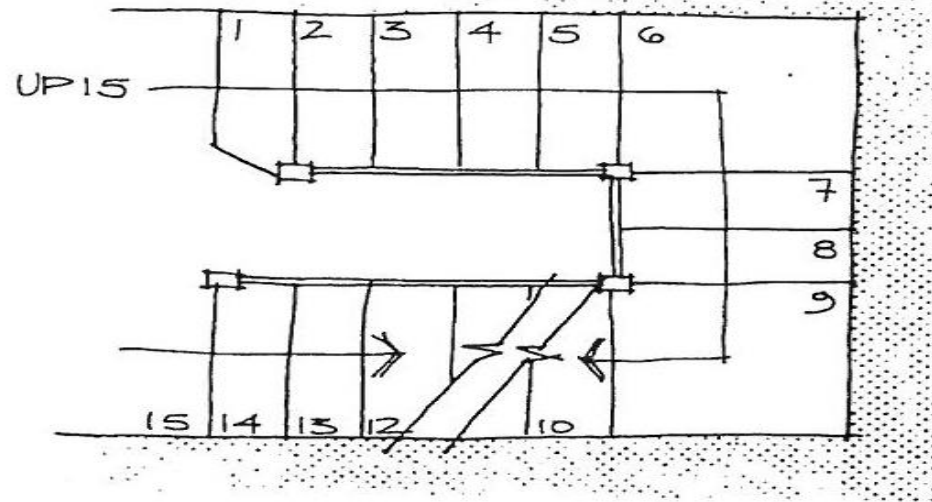
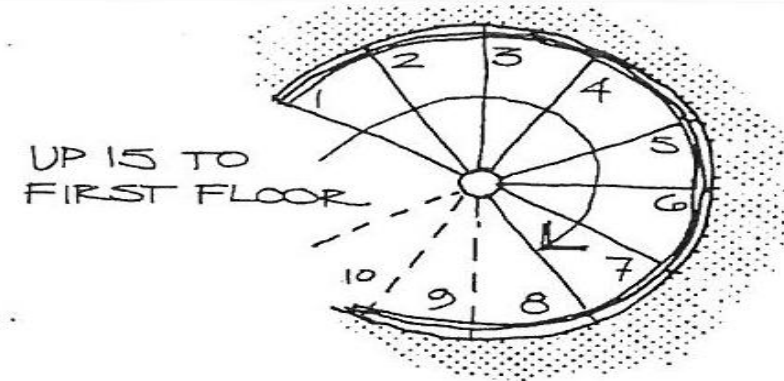
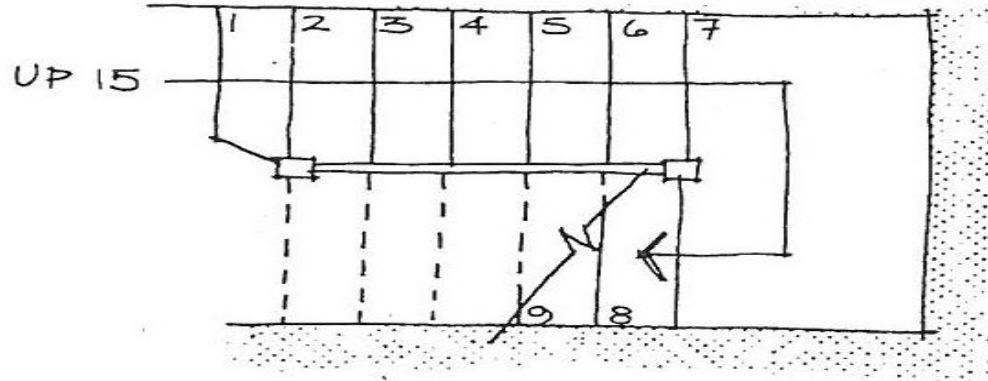
Stairway Detail Sketches

- Height between lower floor and upper floor can be obtained using a spirit level



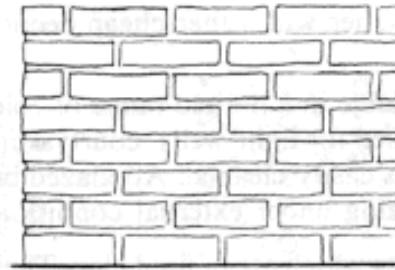
Measuring floor-to-floor heights at a staircase.

Stairway Detail Sketches

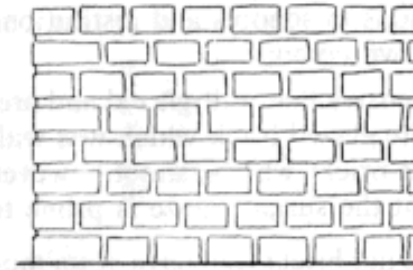


External Details

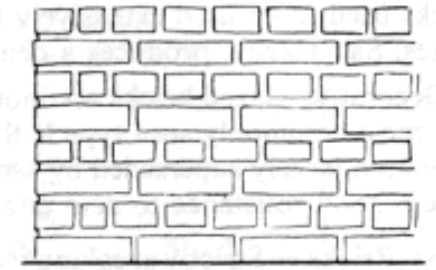
- There are various types of brickwork bond used within the industry.
- Stretching / Stretcher is the common use bond type.
- More contemporary Stack bond with vertical 'perps' can also be used with sufficient bed joint reinforcement at suitable vertical centres.



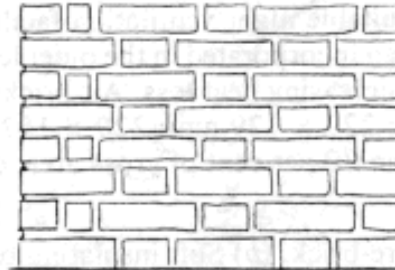
STRETCHING BOND.



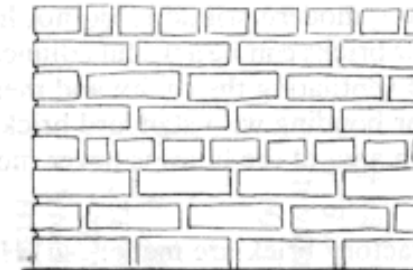
HEADING BOND.



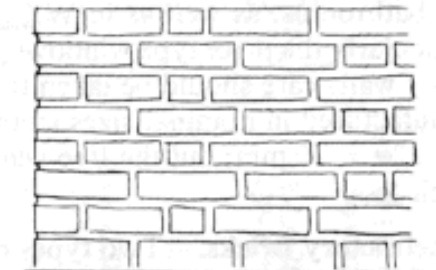
ENGLISH BOND.



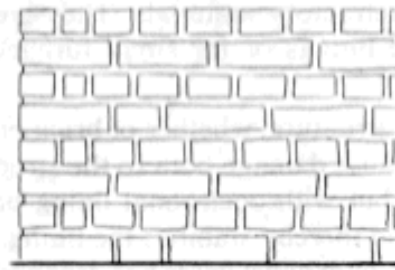
FLEMISH BOND.



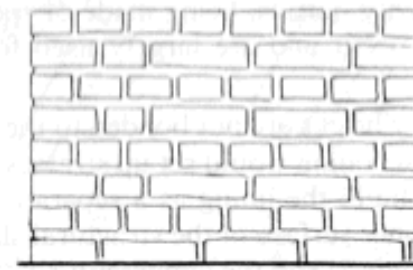
ENGLISH GARDEN
WALL BOND.



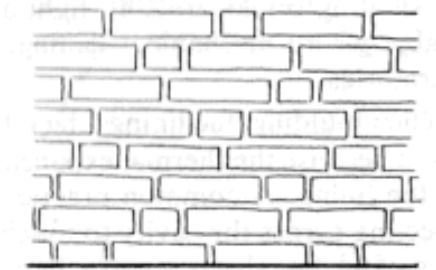
FLEMISH GARDEN
WALL BOND.



ENGLISH CROSS BOND.



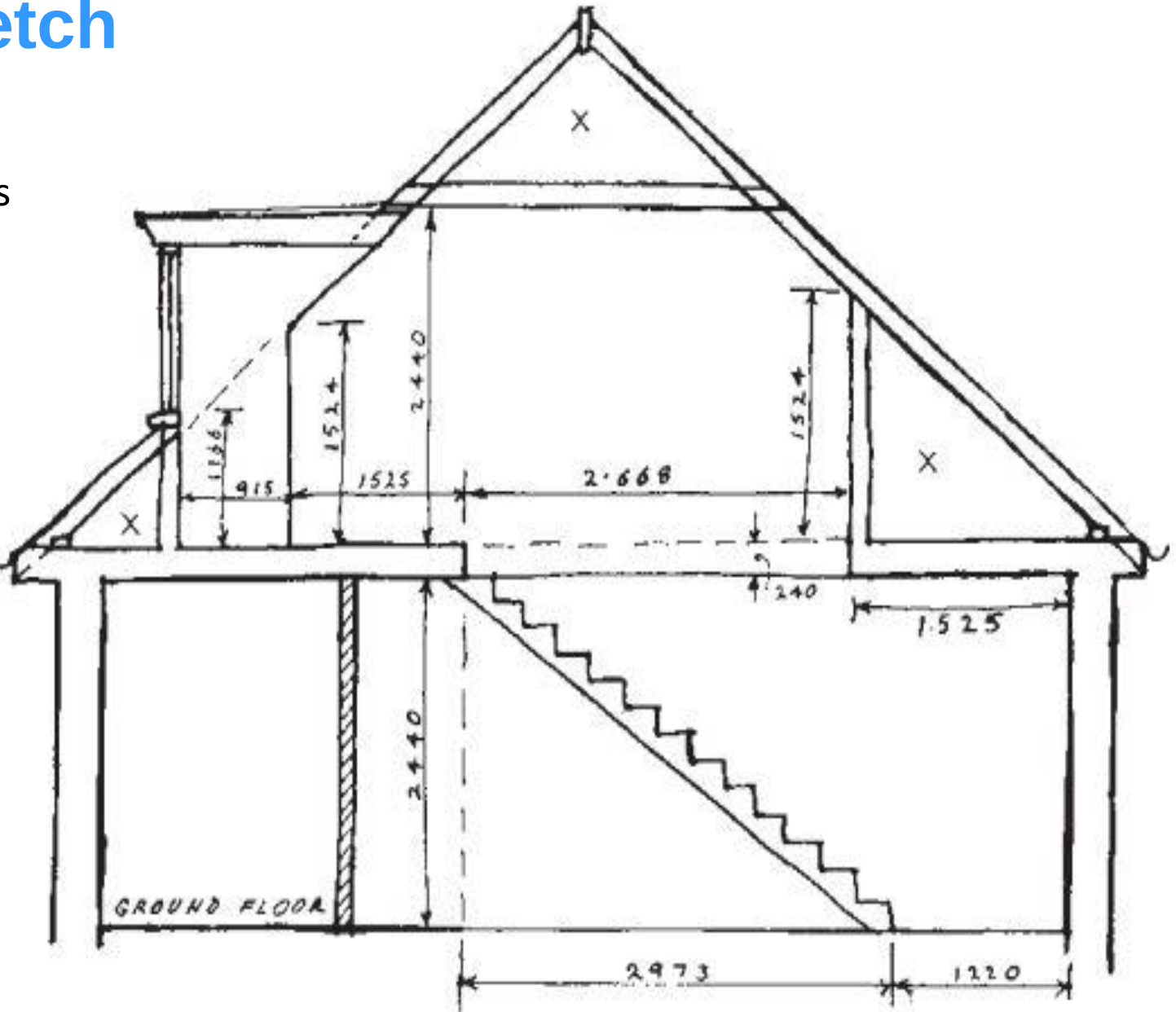
DUTCH BOND.



MONK BOND.

Section through Sketch

- Section through building can show similar details as floor plan sketches acting as a check
- Mark all voids that cannot be measured such as roof spaces
- Establish wall thickness at window and door openings



**Remember:
Your Report Must Be
ABC!!!**

Contents

Title page

Summary

Contents

Introduction

Body

Conclusions

Appendices

RICS Home Surveys

RICS Building Survey

Property address: 27 Churchfield Cottages

Client's name: Andrew Boast

Date of inspection: Tuesday 12th January 2015

Download Example Report Here

RICS The quality of inspection is guaranteed by the RICS

Further Reading Materials

- Adrian Tagg (2018). *Technical due diligence and building surveying for commercial property*, 1st Edition, Taylor & Francis, London UK.
- Historic England (2019). *English heritage methodology and guidance for surveying listed buildings*. Online. Available at <<https://historicengland.org.uk/advice/technical-advice/recording-heritage.pdf>> [Accessed 11/02/2021].
- Kieran Morgan (2015). *Technical writing process: the simple, five-step guide that anyone can use to create technical documents such as user guides, manuals, and procedures*. 1st Edition, Aust.
- RICS Guidance Note (2010). *Building surveys and technical due diligence of commercial property*, 4th edition (GN 63/2010). Online. Available at <<https://www.rics.org/building-surveying/building-surveys-and-technical-due-diligence-of-commercial-property-4th-edition-rics.pdf>> [Accessed 11/02/2021].