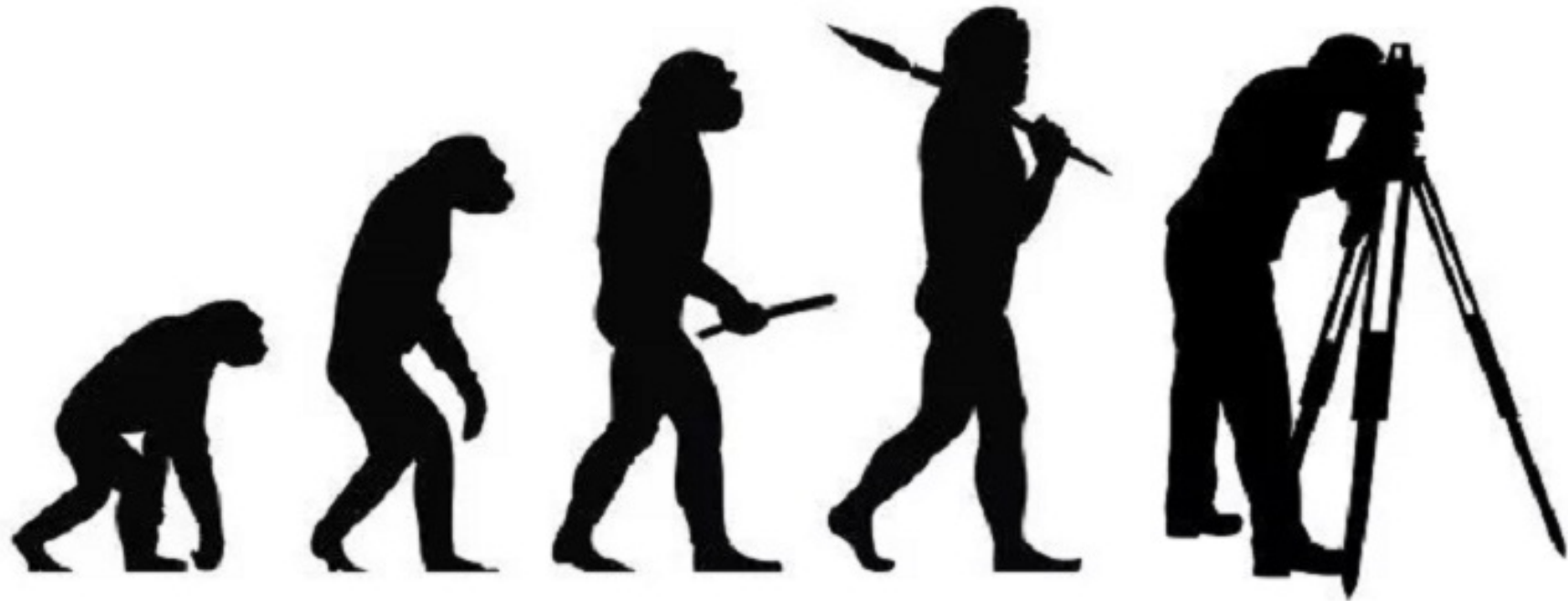


Lecture 6: Digital Surveying



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





PLANNING

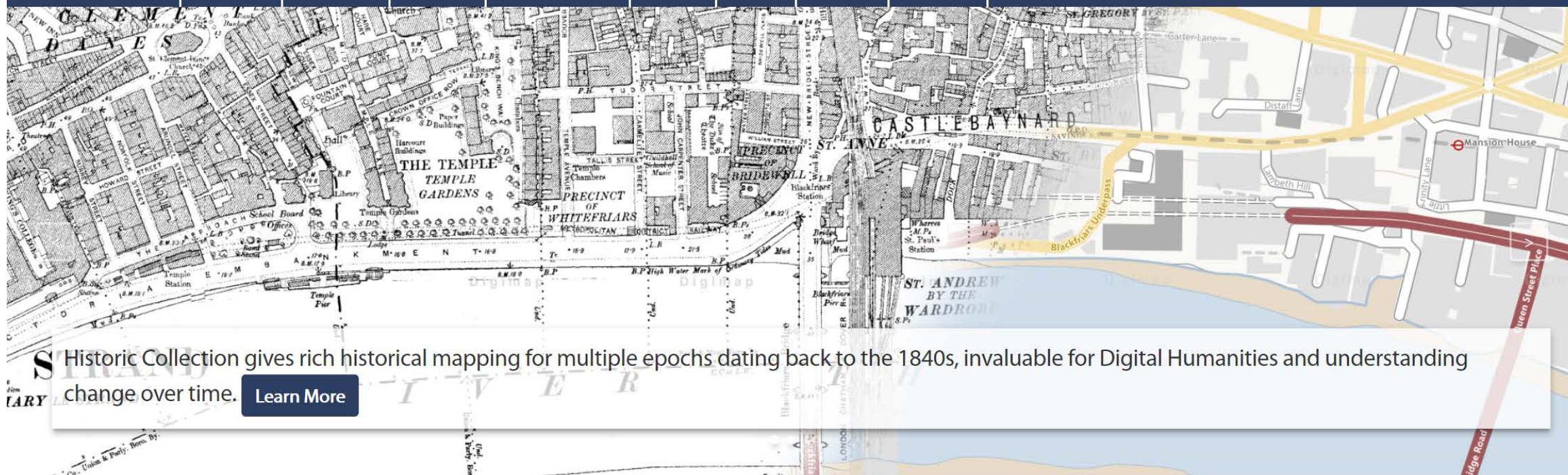
Research, analysis,
and decision making.

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 ~~is~~ 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. Do 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

**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



[Ordnance Survey](#)[Historic](#)[Geology](#)[Marine](#)[Environment](#)[Aerial](#)[Lidar](#)[Global](#)[Society](#)

Historic Collection gives rich historical mapping for multiple epochs dating back to the 1840s, invaluable for Digital Humanities and understanding change over time. [Learn More](#)

What is Digimap?

Digimap is an online map and data delivery service, available by subscription to UK Higher and Further Education establishments. Operated by EDINA at the University of Edinburgh, Digimap offers a number of data collections, including Ordnance Survey, historical, geological, LiDAR and marine maps and spatial data.

What are we offering?

Digimap offers access to a range of datasets for the purposes of education and research. Create or interrogate a map online by selecting an appropriate base map, adding annotations and customising the content, use measurement and query tools to learn more about any study area. Download the raw spatial data in a wide range of formats for use in local GIS, CAD or image processing software.

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<https://digimap.edina.ac.uk/>

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

Surveying Today - What are the Five Main Areas on Surveyors Work?

- Research, analysis, and decision making.
- Field work {Data acquisition}.
- Computing {Data processing}.
- Mapping {Data representation}.
- Stake-out / Setting out

Building surveys; Survey document preliminaries

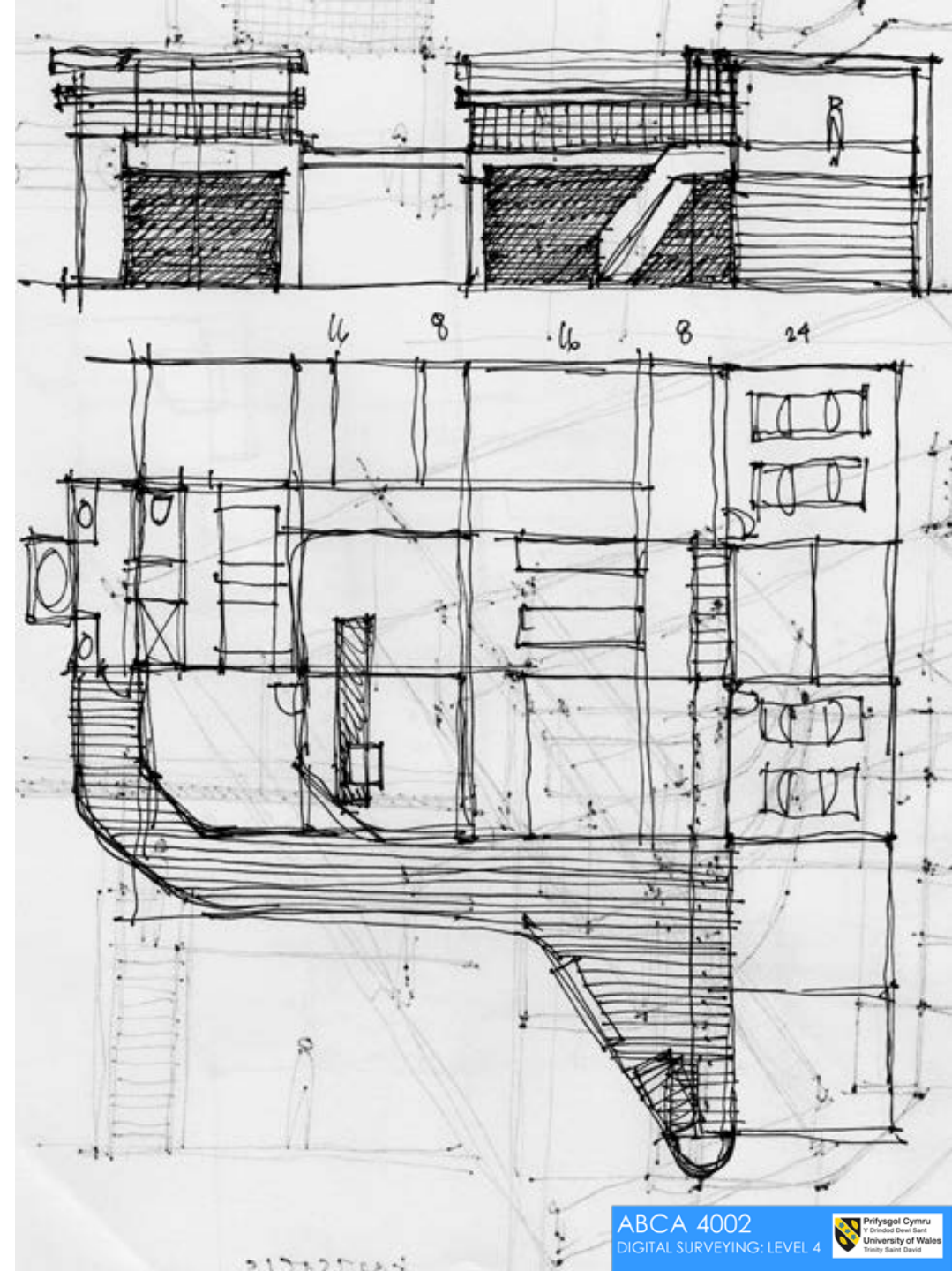
- Title and address of property
- Client's name, address and contacts
- Survey date and time
- Property status freehold, leasehold or common hold
- Occupancy occupied or vacant. If vacant, source of keys
- **Extent of survey, e.g. full structural services reports**
- Specialists in attendance, e.g. electrician, 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

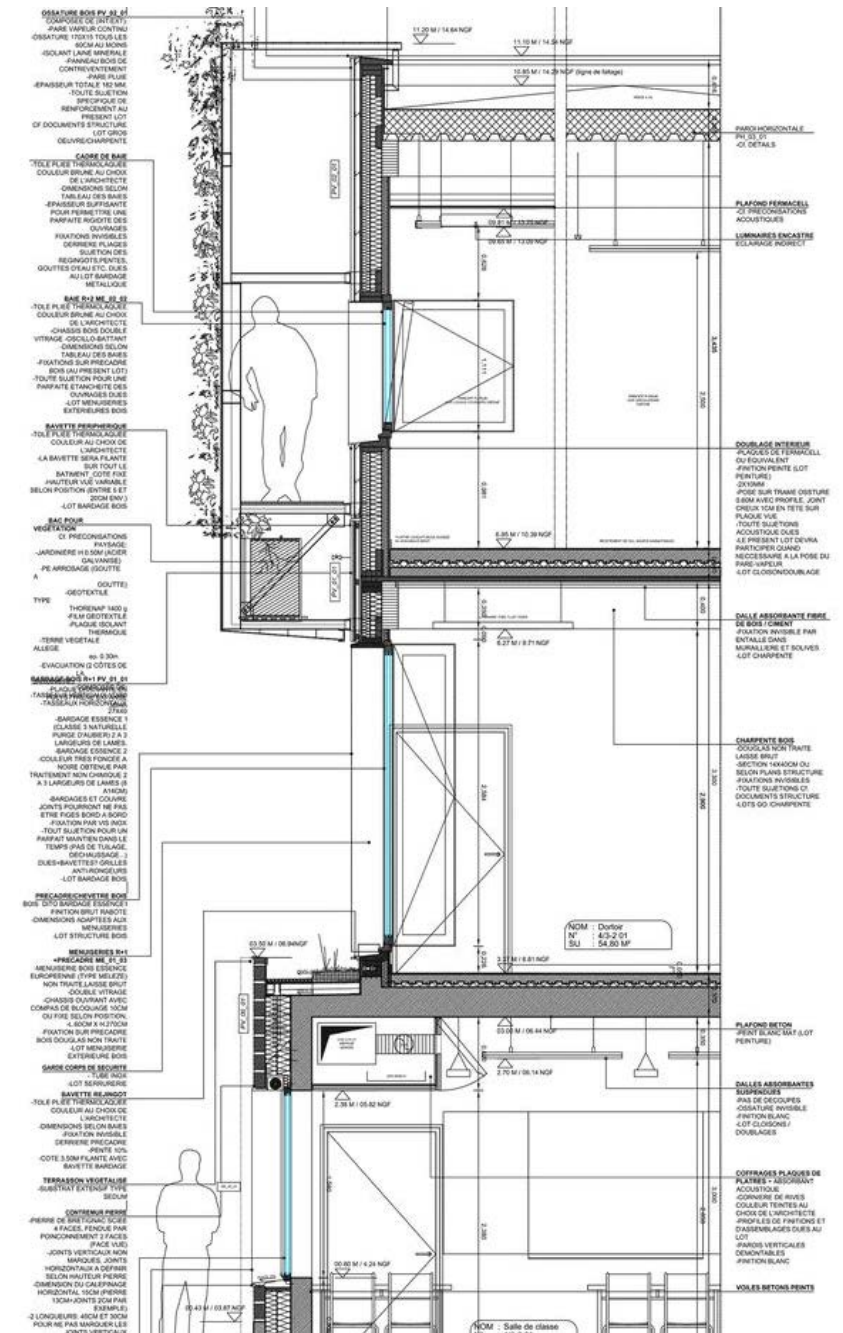
Sketches and Working Drawings

- Sketches are freehand drawings of an object for a project done in order to get the idea down on paper.
 - Sketches are not usually drawn to scale.
 - Neatly drawn sketches with fairly accurate dimensions are usually sufficient for simple projects.
 - Sketches of larger and more complicated projects can serve as the basis for accurate working drawings.



Sketches and Working Drawings

- Working drawings are complete drawings
presented in universal graphical language
so that the object depicted can be constructed from the drawing alone without additional information.
- Dimensions - Working drawings use lines scaled to the dimensions of the actual objects.
- Views - Working drawings show specific views of an object with enough detail to enable project construction.



Level of detail Building Envelope

- Age of covering / finish
- Repairs / Patch repairs and appropriateness.
- Replacements.
- Renewals.
- general condition.
- defects damage.
- evidence of leakage, water ingress.
- Cracks
- Settlement / Subsidence
- Missing details (flashings, downpipes, tiles, dpc etc)
- Resultant issues – Damp / Dry Rot / Wet Rot / Woodworm/ Mould



Resultant Issues: Damp

Assessment of Dampness in Buildings

Surveying Types of Dampness

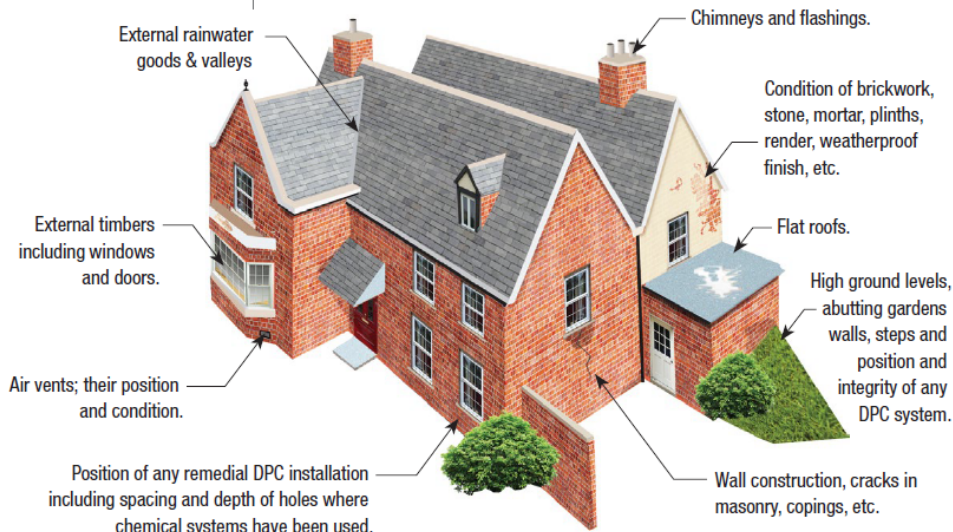
Before treating a wall for rising damp, it is essential to determine whether the dampness in the wall can be solely attributed to rising damp – or whether other causes such as condensation or rain penetration may be contributing to the dampness. The solutions described in this guide are solely for the treatment of rising damp. Solutions for other types of dampness can be found at www.safeguardeurope.com

The Survey

It is essential when investigating the potential for rising dampness to eliminate other sources of water ingress. Care must be taken to eliminate other potential sources of moisture, especially condensation in the colder months, and it is therefore essential to ensure that a full investigation is always undertaken. If any other sources are identified then these must be first eliminated before a proper assessment of any rising dampness can be made as it can be very difficult to distinguish between two or more interfering sources of water ingress.

Should it be noted that previous damp-proofing works have been undertaken then it is essential to take great care ensuring that the evidence of dampness is correctly evaluated. The following gives a guide to on-site routine procedures for the survey:

1. External Examination:



2. Primary Internal Examination (Visible Signs):

- Fungal decay in skirting and/or other timbers.
- Peeling/blistering wallpaper, peeling/blistering paintwork.
- Efflorescence.
- Mould growth, staining.
- Damp/wet patches, water droplets, water runs.

3. Secondary Internal Examination:

(assuming correct use of properly functioning and calibrated electrical moisture meter)

- Examine both perimeter and centre of solid/timber suspended floors.
- Check moisture content of timber skirting (top and base).
- Examine and check condition of the floor/wall junction, edge of DPM of floor.
- Check any remedial damp-proof course installation including position and depth of holes (if inserted from inside).
- Note **distribution** of moisture meter readings both vertically and horizontally on the surface of walls.
- Check for efflorescence beneath wallpaper finishes.
- Note any use of polystyrene sheet/foil backing beneath wallpaper.
- Note any new plasterwork, height of replastering, its condition and if possible its type, e.g. renovating, sand/cement, lightweight premix gypsum, etc.
- Lift floorboards and thoroughly examine timbers and subsite.
- Check for suitable subfloor ventilation.
- Look for internal plumbing defects and water dripping from cold pipes as the result of condensation.

4. Tertiary Internal Examination:

- Check (if possible) on history and use of property.
- Evaluate 'lifestyle', e.g. use of central heating, paraffin or flueless gas heaters, drying, washing and cooking, degree of ventilation, etc.

Once any form of dampness has been identified then it is essential that the risk of decay to any timbers is assessed and appropriate remedial measures undertaken.

REMEMBER: a combination of dampness and wood leads to potential rot.

The primary task of the investigator is to correctly identify the source of dampness. This is best achieved by a process of investigation and elimination. Extreme care must be taken, for example, in the winter months to eliminate condensation as one of the potential causes of dampness. A basic guide to dampness problems is given in Table 1 on the next page.

Symptom	Diagnosis
Decayed skirtings, damp base of wall, damp around edge of solid floor	- Rising dampness - Rising dampness + defect in floor/wall junction - Faulty edge to DPM of floor - High ground level/failed tanking skirting/floor
Surface efflorescence just above skirting/floor	- Gypsum finishing in direct contact with damp solid floor or damp masonry at base of wall - Gypsum finish/porous plasterwork taken below timber suspended floor and subfloor and condensation at floor/wall junction
Dampness at base of wall up to 1.5 m* in horizontal band	- Rising dampness - Low level rain penetration (splashback)
Stains, especially in horizontal band, noticeably damp in humid conditions	Heavy contamination with hygroscopic salts
Damp patches on surface increasing in size during/ following rain; sometimes heavy efflorescence	Rainwater penetration; external defect
Stains/damp/efflorescence on chimney breast	- Contaminated plasterwork from combustion products - Condensation in flue - Water running down chimney flue
Mould growth on cold surfaces, window reveals, ceiling/wall junction, etc	Condensation
Free surface water, water run marks, water droplets, dripping water	- Condensation - Severe rainwater penetration - Severe plumbing leak
Damp timber floorboards around edge of floor but not in centre	- Subfloor condensation at floor/wall junction - Floorboards in direct contact with damp masonry or damp joists
Floorboards damp away from wall	Subfloor condensation
Damp at first floor level and above	- Condensation - Rainwater penetration - Plumbing defects

Resultant Issues: Damp

Use of Electrical Moisture Meters

The proper use of a surface electrical moisture meter can give a useful indication as to the existence of a rising damp complex but cannot give absolute proof, especially where remedial works have been previously carried out. (See Property Care Association DP1, 'The use of electrical moisture meters to establish the presence of rising dampness').

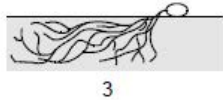
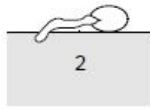
Electrical moisture meters should be used to obtain a "moisture profile" by taking readings at regular intervals (usually 100 mm) vertically up the wall being investigated. The typical moisture profile for walls suffering from rising damp is high surface readings on the lower sections of wall followed by a sudden 'cut-off' at the top of the rise of moisture.

However, other meter reading patterns can be obtained during investigations. Some possible interpretations are given in the table on the next page. Please note that it is the pattern of the readings which are important.

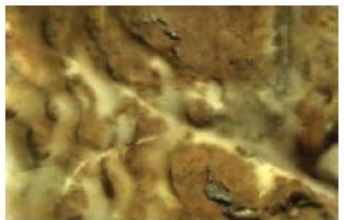


Mould growth as a result of condensation could be caused by a lack of ventilation, rather than penetrating damp.

Resultant Issues: Dry Rot



Mycelium



Developing strands

<https://www.safeguardeurope.com/>

Identification of dry rot

- The wood shrinks, darkens and cracks in a 'cuboidal manner' (typical 'brown' rot damage)
- A silky grey to mushroom coloured skin frequently tinged with patches of lilac and yellow colouration develops under less humid conditions. This 'skin' can be peeled like a mushroom.
- White fluffy cotton wool-like mycelium develops under humid conditions: 'teardrops' may develop on the growth.
- Strands develop in the mycelium; these are brittle when dry, and crack on bending.
- Fruiting bodies are a soft fleshy pancake or bracket with an orange ochre surface: the surface has wide pores.
- Rust red coloured spore dust frequently seen around fruiting bodies.
- Active decay produces a musty, damp odour.





Millbank Primary School





Resultant Issues: Wet Rot

Wet rot is timber that is decaying naturally in the presence of high moisture levels. It is a general term used to describe a variety of fungal species responsible for wood rot, the most common being 'Cellar Fungus' (Coniophora Puteana).

Any timber exposed to excess moisture can provide the ideal breeding ground for wet rot spores, meaning wet rot can occur for a number of reasons.



- Look out for localised fungus growing on timber.
- Timber affected by wet rot will feel soft and spongy (even through a coat of paint) and look darker than surrounding timber.
- When dry, the timber will easily crack and crumble into fine particles. It can also be susceptible to shrinkage.
- Some types of wet rot cause the wood to bleach. This is common in doors and window frames.
- Look for damaged or flaky paint. If the paint finish is damaged, this can increase the risk of wet rot. If you suspect wet rot and the paint is not damaged, push a thin bladed knife into the painted timber. The blade should stop after a short distance. If it goes in up to the handle, it is almost certainly a sign of rot behind the paint.
- Often wet rot is associated with a damp musty smell.
- When no obvious fungus is present, wet rot can generally be identified and differentiated from dry rot by the differing colour of the decayed timber as well as the size and type of cracking by the timber as the wet rot progresses.

Resultant Issues: Wormworm



What are Woodworm?

Woodworm is a generic name for the larvae of a group of beetles that complete their life cycle in timber. In nature they play a valuable role in recycling dead timber in the forest, however, when they attack timbers that have been used to make furniture or buildings, they can become an unwanted and often destructive pest.



Woodworm play a vital role in nature by helping to break down dead wood and return the nutrients to the forest floor.

1. **Presence of Fresh Bore Dust (Frass)** – The presence of fresh bore dust adjacent to or beneath emergence holes can be a strong indication of an active woodworm infestation. However, it is important to remember that the frass will be present in the old bore holes within the wood forever, and, therefore vibration (e.g. that caused by foot traffic) can sometimes dislodge this frass, giving the false impression that the woodworm are still active.



2. **Presence of Live Larvae in Timber** – The strongest indication of an active infestation is the presence of live larvae which may be found in timber that has been removed.

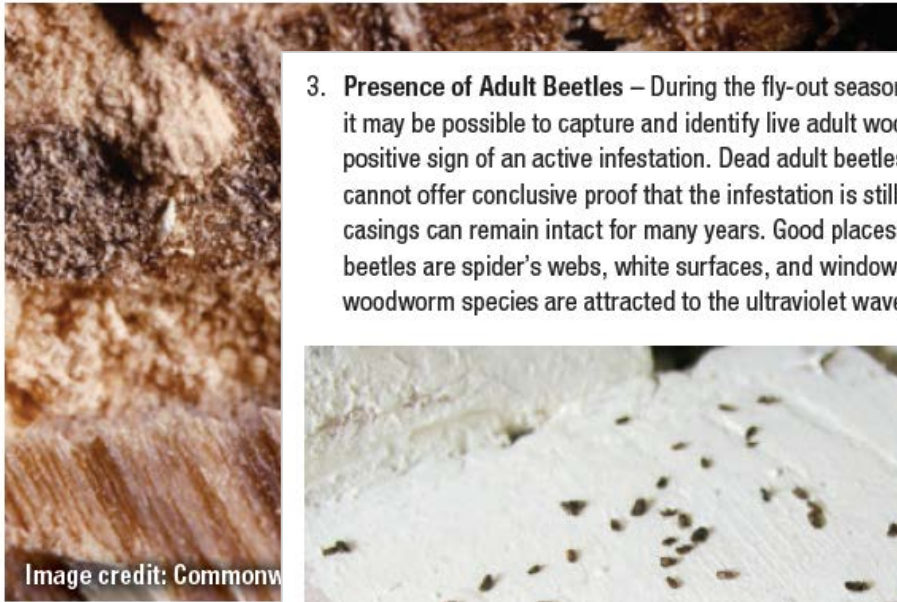


Image credit: Commonw

3. **Presence of Adult Beetles** – During the fly-out season (generally spring) it may be possible to capture and identify live adult woodworm beetles as a positive sign of an active infestation. Dead adult beetles may also be found, but cannot offer conclusive proof that the infestation is still active because casings can remain intact for many years. Good places to look for evidence of beetles are spider's webs, white surfaces, and window sills (adult beetles of many woodworm species are attracted to the ultraviolet wavelengths found in sunlight).



Image credit: Brick-Tie Preservation

4. **Presence of Steely Blue Beetle (*Korynetes caeruleus*)** – This beetle is a predator of The Common Furniture Beetle (*Anobium punctatum*) and Deathwatch Beetle (*Xestobium rufovillosum*) therefore its presence is a strong positive indicator of an active infestation of either of these two species of woodworm.

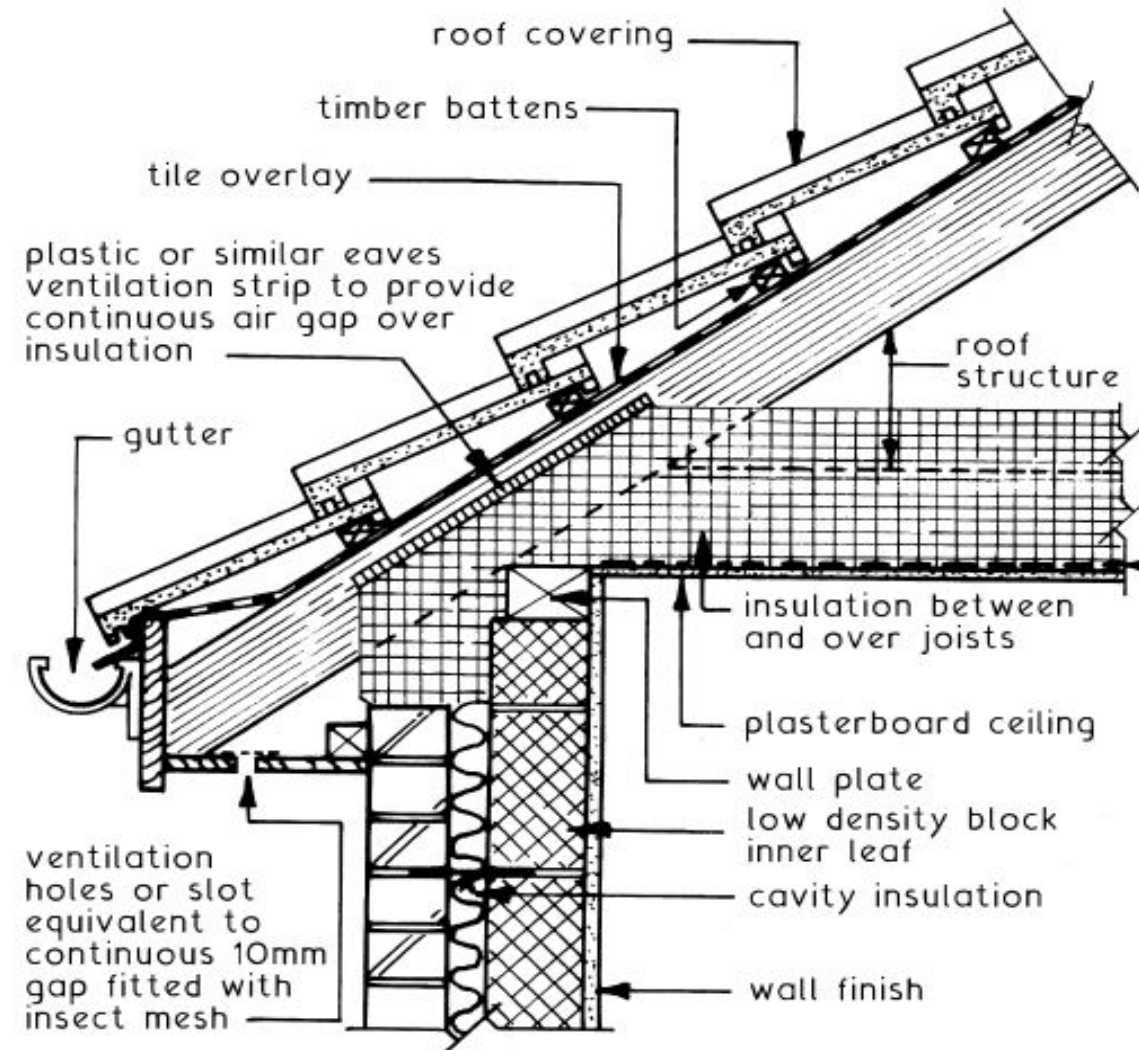


5. **Monitoring for Presence of New Emergence Holes Using the "Paper Test"** – This involves lining paper being stuck over the surface of timber in areas where active infestation is suspected. The paper can then be monitored periodically over several years. If an adult beetle emerges from the underlying timber it will also cause a hole in the monitoring paper – indicating that the infestation is active.



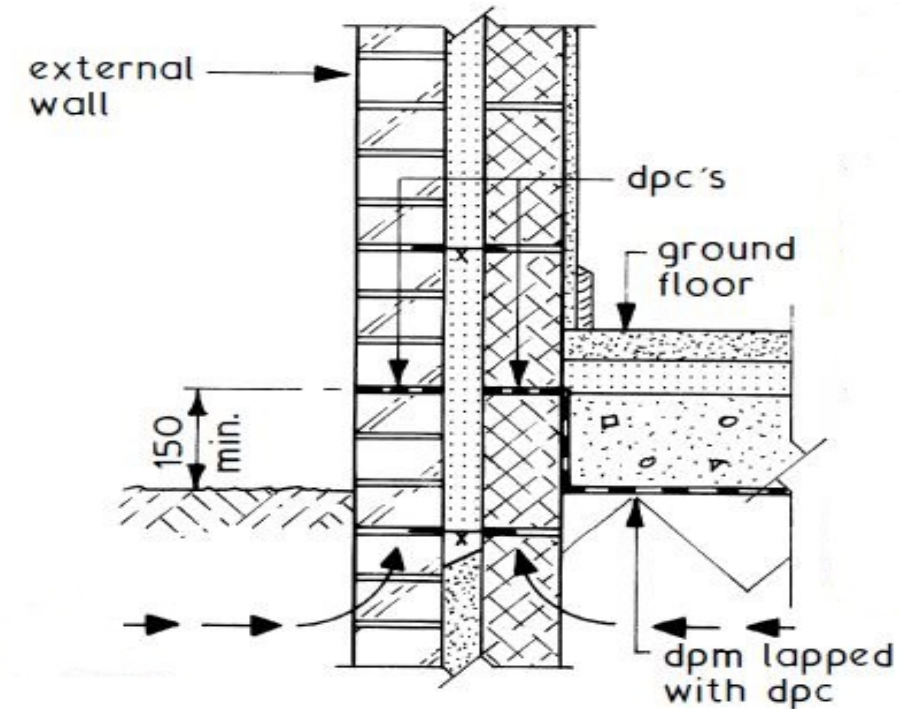
Level of detail for roofs

- 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



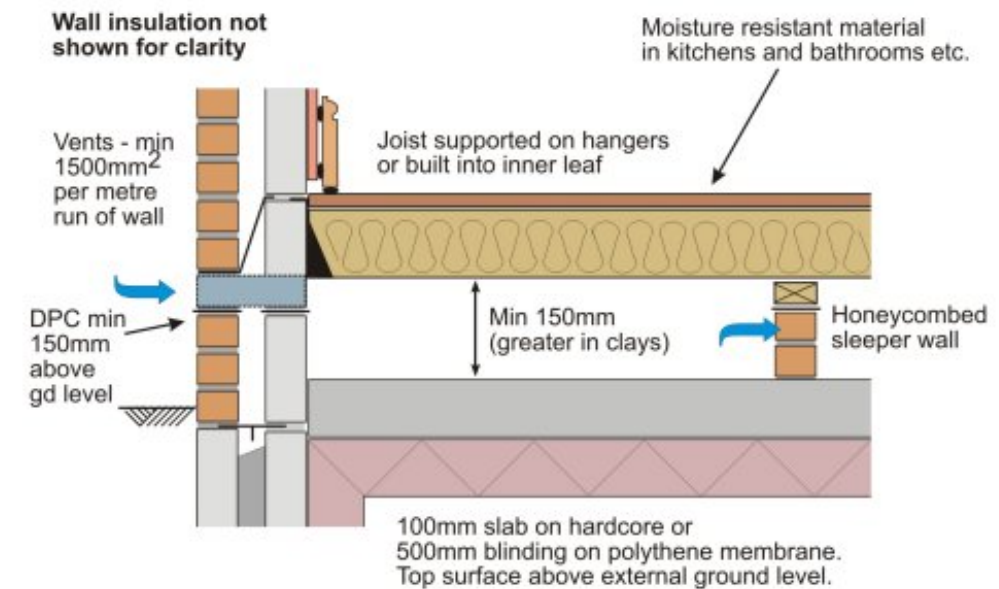
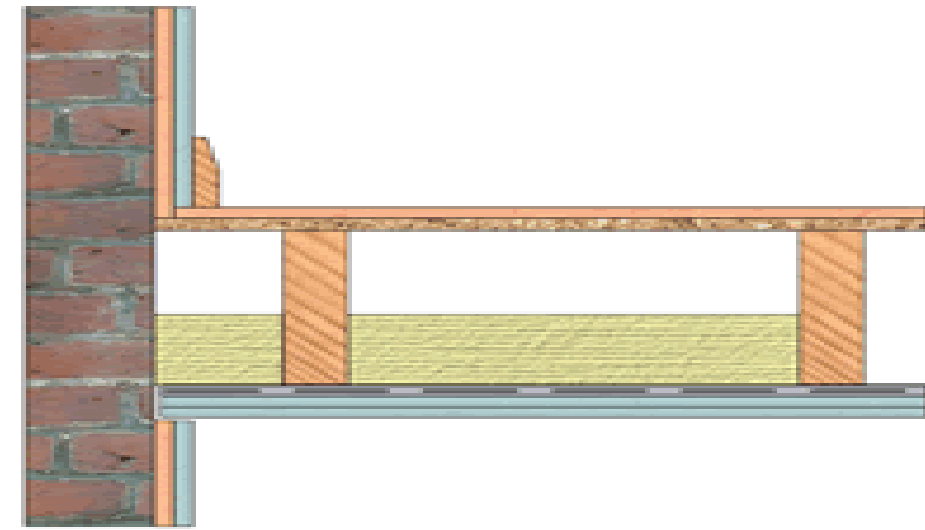
Level of Details for Walls

- 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, ventilation (trickle vents)
- Settlement signs of cracking, distortion of window and door frames specialist report



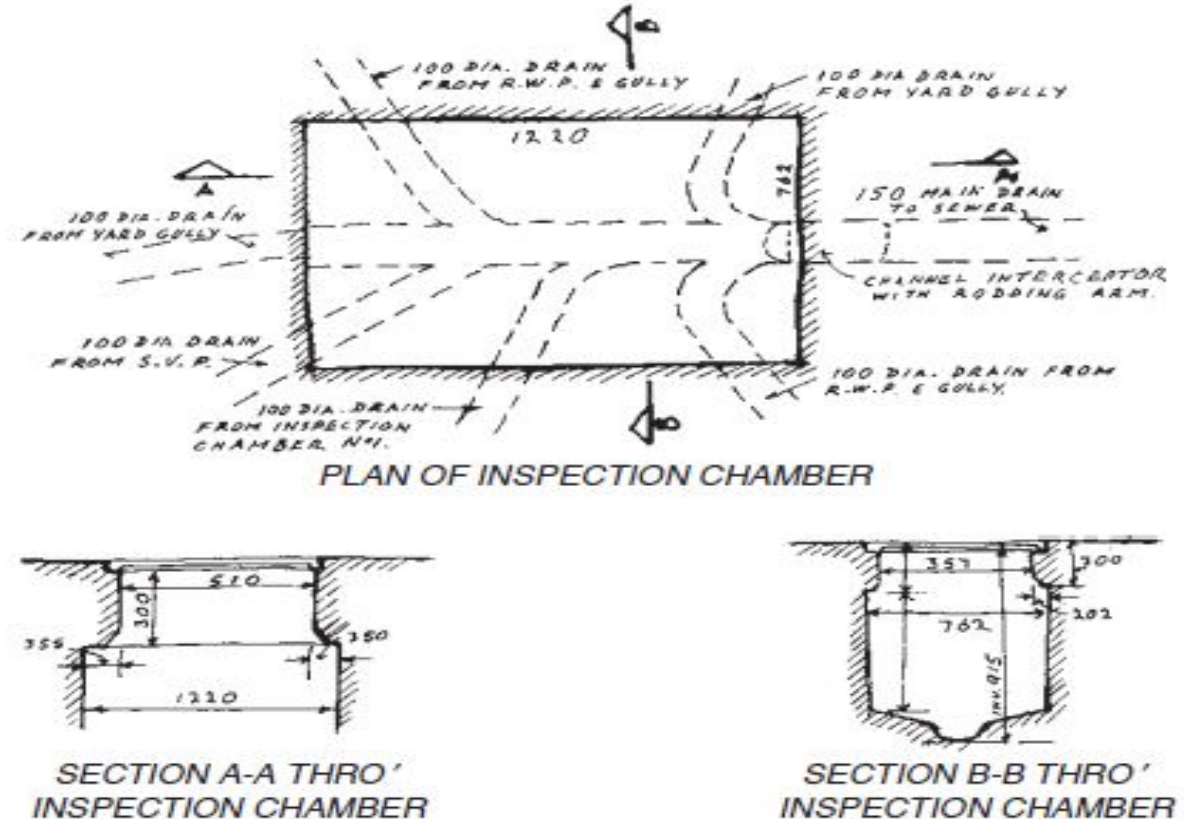
Level of Detail for Floors

- 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
- Defects / fall, level of floor.



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

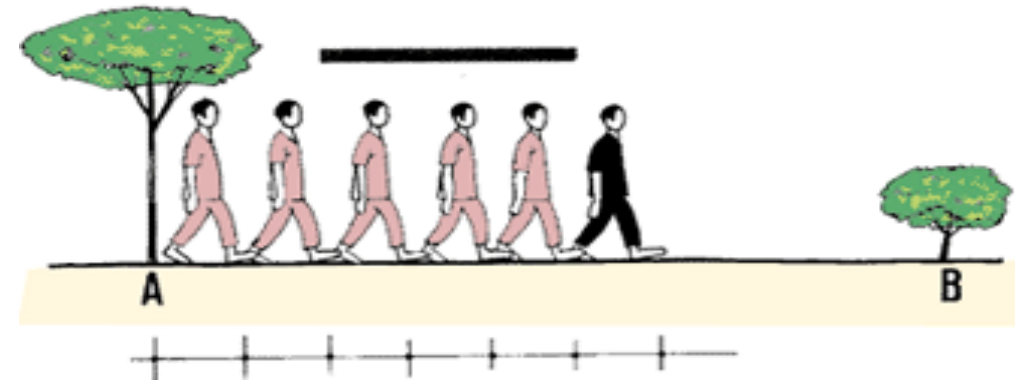


Working Arrangement Planning

- You should be able to survey a single room in by yourself (NOTE: LONE WORKING RISK). In general for surveys work in pairs.
- One person holds the end of the tape and records the measurements while the other reads them off the tape and calls them out to their partner. This principle remains the same when using digital laser measures.
- If you are surveying a large or complex building, divide up the work by assigning different floors or parts of the building to different pairs. Some measurements running the whole length of the building will help to tie together the work of different pairs when combining the drawings.
- Sometimes, you will need to work in teams. A team consists of as many pairs as are needed to complete the survey in the time available. First, each team makes its own survey and then each team makes a complete set of drawings

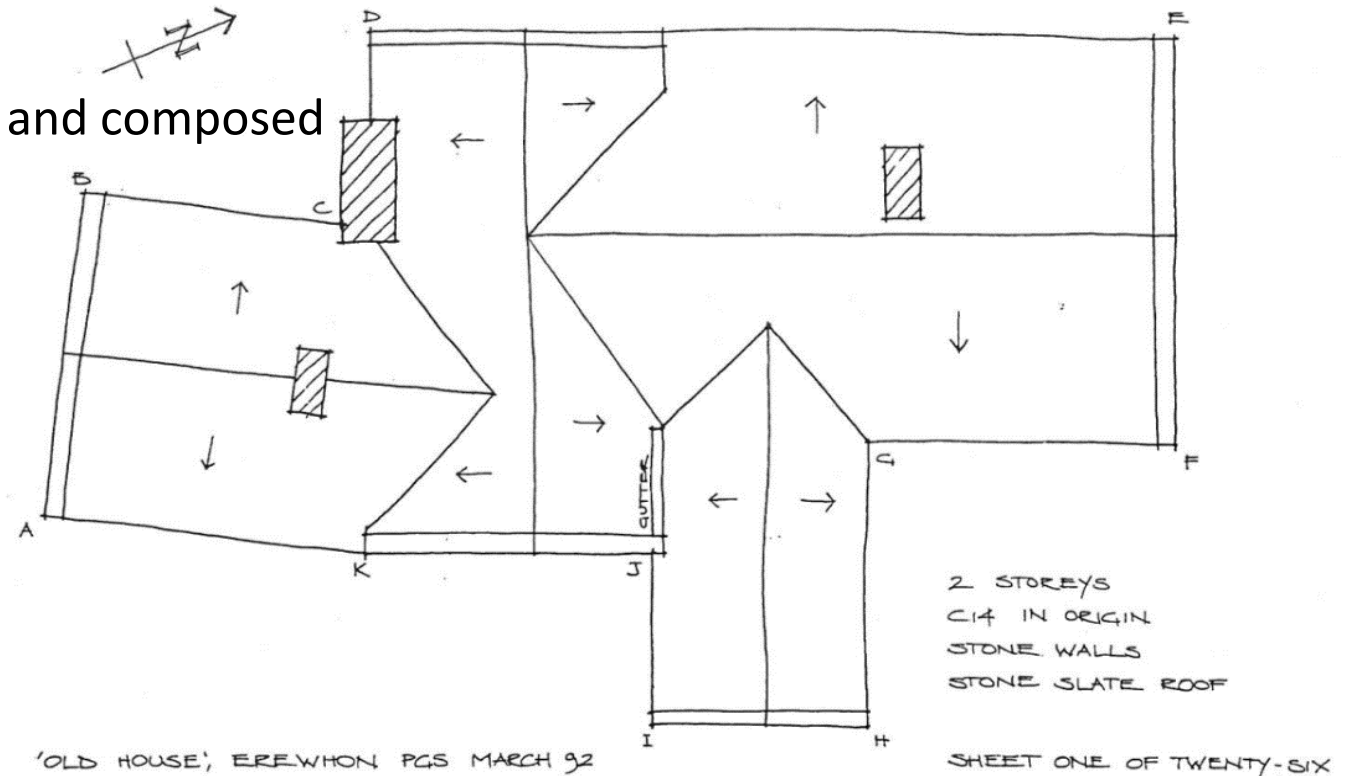
Surveying Procedure

- Prepare a site plan sketch
- Pace out boundary measurements / measure with other liner devices if available.
- Note boundary features, walls, fences, drainage positions, vegetation and trees.

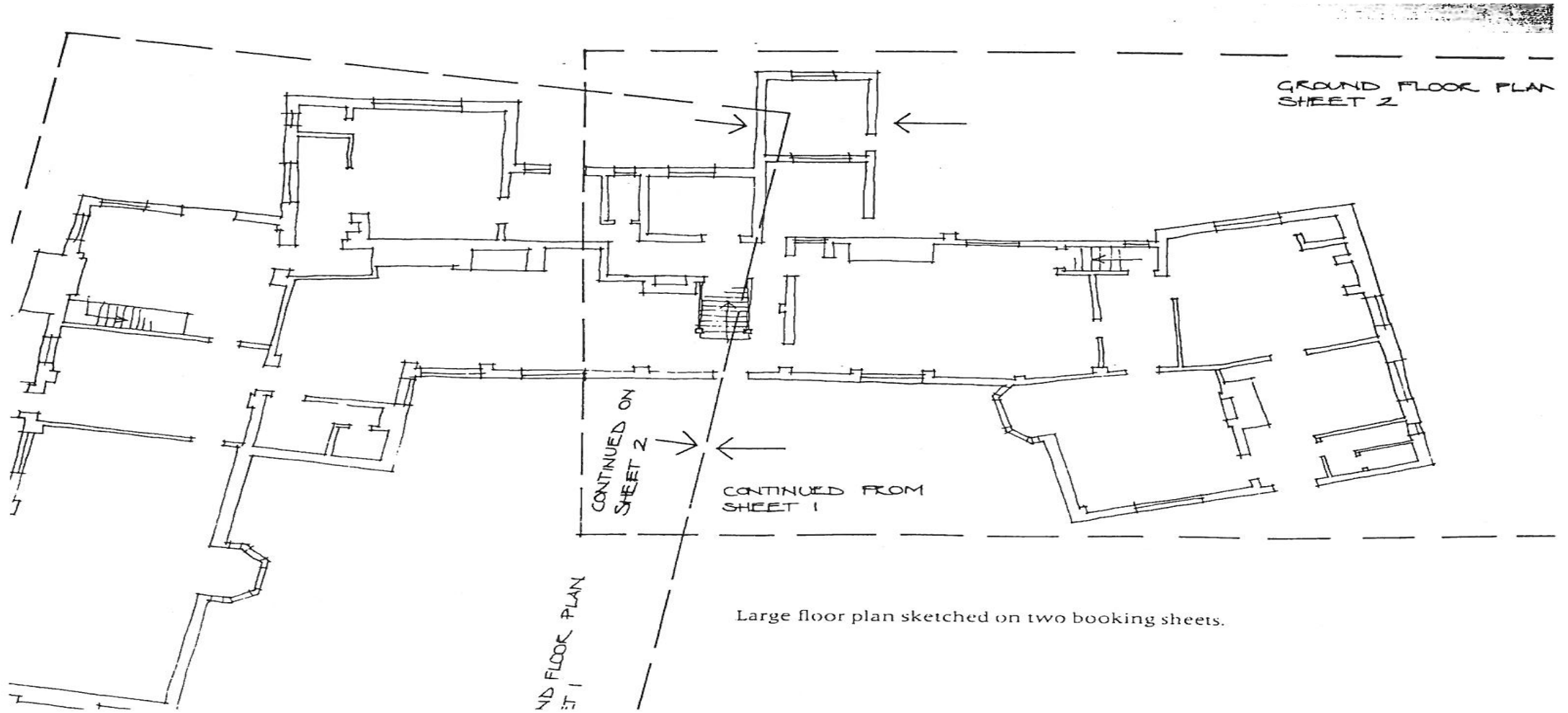


Surveying Procedure

- Before any measurement can take place prepare sketch plans, section and elevations
- Show as much information as possible include
 - A north point (use compass or OS sheet)
 - Arrangement of roof slopes, stacks and dormer windows
 - A reference letter for each corner
 - Note indicate number of storeys, age, and composed material
 - Surveyor name
 - Sheet number



Surveying Procedure; Example of ground floor sketch on two sheets



Surveying Procedure

Starting with ground floor, draw floor plans for each level

- Drawn at a plane at 1200mm
- In order to keep ground floor plan roughly in proportion, start from outside by drawing the perimeter.
- Take each wall in turn record all details (projections, openings, steps, rails etc.).
- Prepare internal arrangement on completion of perimeter (work methodically on a room by room basis).
- Distinguish between load and non-load bearing walls
- Best to establish overall plan before adding detail, e.g. Reveals, door swings, plant, fittings, etc.
- Stairs and stair well, showing landings, risers numbers of risers, arrows up or down. Note any intricate detail.
- Note direction of floorboards and floor, wall, ceiling finishes

Surveying Procedure

If accessible, draw a roof plan showing the following features

- Roof pitches and direction of slope.
- All hips, valleys and ridges, parapets, gutters, roof lights, dormer windows, chimneys etc.

Draw sections conveying maximum the amount of information

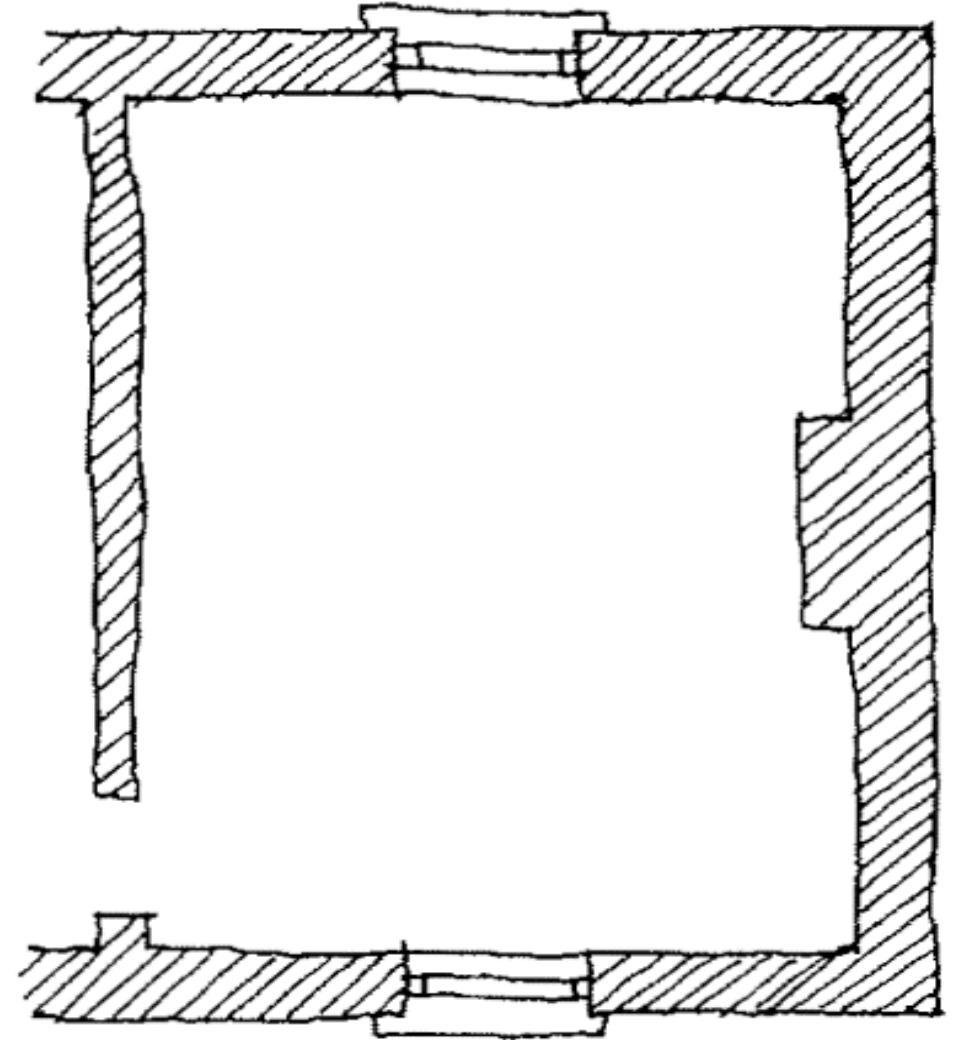
- Shape and arrangement of timber roof
- Levels of floors and thickness
- Relationship between ground and basement/ground floor levels
- Staircases (including headroom)
- Heights of ceilings, doors windows and sills

Draw elevations for each face of building

- Windows and doors
- Plinths and string courses
- Rainwater goods and pipework
- Roof, chimney stacks etc.

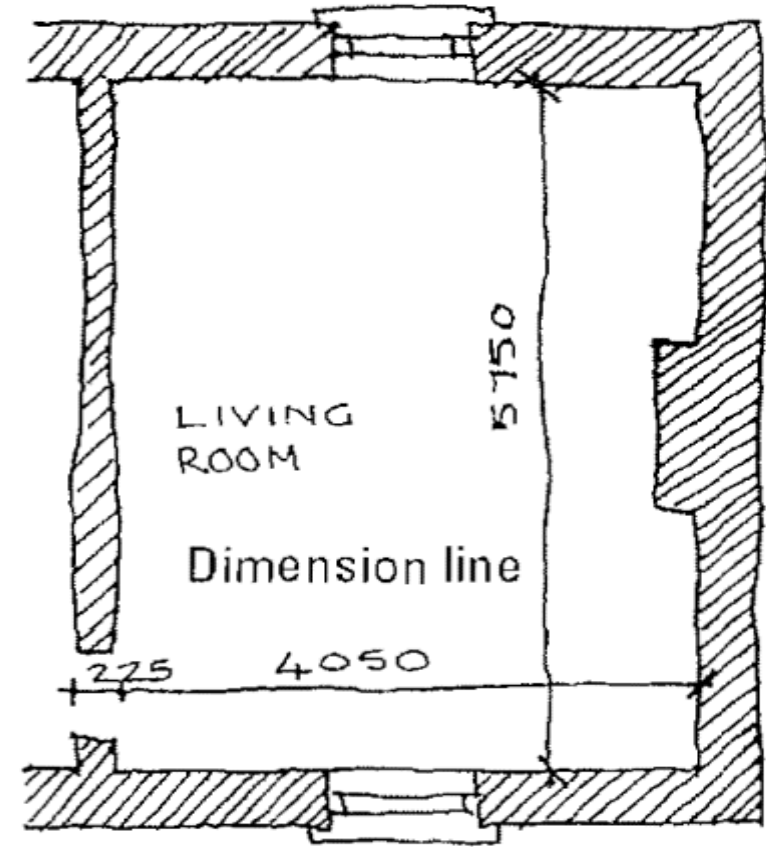
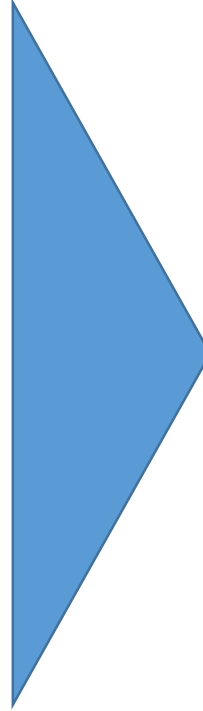
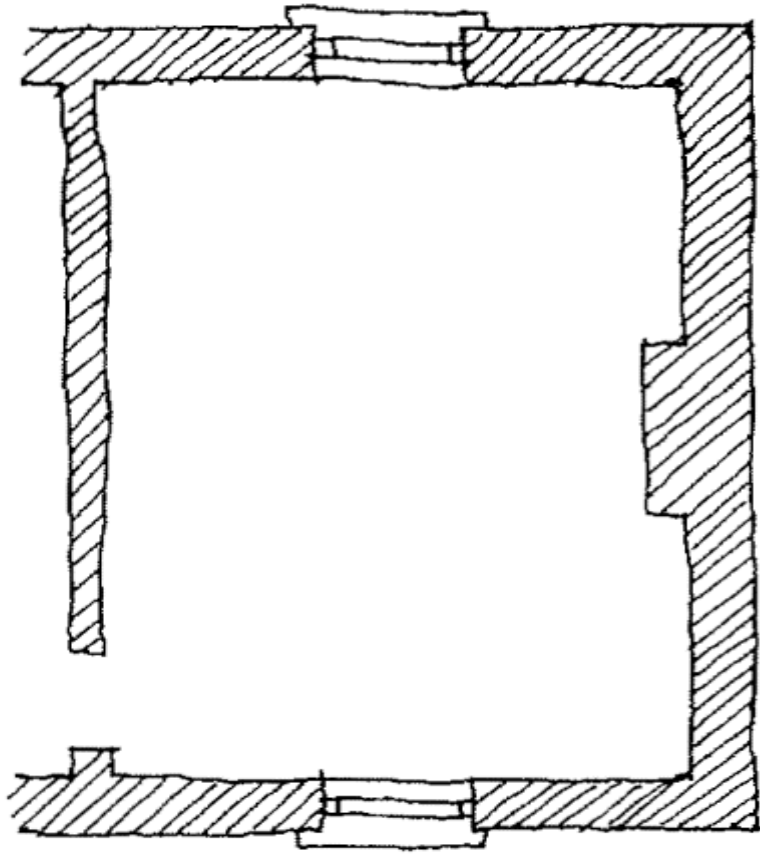
Measuring Internal Detail

- 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.



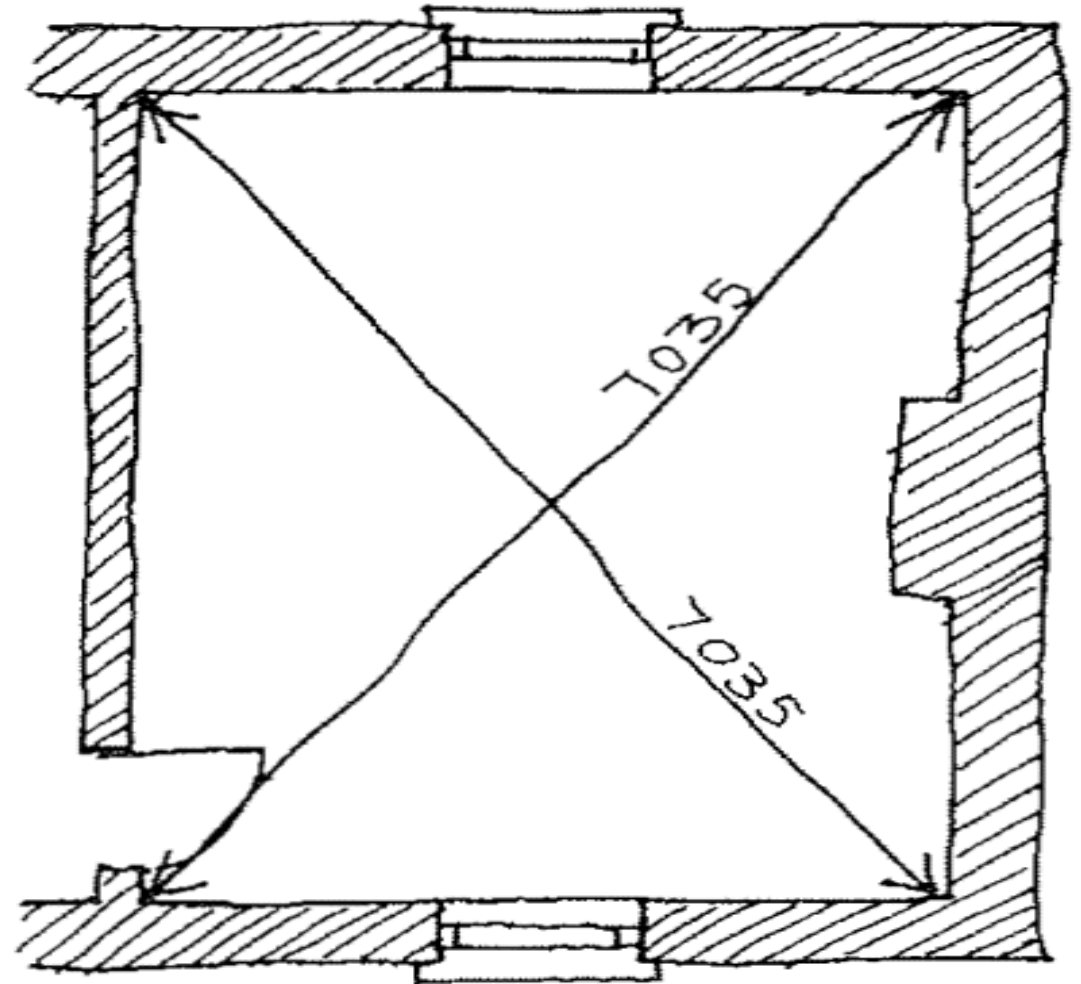
Draw a rough plan of the room

Sketch Drawings



Diagonal Checks

- Sometimes, the corners of rooms are not proper right angles, causing problems when you try to draw the plan .
- To avoid this, take diagonal measurements from corner to corner of the room. If the two diagonal measurements are the same, there is generally no problem. If the measurements are different, record them



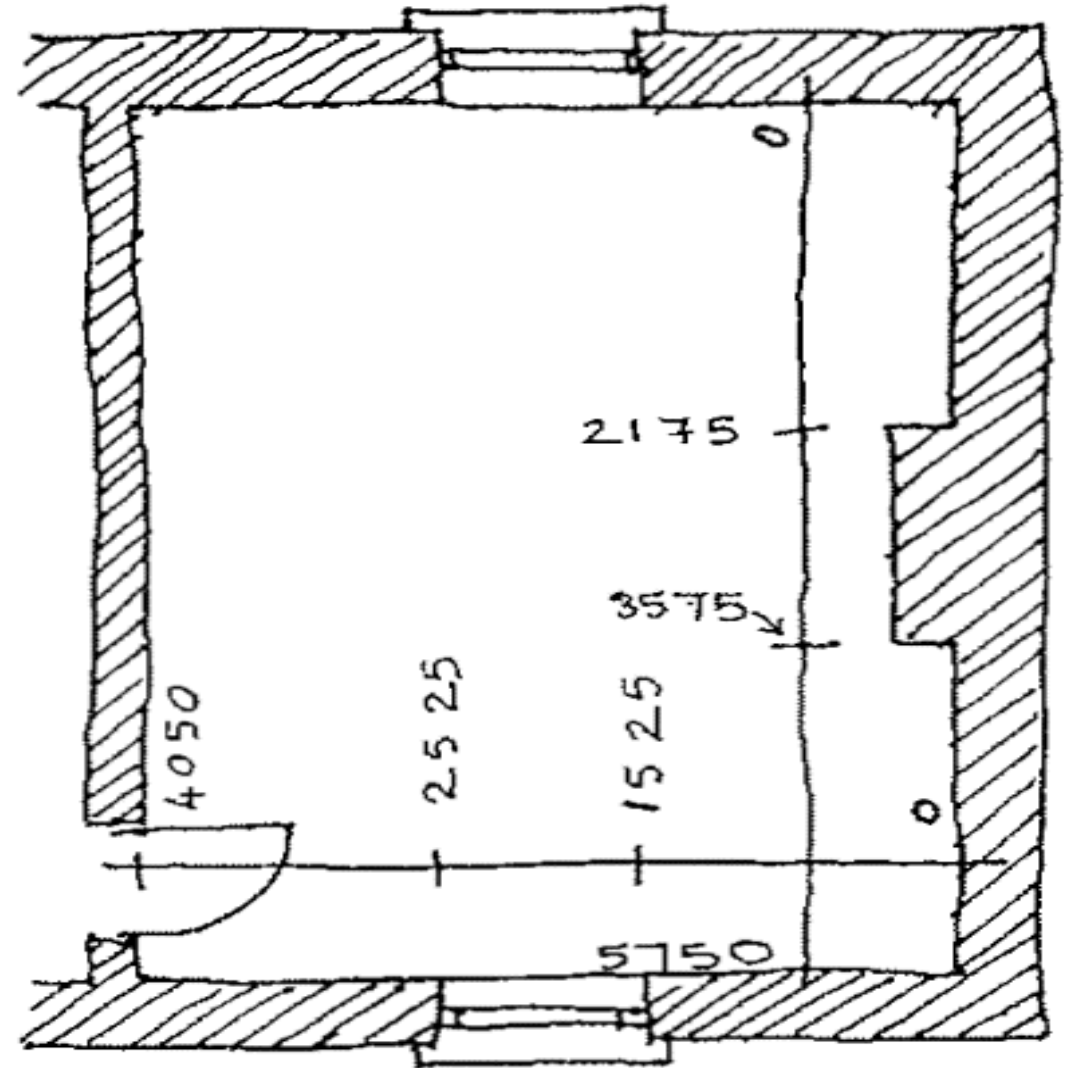
Detailed Measurements

- Two volunteers required.



Detailed Measurements

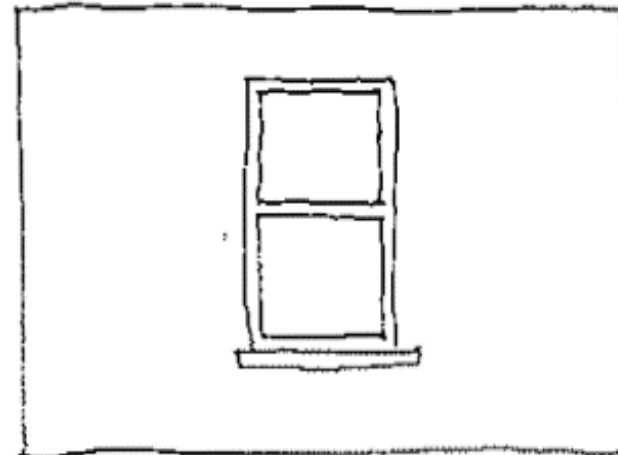
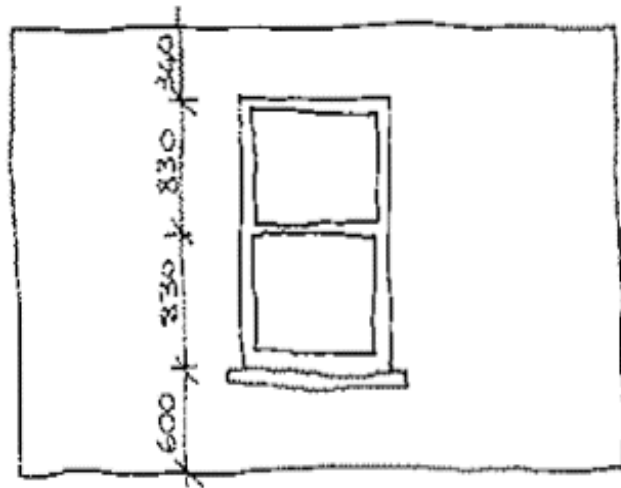
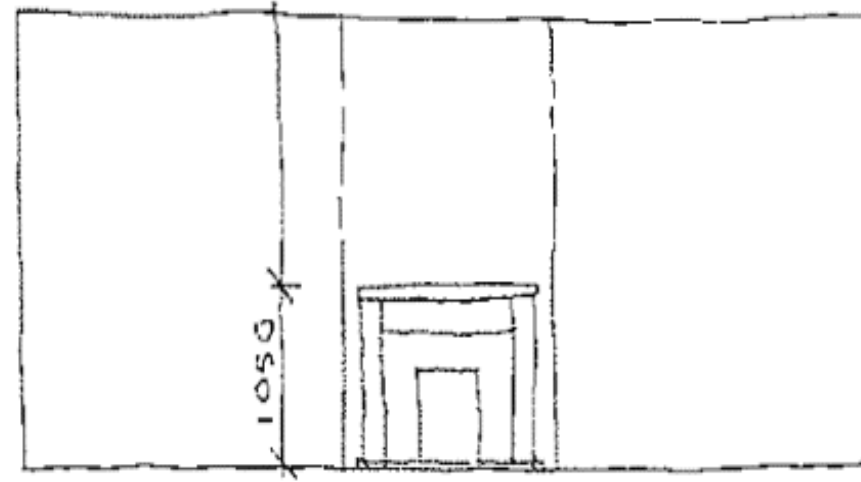
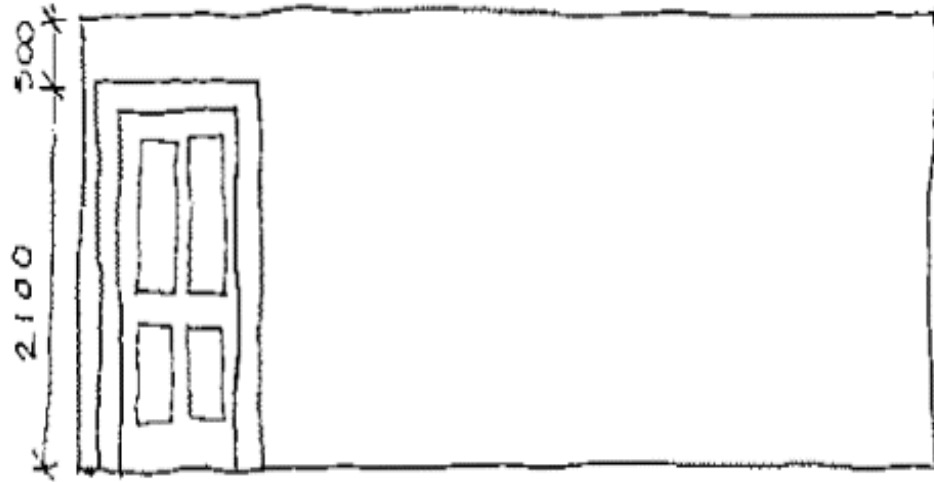
- Next, starting in one corner, take running measurements along one wall.
- Note on your plan where each window, door, recess and so forth starts and finishes.
- When you get to the next corner, start at zero again and measure the second wall. Continue around the room, measuring from zero at each corner, until you get back to where you you started.



Take running measurements

Internal Elevations

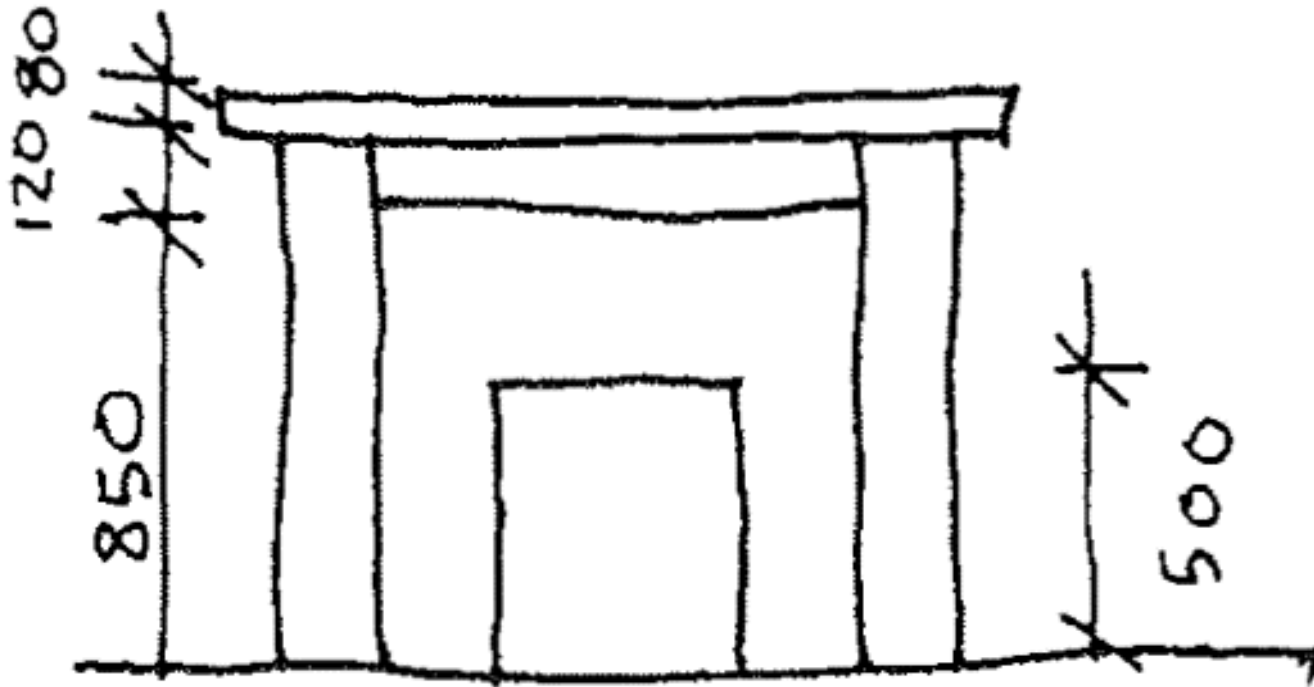
Draw a rough elevation of each wall of the room. Then measure the heights of ceilings, doors, windows, cupboards etc. Note the measurements on your elevations, using dimension lines just as you did on plan.



Additional Detail

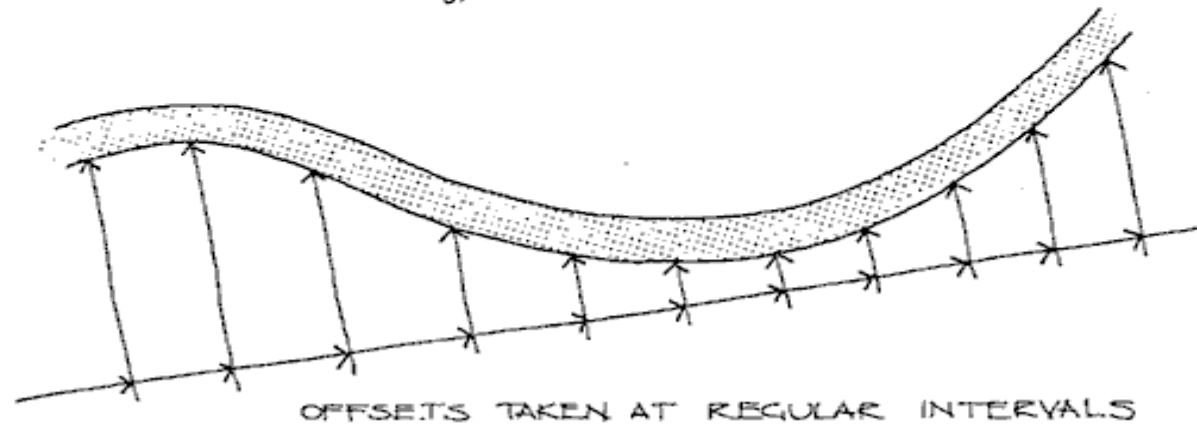
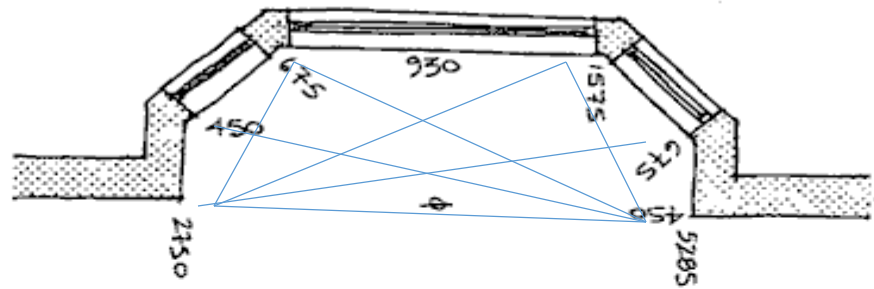
If you come across something you want to measure in detail - an interesting fireplace or window, for example - make a separate sketch of it at a larger scale. For detailed features, take photographs

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



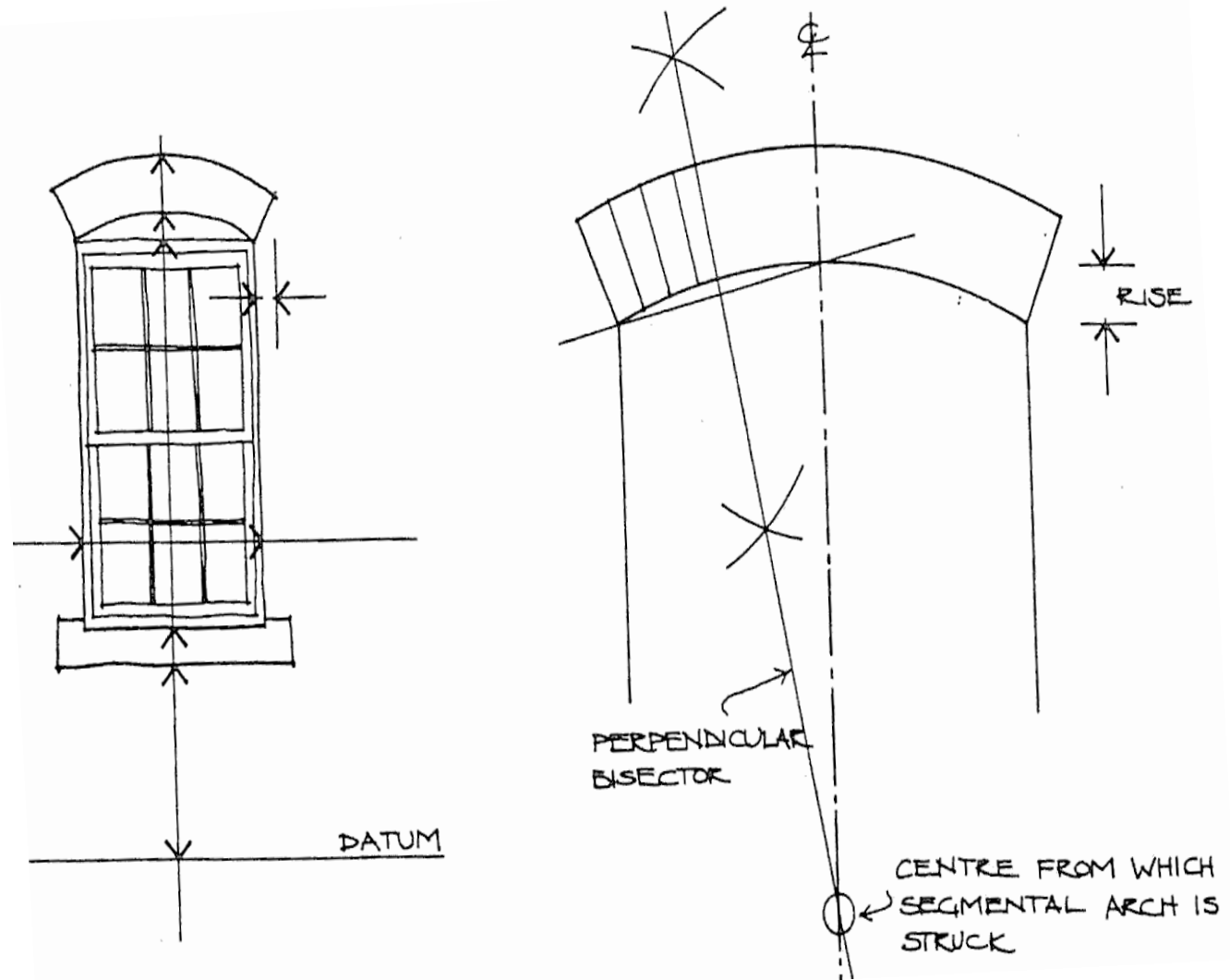
Measuring Bay and Meandering Walls

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



Segmental Arch Details

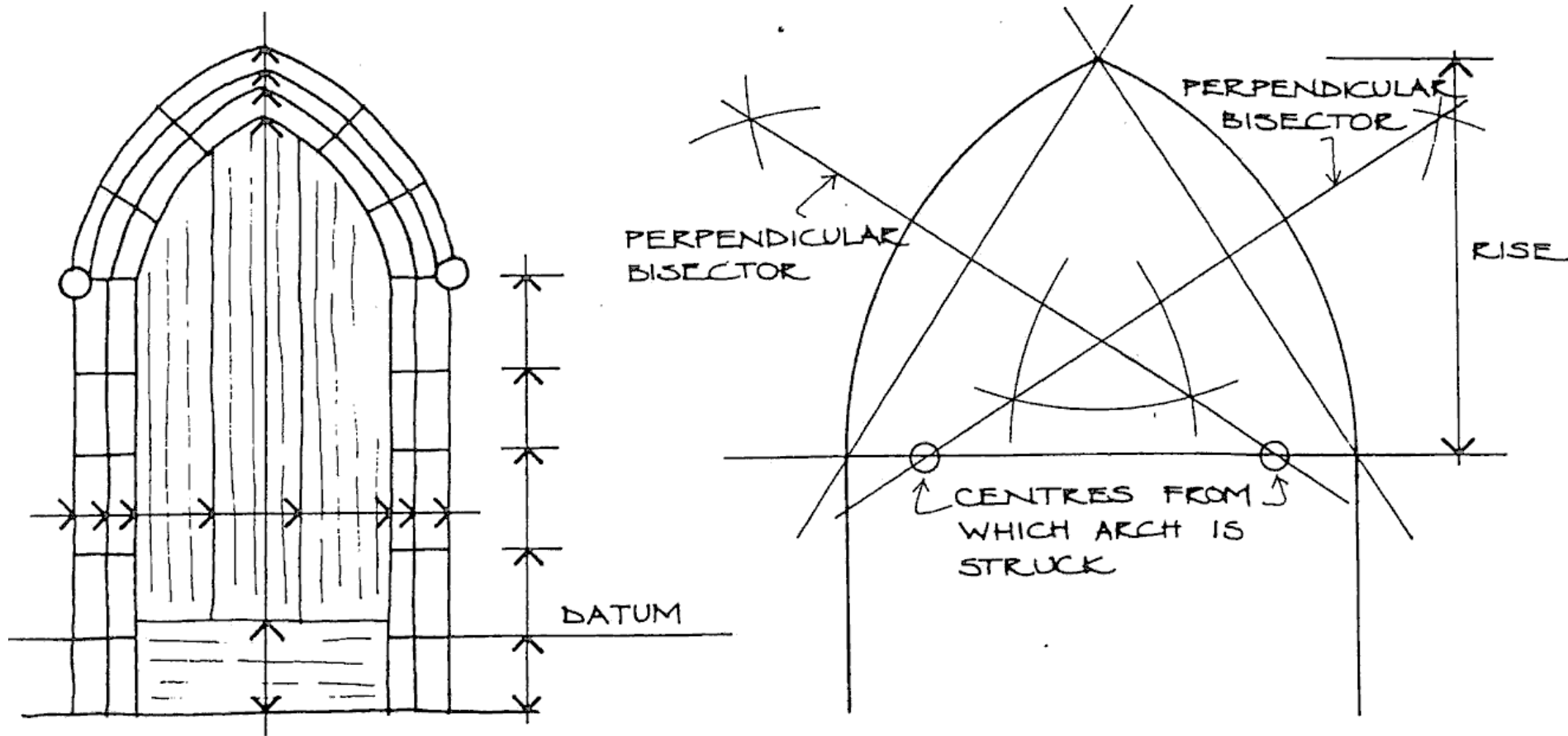
- Measure from datum to the underside and top of sill, top of window, and rise to the underside of arch centre
- Measure arch span and estimate point at which the arch was struck.
- Note the number of bricks used



Gothic Arch Details

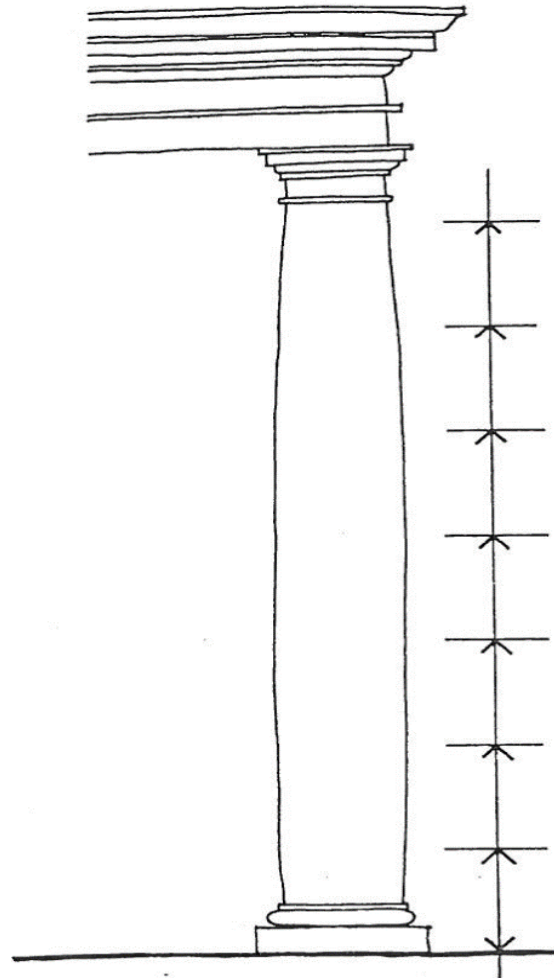
- Measure from datum to the underside and top of arch, and any additional features
- Measure from the datum to the springing point of the arch on both sides estimate point at which the arch was struck.

Note the number of masonry blocks or bricks used

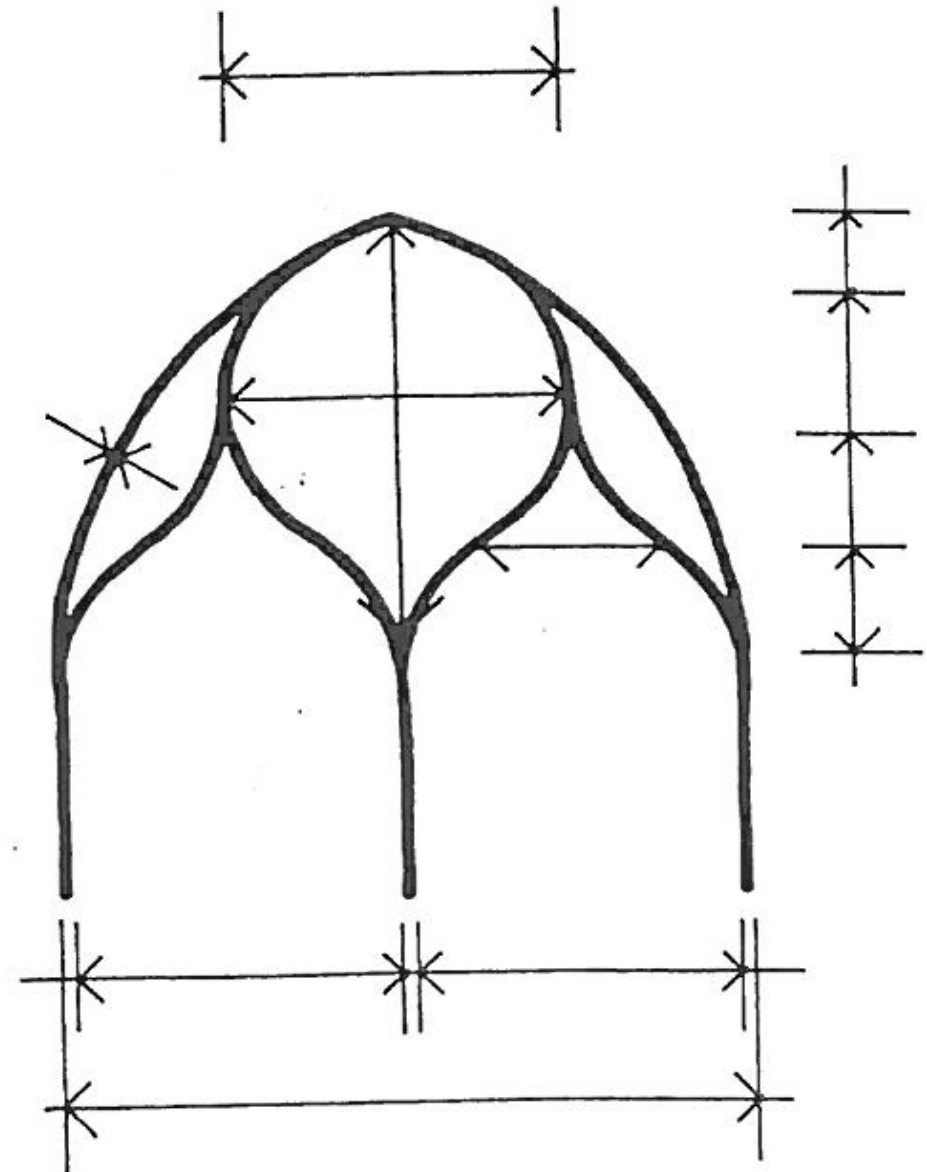


Measuring Tracery and Entasis

- The centres of all curves must be established

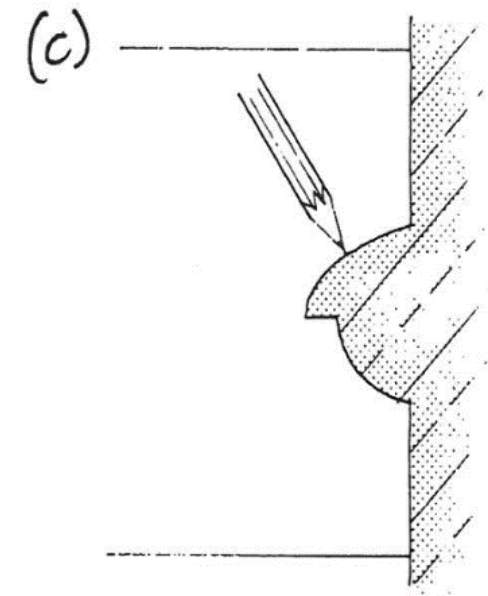
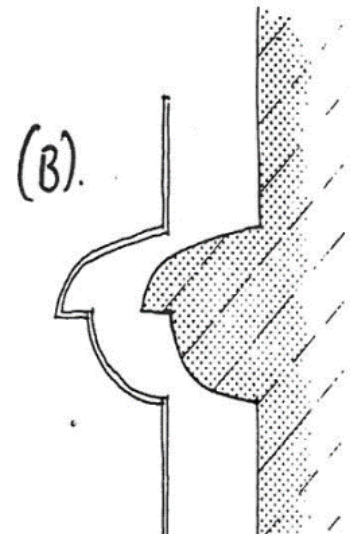
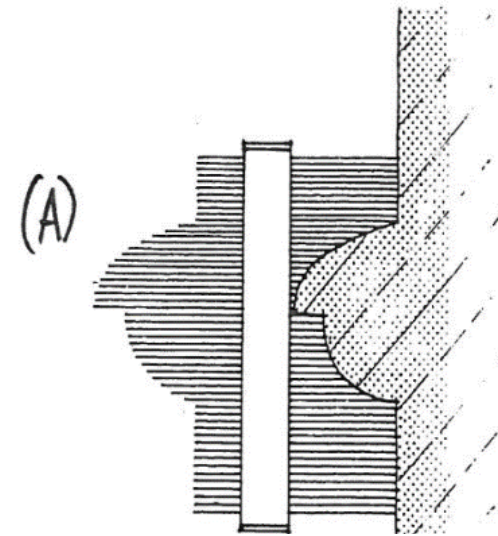


CIRCUMFERENCE TAKEN
AT REGULAR
INTERVALS FROM
WHICH VARIATION
IN DIAMETER
CAN BE CALCULATED

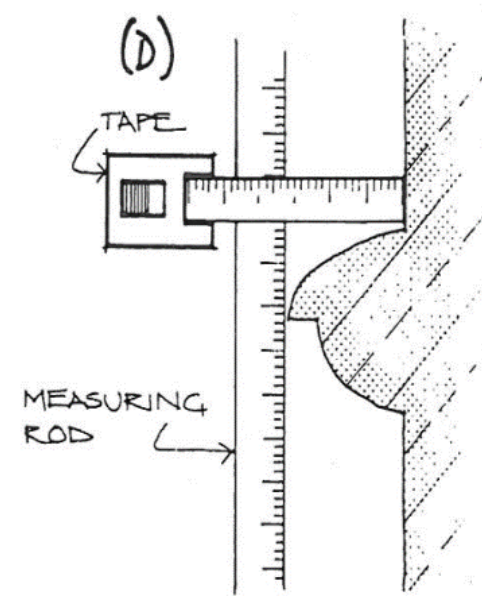


Measuring Mouldings

- 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



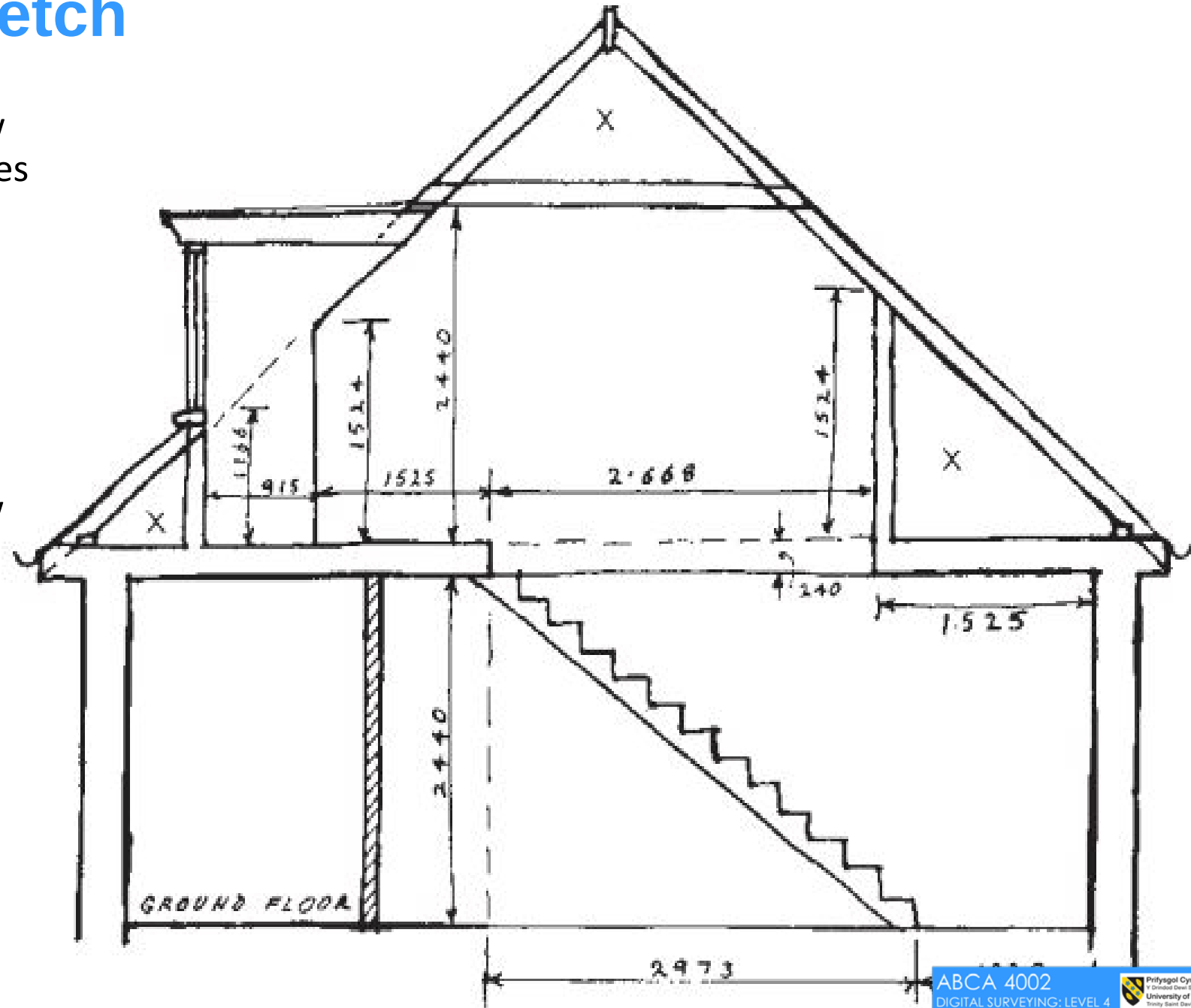
TRACING ONTO PAPER



USING OFFSETS

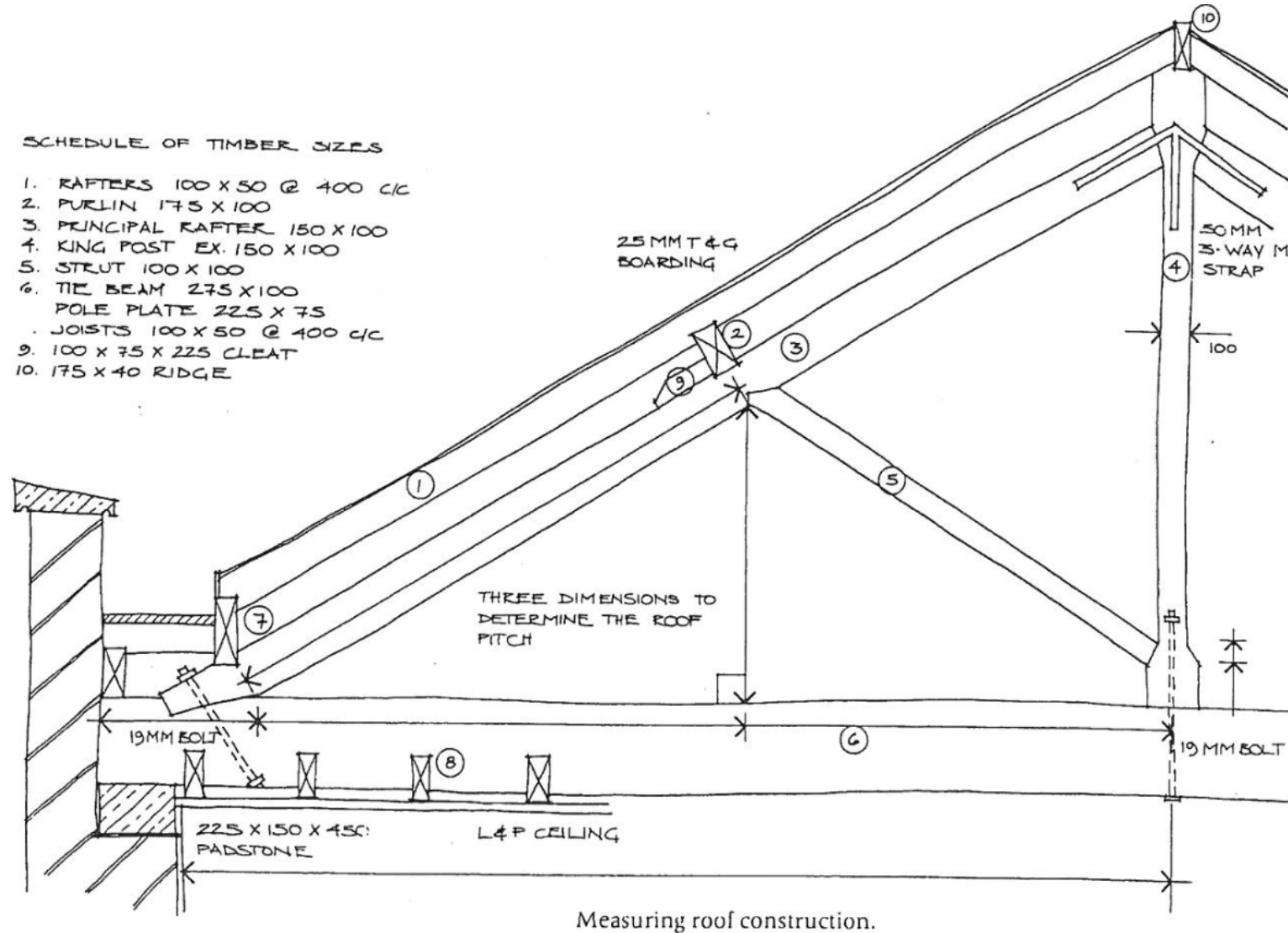
Section through Sketch

- 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



Roof Detail Sketch

- Roof pitch measured using **trilateration**. Calculating the angle through use of trigonometry. SOH CAH TOA
- OR – most modern digital laser measures allow for angle calculation. Check the rafters and rook are parallel and that there are no packer or offsets to the roof finish,
- Each component part measured and referenced

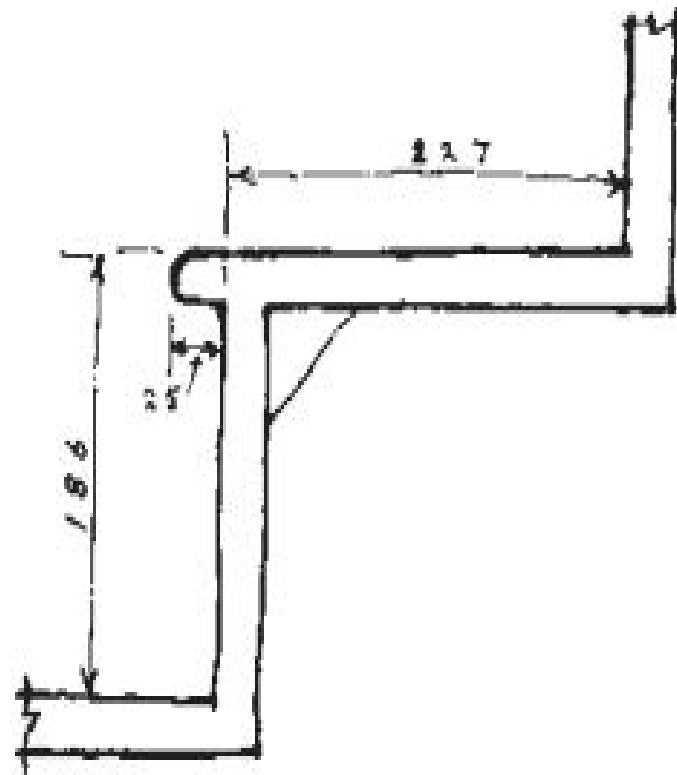


PITCH MEASURED USING TRILATERATION.

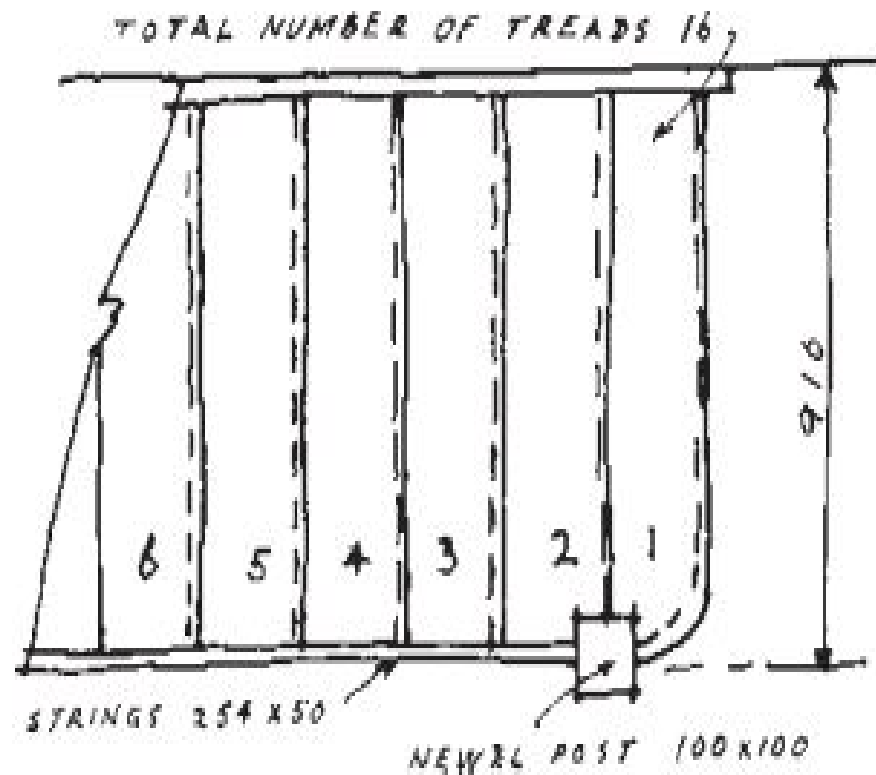
Stairway Detail Sketches

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.



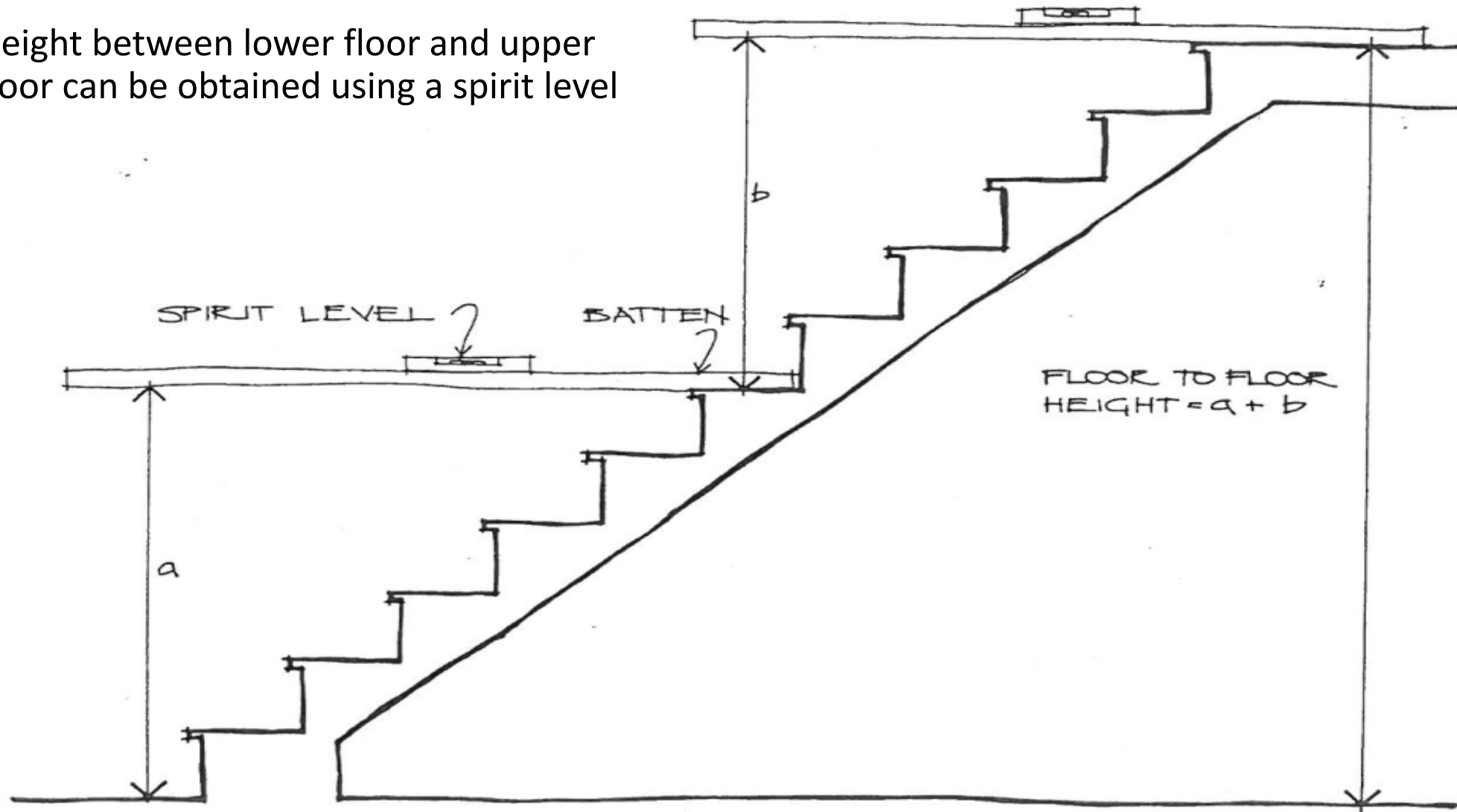
SECTION THRO' TREAD & RISER



PART PLAN OF STAIR

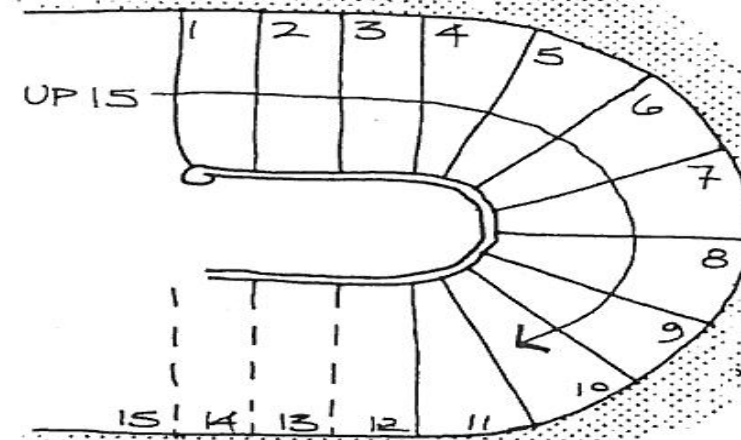
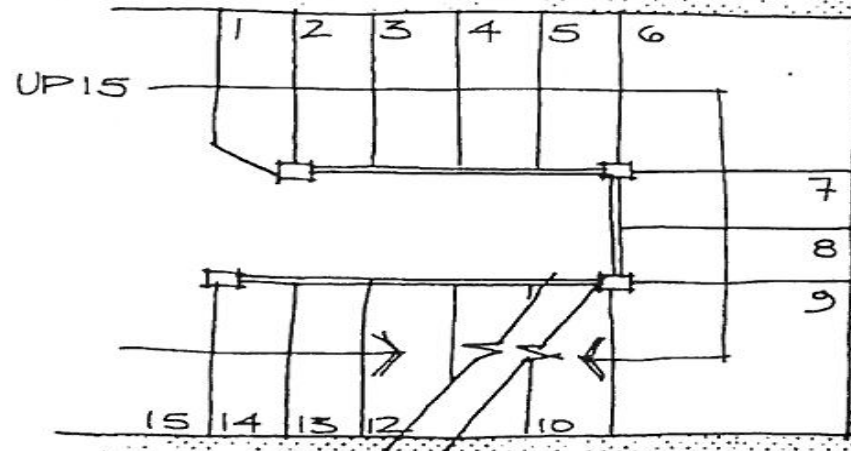
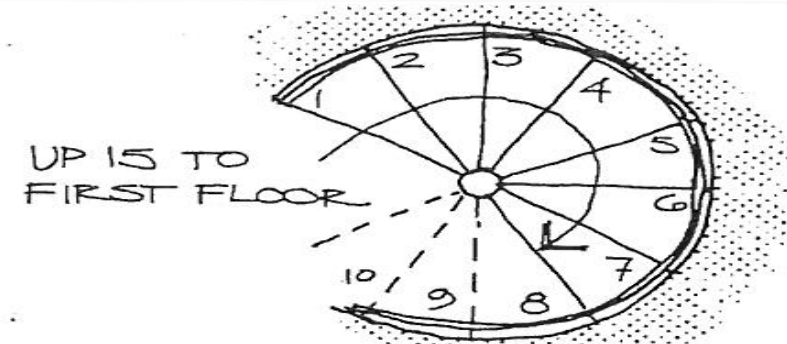
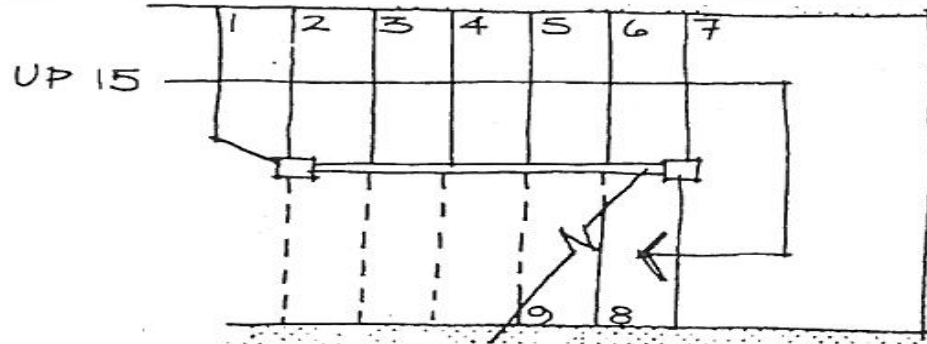
Stairway Detail Sketches

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



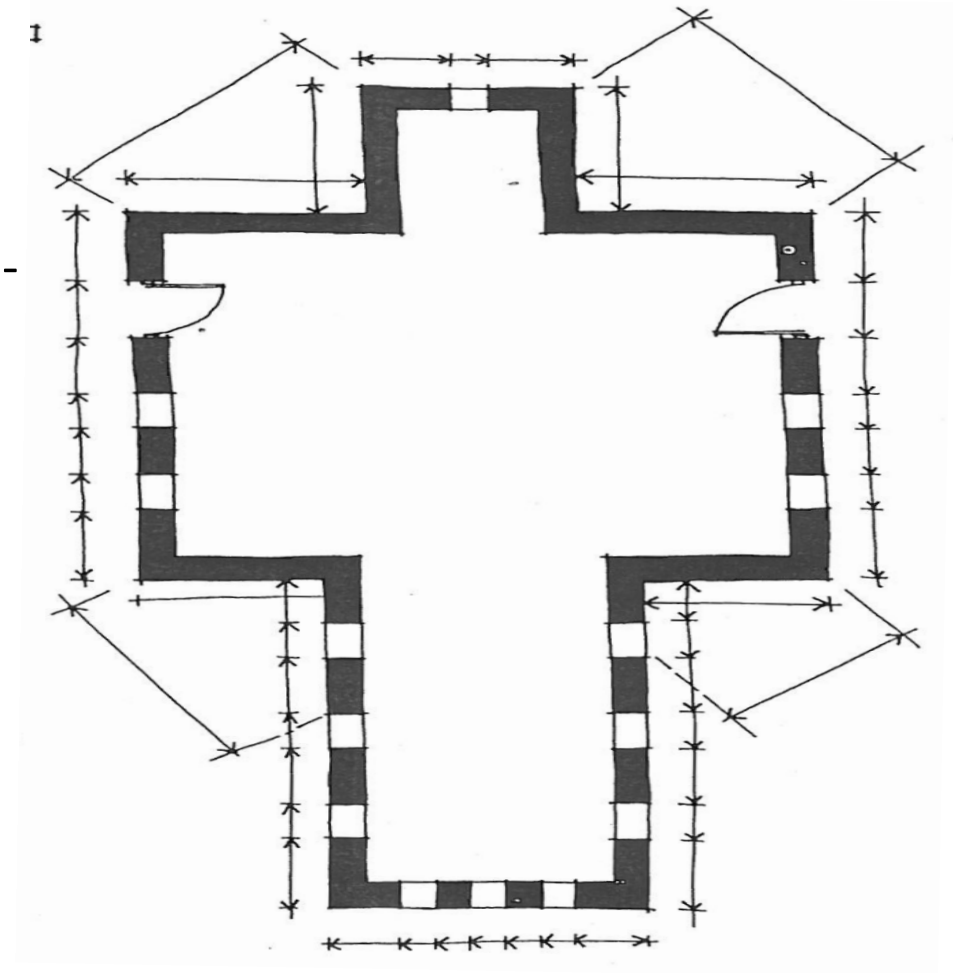
Measuring floor-to-floor heights at a staircase.

Stairway Detail Sketches



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

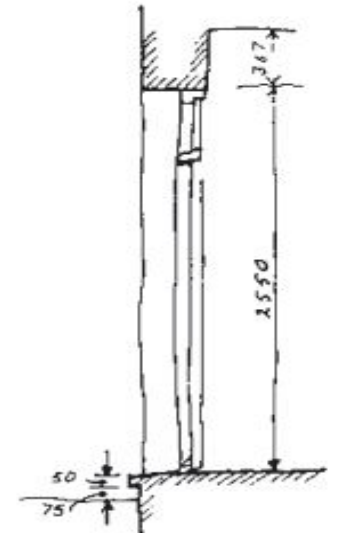


External Detail Sketches

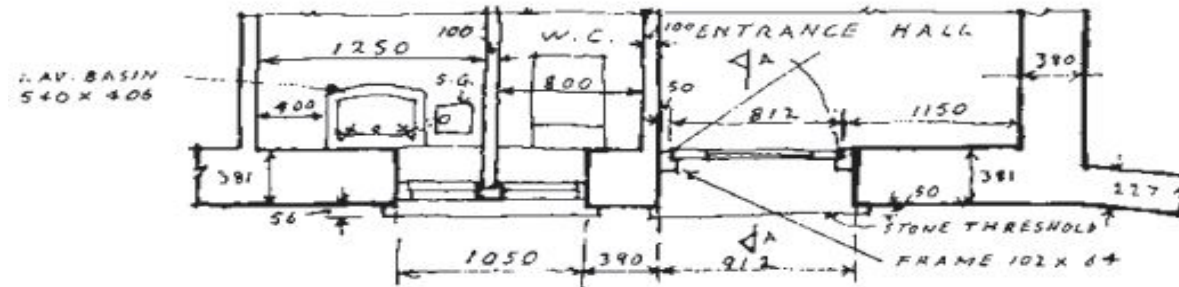
- Use DPC level or plinth/bell as a datum and relate all measurements to this datum
- Calculate the external ground or pathway slope (below datum)
- Draw section through each doorway and window, to tie into internal Measurements.



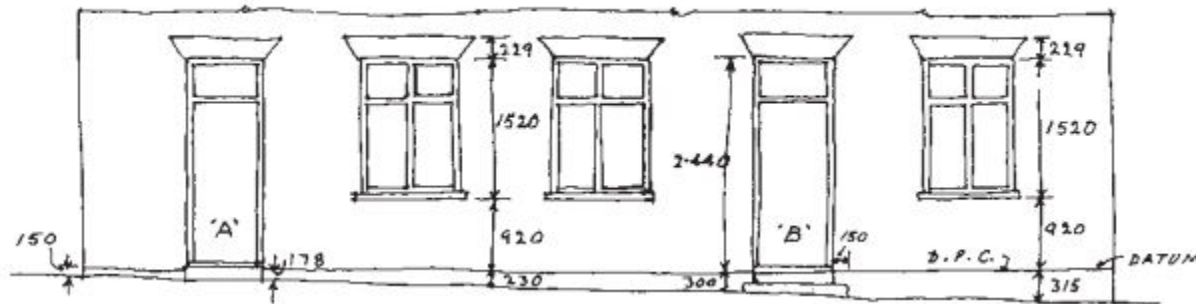
PART ELEVATION (N.E.)



SECTION A-A

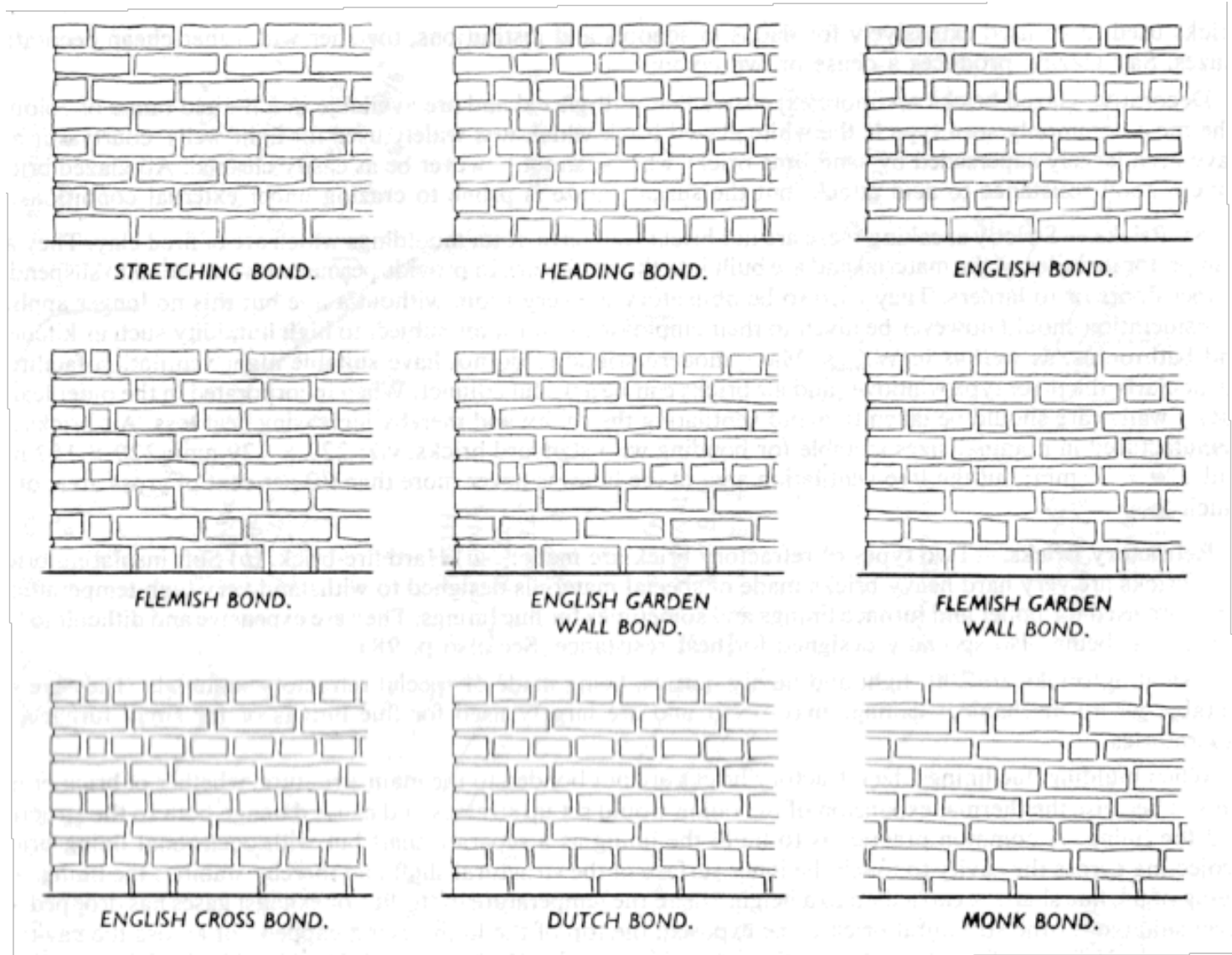


PART GROUND FLOOR PLAN

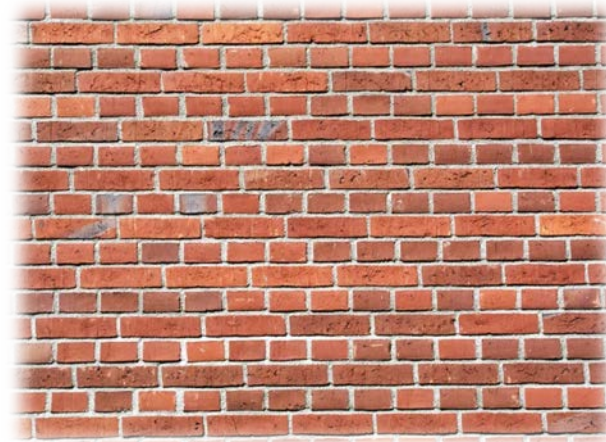
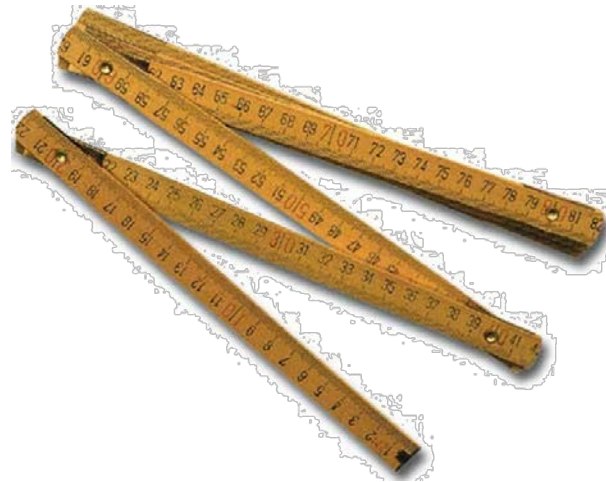
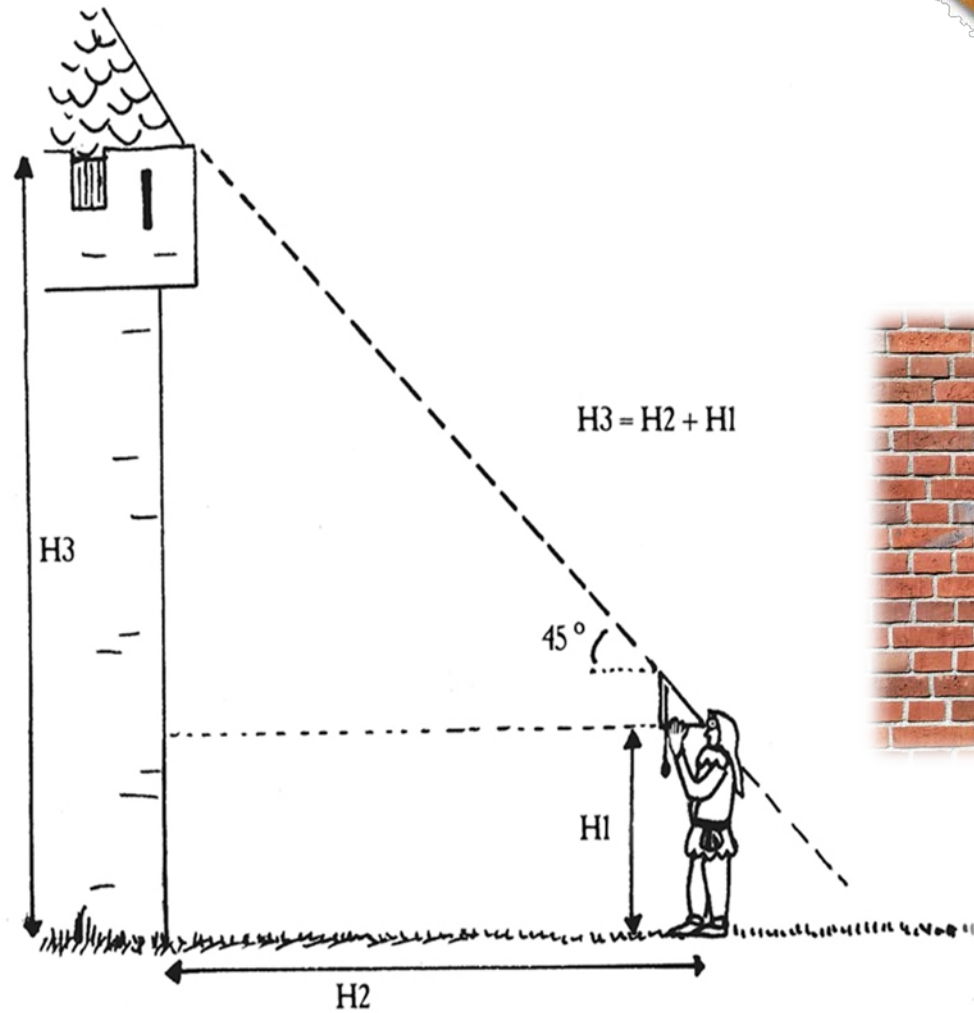


External Details

- 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.



Other techniques



Next week...
additional data and
Production Information