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PRE-PURCHASE INSPECTION – RESIDENTIAL BUILDING REPORT

Complies with Australian Standard AS 4349.1- 2007 Inspection of Buildings Part 1: Pre-Purchase Inspections – Residential buildings – Appendix "C"

Client: Patricia Johnson

Address of Property Inspected: 27 Perkins St
Sandgate 4017

The purpose of the inspection is to identify the major defects and safety hazards associated with the property at the time of the inspection. The inspection and reporting is limited to Appendix C AS4349.1-2007.
The report does not include an estimate of the cost for rectification of the Defects. The overall condition of this building has been compared to similarly constructed & reasonably maintained buildings of approximately the same age.

Inspection Details

Date of the Inspection: 18/04/23

Weather Conditions at the time of Inspection: Dry

Recent Weather Conditions: Dry

Building Furnished: No

CONTACT THE INSPECTOR

Please feel free to contact the inspector, Mark Walker who carried out this inspection on 0413 052 580. Often it is very difficult to fully explain situations, problems, access difficulties, or timber pest activity and/or damage in a manner that is readily understandable by the reader. Should you have any difficulty in understanding anything contained within this report then you should immediately contact the inspector and have the matter explained to you. If you have any questions at all or require any clarification then contact the inspector prior to acting on this report.

Yours Sincerely

.....
Signed for and on behalf of Mark Walker
QBCC Building & Pest Lisc No. 1097513

Description and Identification of the Property Inspected

Style: Highset Home

Construction Type: Chamferboard, Clad

Piers: Concrete

Flooring: Tongue and Groove Hardwood, Tongue and Groove Pine

Roofing: not accessible

Roof covering: Corrugated metal

Other Inspections and Reports Required

It is Strongly Recommended that the following Inspections and Reports be obtained prior to any decision to purchase the Property and/or before settlement. Obtaining these reports will better equip the purchaser to make an informed decision.

Council Plan Inspection
Timber Pest Inspection
Mould Inspection
Electrical Inspection
Drainage Inspection
Hazards Inspection
Plumbing Inspection
Appliances Inspection
Durability of Exposed Surface
Gasfitting Inspection
Asbestos Inspection
Smoke Alarm Compliance Inspection

INSPECTION FINDINGS

The following areas were inspected where present and within the scope of the inspection - *Site, Exterior, Interior, Services, The Roof Interior, The Roof Exterior, The Subfloor, Cracking to Building Members*

THE SITE

Description of the Defects/Safety Hazards, Location and the Inspector's Recommendations

Driveways: No major defects at time of inspection.

Surface Water Drainage: Water entry evident to the subfloor. A drainage upgrade is recommended – refer Drainage Contractor.

Fences: Some wet rot to the left, right and rear fence. This will deteriorate over time with replacement being required at some point.

THE EXTERIOR OF THE BUILDING

Description of the Defects/Safety Hazards, Location and the Inspector's Recommendations

Walls : No major defects at time of inspection.

External Cladding: No major defects at time of inspection.

Doors: A series of minor works required to doors – refer Carpenter/Glazier.

Windows: heavy wet rot to sills to the front and front left – refer carpenter for repairs
Windows are due for servicing – refer Carpenter/Glazier.

Stairs: No major defects at time of inspection.

Balconies: No major defects at time of inspection.

Verandahs: Note (E1) No major defects at time of inspection.

Balustrades: It is strongly recommended that the hand rails at the front and rear stairs be upgraded to meet current standards (safety issue) – refer Carpenter.

External Paintwork: Deterioration to exterior paintwork – refer Painter.

E(1) It is recommended the structural integrity and construction of the verandah be inspected by a Structural Engineer prior to proceeding. It is further recommended that the verandah be inspected at least every 12 months by a Structural Engineer.

THE INTERIOR OF THE BUILDING

If present the following elements were inspected:

The Rooms: Ceilings, Walls, Floors, Windows, Doors and Frames, Insect Screens, Trims and Cupboards/Robes.
Kitchen: Bench Top, Cupboards, Sink, Taps and Tiles.
Bathrooms, Toilets, En-suite and Laundry: Cistern and Pan, Taps, Tiles, Bath, Shower, Vanity, Tubs/Cabinet and Ventilation.

Description of the Defects/Safety Hazards, Location and the Inspector's Recommendations

Entry: No major defects at time of inspection.

Hall: No major defects at time of inspection.

Linen Cupboard: No major defects at time of inspection.

Lounge Room: No major defects at time of inspection.

Dining Room: wet rot to VJ's beneath window – refer carpenter

Kitchen: No major defects at time of inspection.

Laundry: No major defects at time of inspection.

Toilet: No major defects at time of inspection.

Bathroom: Heavy wet rot to vanity
Non professional sealing to shower – Due for renovation

Bedrooms: No major defects at time of inspection.

Floors: Undulations to the floors – refer Note H(3).

H(3). FLOOR UNDULATIONS

Varying degrees of timber floor undulations are often experienced on especially older style homes. With timber stumps, these height variations are usually caused by failure (wet rot or pest damage) below the ground/concrete floor or some subsidence or settlement. Undulating floors supported by concrete stumps are sometimes the result of a lack of re-levelling when the old timber stumps are sporadically replaced. On some occasions (not often) the stumps can subside due to inadequate bearing soils below – especially if the home has a heavy tile roof. Without soil testing there is no accurate way of determining the reasons for the height variations and some floors will continue to move due to these unstable/reactive soils or clays below. If re-levelling of the floor is undertaken, significant repair costs can result if works such as cupboards, showers, tiling or repainting have been undertaken on the undulating floor. Works to other areas such as windows and doors similarly may be needed as floor height variations are transferred throughout the structure above. A degree of floor undulation is to be expected on most older stumped homes.

SERVICES

Electrical Installation: Safety Device Evident.
All electrical wiring, meter-box and appliances need to be checked by a qualified electrician. The checking of any electrical item is outside the scope of this report. It's recommended that a licensed electrician be consulted for further advice.

Plumbing: All plumbing needs to be inspected and reported on by a plumber. It's recommended that a licensed plumber be consulted for further advice.

Hot Water Service: All hot water services need to be inspected and reported on by a plumber and/or electrician. It's recommended that a licensed plumber and/or electrician be consulted for further advice.

Gas: All gas services need to be inspected and reported on by a gas plumber. It's recommended that a licensed gas plumber be consulted for further advice.

Phone: All phones, phone lines and outlets need to be inspected and reported on by a telecommunications technician. It's recommended that a telecommunications technician be consulted for further advice.

Smoke Detectors: Evident.
Australian Standard AS 3786-2014 - Advises that Smoke detectors are required for all buildings where people sleep. It is recommended that an electrician be consulted to give advice on those installed or install these detectors.

THE ROOF EXTERIOR

Description of the Defects/Safety Hazards and the Inspector's Recommendations

Roof Covering: *As we could not access the roof due to height restrictions we recommend a roof and gutter inspection by a Roofing Contractor.*
Some sagging to roof sheeting at the front (visible from the ground) – Refer builder

Gutters/Downpipes: *As we could not access the roof due to height restrictions we recommend a roof and gutter inspection by a Roofing Contractor.*

Valleys: *As we could not access the roof due to height restrictions we recommend a roof and gutter inspection by a Roofing Contractor.*

Eaves: *As we could not access the roof due to height restrictions we recommend a roof and gutter inspection by a Roofing Contractor.*
wet rot to soffit trims to rear – refer roofing contractor

Fascias and Barges: *As we could not access the roof due to height restrictions we recommend a roof and gutter inspection by a Roofing Contractor.*

THE SUB FLOOR

Description of the Defects/Safety Hazard, Location and the Inspector's Recommendations

Floor Framing Timbers: Old wet rot to bearer junction and joins

Underside of the Flooring System: Moderate borer damage to the pine floorboards – refer Carpenter for repair/replacement as required.
Pest damage to bearers and joists to the left side and flooring and isolated areas – refer to pest controller
Moderate wet rot under bathroom- refer carpenter for repair

Piers/Posts/Supports: Some cracking to 5 piers. This is a common finding that as water penetrates the piers, it rusts the steel reinforcing causing the stumps to "blow" out. Repairs should be undertaken to extend the life of the stumps, however replacement will be required at some point.
Heavy cracking to 2 piers – refer Restumping Contractor for replacement.

Termite Shielding: Antcapping is inadequate/breached - refer Pest Controller for advice.

Battens & Batten Frames: Pest damage and we trot evident – refer Carpenter for repair/replacement.

Sub-floor ventilation: Ventilation is important in minimising infestations by timber pests and helps prevent damp problems. The Inspector considers that the ventilation in this property is: Adequate

IMPORTANT: All Recommendations made in the above Inspection Findings or elsewhere in this Report should be carried out/or considered in your decision process, prior to purchase or settlement.

Conclusion and Summary

The purpose of the inspection is to identify the major defects and safety hazards associated with the property at the time of the inspection. The inspection and reporting is limited to a visual assessment of the Building Members in accord with Appendix C AS4349.1-2007.

The overall condition of this building has been compared to similar constructed buildings of approximately the same age where those buildings have had a maintenance program implemented to ensure that the building members are still fit for purpose.

The incidence of Major Defects in this Residential Building as compared with similar Buildings is considered: Typical

The incidence of Minor Defects in this Residential Building as compared with similar Buildings is considered: Typical

The overall condition of this Residential Dwelling in the context of its age, type and general expectations of similar properties is: Average (mostly)

Please Note: This is a general appraisal only and cannot be relied on its own – read the report in its entirety.

This Summary is supplied to allow a quick and superficial overview of the inspection results. This Summary is NOT the Report and cannot be relied upon on its own. This Summary must be read in conjunction with the full report and not in isolation from the report. If there should happen to be any discrepancy between anything in the Report and anything in this Summary, the information in the Report shall override that in this Summary.

Definitions

High: The frequency and/or magnitude of defects are beyond the inspector's expectations when compared to similar buildings of approximately the same age that have been reasonably well maintained.
Typical: The frequency and/or magnitude of defects are consistent with the inspector's expectations when compared to similar buildings of approximately the same age which have been reasonably well maintained.
Low: The frequency and/or magnitude of defects are lower than the inspector's expectations when compared to similar buildings of approximately the same age that have been reasonably well maintained.
Above Average: The overall condition is above that consistent with dwellings of approximately the same age and construction. Most items and areas are well maintained and show a reasonable standard of workmanship when compared with buildings of similar age and construction.
Average: The overall condition is consistent with dwellings of approximately the same age and construction. There will be areas or items requiring some repair or maintenance.
Below Average: The Building and its parts show some significant defects and/or very poor non- tradesman like workmanship and/or long term neglect and/or defects requiring major repairs or reconstruction of major building elements.
Major Defect: Is a Defect requiring building works to avoid unsafe conditions, loss of function or further worsening of the defective item.
Minor Defect: Any defect other than what is described as a major defect.










LG



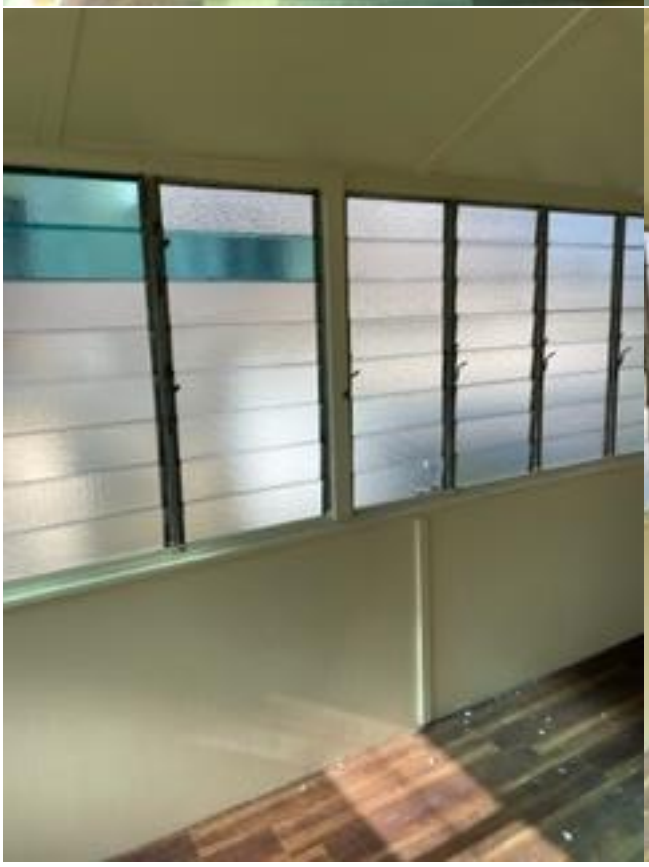














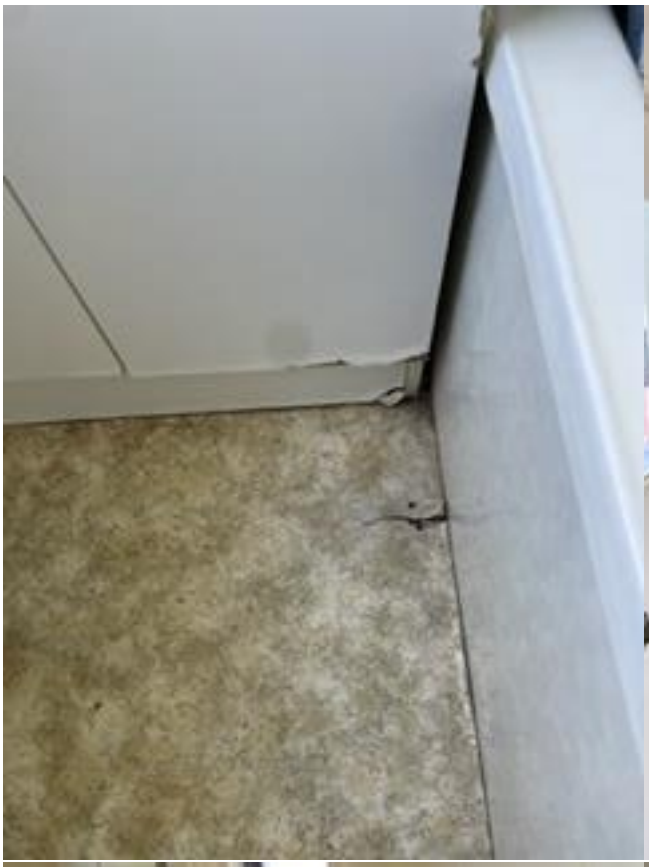











READILY ACCESSIBLE AREAS INSPECTED

☒ The Home Interior ❑ The Roof Exterior ☒ The Grounds including Fences

☒ The Home Exterior ☒ Any Accessible Roof Space ❑ Outbuildings

☒ Any Sub Floor Space

AREAS NOT INSPECTED

The inspection did not include the following areas which were not readily accessible or inaccessible or obstructed at the time of inspection.

BUILDING INTERIOR

In inspecting the building interior there was no inspection of areas more than 3.6 m above floor levels.

Was the inspection of a strata or company title property (e.g. a home unit or townhouse) or other Class 2 building or equivalent? …☒ No ❑ Yes

NOTE. If the inspection was limited to assessing the interior of a particular unit or lot, the Client may have additional liability for defects or faults in the common property. This additional liability can only be addressed through the undertaking of a Special-Purpose Inspection Report which is adequately specified.

Were there any obstructions which may conceal possible defects? …❑ No ☒ Yes

Ground Floor (including timber joinery)
☒ Floor Coverings
☒ No access to wall framing due to internal wall linings.

NOTE. The consultant did not move or remove any ceilings, wall coverings, floor coverings (including carpeting and wooden floorboards), furnishings, equipment, appliances, pictures or other household goods. In an occupied property, furnishings or household items may be concealing defects which may only be revealed when the items are moved or removed.

Were there any areas/rooms/units which did not permit entry? …☒ No ❑ Yes

BUILDING EXTERIOR, ROOF EXTERIOR AND SITE

In inspecting the building exterior, roof exterior and site there was no inspection of areas more than 3.6m above ground or floor levels.

Were there any areas which did not permit entry? …❑ No ☒ Yes

☒ Physical roof access not possible due to height of roof (not accessible from a 3.6m ladder – as per Australian Standard). The Consultant is not permitted to a height where a fall of 2.0 metres or more is possible as per Workplace Health and Safety Restrictions.
☒ No access to the right side external wall due to zero lot line

Were there any obstructions which may conceal possible defects? …❑ No ☒ Yes

☒ Vegetation - Fences
☒ The obstructions should be removed, if possible, and reinspection undertaken or a pest and wet rot treatment undertaken as there could be current concealed termite activity and/or damage.

NOTE. The consultant did not move or remove any obstructions including wall cladding, awnings, trellis, earth, plants, bushes, foliage, stored materials, debris, rubbish, etc. Such items may be concealing defects which may only be revealed when the items are moved or removed.

Were there any areas/rooms/units which did not permit entry? …☒ No ❑ Yes

ROOF SPACE

In inspecting the roof space of any pitched roof there was no inspection of areas where accessibility was less than 600 mm high by 600 mm wide (but includes areas at the eaves of accessible roof spaces, that are within the consultant's unobstructed line of sight and within arm's length from a point with conforming clearance, i.e. 600 mm high by 600 mm wide).

Were there any areas which did not permit entry? …❑ No ☒ Yes

☒ No access was possible to inspect the following roof frames, as these were skillion roofs (sealed on the rake) or shallow roof cavities where provision of a manhole would not have given reasonable access: **Enclosed verandahs, kitchen dining**
☒ These areas of the roof cavity were inaccessible due to lack of a manhole in this area (a manhole should be cut and reinspection should be undertaken): **All of roof.**

Where access is denied to roof members, alternate more invasive means of inspection should be undertaken.

NOTE. Bodily access should be provided to the interior of all accessible roof spaces. In accordance with Australian Standard AS 4349 the minimum requirement is a 450mm by 400 mm access manhole.

UNDERFLOOR SPACE

Note: In inspecting the subfloor space of suspended floors there was no inspection of areas where accessibility was less than 400 mm high by 600 mm wide (but includes areas that are within the consultant's unobstructed line of sight and within arm's length from a point with conforming clearance, i.e. 400 mm high by 600 mm wide).

Were there any areas which did not permit entry? …❑ No ☒ Yes

☒ The method of construction does not allow access (infill slab) – all of floor.

NOTES:
1. *Bodily access should be provided to all accessible subfloor areas. In accordance with Australian Standard AS 4349 the minimum requirement is a 500 mm x 400 mm access manhole.*
2. *In the case of suspended floors, if the clearance between the ground and structural components is less than 400 mm, Australian Standard AS 3660 recommends that the soil be removed to provide the required clearance, subject to maintaining adequate drainage and support to footings.*

Were there any obstructions which may conceal possible defects? …☒ No ❑ Yes

Important Advice

***Note*:** In the case of strata and company title properties, the inspection is limited to the interior and immediate exterior of the particular unit being inspected. The exterior above ground floor level is not inspected. The complete inspection of other common property areas would be the subject of a Special-Purpose Inspection Report which is adequately specified.

Trees: Where trees are too close to the house this could affect the performance of the footing as the moisture levels change in the ground. A Geotechnical Inspection can determine the foundation material and provide advice on the best course of action with regards to the trees.

The septic tanks: Should be inspected by a licensed plumber.

Swimming Pools: Swimming Pools/Spas are not part of the Standard Building Report under AS4349.1-2007 and are not covered by this Report. We strongly recommend a pool expert should be consulted to examine the pool and the pool equipment and plumbing as well as the requirements to meet the standard for pool fencing. Failure to conduct this inspection and put into place the necessary recommendations could result in finds for non compliance under the legislation.

Surface Water Drainage: The retention of water from surface run off could have an effect on the foundation material which in turn could affect the footings to the house. Best practice is to monitor the flow of surface water and stormwater run off and have the water directed away from the house or to storm water pipes by a licensed plumber/drainer.

Important Information Regarding the Scope and Limitations of the Inspection and this Report

Important Information **Any person who relies upon the contents of this report does so acknowledging that the following clauses, which define the Scope and Limitations of the inspection, form an integral part of the report.**

1) This report is NOT an all encompassing report dealing with the building from every aspect. It is a reasonable attempt to identify any obvious or significant defects apparent at the time of the inspection. Whether or not, a defect is considered significant or not depends too a large extent, upon the age and type of the building inspected. This report is not a Certificate of Compliance with the requirements of any Act, Regulation, Ordinance or By-law. It is not a structural report. Should you require any advice of a structural nature you should contact a structural engineer.

2) **THIS IS A VISUAL INSPECTION ONLY** limited to those areas and sections of the property fully accessible and visible to the Inspector on the date of Inspection. The inspection DID NOT include breaking apart, dismantling, removing or moving objects including, but not limited to, foliage, mouldings, roof insulation/ sisalation, floor or wall coverings, sidings, ceilings, floors, furnishings, appliances or personal possessions. The inspector CANNOT see inside walls, between floors, inside skillion roofing, behind stored goods in cupboards and other areas that are concealed or obstructed. The inspector DID NOT dig, gouge, force or perform any other invasive procedures. Visible timbers CANNOT be destructively probed or hit without the written permission of the property owner.

3) This Report does not and cannot make comment upon: defects that may have been concealed; the assessment or detection of defects (including rising damp and leaks) which may be subject to the prevailing weather conditions; whether or not services have been used for some time prior to the inspection and whether this will affect the detection of leaks or other defects (*eg. In the case of shower enclosures the absence of any dampness at the time of the inspection does not necessarily mean that the enclosure will not leak*); the presence or absence of timber pests; gas-fittings; common property areas; environmental concerns; the proximity of the property to flight paths, railways, or busy traffic; noise levels; health and safety issues; heritage concerns; security concerns; fire protection; site drainage (apart from surface water drainage); swimming pools and spas (non-structural); detection and identification of illegal building work; detection and identification of illegal plumbing work; durability of exposed finishes; neighbourhood problems; document analysis; electrical installation; any matters that are solely regulated by statute; any area(s) or item(s) that could not be inspected by the consultant.
Accordingly this Report is not a guarantee that defects and/or damage does not exist in any inaccessible or partly inaccessible areas or sections of the property. (**NB: Such matters may upon request be covered under the terms of a Special-purpose Property Report**.)

4) **CONSUMER COMPLAINTS PROCEDURE:** In the event of any dispute or claim arising out of, or relating to the Inspection or the Report, or any alleged negligent act or omission on Our part or on the part of the individual conducting the Inspection, either party may give written Notice of the dispute or claim to the other party. If the dispute is not resolved within twenty one (21) days from the service of the written Notice then either party may refer the dispute or claim to a mediator nominated by Us. The cost shall be met equally by both parties or as agreed as part of the mediated settlement. Should the dispute or claim not be resolved by mediation, one or other of the parties may refer the dispute or claim to the Institute of Arbitrators and Mediators of Australia who will appoint an Arbitrator who will resolve the dispute by Arbitration. The Arbitrator will also determine what costs each of the parties are to pay.

5) In the event any litigation is bought as a result of the inspection and/or report, you indemnify us against any legal fees and expenses incurred where you have not first allowed Us the opportunity to visit the property to investigate the complaint and provide you with a written response within 28 days.

6) **ASBESTOS DISCLAIMER: "No inspection for asbestos was carried out at the property and no report on the presence or absence of asbestos is provided.** If during the course of the Inspection asbestos or materials containing asbestos happened to be noticed then this may be noted in the **Additional Comments** section of the report. Buildings built prior to 1982 may have wall and/or ceiling sheeting and other products including roof sheeting that contains Asbestos. Even buildings built after this date up until the early 90s may contain some Asbestos. Sheeting should be fully sealed. If concerned or if the building was built prior to 1990 or if asbestos is noted as present within the property then you should seek advice from a qualified asbestos removal expert as to the amount and importance of the asbestos present and the cost of sealing or removal. Drilling, cutting or removing sheeting or products containing Asbestos is a high risk to peoples' health. You should seek advice from a qualified asbestos removal expert."

7) **MOULD (MILDEW AND NON-WOOD DECAY FUNGI) DISCLAIMER*:*** Mildew and non wood decay fungi is commonly known as Mould. However, Mould and their spores may cause health problems or allergic reactions such as asthma and dermatitis in some people. **No inspection for Mould was carried out at the property and no report on the presence or absence of Mould is provided.** If in the course of the Inspection, Mould happened to be noticed it may be noted in the **Additional Comments** section of the report. If Mould is noted as present within the property or if you notice Mould and you are concerned as to the possible health risk resulting from its presence then you should seek advice from your local Council, State or Commonwealth Government Health Department or a qualified expert such as an Industry Hygienist.
8) **MAGNESITE FLOORING DISCLAIMER*:*** No inspection for Magnesite Flooring was carried out at the property and no report on the presence or absence of Magnesite Flooring is provided. You should ask the owner whether Magnesite Flooring is present and/or seek advice from a Structural Engineer.
9) **ESTIMATING DISCLAIMER*:*** Any estimates provided in this report are merely opinions of possible costs that could be encountered, based on the knowledge and experience of the inspector, and are not estimates in the sense of being a calculation of the likely costs to be incurred. The estimates are NOT a guarantee or quotation for work to be carried out. The actual cost is ultimately dependent upon the materials used, standard of work carried out, and what a contractor is prepared to do the work for. It is recommended in ALL instances that multiple independent quotes are sourced prior to any work being carried out. The inspector accepts no liability for any estimates provided throughout this report.

IMPORTANT DISCLAIMER

DISCLAIMER OF LIABILITY: -No Liability shall be accepted on an account of failure of the Report to notify any problems in the area(s) or section(s) of the subject property physically inaccessible for inspection, or to which access for Inspection is denied by or to the Inspector (including but not limited to or any area(s) or section(s) so specified by the Report).

DISCLAIMER OF LIABILITY TO THIRD PARTIES: - We will not be liable for any loss, damage, cost or expense, whatsoever, suffered or incurred by any Person other than You in connection with the use of the Inspection Report provided pursuant to this agreement by that Person for any purpose or in any way, including the use of this report for any purpose connected with the sale, purchase, or use of the Property or the giving of security over the Property, to the extent permissible by law. The only Person to whom We may be liable and to whom losses arising in contract or tort sustained may be payable by Us is the Client named on the face page of this Agreement.

NOTE W

CSIRO GUIDE
GUIDE TO HOME OWNERS ON FOUNDATION MAINTENANCE AND FOOTING PERFORMANCE (updated for AS 2870-1988)

This guide is designed to assist home owners with:

1. **interpretation of significant cracking/movement in dwellings; and**
2. **maintenance of homes with clay foundations.**

If further advice is required after reading this guide we recommend engaging a professional engineer from your local Yellow Pages Directory.

1. INTRODUCTION

This guide was prepared by Dr P F Walsh of CSIRO, with advice from the Standards Australia Committee on Residential Slabs and Footings, to provide guidance to home owners on their responsibilities for the care of a clay foundation, and to discuss the performance that can be expected from a footing system. (The ground that supports a house is called a foundation, and the concrete structure that transfers the load to this foundation is the footing system).

The best information about the design and construction of footing systems is contained in the Australian Standard 'AS 2870 - Residential Slabs and Footings'. That Standard gives a system of site classification, prescribed footing and slab designs and construction methods that provides an excellent footing system for Australian houses. However, a warning is given that the chance of a footing failure is higher if extreme site conditions, such as the following, are permitted to occur.

(a) planting of trees too close to a footing;
(b) excessive watering of gardens adjacent to the house
(c) lack of maintenance of site drainage; and
(d) failure to repair plumbing leaks.

The Standard further states that compliance with this guide is a way to avoid extreme site conditions.

Clay foundations are the cause of major problems for houses. Clays are very fine-grained soils that are plastic and sticky when wet, and hard and strong when dry. All clays swell or shrink to some degree as they become wet or dry out. 'Reactive' clays swell or shrink to such an extent that foundation movements can damage houses.

All house sites are classified. Reactive-clay sites are classified as M, H or E, in order of increasing reactivity. Proper maintenance of such clay sites requires that the moisture content of the clay should be kept reasonably constant.

Some minor cracking of masonry walls is almost inevitable despite proper design, construction and maintenance. Very slight cracks up to 1mm wide could be expected in most houses. Larger cracks, up to 5mm, may occur in some houses with properly designed and constructed footings, if reactive clay sites have been subject to large changes of moisture. Cracks larger than 5mm are regarded as significant damage.

Further information on these topics is given in the following sections. The guide has been updated to be consistent with the revised edition of AS 2870 which was published in 1989.

2. SITE CLASSIFICATION

AS 2870 requires all sites to be classified by an engineer or the builder. The emphasis has been placed on reactive clays that swell and shrink with changes of moisture content because these are the most common cause of problems. The classification system is fairly complicated but, as a general guide, the following may be helpful in understanding the system for clay sites.

S Clays that have not given trouble in the past

M Moderately reactive clays that may cause minor damage to brick houses on old-style light strip footings. Moderately reactive clays are common and occur, for example, in Eastern Melbourne and Western Sydney.

H Highly reactive clays that frequently damage houses even with strong footings. No examples occur in major cities except Adelaide. Other occurrences include outback NSW, Darling Downs and Horsham.

Since the precautions necessary depend on the reactivity of the site, the owner should check the classification that is shown on the house plans.

The maintenance of the building and the site is the responsibility of the owner, and so the owner should be familiar with the requirements of this guide.

3. CARE OF CLAY FOUNDATIONS

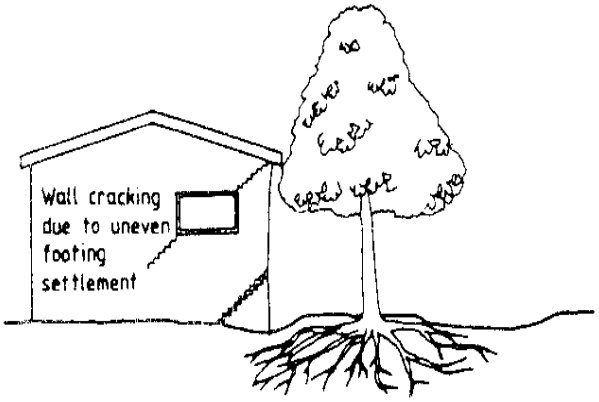
All clays move with changes of moisture content, so the aim is to minimise such changes in the clay by:

- draining the site;
- keeping gardens and trees away from the house
- adequate but moderate garden watering; and
- repairing plumbing leaks

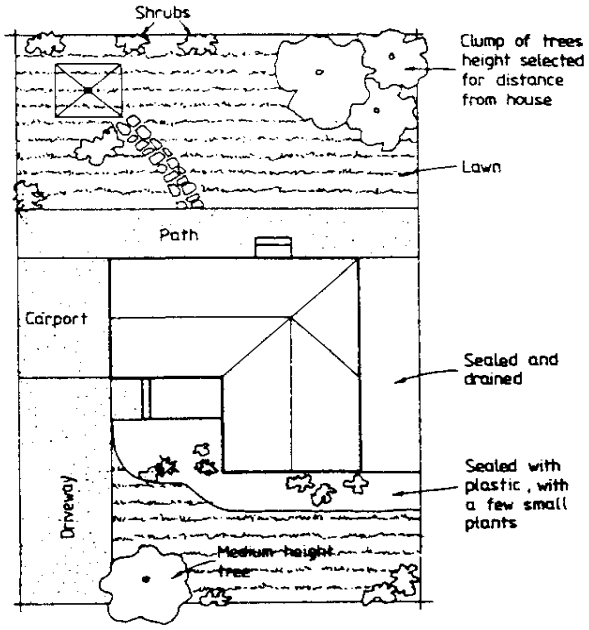
On a reactive-clay site there are some restrictions on the way the owner can develop the garden around the house. These restrictions apply mainly to brick houses. In most cases, only minimal precautions are justified for framed houses clad with timber or sheeting.

The site must be well drained. Under no circumstances should water be allowed to lie against the house or even near the house. The ground immediately next to the house should be graded away with a slope of about 50mm over the first metre. Suitable surface drains

should be provided to take the surface water away from the house. Where topsoil is brought in, it should not interfere with the site drainage, nor should it raise the ground level enough to block the weepholes in the brick walls or any subfloor vents.
Large garden beds are best not located near the house. This will avoid the possibility of introducing too much moisture to the foundation clay by over watering. The zone near the house should be planned for paths or covered with gravel and plastic sheeting. Small shrubs may be planted at reasonable spacings.
Gardens and lawns should be watered adequately but not excessively. Uniform, consistent watering can be important to prevent damage to the foundation during dry spells such as droughts or dry summers.
Trees and large shrubs require substantial amounts of water, and if the soil near the tree dries out, the roots will extend in search of soil moisture. Tree watering is important in late summer and in drought. The use of slow drip watering systems may be appropriate. It has also been found useful to drill holes near trees and fill them with gravel to allow water better access to the tree roots. Otherwise, clays will shrink as they dry. and a house may settle as shown below.
Removal of large trees creates the opposite problem. As soil moisture is gradually restored, clays swell and may lift shallow footings.
Many factors determine the extent of clay drying by trees, and the more important include the soil type, the size and number of trees, and their species. Trees obtain moisture from roots that spread sideways and the drying zone is influenced by the extent of these roots. For single trees, the drying zone is usually one-half to twice the tree height, but the zone may be larger for groups or rows of trees. Although it is known that the species can influence the extent and severity of the drying zone, little definite information is available. Some Australian trees are particularly efficient in extracting water from very dry soils and can be more dangerous than non-Australian species that use large amounts of water in normal conditions. The effect of tree drying on the amount of movement is also related to the reactivity of the clay. To minimise the risk of damage, trees (especially groups of trees) should not be planted near the house on a reactive clay site, and the following limits are recommended.



TREES CAUSE SHRINKAGE AND DAMAGE



GARDENS FOR REACTIVE SITES

d = 1 1/2 h for Class E sites
d = 1 h for Class H sites
d = 3/4 h for Class M sites

where d is the distance of the tree from the house, and h is the eventual mature height of the tree. These values should be increased by 50% if the trees are in a dense group. These rules mean that on the average suburban block, trees that grow higher than 8 to 9 m are often impractical unless the owner accepts the risk of some damage to the house. If large trees are desired, it may be practical to adopt a specially designed footing system, e.g., a piled footing system.
A leak in the plumbing can cause the footings of a house on a reactive clay to move. The water seeps into the clay causing it to swell and push the footing system upwards. Any obvious leaks in stormwater, drainage, or sewerage pipes should be investigated. Leaking water pipes can be detected by turning off all the taps and checking if the water meter records any flow.
The above restrictions may seem onerous for new home owners, but lack of site maintenance on a reactive clay can cause damage to the house. Still, the whole issue should be kept in some perspective. The damage to houses caused by reactive clays is mostly unsightly cracks in the brickwork. In the typical Australian brick veneer house, the brickwork does not support the structure. It is the timber frame that carries the walls and roof loads, so brick cracks do not affect the structural safety of the house.
If owners choose to disregard some of the above restrictions and, say plant large trees all around the house, they should not blame the builder, the engineer or the Council if the house suffers some cracking.

4. PERFORMANCE OF FOOTING SYSTEMS

All building materials move. Concrete and timber shrink, bricks grow, and so on. Many building practices have been evolved to reduce the damage that such movements cause, and the minor difficulties that arise are usually repaired without significant problems.

The footing of a house is more likely to move on reactive clays. Some house walls may be more sensitive than usual, and may crack even though the footing system has performed its design task. Such cracking must be expected occasionally and this is expressed in the performance requirements of AS 2870 (See Appendix A).

The performance requirement of AS 2870 suggests that Category 0 to 1 damage may be expected for houses on a reactive-clay site, but that the damage is of little consequence. Category 2 is clearly not satisfactory (isolated cracks up to 5mm wide), but it still does not constitute significant failure and could be expected to occur under adverse conditions for the occasional house.

For these categories of damage, it is the intention of AS 2870 that consequent repairs are part of the normal house maintenance and are therefore the responsibility of the owner.

Nonetheless, to ensure that the damage does not proceed to a more serious state, the owner should take some action.

(a) Check that the recommendations on site treatment, drainage, garden arrangement, trees etc., have been observed.

(b) Keep a record of the crack width against the time of the year. If the damage is as high as Category 2 and seems to be increasing, the owner should consult the builder who may be able to offer more specific advice. If this does not prove satisfactory, the owner should engage a consulting engineer who specialises in house footings.

(c) Engage a plumber to check for leaks if this is suspected to be the cause.

(d) Replace soil moisture in dry spells by watering. Such watering can be more effective if holes or trenches are dug into the clay. The holes or trenches should be filled with compacted crushed rock or gravel and moderately watered. Some trees may need to be removed or kept pruned.

Complete stability is difficult to achieve, so repairs to damaged walls should include methods that will disguise further movements. Extra joints should be included in external masonry walls and further cracking in internal walls can be concealed by flexible paints, wall paper, or panelling. Repairing of cracks with brittle fillers should be avoided unless the cracks have stabilised.

For the more serious categories of damage, the steps to be taken are similar, except that there should be little delay in seeking advice. Remedial action for significant failure may still only include attention to stabilising moisture conditions as described above, but could also involve constructing a concrete wall in the ground to stop drying of the foundation clay. Underpinning is usually not satisfactory in reactive clays.

Experience indicates that lack of maintenance is responsible for many failures. Even with proper design and site maintenance the occasional failure may still occur because footing behaviour is so complex.

5. SHRINKAGE OF CONCRETE FLOORS

Concrete needs water. Firstly to allow the fresh concrete to flow and, secondly, to develop strength during its first few weeks. As a slab starts to dry, it shrinks and tries to contract. Some of this movement is restrained or resisted by friction on the bottom of the slab and by the beams in the ground. This restraint causes tension or stretching forces in the slab and these forces are often large enough to crack the slab.

Shrinkage cracking is almost inevitable and does not represent failure. Most owners never notice the cracks because they often do not occur until after the carpets are laid. Cracks under brittle or sensitive floor coverings are of concern but the risk of damage can be reduced by using flexible mortars and glues for fixing slate and tiles etc. Also it helps to delay installing the floor covering until after the shrinkage has occurred. The length of delay should be at least three months after the slab has started to dry. (i.e. from the time the slab is last wet from rain or during construction).

6 ADHESIVE-FIXED FLOOR COVERINGS

A concrete slab takes a long time to dry. For example, under temperate conditions a slab will take about three months to dry. Moisture in the concrete can interfere with the bond or break down the adhesive used to attach floor coverings. However, a range of adhesives is available for various floor coverings and these should perform quite well on slabs that have been allowed to dry sufficiently.

7. CONCLUSION

This guide has been prepared to advise owners on how to care for the foundation of their houses and what to expect from a well-designed footing system. The main concern with foundation maintenance is to prevent the foundation soil becoming too wet or too dry, and a variety of recommendations are given to achieve this.

Additional information may be found in the following reports which are available from their publishers. CSIRO (1985). 'House Cracking in Drought Periods', CSIRO Australia Information Sheet No, 10-88. Division of Building Research. Cameron, D.A. and Earl, I. (1982). Trees and Houses: A Question of Function. Cement and Concrete Association, Melbourne. Martin, K.G., Lewis, R.K., Palmer, R.E. and Walsh, P.F., (1983). Floor Coverings on Concrete Slab-on-ground. CSIRO Australia Division on Building Research Report. Cameron, D.A. and Walsh, P.F. (1984). Damage to Buildings on Clay Soils. National Trust Technical Bulletin 5.1.