

ENGINEER'S FIELD HANDBOOK

Site Investigation of Schools and Health Facilities in Pakistan

Capacity Development for
Climate-Resilient Infrastructure (CD-CRI)



SITE ASSESSMENT



SAFETY FIRST



CLIMATE
RESILIENCE



WATER
RESILIENCE



INFRASTRUCTURE
INSPECTION



SUSTAINABLE
FUTURE



BUILDING RESILIENT COMMUNITIES
FOR A SAFER, SUSTAINABLE TOMORROW



Document control

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Work-control labels

These labels control the field task only. They are not building classifications, occupancy decisions, emergency placards, or design approvals.

Label	Use	Minimum record	Release
PROCEED	Approved work may continue within the current controls.	Task or area, controls in force, any restriction.	Continue; reassess when conditions or scope change.
PAUSE	A local control, clarification, or operational arrangement is required.	Condition, interim action, owner and time.	The named authority completes and releases the control.
STOP	The team withdraws and uses the agreed emergency or site route.	Time, location, reason, action, recipient, acknowledgement.	Re-entry or restart only through the responsible authority.
REFER	The question is outside scope, competence or available evidence.	Question, consequence, specialist or evidence needed, recipient.	The responsible engineer or specialist accepts the referral.

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How to use this Handbook

This Handbook serves more than one reader, and not every chapter serves all of them. The table below states where each reader should start. Chapters 8, 9 and 12 are written to be used while standing in front of a building; the rest are written to be read before the visit or after it.

Reader	Start with	What these chapters give you
Field engineer collecting evidence	Chapters 1 to 6, 10, 15 and 17, and Annexes A to F	The visit sequence, the identity system, what has to be recorded, what stops the work, and the forms the visit is completed on.
Structural specialist	Chapters 7 to 9, 11, 13, 14 and 16, and Annex G	Typology and load path, damage states and mechanisms, diagnosis and confidence, testing, post-event work, and one complete worked visit.
Planner, facility manager or program officer	Chapters 1, 2, 5, 6, 12 and 17	What a visit can and cannot deliver, what the hazard cards capture, what safeguarding requires, and what the handover contains. Chapter 1 in particular states the boundary: this Handbook records and escalates, and does not evaluate.
Master trainer with one day	Chapters 1, 8, 9 and 12, and the worked visit at Annex G	The minimum set that transfers the method: the four work-control labels, typology recognition, damage and crack mechanisms, the hazard cards, and one example carried from brief to handover.

1 Purpose, Authority and Field Decisions

A site visit produces one thing of lasting value: evidence that another engineer can locate, understand and rely on. Everything in this Handbook serves that outcome.

1.1 Scope and boundary

Before any field work begins, the team should be clear about what this Handbook governs and what it does not. Table 1.1 sets out when it applies, what must be in place before a visit starts, whose authority governs, and where its remit ends.

Table 1.1 : Scope and boundary of this Handbook

Control	Requirement
Use when	A qualified engineer or a supervised field team is collecting evidence for screening, structural assessment, hazard review or pre-design investigation.
Required input	A named assignment, the facility and block scope, the responsible engineer, the site contact, approved access, and the applicable procedures.
Authority	The project brief, applicable law and the decisions of the Authority Having Jurisdiction govern, in that order, together with the approved site controls.
Boundary	This Handbook records and escalates. It does not establish design actions, acceptance criteria, test correlations, structural capacity or intervention decisions.

1.2 Field sequence

The visit runs as one controlled loop, shown in Figure 1.1; any change in conditions returns the team to the arrival safety gate.

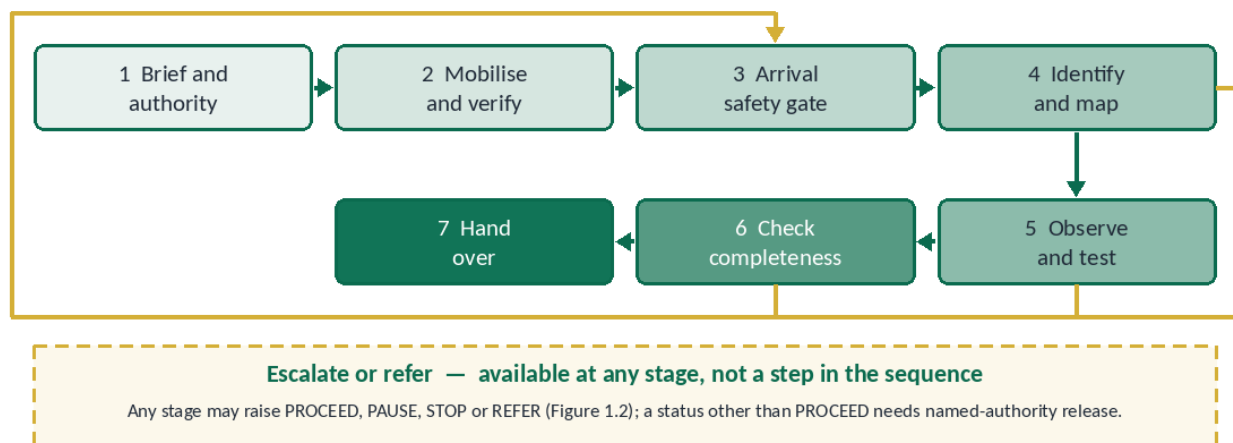


Figure 1.1: The field visit control loop

1.3 Field checks

Table 1.2 Field checks for visit control

Check	Verify	Record
Field status	Use PROCEED, PAUSE, STOP or REFER as work-control labels only.	Do not present these labels as a building verdict or safety placard.
Controlling procedure	Locate the relevant assessment procedure before relying on a field card.	Record the procedure and any unresolved conflict.
Observation against interpretation	Separate what was seen or measured from interpretation and recommendation.	Use distinct fields; identify the responsible engineer.
Evidence limit	State inaccessible areas, unverified drawings, missing tests and assumptions.	Never fill a gap with a plausible value.
Field change	Record any change to scope, access, method, team or facility operation.	Obtain approval where the brief or site control requires it.
Communication	Use agreed contacts and protected channels for urgent and routine information.	Preserve time, sender, recipient and response.

Figure 1.2 gives the four labels as a pocket card with their release rules.

PROCEED	Approved work may continue within the current controls. Release: Continue; reassess when conditions or scope change.
PAUSE	A local control, clarification or operational arrangement is required. Release: The named authority completes and releases the control.
STOP	The team withdraws and uses the agreed emergency or site route. Release: Re-entry or restart only through the responsible authority.
REFER	The question is outside scope, competence or available evidence. Release: The responsible engineer or specialist accepts the referral.

Figure 1.2 Work-control label card

1.4 Required record

Every visit close with the same core set of records, whatever its scope. Table 1.3 lists them and the minimum content each must carry if the visit is to remain traceable once the team has left site.

Table 1.3 Minimum record for every visit

Record	Minimum content
Visit control	Project, facility, block, date and time, team, and the procedures applied.
Decision sought	The question the evidence must answer, and who will decide it.

Record	Minimum content
Scope and exclusions	Accessible areas, permitted methods, excluded systems and deferred work.
Field status log	Status, reason, time, location, action, recipient and release authority.
Evidence registers	Observation, photograph, test, sample and monitoring references, and file locations.

1.5 Stop and referral triggers

Table 1.4 Stop and referral triggers: visit control

Condition	Status	Response
Unsafe or unauthorized work	STOP	Withdraw to the agreed safe location and contact the named authority.
Task outside competence or approved supervision	REFER	Record the question and the specialist required; do not offer an informal conclusion.
Procedures conflict or are unavailable	PAUSE	Record the conflict and obtain direction before applying a criterion.
Pressure to omit, alter or backdate evidence	STOP	Preserve the original record and notify the project quality route.
Immediate threat to people or facility operation	STOP	Use the site emergency route; a work-control label does not substitute for authority action.

Figure 1.3 applies at every field task, in every chapter. It consolidates the stop and referral conditions used throughout this Handbook into one decision flowchart.

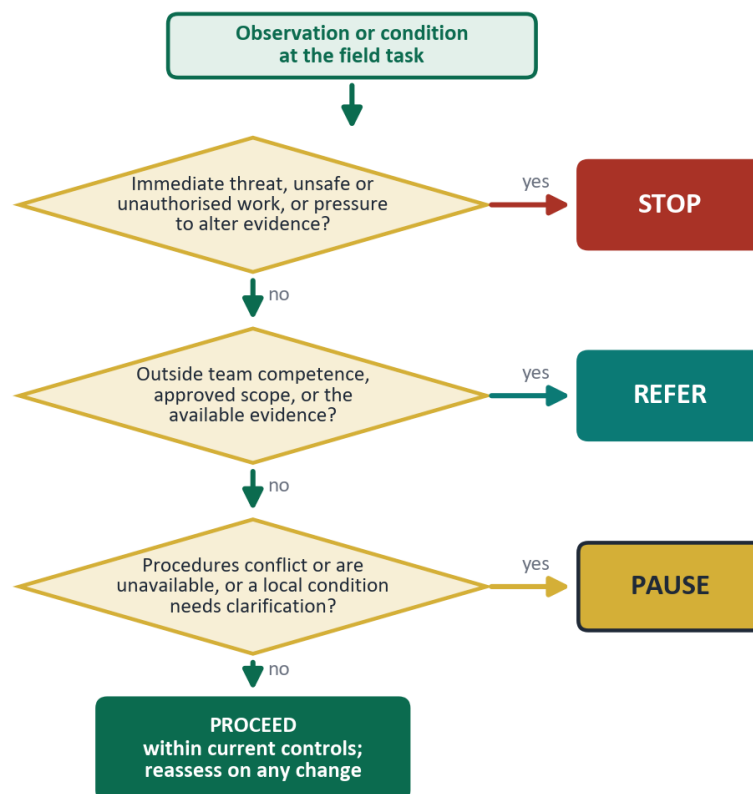


Figure 1.3 Master field decision flowchart

1.6 Referral route

A label that is raised and goes nowhere is not a control. This section states what the four labels are, what they are not, and what happens to a REFER after it leaves the field.

- 1.6.1** The four work-control labels govern the field task only. They are not a building classification, an occupancy decision, an emergency placard, a design approval, or a referral in themselves. Nothing in this Handbook authorizes the field team to issue a verdict on a building.
- 1.6.2** A REFER raised in the field is recorded in Table A.3 at the time it is raised, with the question, the consequence if it is not answered, the specialist or evidence required, and the recipient. The record is made during the visit and is not reconstructed afterwards.
- 1.6.3** The record is transmitted the same day to the responsible engineer named in the assignment brief at Table B.1. That engineer, and not the field team, enters the referral into the assessment record and owns every step from that point, including any time limit that attaches to it.
- 1.6.4** Where the project has issued a referral form and a referral code list, Table A.3 is completed against that instrument and the code is recorded alongside the entry. Until such an instrument is issued, Table A.3 is the record of the referral. A REFER is never closed in the field.

REQUIREMENT

A REFER written in the log and not transmitted is not a referral. The field team is responsible for raising it, recording it and transmitting it; the responsible engineer is responsible for accepting it. Record the time of both.

2 Assignment, Competence, Access and Safeguarding

Decide whether the proposed team, permissions and controls are adequate before travel or site entry.

2.1 Field sequence

1. Convert the requested service into blocks, areas, methods, records and exclusions.
2. Match each task to competent personnel, supervision and specialist support.
3. Identify permits, escorts, shutdowns, infection controls and restricted times or areas.
4. Agree safeguarding, consent, privacy, language and inclusive-engagement arrangements, and confirm which consent instrument applies to photography under Table D.5.
5. Issue the contact and escalation tree and the pre-visit information request.
6. Hold a readiness review; defer any task whose critical control is unresolved.

2.2 Field checks

Competence, authority and safeguarding are settled before the team travels, not negotiated at the gate. Table 2.1 sets out what is verified under each heading and what has to be recorded to show it was in place.

Table 2.1 Field checks for assignment, competence and safeguarding

Check	Verify	Record
Technical competence	Match typology, hazards, test methods and expected decisions to named experience.	Record supervision and the tasks that require a specialist.
Access authority	Confirm who may authorize entry, opening up, shutdown, roof access and excavation. For government schools and health facilities this includes district education or health department authorization where applicable.	Record conditions and permit references.
School safeguarding	Plan contact through authorized staff; avoid unsupervised interaction and identifiable images of children. A female team member is included where a girls' school or interviews with female staff require it. Confirm the consent arrangement that applies to any photograph before the visit, not at the gate.	Follow the client and site safeguarding route. Record the source, usage rights, identifiability and consent basis of every image in the photograph provenance and consent register at Table D.5, Annex D. Where the project has issued its own consent instrument, that instrument governs and is referenced in Table D.5; until it is issued, Table D.5 is the project record of consent.
Health-facility controls	Coordinate infection prevention, patient privacy, sterile and restricted areas, and service continuity.	Record prohibited methods and approved windows.

Check	Verify	Record
Inclusive participation	Provide safe, respectful ways for women, persons with disabilities and under-represented staff and users to contribute.	Record barriers and accommodations without sensitive personal detail.
Data protection	Define approved devices, storage, transfer, naming, retention and access.	Separate technical evidence from personal information.
Emergency communication	Confirm site alarm, muster point, medical and authority contacts.	Brief every team member before entry.

2.3 Stop and referral triggers

Some conditions cannot be resolved by the field team at all. Table 2.2 lists those that arise before or during mobilization, together with the response each requires.

Table 2.2 Stop and referral triggers: assignment and access

Condition	Status	Response
No responsible engineer, or the decision sought is unclear	PAUSE	Return the brief for clarification.
Required competence or supervision unavailable	REFER	Re-plan with a qualified specialist.
Access, privacy or safeguarding authorization absent	STOP	Do not enter, record or interview until authorized.
Method conflicts with live facility operation	PAUSE	Coordinate an approved alternative or an agreed working window.
Unmanaged conflict of interest or integrity concern	STOP	Use the project quality and integrity route.

3 Mobilization, Equipment and Data Readiness

Confirm that equipment, forms, references and logistics can produce reliable, recoverable records under the conditions expected on site. Possessing a device does not authorize its use and does not make its output suitable for the intended engineering decision.

3.1 Field checks

Readiness is checked against the evidence the visit has to produce, not against habit. Table 3.1 covers each category of equipment and data, what is verified before departure, and what is recorded.

Table 3.1 Equipment and data readiness checks

Item	Verify	Record
Observation kit	Approved protective equipment, lighting, measuring, marking and documentation tools suited to the access available.	Item references and limitations.
Imaging	Camera or device clock, resolution, storage, location key and privacy settings.	Take a reference image and confirm it can be retrieved.
Measurement	Tape, laser, level, plumb or other devices checked against an appropriate reference.	Check result and any environmental limitation.
Test equipment	Method-specific transducers, reference blocks, couplant, batteries and the controlled procedure.	Operator and verification status.
Sampling and opening up	Authorized tools, utility detection, containment, labels, containers and making-good materials.	Do not mobilize intrusive work without permits and a repair route.
Data resilience	Primary and backup storage, naming template, offline forms, charging and power.	Test one complete capture-to-backup cycle.
Site logistics	Travel, weather, communication, safe storage, waste and decontamination arrangements.	Confirm against the actual facility type.

3.2 Stop and referral triggers

A readiness failure found in the office is an inconvenience; the same failure found on site is a wasted visit. Table 3.2 lists the conditions that stop mobilization and the response to each.

Table 3.2 Stop and referral triggers: mobilization and readiness

Condition	Status	Response
Required safety or method equipment unavailable	STOP	Do not substitute without approved equivalence.
Calibration expired, device damaged or reference check failed	REFER	Quarantine the equipment, identify affected data and obtain a replacement.
Data cannot be stored or backed up securely	PAUSE	Restore record controls before evidence is captured.

Condition	Status	Response
Intrusive equipment mobilized without permit, utility scan or making-good route	STOP	Remove from use until the full control package is approved.
Weather or access exceeds equipment or procedure limits	PAUSE	Record the condition and the approved alternative.

3.3 Equipment list

Table 3.1 checks equipment by function the list below names the items so that the readiness check in Section 3.1 can be completed item by item and any shortfall is visible before the team leaves rather than on site.

Table 3.3 Named equipment list for a field visit

Category	Items	Checked before departure
Protective equipment	Helmet, safety footwear, high-visibility vest, gloves, eye protection, dust masks, ear protection where required, first-aid kit.	Condition and fit; one complete set per team member.
Measuring	5 m tape, 30 m tape, laser distance meter, 600 mm spirit level, plumb bob and line, crack width gauge or graduated crack card, feeler gauges, calipers, folding rule.	Laser checked against the 5 m tape over a known distance; crack gauge legible; result of the check recorded.
Marking and identification	Chalk, lumber crayon, non-permanent markers, numbered targets or labels, scale cards, north indicator, slate or whiteboard for photograph identification.	Sufficient quantity for the number of blocks in scope.
Imaging	Camera or device with date and time set correctly, spare battery or power bank, storage, torch or head torch.	Reference image taken and retrieved from storage.
Recording	Printed proformas and the annex registers required for the visit, clipboard, weatherproof cover, pens and pencils, backup notebook.	One complete set per team plus one spare; the registers match the scope of the visit.
Access and inspection aids	Binoculars, inspection mirror, moisture meter where required, measuring rod. A ladder or other access equipment only where the approved access method covers it.	Approved access method confirmed for each observation that needs height.
Test equipment, where the visit includes testing	Method-specific instruments, transducers, reference blocks, couplant, batteries, and the controlled procedure for each method.	Calibration status current; pre-use reference check carried out and recorded.
Site logistics	Water, sun protection, charged phone, contact list, vehicle fuel, waste bags, decontamination materials.	Confirmed against the facility type, the travel distance and the expected weather.

4 Arrival, Immediate Safety and Escalation

Decide whether the team can enter and continue, must pause for controls, or must withdraw and escalate. This check is not an emergency posting system, an occupancy certificate or a substitute for specialist emergency assessment.

4.1 Field sequence

1. Check in with the authorized site representative and reconcile facility and block status.
2. Receive current alarm, incident, utility, operational, restricted-area and weather information.
3. Observe from a safe external position before approaching or entering.
4. Confirm permits, escorts, protective equipment, exclusion zones, communication and escape routes.
5. Assign the work-control label for the field task.
6. Log changes continuously and repeat the check whenever conditions change.

4.2 Field checks

The arrival check decides whether the team enters, and it is made from outside the building. Table 4.1 sets out what is observed before entry and the route each observation takes if it is not satisfied.

Table 4.1 Arrival and immediate safety checks

Check	Observe	Route
External approach	Ground movement, leaning or fallen elements, loose façade or roof items, flooding, fire or smoke, damaged utilities, obstructed access.	Do not approach through a suspected fall, collapse or flow path.
Occupancy and operations	Who is present, critical services, vulnerable users, evacuation constraints, recent disruption.	Coordinate without obstructing emergency, clinical or teaching functions.
Utilities and stored energy	Reported or apparent electrical, gas, fuel, steam, pressure or water source.	Use the site isolation authority; do not test by contact.
Environmental and biological hazards	Contamination, sewage, mould, chemicals, dust, sharps, infection-control zones, animals and insects.	Apply specialist or site controls, or refer.
Access systems	Stairs, floors, roofs, ladders, scaffolds, excavations, confined spaces and lighting.	Use only approved access and fall protection.
Change indicators	New sounds, movement, falling material, rising water, wind, aftershock, smoke or progressing distress.	Withdraw and reassess immediately.

CAUTION

Protect people first and preserve evidence second. Do not remain in a hazardous position to finish a form or obtain a photograph.

5 Facility, Block and Record Identification

Create one stable identity system so that every observation, photograph, test, sample, drawing and recommendation refers to the same facility, block, level and location. A provisional field label shall not overwrite an existing institutional asset identifier without controlled reconciliation.

5.1 Field sequence

1. Collect all known facility, campus, asset and block identifiers with their sources.
2. Walk the site perimeter by an authorized safe route and reconcile the block inventory.
3. Assign stable provisional identifiers to unmatched blocks, levels, grids or faces and external areas.
4. Mark additions, separations, shared structures, links and apparently demolished blocks.
5. Create the location key to be used by every team member and device.
6. Issue an identifier-conflict log for office reconciliation.

5.2 Field checks

Identification is what allows a later reader to find the same wall the team stood in front of. Table 5.1 sets out what is verified for each part of the identity record and what is written down.

Table 5.1 Field checks for facility and block identification

Check	Verify	Record
Facility identity	Official and common names, addresses, coordinates, owner or operator, site contact.	Record the source and spelling; avoid personal data that is not needed.
Block inventory	Separate structures, wings, additions, canopies, tanks, boundary and retaining structures, and links.	One row and one provisional identifier per physical unit.
Level and grid logic	Consistent level names, elevations, cardinal faces and any available grid.	Use the same convention in photographs, tests and drawings.
Construction phases	Visible joints, material and detail changes, and records suggesting different dates.	Record as evidence, not as a confirmed age.
Shared dependencies	Common stairs, corridors, utilities, retaining or site works serving several blocks.	Map the interdependency and the service consequence.
Record reconciliation	Compare drawings, prior reports, signage and the field configuration.	Log each mismatch; do not force a match.
Facility code	The national facility dataset code for the facility: the education dataset code for a school, the health dataset code for a health facility, and both where a site carries both functions.	Record the code exactly as issued, with the dataset it comes from and the source of the code. Where no code can be established, record 'not established' and the enquiry made; do not invent or abbreviate one.

Check	Verify	Record
Coordinates	A single position fixed at the main entrance to each block, taken with the device location setting on, not scaled from a map.	Decimal degrees to five places, with the datum stated (WGS 84 unless the project directs otherwise), the device used, and the accuracy the device reported.

5.3 Stop and referral triggers

Identification conflicts are common, and they are rarely resolved by field teams. Table 5.2 lists the conditions that must be escalated rather than assumed away.

Table 5.2 Stop and referral triggers: identification

Condition	Response
Two records may refer to different physical blocks	Preserve both identifiers and seek confirmation before merging.
An unrecorded occupied or additional structure is found	Notify the responsible engineer and owner; do not assume it is in scope.
A location cannot be reconstructed from the record	Recapture. Do not accept an orphan photograph or reading as complete evidence.
A shared element cannot be assigned to one block	Use a shared-element identifier and map every dependent block.

6 Documents, Interviews and Operational Context

Separate documented facts, stakeholder account and field observation, while capturing how the facility actually operates and what disruption would mean. An interview is evidence of a reported condition, not proof of geometry, material, event intensity, causation or capacity.

6.1 Field checks

Documents and interviews explain what the building has been through, but neither is evidence of its present condition. Table 6.1 sets out what is verified in each and how it is recorded, so that reported information is never mistaken for observed information.

Table 6.1 Field checks for documents and operational context

Check	Verify	Record
Document status	As-designed, approved, shop, as-built, sketch, prior report or unknown; date, revision and source.	Do not call a drawing as-built unless evidence supports it.
Alterations and loading	Reported extensions, removals, equipment, tanks, roofs, openings, partitions and change of use.	Locate and verify; do not infer weight or capacity.
Incident history	Earthquakes, floods, wind, fire, settlement, impact and leakage, with dates and repair actions.	Record the reporter's role and the uncertainty.
Maintenance and recurrence	Repeated cracks, leaks or repairs, blocked drainage, corrosion, roof failures and monitoring.	Seek records and photographs; map the affected locations.
School operation	Timetable, assembly and egress, children with disabilities, sanitation, shelter use and closure constraints.	Avoid identifiable child data; capture the operational consequence.
Health operation	Clinical and diagnostic areas, emergency access, oxygen and medical utilities, infection zones and continuity priorities.	Coordinate with authorized clinical and facility staff.
Community and access	Seasonal access, evacuation routes, adjacent hazards, and people who may be disproportionately affected.	Record engineering-relevant constraints respectfully.

6.2 Stop and referral triggers

Access to records and to people carries obligations the field team cannot waive. Table 6.2 lists the conditions that require escalation and the response to each.

Table 6.2 Stop and referral triggers: documents and interviews

Condition	Response
A restricted or sensitive record is offered without authority	Do not capture it; refer to the data owner and the approved request route.
Interview pressure, coercion or a safeguarding concern arises	Stop and follow the safeguarding protocol.
A planned inspection or test would disrupt a critical operation	Pause and agree an operationally safe alternative.

Condition	Response
A record contradiction changes scope or the understanding of immediate safety	Escalate promptly to the field lead and responsible engineer.
An allegation of concealed alteration, damage or falsified record is made	Record it neutrally and use the project integrity route.

7 Typology, Materials and Load-Path Walkdown

Develop a field-supported description of the actual structural systems and load paths, including uncertainty and mixed or altered construction. Do not assign a typology from appearance alone where finishes, additions or inaccessible interfaces leave material uncertainty.

7.1 Field sequence

1. Review the claimed structural system and identify the features that must be verified.
2. Trace gravity and lateral load paths from roof and floors, through the vertical systems, to the foundations and the ground.
3. Record materials, connections, diaphragms, collectors, joints, foundations and apparent alterations.
4. Identify mixed systems, discontinuities, shared elements and non-structural components affecting response.
5. Select targeted verification or testing for the unknowns that matter.
6. Issue a typology and load-path sketch with confidence stated and questions listed.

Figure 7.1 is the generic section to trace against: gravity in one color, lateral in the other, unverified links marked.

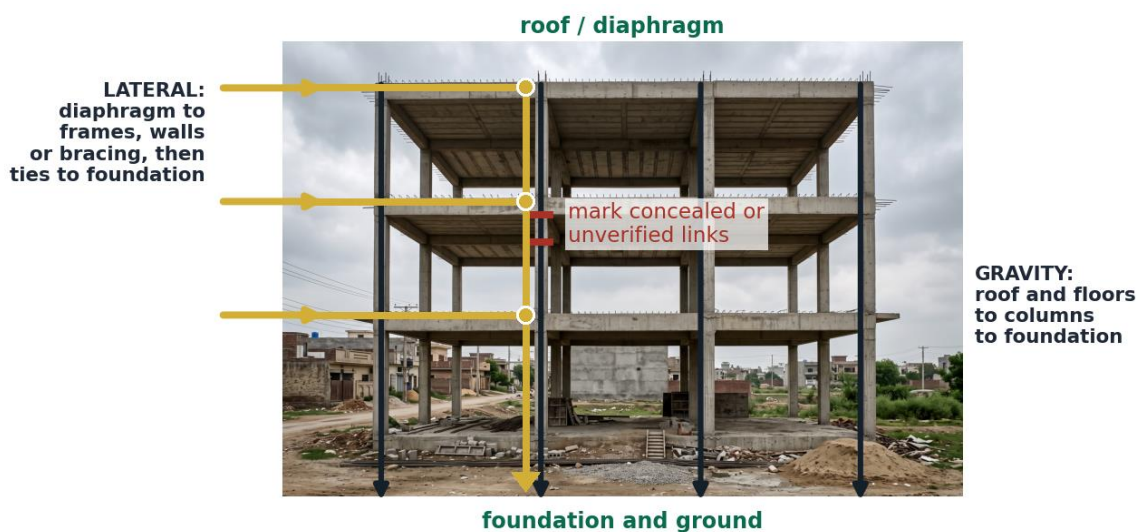


Figure 7.1 Load-path walkdown reference

7.2 Field checks

The walkdown works through the structure in the order load travels, and records what was seen rather than what was expected. Table 7.1 sets out the checks for each part of the load path and what has to be recorded against each.

Table 7.1 Field checks for the load-path walkdown

Check	Observe	Record
Gravity system	Roof and floor span direction, supports, bearing, beams, walls and columns, transfer conditions, route to foundation.	Sketch the continuous path and mark concealed or unverified links.
Lateral system	Frames, walls, bracing, masonry participation, diaphragm and tie routes in each direction.	Record observed connectivity; do not assume monolithic action.
Diaphragms and roofs	Material, orientation, joints, anchorage, openings, deterioration, added mass and equipment, flexible segments.	Map level by level.
Vertical elements	Material or system changes, offsets, discontinuities, captive or short conditions, unsupported wall panels.	Locate on plan and elevation; photograph interfaces.
Connections	Visible bearing, seating, anchorage, reinforcement clues, bolts, welds, ties and deterioration.	State visibility; distinguish observed from inferred.
Foundation interface	Accessible type clues, plinth or basement, settlement, scour, drainage, adjacent excavation.	Record evidence without guessing footing geometry.
Mixed and altered construction	Additions, infills, removed walls, new openings, tanks, roof replacement, shared walls.	Map the construction phase and the load-path consequence.
Non-structural interaction	Parapets, ceilings, services, cladding, partitions and contents that may fall, restrain or impact the structure.	Route immediate hazards and modelling questions separately.

7.3 Stop and referral triggers

Where the load path cannot be established, or where establishing it would need work beyond the approved scope, the question is escalated rather than answered by inference. Table 7.2 lists those conditions.

Table 7.2 Stop and referral triggers: typology and load path

Condition	Status	Response
No credible gravity path, or apparent unsupported or failed support	STOP	Withdraw from the affected area and use the emergency or site authority route.
A consequential system is hidden, or records conflict	REFER	Do not assign capacity or a model property from appearance.
An alteration appears active, unauthorized or destabilizing	PAUSE	Record from a safe position and notify the responsible engineer and site authority.
Access requires removing a structural, fire or infection-control element	STOP	Obtain an approved opening-up and making-good plan.
The observed system is outside team competence	REFER	Engage the appropriate material, heritage or geotechnical specialist.

8 Recognizing Structural Typologies in the Field

Typology drives almost every later decision: which failure mechanisms are credible, which tests are worth doing, and which strengthening measures are even applicable. It is also the judgement most often made too quickly, from a rendered façade that conceals what is behind it.

The reason typology is established before anything else is that it decides which failure is credible. The same diagonal crack means one thing in a confined masonry wall, where the tie-columns hold the panel together after it cracks, and another in plain unreinforced masonry, where nothing does. Getting the typology wrong does not produce a slightly wrong answer. It produces the right answer to a different building.

8.1 How to establish typology

1. Identify what carries gravity load, and by what route, before considering the lateral system.
2. Establish whether walls are load-bearing or infill. Look at openings, lintels, wall thickness changes at storey level, and the way the roof or floor bears.
3. Find at least one location where the construction is exposed—for example, at a service penetration, damaged area, roof space or stair soffit—and record what is actually there
4. Check whether the same system continues over the full height and plan, or whether the building is a composite of phases.
5. Record the features you could not verify, and what would be required to verify them.

8.2 Recognition guide

Table 8.1 Field recognition of structural typologies

Typology	Register code	Field indicators	Record and measure	Common misreading
Adobe or earthen	A	Thick walls, earthen or unfired blocks, mud plaster, minimal openings, timber roof on wall bearing, erosion at the base.	Wall thickness, unit size, mortar type, base condition, roof bearing detail, moisture damage.	Cement render over an earthen wall reads as masonry. Check at a break or a service opening.
Unreinforced masonry	URM	Fired brick or block in mud or cement mortar, no visible confining elements, wall thickness typically stepping with height.	Unit and mortar type, wall thickness and number of leaves, bond pattern, presence of through-ties, condition at corners and intersections.	A concrete band at one level does not make the wall confined. Confinement requires a complete system.
Stone masonry	SM-R / SM-D	Random rubble or dressed stone; irregular unit geometry; wide mortar joints in rubble work.	Unit type and dressing, wythe arrangement, presence of through-stones, mortar condition, wall taper.	Facing stone over rubble core reads as solid dressed masonry. Probe or find an opening.

Typology	Register code	Field indicators	Record and measure	Common misreading
Confined masonry	CM	Reinforced-concrete tie-columns at corners, intersections and openings, and tie-beams at every floor and roof level, cast against the masonry.	Location and continuity of tie elements, dimensions, whether the masonry was built before the confining element was cast, connection at intersections and to foundations.	Isolated vertical strips without tie-beams, or tie elements cast before the panel, do not confine the panel.
Reinforced masonry	RM	Reinforcement within the units, vertically and horizontally; grouted cores.	Unit type, core grouting evidence, reinforcement spacing where visible or detectable.	Rarely distinguishable visually. Confirm by cover meter or by opening up before relying on it.
Timber-braced masonry (dhajji-dewari)	DD	Timber frame with diagonal bracing at each panel, infilled with brick or stone.	Timber member sizes and condition, brace arrangement, connection detail, infill material, moisture and insect damage.	Later cement render conceals the timber. Look at the soffit, gables and any damaged area.
Timber-laced masonry (bhatar; cator-and-cribbage)	DD-L	Horizontal timber lacing bands at intervals up the wall, with stone masonry between. No diagonal members.	Band spacing and continuity, timber size and condition, corner detail and lap, masonry between bands, moisture and insect damage.	Mistaken for plain stone masonry where render or pointing hides the bands, or read as dhajji-dewari, which it is not.
Concrete frame, non-ductile	C1	Columns and beams carrying load; wide tie spacing where exposed; construction generally predating current seismic detailing practice.	Member sizes, cover, tie spacing where visible or detected, joint condition, infill arrangement, year of construction.	Age alone is not proof. A building may have been retrofitted or built to a higher standard.
Concrete frame with infill	C3	Frame plus masonry panels; the panel may be full height or leave a window band.	Panel height relative to storey height, clear column height, panel thickness, whether the panel is tight to the frame, gaps and separation.	The distinction between full-height and partial-height infill changes the governing mechanism. Measure the clear column height.
Concrete wall or dual system	C2	Continuous concrete walls, often around stairs and lifts, in addition to or instead of frames.	Wall locations and continuity in plan and over height, thickness, coupling beams, openings.	A blockwork stair enclosure is not a shear wall. Confirm the material.

Typology	Register code	Field indicators	Record and measure	Common misreading
Steel frame	S1 / S2	Steel columns and beams, bolted or welded; moment connections or diagonal bracing.	Member sizes and orientation, connection type and condition, bracing arrangement, corrosion, fire protection.	Encasement or boarding hides both the section and the connection. Find an accessible node.
Pre-engineered steel	S3	Tapered portal frames, light secondary members, sheeted envelope, generally single-storey.	Frame geometry, purlin and girt arrangement, base detail, sheeting fixings, bracing.	The fastening of the envelope, not the frame, usually governs wind performance.
Light frame or prefabricated	S3	Demountable or modular units, light framing, panel construction.	Panel and frame arrangement, connections between units, hold-down to foundation, condition of joints.	Units placed without positive hold-down rely on friction alone.

Codes are those of the typology register at Table 4-1 of the Structural Health Assessment Manual, so that the code written in the field is the code the office reads. Record the code, not the description. A building combining two typologies in different directions or storeys is recorded as MX with both constituents named.

Figure 8.1 pairs the recognition guide with eight photographs of the forms as they appear in the field.



- ① Adobe / earthen: mud walls, timber roof bearing
- ② Unreinforced brick masonry: no confinement
- ③ Stone masonry: rubble walls, timber lintels
- ④ Confined masonry: tie-columns and tie-beams
- ⑤ Dhajji-dewari: timber braces, stone infill
- ⑥ Concrete frame with infill and window band
- ⑦ Concrete frame, non-ductile: wide tie spacing where exposed
- ⑧ Pre-engineered steel: tapered portals

Figure 8.1 Eight common structural typologies

REQUIREMENT

Where the typology cannot be established from what is visible, record it as unresolved together with the checks needed to establish it. Do not resolve the ambiguity by choosing the more familiar system, and do not resolve it by choosing the more conservative one: the conservative assumption for one action may be unconservative for another.

8.3 Features that change the mechanism

Table 8.2 Configuration features that change the governing mechanism

Feature	Why it matters	What to record
Partial-height infill or a continuous window band	Shortens the clear column height and can convert a ductile flexural member into a brittle shear member.	Clear height above and below the band, panel thickness, whether the panel is tight to the column.
Open or lightly infilled ground storey	Concentrates drift and damage at one level.	Infill arrangement at each storey, storey heights, any change of use at ground level.
Unrestrained parapet or gable	A falling hazard over occupied and egress areas, and a common source of injury.	Height above roof, thickness, restraint if any, condition, what lies below.
Roof or floor without positive anchorage to walls	The diaphragm cannot restrain the wall out of plane, and the wall cannot transfer load into the diaphragm.	Bearing detail, any visible tie or strap, seating length, condition of the bearing.
Inadequate separation from an adjacent building	Impact between buildings of different height or stiffness.	Gap width, relative heights and floor levels, evidence of past contact.
Later extension or added storey	Load path, foundation capacity and dynamic response may all differ from the original design.	Junction detail, whether the addition is tied or separated, foundation evidence, apparent construction date.
Heavy roof on weak walls	High inertial demand delivered to walls with limited capacity.	Roof construction and approximate thickness, wall material and thickness, bearing detail.

Figure 8.2 shows four of the features as they appear in the field, and the mechanism each one changes.



- ① Short column: partial-height infill or window band shortens the clear height
- ② Open or lightly infilled ground storey: drift concentrates there
- ③ Unrestrained parapet or gable over an occupied or egress area
- ④ Pounding: floor levels misaligned across a narrow gap

Figure 8.2 Features that change the mechanism

9 Damage States and Crack Reference

Damage is recorded per component and per mechanism, so that a later evaluation can distinguish between a member that is lightly cracked in flexure and one that is approaching shear failure. Recording only the worst descriptor for an element discards the information the evaluation needs.

The reason damage is recorded this way is that the evaluation which follows works on mechanisms, not on impressions. A column recorded only as moderately damaged tells the engineer nothing about whether it is losing flexural capacity slowly or approaching a brittle shear failure, and those two require different action on different timescales. Recording the worst descriptor and stopping throws away the distinction the decision depends on.

9.1 Recording damage

9.1.1 A damage state is recorded for each component and, within each component, for each mechanism separately. A column may carry light flexural cracking and moderate shear cracking at the same time, and both are recorded: recording only the worst descriptor for an element discards the information the evaluation needs. For each component, record the mechanism observed, the extent, and the damage state against the descriptors in this chapter. Table 9.1 applies to concrete members and masonry walls only. For earthen, stone, timber-laced and timber-braced typologies, record the condition descriptors given later in this chapter and name the guidance relied on. For steel and other materials, record a neutral material-specific description of the mechanism, extent and condition, and refer to the specialist guidance listed in the References where a formal damage-state classification is required. Where two mechanisms are present, record both.

9.1.2 Record crack width as a measured value with the instrument used, not as an adjective. Measure at the widest point, record to 0.1 mm, and state where on the crack the measurement was taken. Assign the width band from the crack-width band tables published later in this chapter, which are the classification adopted for the project; do not import a band from another source without recording it. Width is recorded, and banded, separately from the damage state.

9.1.3 Record whether the crack is active. Fresh, un-weathered faces, displaced edges, cracked finishes over an earlier repair, or a change against a dated reference all indicate activity. Where activity governs the decision, install a monitor as soon as the approval required by 14.2 is obtained. Where that approval cannot be obtained during the visit, record the requirement and the proposed location as an open item.

9.2 Damage-state descriptors

Table 9.1 Damage-state descriptors by material

State	Concrete members	Masonry walls
Insignificant	Fine cracking visible on close inspection; no spalling; no displacement.	Fine cracking in plaster or mortar joints; no displacement; no bulging.
Slight	Distributed fine cracking following the expected pattern for the action; no cover loss; reinforcement not exposed.	Cracking in mortar joints, generally stepped; units intact; no out-of-plane movement.
Moderate	Cracking clearly developed and wider along one dominant path; local cover spalling; reinforcement may be visible but not distorted.	Cracking through units as well as joints; minor spalling at corners; slight bulging or separation at intersections.
Heavy	Wide cracking; substantial spalling; reinforcement exposed over a length; possible buckling of longitudinal bars; loss of stiffness apparent.	Through-wall cracking; units displaced; visible out-of-plane movement; separation at wall intersections; partial loss of bearing.
Extreme	Crushing of the compression zone; core damage; buckled or fractured reinforcement; visible shortening or permanent displacement of the member.	Substantial displacement or partial collapse of the panel; loss of support to the diaphragm; the wall no longer acts as a unit.

The five damage states are those of FEMA 306. The fifth state is named Extreme in that source and is so named here. Condition descriptors for earthen, stone, timber-laced and timber-braced construction are given later in this chapter.

The descriptors in Table 9.1 classify the damage state. Crack width is always recorded separately as a measured value with the instrument used, in accordance with 9.1.2.

9.3 Crack mechanism reference

Table 9.2 Crack mechanism reference

Mechanism	Typical pattern	Corroborating evidence	Do not confuse with
Flexural	Near-perpendicular to the member axis, starting at the tension face, closely spaced along the high-moment region.	Location of the crack group relative to supports and spans; crack width greatest at the tension face.	Shrinkage cracking, which is not related to the moment diagram.
Shear	Diagonal, often at roughly 45 degrees, widening towards mid-depth; in columns, crossing diagonals under reversed loading.	Position within the shear span; associated crushing at the crack tip in later stages.	Diagonal settlement cracking, which usually runs between openings and is not confined to the shear span.
Settlement	Stepped in masonry, following the mortar joints; wider at one end; often through openings; frequently accompanied by out-of-plumb.	Level survey, door and window binding, relationship to ground conditions or drainage, external evidence of movement.	Thermal cracking, which recurs at regular spacing and is more nearly vertical.

Mechanism	Typical pattern	Corroborating evidence	Do not confuse with
Thermal and shrinkage	Regularly spaced; often at a change of section or at restraint points; typically, does not follow the load path.	Spacing relative to joints and restraints; correlation with exposure and orientation.	Structural cracking, which relates to the load path and is usually not uniformly spaced.
Corrosion-induced	Following the line of embedded reinforcement; accompanied by rust staining and, later, delamination and spalling.	Cover measurement, hollow sound on tapping, carbonation or chloride evidence, exposure and moisture source.	Plastic settlement cracking, which also follows bars but occurs early and lacks staining and delamination.
Overload or impact	Localized, often with crushing or displaced material; not part of a distributed pattern.	Evidence of the loading event; condition of adjacent components.	Progressive deterioration, which develops without a discrete event.
Rocking (masonry pier, in-plane)	Horizontal cracking at the top and bottom bed joints of a pier, the pier itself remaining substantially whole between them. Crushing may appear at one toe at a later stage.	Slender pier: height greater than length. Low vertical load. Little or no diagonal cracking. Cracking present at both ends, not one.	Sliding, which shows lateral offset along a single joint and does not crack both ends of the pier.
Sliding on a bed joint (in-plane)	Horizontal displacement along one continuous bed joint, so that the courses above have moved relative to those below. Often at a damp-proof course or a change of mortar.	Weak or lime mortar, low vertical load, a membrane or slip plane at the joint. Measure the offset across the joint; it is the diagnostic quantity.	Rocking, which cracks at both ends of the pier without lateral offset; and thermal movement, which recovers.
Diagonal cracking (masonry pier, in-plane shear)	Stepped cracking through bed and head joints, or straight cracking through the units, running broadly corner to corner across a pier. Forms an X where loading has reversed.	Squat pier: length comparable with or greater than height. Higher vertical load. The crack passes through units where the units are weaker than the mortar, and around them where they are not.	Settlement cracking, which runs between openings, widens towards one end and is accompanied by out-of-plumb rather than by a symmetrical X.
Toe crushing (in-plane)	Crushing, spalling and vertical splitting of the masonry at the compressed corner of a pier, at the base or at the head.	High vertical load. Follows an advanced stage of rocking, so check for bed-joint cracking at both ends. Inspect both toes: the loading reverses.	Local impact or overload damage, which is not paired at the opposite corner and does not accompany a rocking pattern.

Figure 9.1 shows the typical pattern for each mechanism in Table 9.2; the corroborating evidence still decides.



Figure 9.1 Crack mechanism patterns

9.4 What to capture for each finding

- Location to element and face, using the visit location key.
- Neutral description of the pattern, before any interpretation.
- Measured width, length and, where accessible, depth, with the instrument stated.
- Whether the crack passes through units or follows joints, and whether it crosses a construction joint.
- Evidence of activity, and the reference against which any future comparison will be made.
- Associated signs: staining, spalling, displacement, moisture, deformation of adjacent elements.
- Context photograph, detail photograph and a scale reference in frame.
- The mechanism or mechanisms considered, and what evidence would distinguish between them.

9.5 Crack-width bands

The bands below are the classification adopted for the project under clause 9.1.2. They are published here so that every team uses the same bands, and they apply until the project or the Authority Having Jurisdiction determines otherwise. Two tables are given because masonry and concrete are banded on different bases.

Table 9.3 Crack-width bands for masonry walls

Band	Description	Crack width	What the band usually indicates
0	Negligible	Hairline, below 0.1 mm	No action arising from the width alone.
1	Very slight	Up to 1 mm	Fine cracking, generally confined to finishes and internal decoration.
2	Slight	Up to 5 mm	Cracks visible externally; doors and windows may begin to stick; repointing likely.
3	Moderate	5 to 15 mm, or several cracks above 3 mm	Repointing and some replacement of masonry usually required; service pipes may fracture; weather-tightness often impaired.
4	Severe	15 to 25 mm, subject also to the number of cracks	Sections of wall may require replacement; frames distorted; floors may slope noticeably.
5	Very severe	Generally, above 25 mm, subject also to the number of cracks	Major repair involving partial or complete rebuilding; danger of instability.

Source: BRE Digest 251, categories of damage for low-rise masonry. The classification was developed for settlement and subsidence damage in low-rise buildings. Width alone does not place a wall in a band: the number of cracks, their location, and whether they are continuous through the wall all govern alongside the width, and the ease of repair is part of the original definition.

Table 9.4 Crack-width bands for concrete members

Exposure condition	Reasonable crack width at the surface
Dry air, or protected by a membrane	0.41 mm
Humidity, moist air, or in contact with soil	0.30 mm
Exposed to de-icing chemicals	0.18 mm
Seawater or seawater spray; wetting and drying	0.15 mm
Water-retaining structures	0.10 mm

Source: ACI 224R. These are durability and serviceability guides for reinforced concrete under service load. They are not damage states, and a width above the value shown is a trigger to investigate the cause, not a finding of structural inadequacy.

REQUIREMENT

Crack width is a recording band, not a verdict. For a component damaged by an earthquake the damage state is established from the mechanism and the descriptors at Table 9.1, and not from width alone: residual width depends on the point in the cycle at which the structure came to rest, and a wide crack that has closed can accompany more damage than a narrow one that has not. Record the width, record the band, and record the mechanism separately. This Handbook does not convert a band into a decision.

9.6 Masonry mechanisms: in-plane and out-of-plane

Telling the in-plane mechanisms apart is the main diagnostic task on a masonry site, because each one points to a different remedy. The four in-plane mechanisms are carried in Table 9.2 alongside the general crack mechanisms. Out-of-plane behavior is set out below. Out-of-plane wall failure is the mechanism most often behind loss of life in single-storey school buildings, and its cause is already named in Table 8.2: a roof or floor without positive anchorage to the walls. This section gives what that failure looks like before it happens.

Table 9.5 Out-of-plane indicators in masonry walls

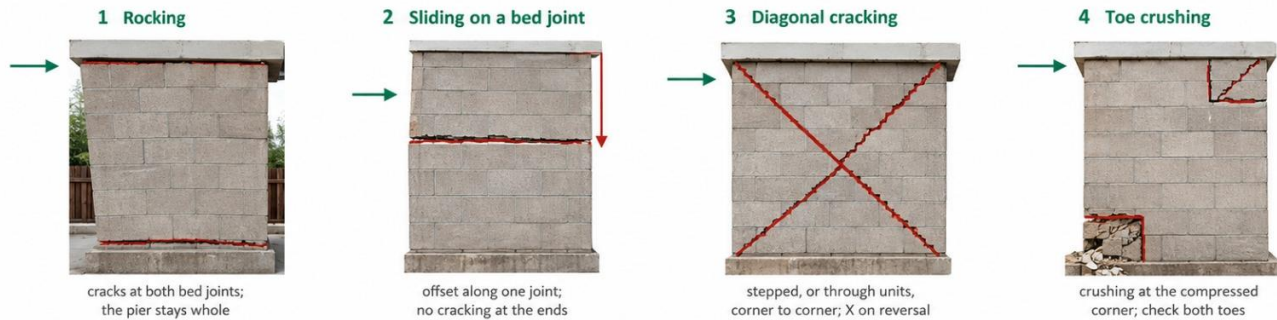
Indicator	What to look for	What to measure	Configuration feature in Table 8.2
Horizontal crack near mid-height	A continuous horizontal crack in a bed joint at roughly mid-height of the wall, sometimes open on one face only. The wall is spanning vertically and has hinged.	Crack width and length; the face on which it is open; whether it passes through the wall thickness; height of the crack above floor level.	Roof or floor without positive anchorage to walls.
Vertical cracking at wall junctions	Vertical separation where a wall meets a return or cross wall, usually widening towards the top. The wall is no longer restrained at its edge.	Width at the head and at the base; whether the return is toothed in or simply butted; length of the separation.	Roof or floor without positive anchorage; later extension or added storey.
Separation at the wall head	A gap opening between the top of the wall and the underside of the roof or floor, with loss of bearing. Often visible only from a ladder or from the roof.	Remaining seating length; gap width; whether any tie, strap or bearing plate is visible; condition of the bearing surface.	Roof or floor without positive anchorage; heavy roof on weak walls.
Bulging or leaning	The wall face out of plane, usually greatest near mid-height, sometimes with a horizontal crack at the same level. Read against a plumb line, not by eye.	Lean recorded as an offset in mm over the wall height in m, with the height stated; the face towards which it leans; whether the lean is uniform or localized.	Heavy roof on weak walls; unrestrained parapet or gable.

Record the indicator, not the conclusion. An out-of-plane indicator establishes that the wall is not restrained; it does not establish capacity, and it is not a basis for declaring a building safe or unsafe in the field.

Figure 9.2 shows the four in-plane mechanisms and the four out-of-plane indicators together.

In-plane mechanisms (masonry piers)

arrow = direction of shaking



Out-of-plane indicators (walls)

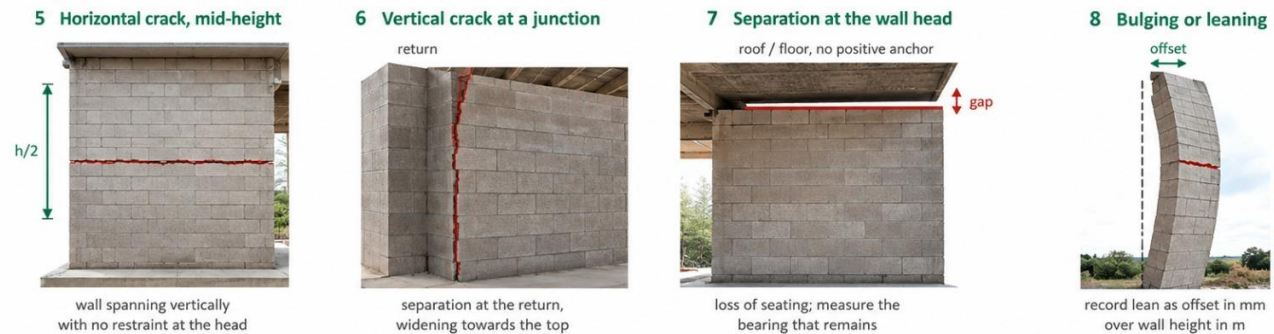


Figure 9.2 Masonry failure mechanisms: in-plane and out-of-plane

9.7 Condition descriptors for earthen, stone and timber typologies

Chapter 8 provides guidance on recognizing adobe and earthen construction, stone masonry, timber-laced masonry and timber-braced masonry. Table 9.1 does not cover them. The descriptors below are what is recorded for those typologies instead.

Table 9.6 Condition descriptors for earthen, stone and timber typologies

Typology and code	What to describe	Condition indicators, least to most severe
Adobe and earthen (A)	Wall plumb, base condition, corner integrity, roof bearing, moisture path, surface loss.	Surface erosion and loss of plaster; shrinkage and settlement cracking at corners and openings; through-wall cracking; softening or undercutting at the base; separation at corners; loss of roof bearing or partial collapse.
Stone masonry, random rubble (SM-R)	Wythe separation, presence of through-stones, bulging, corner and junction integrity.	Loss of pointing and mortar; local bulging of one wythe; separation between wythes; displacement of units; corner separation; partial collapse.
Stone masonry, dressed (SM-D)	Joint condition, bedding, unit displacement, lintel bearing.	Loss of mortar from joints; joint opening; unit displacement; through-wall cracking; loss of bearing at lintels or at the wall head.
Timber-laced masonry (bhatar, cator-and-cribbage)	Band spacing and continuity, timber size and condition, corner laps, masonry between bands.	Loss of masonry between bands with the bands intact; decay or insect attack at a band; discontinuity or missing lap at a corner; displacement of a band; loss of a band; collapse of a panel.

Typology and code	What to describe	Condition indicators, least to most severe
Timber-braced masonry, dhajji-dewari (DD)	Frame member condition, brace continuity, connections, retention of infill.	Loss of infill with the frame intact; cracking of infill within panels; loosening at connections; decay or insect attack at member ends; distortion of the frame; loss of a brace; frame collapse.

These are condition descriptors, not damage states, and they are not interchangeable with the five states of Table 9.1. Where a formal damage-state classification is required for one of these typologies, it is obtained through the guidance listed at References and the source is recorded with the classification. Codes are those of the typology register in the Structural Health Assessment Manual.

10 Observation, Measurement, Mapping and Photography

Produce records that another qualified engineer can locate, understand, check and compare without relying on the observer's memory. A photograph or an isolated dimension without location, scale and context is supporting media, not engineering evidence.

10.1 Field sequence

1. Start with orientation and context records for the site, block, level and face.
2. Assign an observation reference before detailed capture.
3. Record what is observed in neutral language before interpreting cause or consequence.
4. Measure using the approved method and state units, reference points and limitations.
5. Capture context, mid-range and detail images with scale and direction where permitted.
6. Mark the observation on plan or elevation and complete the daily traceability and backup check.

Figure 10.1 shows the required sequence: context, relation to the element, then detail with a scale reference.



- ① Context: the whole block, its setting and orientation
- ② Relation: the finding located on the element
- ③ Detail: close view with a scale reference in frame

Figure 10.1 The photograph sequence

10.2 Field checks

A record is only useful if another engineer can locate it, repeat it, and see what it did not cover. Table 10.1 sets out the checks that make an observation traceable and what is recorded for each.

Table 10.1 Field checks for observation, measurement and media

Check	Verify	Record
Location	Facility, block, level, room or zone, grid or face, element reference and view direction.	Use the master key; add a sketch where naming is insufficient.
Observation language	Material, feature, extent, pattern, condition and associated signs.	Avoid unsupported causal terms such as <i>settlement cracks</i> in the observation field.

Check	Verify	Record
Dimensions	Quantity measured, device and method, reference points, units, resolution and any environmental issue.	Retain the raw reading and the transformed value separately.
Photograph sequence	Context, relation to element, detail, and a scale reference.	Unique reference, timestamp and location; no unapproved faces or records.
Sketch and mark-up	Direction, level and face, element boundaries, defect extent, photograph and test references, inaccessible areas.	Date, author, and revision included.
Coverage	Areas inspected, viewed remotely, partially accessible, concealed, or not inspected.	Do not let a blank drawing imply the absence of defects.
Repeatability	Stable reference points and a method allowing future comparison.	Record anything likely to change between visits.

10.3 Stop and referral triggers

Capture stops where it would breach an authority, put a person at risk, or produce a record that cannot be relied on. Table 10.2 lists those conditions and the response to each.

Table 10.2 Stop and referral triggers: observation and recording

Condition	Response
Capture would expose a person, a record or a restricted space without authority	Do not capture; use an approved alternative or redaction route.
Measurement requires unsafe reach, contact or access	Stop and re-plan. Do not trade safety for completeness.
Location or orientation cannot be established	Pause, obtain context, and update the key before further detail.
A device check fails or a reading is implausible or unstable	Preserve the raw result, quarantine the device, check the method and notify the field lead.
An evidence file is lost, corrupt or cannot be linked	Attempt authorized recapture; never recreate a record from memory.

10.4 Minimum measurement set

The dimensions below are taken on every visit, whatever its scope, and recorded in the measurement log at Annex D. They are the measurements that cannot be recovered from a desk, from a drawing or from a photograph once the team has left the site. Taken together they are the complete input to the two derived figures used downstream: wall area as a proportion of floor area in each direction, and wall height divided by wall thickness. Both are derived in the office or by the screening tool, and neither is computed in the field.

Table 10.3 Minimum measurement set for every visit

Measure on every visit	How it is taken	Why it is taken
Block plan dimensions	Overall external length and width of the block on plan, measured per storey where the footprint changes, together with the length and width of any re-entrant or projecting wing. Record on the sketch plan and name the two orthogonal directions with the same convention used for wall length.	Floor area in each storey is the denominator of the wall-area ratio. Without it the wall lengths recorded below cannot be converted into a proportion, and the figure that decides whether a masonry building passes screening cannot be obtained without a second visit.
Wall length in each direction	Tape or laser along each wall on plan, recorded by direction, per block and per storey. Record the two orthogonal directions separately and name them consistently.	Wall area in each direction is one of the two figures that decide whether a masonry building passes screening. It cannot be obtained remotely.
Wall thickness in each direction	At an opening reveal, a service penetration or a damaged area. State where the measurement was taken and whether render or plaster is included in it.	Required with wall length to obtain wall area, and with wall height to obtain the height-to-thickness figure.
Floor-to-ceiling height, and floor-to-floor where it can be seen	Tape or laser at a stated location on each storey. Record the location, not just the value.	Governs the height-to-thickness figure for out-of-plane behaviour, and the clear height of columns.
Opening sizes and positions	Width, height and position of each door and window in the walls measured, recorded by direction.	Openings reduce the effective wall length. A wall length recorded without its openings overstates the wall available to resist load.
Clear column height where a partial-height infill or a window band is present	From the top of the infill or the sill of the band to the underside of the beam.	Table 8.2: a shortened clear height converts a ductile flexural member into a brittle shear member. This is the dimension that establishes it.
Lean, where a wall is visibly out of plumb	Plumb line or level against the wall face; record the offset in mm and the height over which it was measured, in m.	An out-of-plane indicator under this chapter and Chapter 9; a lean stated without its height is not a measurement.

REQUIREMENT

The field records the dimensions. It does not compute the ratios. Wall area as a proportion of floor area in each direction, and wall height divided by wall thickness, are derived in the office or by the screening tool from the plan dimensions, wall lengths, wall thicknesses and heights recorded here. This Handbook records and escalates; under Table 1.1 it does not establish capacity or acceptance criteria, and a ratio computed on site would be a field evaluation. Record the dimensions completely enough that the ratio can be derived without a second visit.

11 Distress Diagnosis and Evidence Confidence

Build and test plausible mechanisms while keeping observation, interpretation, corroboration and uncertainty separate. Crack width, staining, spalling, tilt or a device reading alone does not establish cause, severity, capacity or the required action.

11.1 Field sequence

1. Group observations by element, pattern, chronology and environmental or operational context.
2. List credible mechanisms and the evidence each would predict.
3. Identify evidence that supports, contradicts, or cannot distinguish between the mechanisms.
4. Select proportionate verification through documents, measurement, testing, exposure, or monitoring.
5. Assess the consequence of being wrong and escalate high-consequence uncertainty.
6. Issue a diagnosis record with alternatives, confidence, and the next action.

11.2 Field checks

Diagnosis in the field is a matter of describing what is present and stating how firmly it is known, not of settling on a cause. Table 11.1 sets out what is observed for each class of distress and what is recorded, including the confidence attached to each claim.

Table 11.1 Field checks for distress diagnosis

Check	Observe	Record
Cracking	Orientation, location, continuity, branching, surface and depth evidence, associated movement, leakage or corrosion, and recurrence.	Record pattern and activity evidence; do not label the cause prematurely.
Deformation	Deflection, lean, rotation, separation, bearing and slip, and stability of the reference.	Distinguish measured change from one-time geometry.
Material loss	Spalling, delamination, section loss, erosion, decay, and the extent of loose material.	Map the accessible extent and state the hidden area of uncertainty.
Moisture and chemical signs	Leak path, damp, efflorescence, rust staining, deposits, odor and the exposure source.	Separate the symptoms from a confirmed mechanism.
Connection distress	Opening, crushing, slip, tearing, bolt, weld or anchor evidence, incompatible repair.	Relate to the load path and movement.
Chronology	Reported onset, relation to an event, progression, seasonal recurrence and prior treatment.	Record the source and any corroboration.
Evidence confidence	Direct observation, measured, tested, documented, reported, inferred, or unknown.	Label each claim; avoid a single opaque score.
Consequence	Potential effect on safety, service, durability, analysis or access if the mechanism is true or false.	Route high-consequence uncertainty early.

12 Hazard Field Cards

The cards below structure the walkdown for each hazard. Each records evidence for later evaluation; none produces a verdict on the building.

The reason each hazard carries its own card is that each one writes its evidence in a different place. Flood writes into the ground and the drainage long before it reaches the structure. Wind writes into the fixings before it reaches the frame. Earthquake writes into the configuration before it reaches any single member. One general walkdown finds the damage that is already obvious and misses the evidence that predicts the next event.

12.1 Seismic

The seismic card is used wherever earthquake demand is credible for the site. Table 12.1 sets out what is observed and what is recorded, working from the overall configuration down to the components that could fall.

Table 12.1 Seismic hazard field card

Check	Observe	Record
Configuration	Open, soft or weak-looking storeys, setbacks, discontinuities, asymmetric layout, split levels, short or captive elements.	Record geometry and features; do not assign a code irregularity without formal check.
Diaphragm path	Roof and floor continuity, openings, chords and collectors, wall or frame connection, out-of-plane restraint.	Map observed and concealed links.
Vertical system	Frames, walls, braces and masonry; continuity, offsets, transfer and foundation connection clues.	Record by direction and level.
Separation	Pounding gap evidence, shared walls, stairs and bridges, infill interaction, adjacent falling hazards.	Measure only by an approved safe method.
Component distress	Cracking, crushing, spalling, buckling, yielding clues, connection slip, residual deformation, loss of bearing.	Use a neutral description and an exact location.
Masonry	Wall continuity, returns and cross-walls, diaphragm anchorage, out-of-plane stability, openings, prior alterations.	Do not infer reinforcement or confinement where concealed.
Falling hazards	Parapets, ceilings, services, tanks, equipment, cladding, partitions.	Escalate immediate hazards through the site authority.
Event chronology	Aftershock or change reports, occupancy actions, temporary support, and new versus pre-existing distress.	Record the source and time of every claim.

12.2 Flood, drainage and scour

Flood damage is usually written into the ground and the drainage before it becomes visible in the structure. Table 12.2 sets out what is observed along the water pathway and what is recorded.

Table 12.2 Flood, drainage and scour field card

Check	Observe	Record
Water pathway	Upstream source, overland route, drains and culverts, ponding, entry points, discharge and downstream obstruction.	Map direction and connectivity; note the current condition.
High-water evidence	Marks, debris lines, staining, witness accounts, records, and the local datum.	Record source and reliability; do not average unrelated marks.
Drainage condition	Inlets, gutters, downpipes, channels, outfalls, blockage, damage, backflow and maintenance access.	Photograph context and downstream condition.
Scour and erosion	Loss of ground, undermining, exposed foundation or utility, channel migration, toe erosion, damage to protective works.	Record geometry only where safe; refer interpretation.
Ground response	Settlement, voids, heave, saturation, washout, retaining distress, adjacent excavation.	Coordinate geotechnical review.
Building ingress	Entry route, depth evidence, reported duration, affected materials and services, trapped moisture, contamination.	Map by block and level.
Access and continuity	Road, bridge or path closure, emergency access, sanitation, power, and the consequences for clinical or school service.	Record the impact on vulnerable users without personal data.

12.3 Wind, roof and envelope

Wind damage begins at the envelope and travels inward through whatever holds it down. Table 12.3 sets out what is observed in the roof, its attachments and the openings, and what is recorded.

Table 12.3 Wind, roof and envelope field card

Check	Observe	Record
Exposure context	Open fetch, shielding, topographic position, adjacent roofs, trees, signs and debris sources.	Record geometry and context; exposure classification is an office task.
Roof system	Material, form, span and support, bracing clues, overhangs, edges and corners, drainage.	Map each distinct roof zone.
Attachment path	Covering to secondary members, secondary to primary, primary to walls or frames, walls to foundations.	Record visible type and condition, and concealed links.
Envelope and openings	Doors, windows, vents, louvres, damaged glazing, shutters.	Record condition and the ability to close openings.
Rooftop items	Tanks, solar arrays, services, canopies, signs, ceilings, and later installations.	Record support and attachment evidence, and access limitations.

Check	Observe	Record
Deterioration	Corrosion, timber decay, cracked masonry or concrete, loose fasteners, failed sealant, water damage.	Relate to connection and load-path locations.
Event damage	Uplift or displacement, missing components, progressive opening, debris impact, temporary repairs.	Distinguish current observation from the reported sequence.

12.4 Slope, landslide and ground movement

Ground movement is read from the terrain and the building together, because neither on its own shows whether the movement is still active. Table 12.4 sets out what is observed and what is recorded.

Table 12.4 Slope, landslide and ground movement field card

Check	Observe	Record
Terrain context	Slope position, crest and toe, drainage lines, channels, cuts and fills, retaining structures, adjacent loading or excavation.	Map context without unsafe traversal.
Ground indicators	Scarps, tension cracks, bulging, hummocky ground, settlement, heave, erosion, voids, disturbed drainage.	Use neutral description and an exact location.
Building response	Differential movement, racking, separation, rotation, jammed openings, utility rupture, foundation exposure.	Relate to the ground pattern; do not assume a single cause.
Retaining works	Lean or bulge, cracking, joint opening, drainage, toe condition, backfill loss, unauthorized alteration.	Record accessible faces and hidden-drainage uncertainty.
Water influence	Seepage, springs, leaking services, blocked drains, roof discharge, irrigation, storm runoff.	Map source and path where authorized.
Chronology and activity	Reported onset, relation to rainfall or events, repeat repairs, progressive change, monitoring.	Record source, time and corroboration.
Access and evacuation	Failure or debris routes affecting buildings, roads, assembly points, and emergency access.	Escalate the operational consequences.

12.5 Fire, heat and cascading hazards

After a fire, each material carries its own record of the temperature it reached. Table 12.5 sets out what is observed for each of them and what is recorded, together with the hazards that commonly follow the fire itself.

Table 12.5 Fire, heat and cascading hazards field card

Check	Observe	Record
Incident context	Reported origin and spread, duration, compartments, ventilation and openings, suppression actions, local failure evidence.	Record the source and authority; do not reconstruct a fire from soot patterns alone.
Concrete and masonry	Spalling, cracking, delamination, exposed reinforcement, color and deposits, bond and bearing conditions.	Map extent; reserve material conclusions for testing.

Check	Observe	Record
Steel	Deformation, local buckling, connection, bolt and weld condition, loss of protective coating, restraint effects.	Record residual geometry safely; do not infer residual strength visually.
Timber and other materials	Char and section loss, connection condition, concealed cavities, collapse path.	Refer to a specialist where the material or system requires it.
Global condition	Lean, deflection, displaced bearing, wall and roof support, temporary shoring, load redistribution.	Escalate apparent instability immediately.
Water and weather effects	Ponding, saturation, corrosion risk, mould, weakened finishes.	Map drainage and drying, and the operational constraints.
Utilities and hazardous materials	Electrical, gas and fuel, oxygen and medical systems, batteries, chemicals, asbestos, lead or contaminated debris.	Rely on authorised isolation and specialist controls.

12.6 Deterioration, moisture and durability

Deterioration is a moisture problem before it is a material problem, so the pathway is traced first. Table 12.6 sets out what is observed for each material and what is recorded.

Table 12.6 Deterioration, moisture and durability field card

Check	Observe	Record
Moisture pathway	Roof or plumbing leakage, condensation, rising or ground moisture, façade ingress, drainage, trapped water.	Map source, path and sink; distinguish active from historic evidence.
Concrete and reinforcement	Cracking, delamination, spalling, rust staining, exposed bars, prior patches, interface distress.	Map the accessible extent; quantify only by approved method.
Masonry and mortar	Weathering, erosion, salts and efflorescence, cracking, damp, biological growth, incompatible pointing or render, unit damage.	Record the material layers and the repair history.
Structural steel	Coating breakdown, corrosion pattern, crevices, water traps, connection and contact-material effects.	Do not estimate section loss without measurement.
Timber and organic materials	Moisture, decay, infestation evidence, connection condition, concealed zones.	Refer to a material specialist where required.
Repair compatibility	Hard against soft, permeable against impermeable, thermal and movement mismatch, debonding or edge distress.	Record old and new materials where known.
Exposure and operations	Chemicals, salts, heat, cleaning regime, medical or sanitary use, splash, soil contact, maintenance access.	Record source and frequency without assuming concentration.

12.7 Falling hazards

Falling hazards are carried on their own card because they behave differently from every other finding in this chapter. They are among the commonest sources of injury in this building stock, they are among the cheapest defects to correct, and they are the findings a custodian can act on immediately without waiting for an evaluation. Each one is notified the same day.

Table 12.7 Falling-hazard field card

Item	Observe	Record
Ceiling fans and light fittings over occupied rooms	Fixing to the slab or to a hook rather than to the ceiling board; condition of the down-rod, blade guard and canopy; corrosion; movement when running; whether the fitting is above desks, beds or a circulation route.	Room reference, what lies beneath, fixing type where visible, and the recipient of the immediate notification.
Roof water tanks, solar frames and rooftop plant	Support frame and its fixing to the roof; corrosion at the fixing rather than at the member; packing under legs; whether the load sits over a wall or over the middle of a slab; restraint against sliding.	Position on plan, what lies beneath, frame and fixing condition, and approximate mass where it can be established safely.
Parapets and gables	Height above roof level, thickness, restraint if any, mortar condition, lean, and whether the parapet stands over an entrance, a walkway, a play area or an egress route.	Height, thickness, lean, what lies below, and the recipient.
Free-standing boundary and compound walls	Height, thickness, pier spacing, evidence of a foundation, lean, cracking, and whether the wall borders a route used by children or staff. A boundary wall is not part of the building and is regularly omitted from the survey.	Height, thickness, lean, the length of the affected run, and what lies on each side.
Unsecured shelving, cabinets and equipment in clinical rooms	Whether tall furniture is fixed back to the wall; whether gas cylinders are chained; whether heavy items are stored high; condition of any fixing present.	Room reference, the item, whether a fixing is present or absent, and the recipient.
Cladding, canopies, signage and services	Condition of the fixing rather than of the panel; corrosion at the fastening; previous repairs; position relative to entrances and egress routes.	Location, what lies beneath, fixing condition, and the recipient.

REQUIREMENT

Record what lies beneath the item. A falling hazard over a store room and the same hazard over a classroom door are not the same finding, and the record is what allows the custodian to act on the second one first. Notify through the site authority the same day; recording alone does not discharge the duty. This card does not authorise the team to remove, secure or make safe any item.

13 Non-Destructive Testing and In-Situ Measurement

Collect method-controlled readings that answer a defined engineering question, and retain the raw evidence, the limitations and the correlation required for engineering use. Test output is indirect evidence unless the approved method and a project-specific correlation support the claimed property.

13.1 Field sequence

1. State the engineering question and why the selected method can answer it.
2. Approve locations, coverage, substrate preparation, safety and operational constraints.
3. Verify equipment and record environmental and surface conditions.
4. Run reference or trial measurements and refine the plan without concealing failed trials.
5. Collect raw readings, repeats and anomalies with exact location, operator and time.
6. Review completeness and limitations before interpreting or demobilising.

13.2 Selecting the method

Each method answers a narrow question. Selecting on availability rather than on the question is the most common cause of data that cannot be used.

Table 13.1 Matching the field question to the method

Question in the field	Method	What the output actually is	Required corroboration
Is the concrete consistent across the structure, and where should cores be taken?	Rebound number; ultrasonic pulse velocity	A hardness or velocity value indicating relative variability, not strength.	Cores at selected locations, to establish the correlation.
Where is the reinforcement, and what is the cover?	Cover meter; ground-penetrating radar	An indication of bar position and cover, sensitive to congestion and embedded services.	Physical exposure at one location per element type.
Is reinforcement corroding, and where?	Half-cell potential mapping	A probability of active corrosion at each location, not a measure of section loss.	Targeted opening up in the zones of elevated probability.
Has the carbonation front or chloride reached the steel?	Phenolphthalein indicator on a fresh face; chloride profiling	A depth to the color change, or a chloride content against depth.	Comparison of the measured cover at the same location.
Is there delamination or voiding behind the surface?	Hammer tapping or chain drag; infrared thermography	An indication of the extent of separation, sensitive to surface and weather conditions.	Local removal at representative locations.

Question in the field	Method	What the output actually is	Required corroboration
What is the in-situ stress or stiffness of this masonry?	Flat-jack testing	A direct measurement of stress or deformability of the wall tested.	Sufficient locations to represent the variability of the construction.
What is the actual geometry and verticality?	Survey, plumb, level, laser measurement	Dimensional data with a stated instrument accuracy.	A stable reference and repeat readings where change is suspected.

Figure 13.1 turns Table 13.1 into a selector: state the question, then follow it to the method.

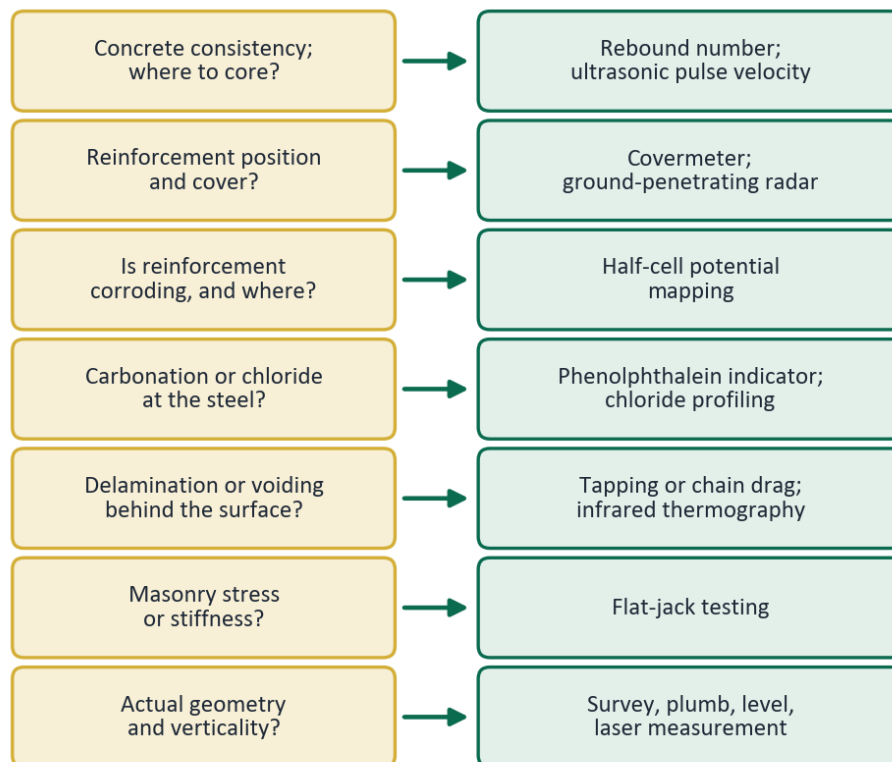


Figure 13.1 Selecting the NDT or in-situ method

Figure 13.2 shows two of the methods in use.

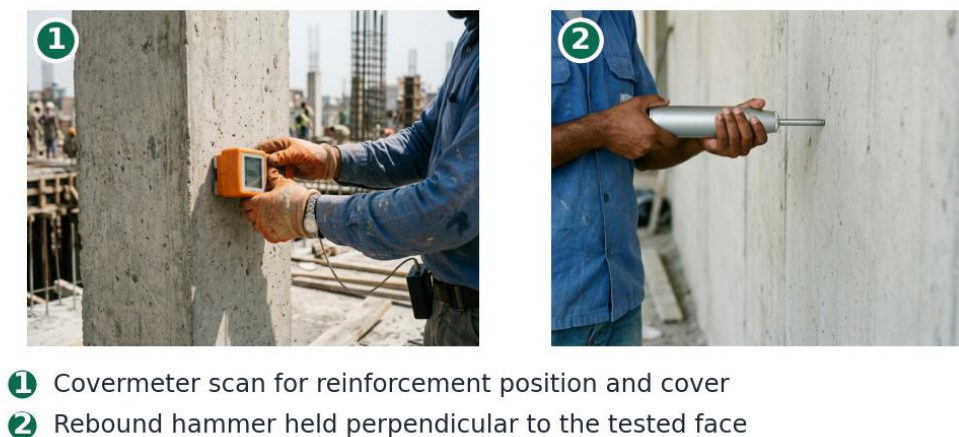


Figure 13.2 Non-destructive survey in practice

13.3 Field checks

A method correctly chosen can still produce unusable data if the way it was run is not recorded. Table 13.2 sets out the checks that control the reading itself and what has to accompany it.

Table 13.2 Field checks for testing and measurement

Check	Verify	Record
Question and method	That the selected method can distinguish between the candidate answers.	Do not use a convenient method for an unrelated property.
Procedure control	Current method, settings, preparation, grid, coupling or contact, environmental limits.	Record deviations before the results are used.
Equipment verification	Item reference, calibration status, pre-use and post-use reference checks, accessories.	Link to each data set.
Location and coverage	Element reference, face, grid, excluded zones, reinforcement and edge influence, and the sampling rationale.	Map every reading; no orphan spreadsheet.
Repeatability	Repeat readings, operator consistency, drift and outlier handling.	Retain all raw results and the reason for any exclusion.
Material effects	Roughness, carbonation, moisture, coatings, geometry, temperature, reinforcement, and heterogeneity.	State the relevant limitations; do not silently correct.
Ground truth	Cores, exposures, known geometry or another approved reference where required.	Do not invent a conversion relationship.
Data status	Raw, validated, excluded, transformed, or interpreted.	Keep each stage traceable and separately stored.

14 Intrusive Testing, Sampling, Monitoring and Making Good

Obtain targeted ground truth or time-dependent evidence without creating an uncontrolled structural, service, safety, heritage or environmental defect. No sample or monitor is representative beyond its documented location, method, and period.

14.1 Field sequence

1. Confirm the question, the minimum intervention, and the consequence of cutting, drilling or opening up.
2. Approve the location after reviewing records, scans, services, reinforcement, prestressing, load path, and temporary support.
3. Prepare labels, chain of custody, containment, environmental and infection controls, and making good materials.
4. Record the condition before, during and after work, preserving sample orientation and context.
5. Install or verify the monitoring reference and its protection or transfer the sample under controlled custody.
6. Complete making good, acceptance, data review and the handover of future monitoring.

14.2 Field checks

Intrusive work is the only part of the visit that changes the building, so each step is approved, recorded, and made good. Table 14.1 sets out the checks for every stage from location approval to reinstatement.

Table 14.1 Field checks for intrusive work, sampling and monitoring

Check	Verify	Record
Location approval	Element function, load-path consequence, reinforcement, services and prestressing, edge and joint conditions, and the representativeness rationale.	Marked on a drawing and approved by the responsible engineer.
Temporary condition	Load restriction or support, access, vibration, dust and water, live services, facility operation.	Controls active before work begins.
Sample identity	Unique reference, block, element and location, orientation and depth, date and time, operator, intended test.	Label survives transport and matches the log.
Sample condition	Dimensions by approved method, damage, moisture protection, contamination, storage and transport.	Report deviations to the laboratory and reviewer.
Opening and exposure	Layer and material sequence, concealed detail, reinforcement and connections, voids, surrounding conditions.	Photograph and sketch before making good.

Check	Verify	Record
Monitoring reference	Stable datum, instrument reference, range and resolution, installation, baseline, environment and protection.	Record reference stability and any reset. A surface-mounted monitor installed without drilling or opening up is not intrusive work; a monitor requiring drilled fixings or opening up follows the approval route in this chapter.
Making good	Preparation, compatible material and detail, curing and protection, finish, fire and waterproofing, acceptance.	Record as-built location, material, batch and status.

14.3 Stop and referral triggers

Work stops where what is found is not what was approved. Table 14.2 lists the conditions that halt intrusive work and the response to each.

Table 14.2 Stop and referral triggers: intrusive work

Condition	Response
Possible prestressing, critical reinforcement, live service or an unstable member is unresolved	Do not drill, cut or open up until verified and approved.
An unexpected void, detail or damage is encountered	Stop, preserve, secure the opening, and obtain revised direction.
Sample identity or custody is lost, or condition is compromised	Quarantine and report the deviation; do not relabel from memory.
A monitoring reference moves, an instrument is disturbed, or a reading meets a project criterion	Preserve the raw record and follow the project response plan.
Making good cannot restore the required structural, fire, water, infection-control or finish function	Hold the area and obtain an approved repair and acceptance.

15 Access, Work at Height and Restricted Spaces

Most of what an assessment needs to see is above head height, behind a finish, or below ground. The access plan therefore determines how much of the building is actually assessed, and it is the part of the visit most often improvised.

15.1 Planning access

15.1.1 Access shall be planned against the evidence required, not against what happens to be reachable. Where a required observation cannot be made safely, it shall be recorded as not inspected, with the access provision needed to close it.

15.1.2 Access equipment and methods shall be approved before mobilization. A ladder, chair, or parapet shall not be used to reach an observation that the approved method does not cover.

Table 15.1 Access requirements by location

Location	Evidence usually required there	Access consideration
Roof space and ceiling void	Diaphragm construction and continuity, roof-to-wall connection, added mass, concealed damage, water ingress.	Fragile surfaces, unguarded edges, unrestrained ceilings, limited headroom, dust, and biological hazards.
Roof surface	Roof system and fixings, rooftop equipment and tanks, parapet condition, drainage.	Fall from height and through fragile materials; weather and wind limits; approved edge protection.
External elevation above ground floor	Crack patterns over full height, out-of-plumb, façade and parapet condition, separation from adjacent buildings.	Prefer measurement from the ground with appropriate instruments before proposing access equipment.
Below plinth or ground level	Foundation type and condition, settlement, scour, drainage, moisture path.	Excavation is intrusive work requiring authorization, services clearance and reinstatement.
Service risers and plant rooms	Concealed structure, penetrations, equipment, mass and restraint.	Live services, isolation, restricted space, and the facility's operational constraints.
Occupied clinical or teaching space	Interior crack mapping, ceiling and equipment condition.	Timing, infection control, safeguarding, and the presence of people unable to move quickly.

15.2 Controls

Access controls are settled before the team leaves the ground, and they are not varied to reach one more observation. Table 15.2 sets out each control and what it requires.

Table 15.2 Access controls and their requirements

Control	Requirement
Approved method	The access method, equipment, and operator competence are approved before the visit and recorded in the assignment.
Structural adequacy of the access route	Where access loads a damaged or suspect element, the route is assessed before use. A structure under investigation is not assumed adequate to carry access equipment.

Control	Requirement
Fragile and unguarded surfaces	Identified in advance; crawling boards, edge protection or exclusion applied; no reliance on ceiling or roof sheeting for support.
Restricted and confined spaces	Entered only under the site permit system, with atmosphere testing, attendant, communication and rescue arrangements in place.
Live services	Isolation obtained from the site authority before working near electrical, gas, medical-gas or pressurized systems. Contact testing is not used to establish whether a service is live.
Weather limits	Roof and elevated work suspended outside the approved wind, rain, and temperature limits.
Occupied areas	Exclusion zones, timing and supervision agreed with the facility; children and patients separated from the work at all times.

15.3 Recording coverage

- 15.3.1** The record shall state, for each block and level, which areas were inspected closely, which were viewed remotely, which were partially accessible, which were concealed, and which were not inspected at all.
- 15.3.2** A drawing carrying no marked observations shall not be read as evidence that no defect exists. Coverage shall be shown explicitly on the same drawing as the findings.

16 Post-Event Reconnaissance

A visit after an earthquake, flood, fire or landslide differs from a routine assessment visit in three ways: the hazard may still be present and changing, the evidence is perishable, and the information is needed quickly for decisions about occupancy that this Handbook does not make.

16.1 Before entering

16.1.1 post-event access shall occur only after release by the authority controlling the incident and within the limits of that release. Release permits controlled access; it does not certify structural adequacy.

16.1.2 The team shall establish, before approach: whether the event sequence is continuing; the status of utilities; whether hazardous materials are present or have been released; which areas are excluded; and the route by which the team will withdraw.

16.2 What changes in the field method

Table 16.1 How a post-event visit differs

Aspect	Routine visit	Post-event visit
Hazard state	Static during the visit.	May change without warning. Reassess continuously; withdraw and reassess on any change indicator.
Evidence durability	Stable; can be revisited.	Perishable. Debris is cleared, water recedes, temporary props are added, and damage is repaired within days. Record early and record generously.
Chronology	Not usually critical.	Central. Every observation is recorded as pre-existing, event-related or unknown, with the basis stated.
Occupancy	Normal operation.	Often disrupted, with people sheltering in or near the building. Record actual occupancy and any control in force.
Interpretation pressure	Low.	High. Requests for an immediate verdict are common; the field team records evidence and refers the decision.

16.3 Field sequence

1. Confirm incident release, utility status, hazardous material controls and exclusion zones.
2. Obtain the authorized timeline: event, aftershocks or further flooding, suppression or rescue actions, and any temporary work already installed.
3. Observe and photograph each elevation from a safe position before approaching, in a consistent sequence.
4. Map the damage by block and level, recording mechanism, extent and, separately, whether it is judged event related.
5. Record falling hazards, obstructed egress, damaged utilities and loss of critical services, and notify each immediately through the site authority.
6. Record what the building is being used for now, and by whom.

7. Establish a monitoring baseline where continuing movement is possible.
8. Hand over the same day where occupancy decisions depend on the evidence.

16.4 Distinguishing event damage

Table 16.2 Indicators distinguishing event damage from pre-existing damage

Indicator	Suggests event-related	Suggests pre-existing
Crack faces	Fresh, un-weathered, sharp edges; dust from the crack still present.	Weathered, dirt-filled, painted over, or plastered.
Finishes	Cracked through recently applied finishes; fallen plaster still loose on the floor.	Cracks reopening along an earlier repair line.
Displacement	Residual displacement with matching evidence at connections and bearings.	Long-term movement with adjusted door and window frames, or packing at bearings.
Distribution	Consistent with the direction and character of the event across several elements.	Localized, or consistent with settlement, drainage, or thermal patterns.
Records and accounts	Reported by occupants as new and absent from prior records or photographs.	Present in prior reports, maintenance records, or photographs.

16.4.1 Where the distinction cannot be made from the evidence available, it shall be recorded as unknown. An assumption in either direction has consequences: attributing pre-existing damage to the event overstates the effect, and attributing event damage to pre-existing causes understates the risk to occupants.

16.5 Immediate hazards

Some findings cannot wait for the evaluation. Table 16.3 lists the conditions that require action during the visit itself, and the action each one demands.

Table 16.3 Immediate hazards and required action

Hazard	Action
Apparent instability, loss of bearing, or a member in a severe damage state	Withdraw, exclude the area and escalate immediately through the site and emergency authority.
Falling hazard over an occupied or egress route	Notify the site authority for immediate control; record the item, its location and what lies beneath.
Damaged utility	Do not approach or test. Refer to the utility and site authority for isolation.
Obstructed or unusable egress	Notify the facility and fire authority separately from the structural report; it is an immediate life-safety issue in its own right.
Building in use as shelter while its condition is unresolved	Report the actual occupancy with the evidence and escalate to the responsible engineer and the authority without delay.

17 Handover, Reporting and Visit Closeout

Transfer a complete, reviewable evidence package that states what is known, what is unknown, what is contradictory, what is urgent, and what is required next. A complete field package is not an assessment conclusion until the responsible engineer performs and documents the evaluation.

17.1 Field sequence

1. Reconcile scope against blocks, areas, methods, coverage, and deferred work.
2. Run identifier, file, photograph, test, sample and monitor traceability checks.
3. Separate observed, measured, tested, documented, reported, inferred, and unknown claims.
4. Summarize immediate actions, unresolved hazards, contradictions, and specialist referrals.
5. Translate field evidence into explicit geometry, material, load-path, and modelling questions.
6. Transmit through the approved route and record acceptance, queries, and controlled revisions.

Figure 17.1 shows the status labels, one of which every claim in the handover carries.

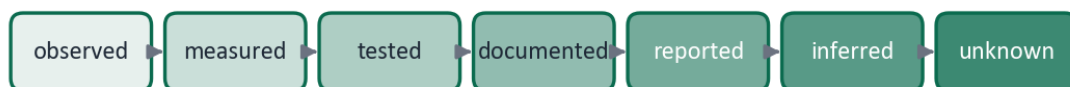


Figure 17.1 Evidence status chain

17.2 Field checks

The handover is checked against what the responsible engineer will need, not against what the team happened to collect. Table 17.1 sets out each check and what has to be recorded for the package to be accepted.

Table 17.1 Field checks for handover and completeness

Check	Verify	Record
Scope completion	Assigned against completed blocks, areas and tasks; the reason for any gap; the need for a return visit.	No blank item treated as complete.
Traceability	Every observation, image, reading and sample map to visit, block, location, author and method.	Orphan and duplicate checks are completed.
Evidence status	Observed, measured, tested, documented, reported, inferred, or unknown.	Status retained at claim level.
Geometry input	Value or feature, units and reference, source, coverage, uncertainty and suitability for use.	Responsible engineer accepts before model use.
Material input	Raw or derived property, method, sample location, correlation and statistical route, limitation.	No field default inserted.
Hazard input	Mapped pathway and event evidence, datum and source, uncertainty, specialist question.	Design parameters remain a separate office task.

Check	Verify	Record
Urgent and residual risk	Open exclusion, temporary control, monitoring trigger, inaccessible area, recipient and owner.	Prominent, acknowledged, and time bound.
Audit trail	Original record, reason for correction, author and reviewer, date, superseded issue.	Never overwrite raw evidence.

Annexes: Cross-walk to the project field instruments

The registers in Annexes A to F are the forms the field team completes. They are not a second record system running beside the project's own instruments. This cross-walk states, for every register, which project instrument covers the same ground and which document is the record of authority where both do.

Where a register duplicates a project instrument and adds nothing, complete the project instrument and cross-refer it from the register rather than writing the same information twice. Where a register carries something the project instrument does not, the register is the record.

Table 0.1 Cross-walk of the annex registers to the project field instruments

Register	What it records	Corresponding project instrument	Record of authority where both cover the same field
A.1 Visit control header	Visit authorization, scope, team and the decision supported	Screening proforma: visit and identification block	The proforma
A.2 Work-control log	PROCEED, PAUSE, STOP and REFER status through the visit	No corresponding instrument	This Handbook
A.3 Referral and urgent notification record	Referrals raised under clause 1.6 and urgent notifications made	Project referral form and code list, where issued	The project referral instrument once issued; this register until then
B.1 Assignment brief	Scope, decision supported, responsible engineer, access	Assignment documentation	The assignment
B.2 Team competence and authorization	Who did the work and under what authority	No corresponding instrument	This Handbook
B.3 Equipment and calibration register	Instruments used and their verified status	No corresponding instrument	This Handbook
C.1 Facility and block register	Facility and block identity, facility code, coordinates, occupancy	Screening proforma: facility identification	The proforma
C.2 Document register	Drawings and reports relied on, and their status	Screening proforma: documents available	The proforma
C.3 Interview, incident and alteration record	Reported history and what requires verification	Screening proforma: reported history	The proforma
D.1 Observation record	Neutral observations by block, level and element	Screening proforma: observed condition	The proforma for the screening outcome; this register for the underlying observation
D.2 Measurement log	Dimensions and readings with device and uncertainty	Screening proforma: dimensional data	The proforma

Register	What it records	Corresponding instrument	project	Record of authority where both cover the same field
D.3 Photograph and media log	Media traceability to observation and location	No corresponding instrument		This Handbook
D.4 Minimum measurement set record	The dimensions required on every visit under Chapter 10	Screening proforma: dimensional data, in part		The proforma for fields it carries; this register for the remainder
D.5 Photograph provenance and consent register	Source, usage rights, identifiability and consent basis for every image	Project consent instrument, where issued		The project consent instrument once issued; this register until then
E.1 to E.4 Diagnosis, testing and monitoring	Candidate mechanisms, test plan, raw readings, samples and monitoring	Not covered by the screening instruments		This Handbook
F.1 to F.4 Handover and completeness	Completion against scope, engineering inputs, open items and transmittal	Whole-building outcome sheet, in part		The outcome sheet for the outcome recorded; this Handbook for the evidence behind it
Table 8.1 typology code	The structural typology assigned in the field	Typology register, Table 4-1 of the Structural Health Assessment Manual		The typology register

Annex A Visit Control and Urgent Notification

The forms in this annex control the visit itself: who authorized it, what work-control status applied at each point, and what was notified urgently. They are completed during the visit, not reconstructed afterwards.

Table A.1 Visit control header

Field	Entry
Project and visit reference	
Facility and blocks	
Date and time	
Field lead and team	
Decision the visit must support	
Scope, methods and exclusions	

Table A.2 Work-control log

Time	Area or location	Status	Condition and reason	Immediate action	Recipient	Release authority

Table A.3 Referral and urgent notification record

Field	Entry
Condition and exact location	
People or operations potentially affected	
Time first observed and current status	
Immediate withdrawal, exclusion or site action	
Evidence references captured from a safe position	
Recipient, channel and time of notification	
Acknowledgement, instruction and time	
Open owner, next review, and re-entry authority	
Referral code, where the project instrument applies	

Field	Entry
Question to be answered, and the consequence if it is not	
Specialist or evidence required	
Time raised, and by whom	
Time transmitted to the responsible engineer	
Time acknowledged and accepted by (name and role)	

This register records both an urgent notification and a referral raised under clause 1.6. Where the project issues a referral form, this register is completed against it and the project code entered in the first row above; until then this register is the record of the referral.

CAUTION

Do not remain in a hazardous position to complete this form. Protect people, withdraw by the approved route, notify, and complete the record from a safe location.

Annex B Assignment, Team and Readiness

The forms in this annex establish that the right team, carrying the right authority and the right equipment, arrived to answer a stated question. They are completed before the team travels.

Table B.1 Assignment brief

Field	Approved entry
Facilities, blocks and areas	
Planned methods and coverage	
Explicit exclusions and deferred work	
Responsible engineer and field lead	
Site authority and emergency contact	
Deliverables, due date and accepting role	

Table B.2 Team competence and authorization

Person	Role or task	Competence basis	Supervision	Authorisation and limitation

Table B.3 Equipment and calibration register

Item	Serial or asset reference	Method	Operator	Calibration status	Pre-use check

Annex C Facility, Block and Context Registers

The registers in this annex fix what was inspected and what was already known about it. Every later observation refers back to the identifiers created here.

Table C.1 Facility and block register

Block reference	Facility code (dataset and code)	Coordinates (decimal degrees, WGS 84)	Name or use	Levels	Apparent system	Occupancy	Status

The facility code and the coordinates are the two fields that allow this field record to be matched to the national facility dataset, and hazard parameters to be read at the building rather than at district level. Enter the facility code on the first row and repeat it only where a site carries more than one facility code. Coordinates are taken per block.

Table C.2 Document register

Document	Originator	Date or revision	Source	Blocks it applies to	Status

Table C.3 Interview, incident and alteration record

Reported item	Source and role	Date range	Location	Verification required

Annex D Observation, Measurement and Media Records

The registers in this annex hold the primary field evidence: what was seen, what was measured, and what was captured as media. Each entry carries the location key so that it can be found again.

Table D.1 Observation record

Reference	Block, level and element	Neutral description	Extent	Media	Immediate action

Table D.2 Measurement log

Reference	Object measured	Device and method	Raw reading	Units reference and	Uncertainty

Table D.3 Photograph and media log

File reference	Subject	Location and direction	Scale reference	Related observation

Table D.4 Minimum measurement set record

Block and storey	Plan length (m)	Plan width (m)	Floor area (m ²)	Direction	Wall length (m)	Wall thickness (mm)	Floor-to-ceiling height (m)	Openings: size and position	Clear column height (m)	Lean: offset (mm) over height (m)

Completed on every visit under the minimum measurement set in Chapter 10. Plan dimensions and floor area are entered once per storey per block; the remaining fields are entered once per wall direction per storey per block. Where the footprint is not rectangular, record the plan dimensions of each part on the sketch and enter the total floor area here. Derived ratios are not entered on this form.

Table D.5 Photograph provenance and consent register

File reference	Taken by, date and place	Subject	Any person identifiable in the frame	Consent basis and reference	Approved uses	Restrictions

REQUIREMENT

No image in which a child, a patient or a member of staff is identifiable is retained, transmitted or published unless the consent basis is recorded in this register and the use proposed is within the approved uses. Clause 2.2 governs. Where the project has issued a consent instrument, that instrument is used and referenced here; until it is issued, this register is the project record of consent and provenance. An image whose provenance cannot be established is not used on a cover or in published material.

Annex E Diagnosis, Testing and Monitoring Records

The records in this annex separate what was observed from what was tested and from what was concluded. They also carry the custody and monitoring information a later reader needs to rely on a reading.

Table E.1 Mechanism and confidence record

Observation set	Candidate mechanism	Supporting evidence	Contradicting evidence	Discriminating check	Confidence

Table E.2 Question-led test plan

Question	Method	Locations	Operator	Acceptance route	Owner

Table E.3 Raw reading and validation register

Reading reference	Exact location	Time	Settings and conditions	Raw value	Status

Table E.4 Opening, sample, custody and monitoring record

Field	Entry
Intrusive work authorization reference and approving engineer	
Opening or sample reference, location and orientation	
Method, date, time and operator	
Chain of custody, transfers, times and persons	
Making good, material, batch, date and acceptance	
Monitoring instrument, baseline and reading schedule	

Annex F Handover and Completeness

The records in this annex close the visit. They state what was completed, what the responsible engineer still needs, what remains open, and who accepted the package.

Table F.1 Field completion matrix

Block or area	Task planned	Completed	Evidence references	Gap	Action owner

Table F.2 Engineering input schedule

Input required	Evidence	Units and reference	Coverage	Uncertainty	Reviewer disposition

Table F.3 Urgent and open-item register

Item	Status or control	Recipient	Acknowledged	Owner	Next review

Table F.4 Transmittal and acceptance record

Field	Entry
Package index and file locations	
Raw data archive location and backup confirmation	
Transmittal reference, sender, recipient and time	
Acceptance by responsible engineer, with date	
Outstanding queries and revision record	

Annex G Worked Visit

The example below illustrates a complete visit from brief to handover. All details are assumed for illustration. It is not a record of any facility.

G.1 Brief and mobilization

A government primary school for girls is reported to have cracks in one classroom block following a wet season. The assignment is to establish the condition of the affected block and provide evidence needed to decide whether detailed evaluation is required. The team comprises two engineers and a supervised technician; access is arranged through the head teacher, with the district education office's authorization; the visit is scheduled outside teaching hours for the affected rooms.

Table G.1 Readiness for the visit

Readiness item	Illustrative outcome
Decision the visit must support	Whether the block requires detailed structural evaluation, and on what evidence.
Scope	One block only; all accessible elevations and interiors; roof access if safe; no intrusive work authorized at this visit.
Exclusions	The remaining blocks; below-ground investigation; any opening up.
Equipment	Measuring and marking kit, crack gauge, level and staff, camera with scale card, moisture meter, crack monitors, protective equipment.
Data	Offline forms and location key prepared; one capture-to-backup cycle tested before departure.
Safeguarding	Contact only through authorized staff; no images including children; classroom access outside teaching hours.

G.2 Arrival and identification

On arrival, the team checks in, receives current information, and observes each elevation from a safe distance before entering. Two structurally distinct blocks are found where the record showed one; the second is a later extension sharing a wall. Both are given provisional identifiers; the conflict is logged, and the shared wall is recorded as a shared element mapped to both. The responsible engineer and the authorized site representative are notified the same day. The second block is not assumed to be within the approved scope, and an open scope decision is recorded before any work on that block proceeds.

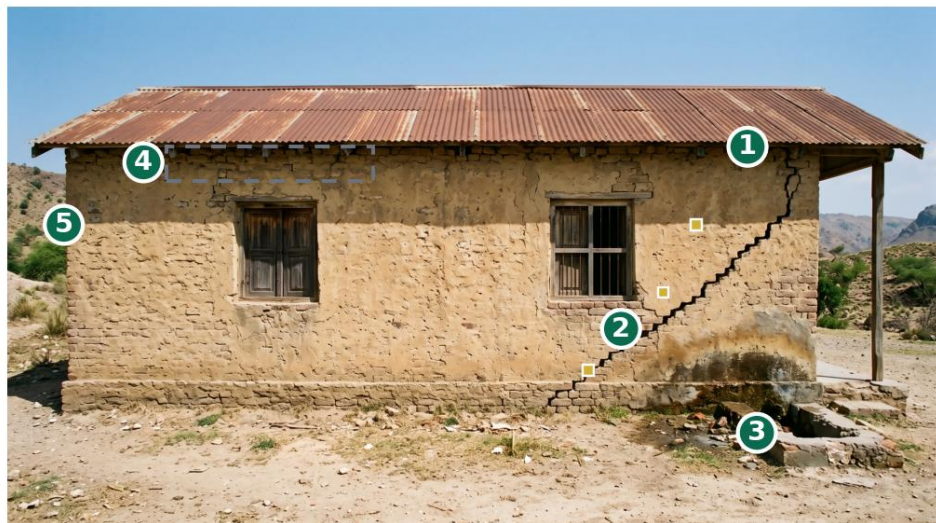
G.3 Walkdown and observation

Table G.2 Observation, with interpretation deferred

Observation	Record made	Interpretation deferred to
Stepped cracking through mortar joints in the rear wall, wider at the eastern end, passing through two window openings.	Measured widths at five points; length; photographs with scale; marked on elevation.	Mechanism table, with settlement and thermal movement both retained.

Observation	Record made	Interpretation deferred to
Doors binding in the two easternmost classrooms.	Location and direction of binding, noted as corroborating evidence.	The same mechanism table.
Damp staining at the base of the rear wall, with a blocked surface drain immediately outside.	Photographs of the drain and the staining; drainage route sketched.	Moisture pathway record; a possible contributor to ground movement.
Roof timbers bearing directly on the wall with no visible tie or strap.	Bearing length measured; photograph of the soffit at an access hatch.	Load-path sketch, with the connection recorded as unverified.
Rear wall out of plumb by a measured amount over the storey height.	Measurement with the instrument and reference stated.	Deformation record, with reference stability noted.

Figure G.1 shows the marked-up elevation record for this visit, with the numbered findings of Table G.2.



REAR (SOUTH) ELEVATION, BLOCK B1

- ① Stepped cracking through mortar joints, wider at the eastern end; width measured at five points.
- ② Crack monitors installed across three cracks; baseline read and photographed.
- ③ Damp staining at the wall base beside a blocked surface drain (reported for maintenance).
- ④ Roof timbers bear directly on the wall; no visible tie or strap: recorded as unverified.
- ⑤ Ceiling void viewed from the access hatch only: coverage limit recorded, not a clear result.

Figure G.1 Worked visit: marked-up elevation record

G.4 Diagnosis and verification

Two mechanisms are retained. Settlement is consistent with the crack pattern widening towards one end, the binding doors and the measured out-of-plumb, and the blocked drain provides a plausible source of ground moisture. Thermal movement is retained because the wall is long, unshaded, and without movement joints. The discriminating evidence is whether the cracks are still moving, and whether movement correlates with rainfall.

Table G.3 Verification actions taken

Action taken at the visit	Purpose
Three crack monitors installed along the same crack, at representative locations; baseline readings taken and photographed.	Establish activity and provide a reference for the next visit.
A level survey along the rear wall recorded against a stable external datum.	Establish the settlement profile rather than a single measurement.
Timber lintel and wall-plate bearing examined at two openings, with bearing length, timber condition and the access limitation recorded.	Establish how the openings and the roof are supported and whether the bearing is sound. Bearing condition corroborates the load path only; establishing capacity requires evaluation against the geometry and material evidence recorded.
Blocked drain and roof discharge reported to the custodian as an immediate maintenance item.	Remove a probable contributing cause without waiting for the evaluation.
Roof-to-wall connection recorded as unverified, with the opening up required identified.	Route the question to the responsible engineer rather than resolving it by assumption.

G.5 Handover

The package transferred comprises the block register with the identifier conflict, the marked elevations and coverage map, the observation, measurement and photograph registers, the mechanism table with both candidates and the discriminating evidence, the monitoring baseline with its reading schedule, and an open register listing the unverified roof connection and the maintenance item reported. The responsible engineer accepts the handover and schedules the follow-up reading before deciding whether detailed evaluation is required.

REQUIREMENT

Note what the visit did not do. It did not declare the block safe or unsafe, did not attribute the cracking to a single cause, and did not recommend a repair. It established the evidence, installed the means to resolve the remaining question, and removed a probable contributing cause.

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