BUILDING PERFORMANCE

Guidance

Granny Flats Foundations Guidance

August 2026

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

New Zealand Government
Te Kāwanatanga o Aotearoa

Ministry of Business, Innovation and Employment (MBIE)
Hīkina Whakatutuki – Lifting to make successful

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This document is issued as guidance under section 175 of the Building Act 2004.

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Document status

This resource is version 1 of MBIE's Granny Flats Foundations Guidance Document and takes effect from August 2026.

Document history		
Status	**Commencement date**	**Alterations**
Version 1	–	–

Contents

1. Purpose

The purpose of this guidance is to assist homeowners, designers and builders to specify safe, Building Code compliant foundations for granny flats built under the non-consented small standalone alone dwelling building consent exemption. This guidance applies to granny flats, which are low-complexity, low-risk, single-storey dwellings constructed using lightweight materials.

For the purposes of this guidance, we refer to non-consented small standalone dwellings as granny flats or the granny flats exemption pathway.

This guidance aims to:

- help homeowners, designers and builders to design and build safe and durable foundations for granny flats
- support consistent interpretation and application of foundation requirements for granny flats under the building consent exemption pathway
- explain how ground conditions influence foundation design and the foundation solutions that may be used in accordance with this guidance
- clarify roles, responsibilities and documentation requirements to ensure compliance with the Building Act 2004 and the New Zealand Building Code
- make it easier for users to follow the correct process, choose suitable foundation systems and ensure that their work meets both legal requirements and performance standards.

1.1 What is in this document

The guidance provides clear, practical information about:

- the types of foundation solutions suitable for granny flats
- where these solutions are suitable
- key considerations for selecting the right foundation type
- how these choices comply with the New Zealand Building Code.

The guidance provides a simple pathway for specifying foundations for granny flats on a range of ground conditions (with limitations).

It provides solutions and an engineering basis for the design of foundations for granny flats that:

- are standalone new builds
- have a net floor area that is equal to or less than 70 square metres
- are constructed in accordance with the conditions of the granny flats building consent exemption.

MBIE has published guidance to support understanding of the building consent exemption for granny flats.

Granny flats exemption guidance

This guidance brings together relevant information from current legislation, regulations, standards and other guidance to support better decision-making and promote consistency across the building sector.

This document is structured in five sections:

Section 1: Purpose of the granny flats foundations guidance	Explains the purpose of this guidance, who it is for and how it applies to foundations for granny flats built under the consent exemption pathway.
Section 2: Background to the foundations guidance for granny flats	Outlines the legislative and policy context for granny flats and explains why foundation-specific guidance has been developed.
Section 3: Site conditions and foundations for granny flats	Provides guidance on assessing and understanding the site and choosing appropriate foundations for granny flats.
Section 4: Foundation types for granny flats	Introduces the main types of foundations suitable for granny flats and explains how different ground conditions influence design choices. Helps users match foundation systems to ground conditions and understand when engineering input is required. Provides design details for a Modified Enhanced Waffle Slab that a designer can use where the site conditions fall within the limits defined for this solution.
Section 5: Appendices	Provides for: • a glossary of terms for this guidance document • test methods • example test scenario • example shallow ground investigation report.

1.2 Limitations of this guidance

This document provides general guidance and is not a substitute for site-specific advice when that is required. It is not intended for use on sites that:

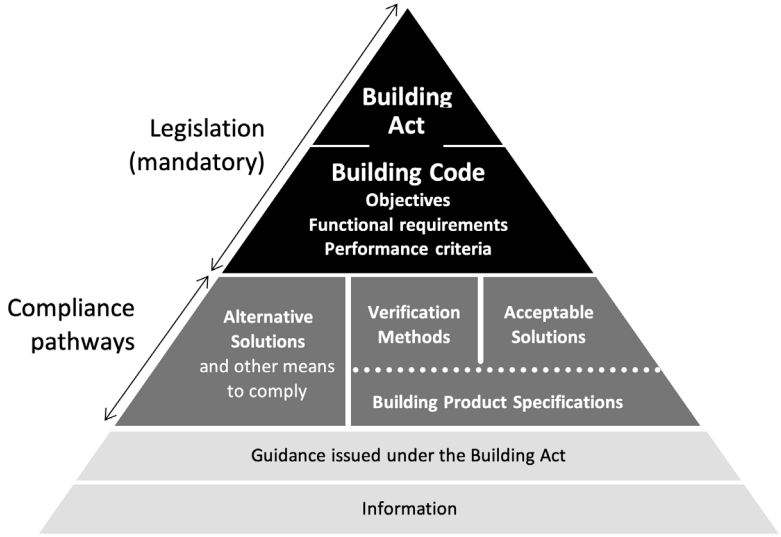
- are subject to one or more natural hazards as defined in section 71(3) of the Building Act 2004, such as erosion, falling debris, subsidence, inundation and slippage
- have contaminated ground that may create a risk to building elements or occupants
- have ground conditions with liquefaction vulnerability greater than Technical Category 2 (TC2) equivalent
- have ground conditions with a soil expansivity classification greater than class "M"
- have zoning restrictions (council district plan) that prevent the building of granny flats
- are located on, above or below a steep gradient (approximately greater than 18 degrees or 1V:3H, vertical to horizontal).

The information provided should be seen as a starting point for granny flats using the foundation solutions that are outlined within this guidance document. It does not override legal requirements under the Building Act 2004 or the Building Code.

While MBIE has taken great care in preparing this guidance, it is not definitive. Importantly, it should not be read as replacing the relevant legislation. Readers must refer to the Building Act 2004, Building Code and the regulations as their primary source documents and be aware that for specific situations or problems, it may be necessary to seek independent legal advice.

Figure 1 below illustrates where this guidance document sits with the building regulatory system.

Figure 1.1 The building regulatory system



1.2.1 Regulatory context

This guidance supports the application of the Building Act 2004, including Schedule 1A provisions that enable certain granny flats (small standalone dwellings) to be constructed without a building consent where specific conditions are met. It is intended to be read in conjunction with the 'granny flats' exemption guidance available on Building Performance (building.govt.nz), which sets out the legislative scope, eligibility conditions and responsibilities.

1.2.2 Acknowledgements

This guidance has been prepared by the Building System Performance team at MBIE, with specialist support from Fraser Thomas Ltd. We would also like to acknowledge and thank those who have contributed to the development of this guidance.

1.2.3 Features of this document

This guidance has been designed for ease of use, with clear structure, plain language and visual cues to help you find the information you need.

- The document is structured into sections that align with the granny flats foundation decision-making process, beginning with investigating and understanding site conditions, through to selecting an appropriate foundation solution. Each section builds upon the preceding content, though users may reference specific sections as needed.
- Use the table of contents at the beginning of the guide to find specific sections.
- Headings and subheadings are used consistently to help you scan and locate relevant information.
- Key concepts, terms and examples are clearly highlighted throughout.
- Where this guidance refers to New Zealand Standards, it applies only to the version current at the time of publication.

In this document, **all references to NZS 3604 refer specifically to NZS 3604:2011 – Timber-framed buildings**.

1.3 Who this guidance is for

This guidance has been developed for a range of people involved in planning, designing and constructing foundations for a granny flat. While each group plays a different role, the shared aim is to support the design and construction of safe, code-compliant and fit-for-purpose foundations for granny flats.

1.3.1 Homeowners

If you're building a foundation for a granny flat, this may be your first time navigating the building process.

This guidance aims to help homeowners understand their responsibilities, explore foundation options for different ground conditions, recognise risks of poor design and know when to seek specialist advice. It also encourages working with Licensed Building Practitioners (LBPs) and engaging confidently with professionals throughout the process.

1.3.2 Designers

This guidance is for designers, including LBPs, structural, geotechnical engineers and architects, who are designing foundation solutions for granny flats.

Designers play a critical role in designing solutions to meet site-specific conditions and comply with the Building Code. Their decisions have a direct impact on the long-term safety and performance of the building.

1.3.3 Builders

This guidance is for builders who have the relevant LBP licence class (foundation or carpentry) and other qualified tradespeople who are responsible for building foundations for granny flats. This guidance helps builders understand their role when working within the consent exempt granny flats pathway.

It provides practical advice on why foundation designs can vary for different ground conditions and what to do if the ground conditions on a site mean that changes to the design are needed to ensure that foundations comply with the Building Code.

1.3.4 Councils

Councils are a key source of information for homeowners and designers planning to build a granny flat foundation. Councils may provide information during the initial research about site conditions and local planning rules and will provide further details through the Project Information Memorandum (PIM) process.

This guidance can also be used by Building Consent Authorities (BCAs) assessing building consent applications for foundation designs for building work outside of the scope of the consent exempt granny flats pathway, or where the homeowner chooses or is required to apply for a building consent.

2. Background

Granny flats are an increasingly important part of Aotearoa New Zealand's housing landscape. These small, standalone, single-storey dwellings provide flexible living options for whānau, support intergenerational housing and contribute to improving housing supply and affordability.

The granny flats building consent exemption (referred to in legislation as non-consented small standalone dwellings) allows dwellings of up to 70 square metres to be built without a building consent, when specific design and construction conditions are met and all work is carried out or supervised by licensed professionals. This guidance supports the design and construction of **safe, durable and Building Code-compliant foundations** for granny flats.

It is intended to be read alongside:

- the Building Act 2004
- the New Zealand Building Code
- the 'granny flats' building consent exemption guidance.

This guidance supports consistent interpretation and application of foundation requirements for granny flats. It explains how site conditions, design choices and professional responsibilities interact to achieve compliant foundation outcomes that protect the safety, stability and durability of granny flats across Aotearoa New Zealand.

2.1 Characteristics of a granny flat

This guidance applies to granny flats which are dwellings that are up to 70m^2, use lightweight construction materials and are within the scope of Schedule 1A of the Building Act 2004. They may use standardised foundation solutions such as those specified in NZS 3604 when built on *'good ground'* or may require different foundation solutions when ground conditions described within this guidance document are present.

A granny flat must be:

- new, standalone and self-contained
- single storey and cannot include a mezzanine floor.

The building is classified as: Housing – detached dwelling (defined by Clause A1 of the Building Code). This means it must:

- comply with all the requirements of the Building Code that apply to this classified use
- be intended for a single household or family.

The net floor area must be 70 square metres or less. Floor area means the overall internal dimensions measured between the finished internal faces of the external walls.

The building must:

- have a maximum floor level of one metre above the supporting ground (measured from the lowest point of elevation)
- have a maximum height of four metres above the floor level
- be designed and built using lightweight building products for the roof cladding with a maximum weight of 20 kilograms per square metre
- be built using light steel or light timber framing for the wall and roof framing
- have wall cladding with a weight not exceeding 220 kilograms per square metre. Refer to section 4.2.1.2 Modified Enhanced Waffle Slab (MEWS)' for wall cladding requirements when choosing to build in accordance with the Modified Enhanced Waffle Slab.

The term, 'granny flat' refers to a non-consented small standalone dwelling that is built under the granny flats building consent exemption pathway.

2.2 Foundation types and ground conditions

This guidance focusses on foundation solutions for granny flats built under the granny flats building consent exemption pathway.

This guidance applies to foundation design for granny flats constructed on:

- **'good ground'**, as defined in NZS 3604, and
- **'suitable ground'**, as defined in this guidance.

It confirms:

- when **NZS 3604 solutions** may be used, and
- when alternative foundation solutions such as **Modified Enhanced Waffle Slab** (a grid of ribs formed by polystyrene pods, creating a lightweight but stiff concrete slab that spreads the building's load evenly) are required.

Foundation selection shall be based on **confirmed ground conditions** determined through investigation (refer to Section 3).

For the purposes of this guidance, *'suitable ground'* refers to sites that meet the applicability criteria set out below:

Expansive soils:

- Limited to sites classified as **Class S (slightly reactive)** or **Class M (moderately reactive)** in accordance with *AS 2870: Residential slabs and footings.*

Liquefaction-prone soils:

- Limited to sites with liquefaction vulnerability **no greater than Technical Category 2 (TC2) equivalent,** as defined in *Repairing and Rebuilding Houses Affected by the Canterbury Earthquakes guidance*.

For the purposes of this guidance, TC2 equivalent refers to sites where:

- liquefaction-induced settlement and deformation are within the performance ranges defined for TC2 sites in MBIE guidance, and
- ground deformation can be accommodated by enhanced shallow foundation systems

Bearing capacity:

- Soils with a minimum **ULS bearing capacity 200 kPa**
- Bearing capacity shall be demonstrated:
  - to a depth sufficient to govern foundation performance, and
  - considering any underlying weaker layers that may influence settlement behaviour.

Ground reliability:

Excludes soils that are **susceptible to degradation or instability,** including but not limited to:

- peat,
- uncontrolled or undocumented fill, and
- organic soils.

Section 3 'Site Conditions' of this guidance document has more detailed information about ground conditions.

2.3 Out of scope

Sites that do not satisfy the relevant criteria for the ground conditions present are **outside the scope of this guidance** and shall require:

- site-specific geotechnical investigation, and
- specific engineering design (SED).

Section 4 'Foundation types for granny flats' of this guidance document has more detailed information about ground conditions.

3. Site conditions

When designing and building foundations one of the most important steps is understanding the ground conditions beneath the site.

Ground conditions shall be assessed to confirm that they are capable of safely supporting the building under all relevant loads, including vertical and horizontal actions.

Site conditions shall be established using:

- preliminary site research, and
- a shallow ground investigation.

The outcome of this assessment shall determine:

- whether NZS 3604 foundation solutions may be used, or
- whether an alternative foundation solution (such as the Modified Enhanced Waffle Slab) is required.

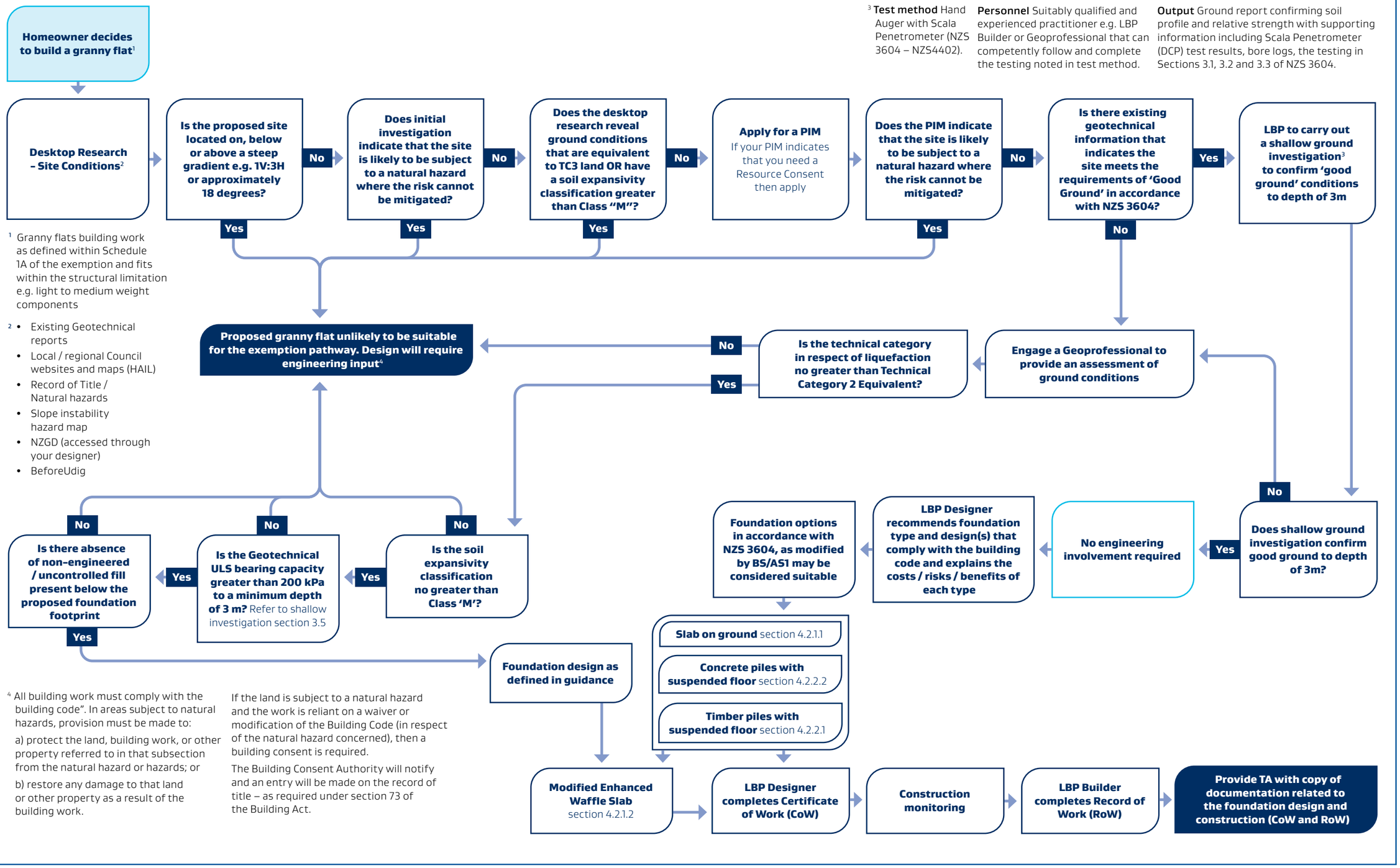
Homeowners must engage suitably qualified and experienced professionals to assist with understanding and determining the ground conditions. The homeowner and their professionals must gather information from a range of sources to help understand what ground conditions are present on site and design appropriate foundations.

This guidance provides a pathway to support homeowners and designers building a granny flat to:

- undertake the appropriate type of soil investigation for a granny flat
- select a foundation type that is suitable for the ground conditions
- use the engineering basis and foundation details provided in this guidance to design granny flats foundations.

Figure 3.1 sets out the pathway homeowners and designers should follow, from initial site research through to selecting an appropriate foundation type. Each step is described in the remainder of this section, with foundation options covered in Section 4.

Figure 3.1 Granny flats foundation selection pathway



[1] Granny flats building work as defined within Schedule 1A of the exemption and fits within the structural limitation e.g. light to medium weight components

[2]
- Existing Geotechnical reports
- Local / regional Council websites and maps (HAIL)
- Record of Title / Natural hazards
- Slope instability hazard map
- NZGD (accessed through your designer)
- BeforeUdig

[3] **Test method** Hand Auger with Scala Penetrometer (NZS 3604 – NZS4402).

Personnel Suitably qualified and experienced practitioner e.g. LBP Builder or Geoprofessional that can competently follow and complete the testing noted in test method.

Output Ground report confirming soil profile and relative strength with supporting information including Scala Penetrometer (DCP) test results, bore logs, the testing in Sections 3.1, 3.2 and 3.3 of NZS 3604.

[4] All building work must comply with the building code". In areas subject to natural hazards, provision must be made to:

a) protect the land, building work, or other property referred to in that subsection from the natural hazard or hazards; or

b) restore any damage to that land or other property as a result of the building work.

If the land is subject to a natural hazard and the work is reliant on a waiver or modification of the Building Code (in respect of the natural hazard concerned), then a building consent is required.

The Building Consent Authority will notify and an entry will be made on the record of title – as required under section 73 of the Building Act.

3.1 Preliminary site research

Before carrying out any on-site investigation or testing, it's important to gather background information about the site. This desktop research helps identify potential risks early, such as natural hazards, planning restrictions or underground services that may affect the foundation design.

Key information can be found in the council's district plan, hazard maps and a Project Information Memorandum (PIM), which is required when building under the granny flats pathway.

Table 3.1: Information to collect during preliminary site research

Information to collect	Why it's important
Location of underground services	Avoids risk of damaging services or restricting future access.
Natural Hazards (BA s71-74; erosion, falling debris, subsidence, inundation, slippage)	Affects foundation suitability and may require a resource and building consent.
Planning restrictions	Understanding planning restrictions about where, how and what can be built on the site ensures the building work is legal.
Geotechnical data	Existing geological and geotechnical information for the site or nearby sites providing useful background information about potential ground conditions.
Presence of uncontrolled fill, peat or organic soil	Identification of potentially unsuitable ground to support granny flats that may need further investigation (may also be found during site investigation).

3.1.1 Information sources for preliminary research

There are key sources of information that can help homeowners and designers better understand the site before building work starts. These include the following:

3.1.1.1 Local council and regional council websites

Local and regional council websites are a valuable source of information when planning a foundation for a granny flat and should be initial source of information.

Some councils offer interactive maps or property search tools that allow users to explore important site-specific details such as flood zones, ground contour, instability susceptibility information, liquefaction vulnerability, erosion-prone areas, planning zones and rules, infrastructure services like stormwater and wastewater networks.

These tools often include aerial imagery, contour data and planning overlays, helping to identify constraints that could affect the foundation design.

Some councils also provide downloadable reports or guidance documents to help interpret the information and understand local requirements.

3.1.1.2 Project Information Memorandum (PIM)

A PIM provides important information from the council about the land that could affect the design or build of a granny flat. This includes details such as natural hazards, geotechnical ground conditions and the location of underground services.

It can also confirm whether the site is subject to any planning rules or restrictions that might affect where or how the building is constructed.

Obtaining a PIM is an important first step and is a requirement of the granny flats building consent exemption pathway.

3.1.1.3 Council property file

A council property file is a useful source of existing information. It contains official records about the property, which can help homeowners make informed decisions early in the process.

By reviewing the file, homeowners may find details on existing buildings, including their location, size and consented plans. It may also show what type of foundation was used, whether any soil or geotechnical reports exist and if there have been any past issues with the land or building work. This can help assess whether the site might need engineering input.

Property files also contain information about drainage, water supply and other services which are important for avoiding issues during construction. Planning constraints like height limits, setbacks, or easements may also be included, as well as any natural hazards like flooding or land instability.

These details are critical for confirming whether a granny flat meets the exemption criteria and can be safely and legally built on the site.

To access a property file, contact the local council – most councils offer an online request form.

3.1.1.4 Record of Title (RoT)

A RoT is a legal document issued by Land Information New Zealand that shows the ownership, boundaries and legal interest for a piece of land. In the context of a granny flat, the homeowner can check for any conditions or encumbrances that are registered to the title, ensure the proposed foundation work fits within the section and complies with setbacks to boundaries and other buildings.

If there are any easements (i.e. for shared driveways, drainage or power lines) that may restrict where buildings can be located, these are indicated to ensure homeowners don’t build over areas they do not have the full rights to use.

3.1.1.5 New Zealand Geotechnical Database (NZGD)

The New Zealand Geotechnical Database (NZGD) provides two different sources of information that can support early site assessments.

The first is a publicly accessible map, which shows the location of geotechnical testing carried out across Aotearoa New Zealand. This map gives homeowners and designers a useful overview of whether testing has been done near the site, but it does not provide the detailed reports behind those tests.

The second is the NZGD database itself, which contains factual geotechnical investigation records – this database is not publicly accessible and can only be accessed by registered user often practicing as a designer or a geotechnical professional. The database includes valuable information such as:

- previous ground reports submitted by geotechnical professionals, which may contain records of bearing strength, groundwater levels that support forming informed decision as to whether *'good ground'* was identified (including to what depth)
- soil and ground conditions, including general classifications of soils in the area and any layering at different depths
- indications of any historical fill, peat, or organic soils.

This information can be useful during feasibility and design scoping stages. However, it should be treated as background context only.

Unless a test has been performed on the exact site to verify, the data can only be considered as indicative as soils can vary significantly over short distances. The information should therefore be used to help guide decisions and complement, not replace, a shallow ground investigation carried out on the property.

NZGD Location Map of Testing
NZGD Database

3.1.1.6 Natural Hazards portal

The Natural Hazards Portal is a useful source of information that brings together council data on risks such as flooding, liquefaction, landslides and coastal hazards, helping homeowners to understand if a site may be affected by these issues before they plan or build a granny flat.

By checking the portal early, informed design decisions can be made, avoiding unexpected challenges whilst ensuring the foundation solution is appropriate for the site conditions.

Natural Hazards Portal: Natural hazards in your area

3.2 Natural hazards and their impact on foundations

If preliminary research or a PIM indicates that the site is likely to be subject to a natural hazard, additional investigation and specialist input will be required before deciding on a foundation solution and it is likely that a building consent will be required.

These hazards can influence what type of foundation is appropriate, whether a specific engineering design (SED) is needed and if the project meets the conditions of the granny flats building consent exemption pathway.

The Building Act 2004 defines a natural hazard as land subjected to:

- erosion (including coastal erosion, bank erosion and sheet erosion)
- falling debris (including soil, rock, snow and ice)
- subsidence
- inundation (including flooding, overland flow, storm surge, tidal effects and ponding)
- slippage.

Where a site is noted in a PIM as 'likely' to be subject to one or more natural hazards, the granny flats building consent exemption pathway is not suitable and a building consent will be required.

The exception to this is where the council confirms in the PIM that it is satisfied that adequate provision has been made to:

- protect the land, building work, or other property from the natural hazard or hazards, or
- restore any damage to the land or other property that occurs as a result of the building work.

Natural hazards include:

Table 3.2: Natural hazards and their impact

Natural hazard	What it means	Why it matters
Flooding	Water may pool or flow across the site during heavy rain.	May require higher floor levels or changes to site drainage.
Erosion	Land may be gradually worn away by water, wind or waves.	Can weaken the stability of the ground supporting the foundation and may need structural advice.
Landslides / Slips / Falling Debris	Steep or unstable slopes may shift or collapse and may be affected by rockfall.	Increases risk to the building and often needs geotechnical advice to mitigate the risk.
Subsidence	Ground may sink or settle vertically due to soil compression, loss of support, or collapse of underlying materials.	Can lead to uneven settlement, cracking and structural damage to foundations if not properly accounted for.

Find information about the natural hazards provisions of the Building Act 2004.

3.3 Geotechnical hazards

Geotechnical hazards are related to the physical properties and behaviour of the soil or ground on the site. These may not be obvious without a shallow ground investigation but can significantly affect whether the standard foundation solutions defined under NZS 3604 will be suitable.

This guidance provides a structured approach for assessing ground conditions and selecting compliant foundation solutions for granny flats, on sites where the following geotechnical hazards are present. Table 3.3 outlines some of these hazards and if the site has one or more of these geotechnical hazards, the foundation design will need to ensure it addresses site-specific risks.

Understanding these conditions helps ensure a foundation is designed in a way that makes it durable and stable while remaining compliant with the Building Code.

Table 3.3: Geotechnical hazards and their impact

Geotechnical hazard	What it means	Why it matters
Liquefaction-prone soil	Ground that is typically loose, water-saturated sands or silts and it can lose strength in an earthquake and behave like a liquid temporarily.	May cause the house to tilt or sink.
Expansive soils	Clay soil that swells when wet and shrinks when dry over time.	Can crack or shift foundations over time.
Low bearing capacity soils	Ground does not meet the good ground criteria and foundations may require specific engineering design to support the expected loads of the building.	Ground cannot safely carry the weight of the building.

3.4 Visual assessment of ground stability

As well as gathering background information, a visual check of the site for signs of movement or instability by way of a walkover is recommended, especially for sloping sites. Warning signs may include cracks in soil or lawns, stepped or diagonal ground cracking, sudden changes in ground level or collapsed and uneven pavements.

A key decision for someone wanting to build a granny flat is that it cannot be located on a steep gradient or be above or below one. A steep gradient is defined as approximately greater than 18 degrees or is 1V:3H (vertical vs horizontal).

A site walkover assessment should also look for leaning trees, power poles, or retaining walls, loose soil or debris.

This will help to identify:

- any visible signs of cracking
- evidence of movement
- any known issues of historic ground cracking.

In sloping areas, pay particular attention to signs of slumping, such as head scarps forming at the top of a slope or bulging ground at the base. If any of these warning signs are present, they may indicate that the vicinity may be susceptible to land instability. In this case a more detailed geotechnical investigation may be required before selecting on a foundation type.

MBIE: slope stability quick guide has more information on the risks of building on sloping land.

3.5 Undertaking a soil investigation

Before deciding on a foundation solution, it's essential to confirm the ground conditions on site. The type of investigation required depends on what the preliminary research or Project Information Memorandum (PIM) reveals about hazards that affect the site.

3.5.1 If hazards or complex ground conditions are present

If the preliminary investigation or PIM identifies natural hazards or geotechnical hazards outside the scope of this guidance, then the consent exempt granny flats pathway is unlikely to be suitable. In these situations, a detailed geotechnical assessment is required before any foundation design decisions are made.

This may involve detailed geotechnical investigations and collaboration between geotechnical and structural specialists working with the designer to identify and mitigate risks. This helps ensure the foundation design complies with the Building Code and addresses site-specific hazards.

Shallow soil investigations for granny flat foundations

When preliminary research and the PIM confirm there are no natural hazards and the geotechnical conditions are within the scope of this guidance a shallow soil investigation is the next step.

This is undertaken by a suitably qualified professional (typically an LBP Builder or a Geotechnician) and will often be sufficient to determine a suitable foundation solution.

This investigation typically involves a hand auger test combined with a Scala Penetrometer (in accordance with NZS 3604) to determine the soil types and layers that exist along with their strength. The results are documented in a ground investigation report which will identify suitable foundation solutions for the granny flat.

Table 3.4: Information to collect during a shallow ground investigation

Information to collect	Why it's important
Soil type and composition	Helps identify if the ground is suitable with adequate bearing capacity for foundation solutions in NZS 3604.
Bearing capacity	Shows if the soil can support the weight of the building.
Depth to undisturbed natural ground	Important if surface layers have insufficient bearing capacity (<200 kPa).
Signs of expansive soil	Swelling and shrinking soil may damage foundations.
Liquefaction	Affects ground stability during earthquakes and impacts foundation solutions.
Groundwater level	Groundwater can affect soil stability on the site and may impact the foundation design.
Drainage characteristics	Poor drainage can affect how surface water behaves which can lead to foundation damage and/or soil erosion.

3.5.2 Soil type and composition

There are a large range of different soil types and compositions, that have different characteristics.

Knowing the soil type and composition on the site i.e. whether the ground is made up of clay, sand, silt or fill, will help determine what kind of foundation will be suitable.

For example, expansive soils such as clay can shrink or swell depending on moisture levels, which may cause movement and cracking in foundations. Likewise, the presence of organic soils or uncontrolled fill could indicate unstable or soft ground.

This guidance provides foundation solutions for granny flats for use on sites with:

- *'Good ground':* as defined in NZS 3604 is any soil or rock capable of permanently withstanding a ULS bearing capacity of 300 kPa (i.e. an allowable bearing pressure of 100 kPa using a factor of safety of 3.0). It excludes potentially compressible ground, expansive soils and any ground which could foreseeably experience movement of 25 mm or greater for any reason. In simpler terms, *'good ground'* is firm natural soil or rock that is strong, stable and not likely to shrink or swell over time and can permanently support a ULS bearing capacity of at least 300 kPa which means it can safely hold the weight of a granny flat.
- **Expansive soils:** soils that have a liquid limit of more than 50% when tested in accordance with [1]NZS 4402 Test 2.2 and a linear shrinkage of more than 15% when tested from the liquid limit in accordance with NZS4402 Test 2.6.
- **Liquefaction-prone soils:** soils that can temporarily lose strength when earthquake shaking increases water pressure in the ground. For liquefaction to occur, three key conditions must be present:
  - loose, granular (typically sands and silts, sometimes gravels)
  - saturated soil (below the groundwater table)
  - sufficient ground shaking (intensity and duration).
- **Low bearing capacity soils:** soils with a ULS bearing capacity of between 200kPa and 300kPa.

The soil type and composition on the site shall be confirmed by a hand auger test as part of the shallow ground investigation.

3.5.3 Ground bearing capacity

In conjunction with soil type, the bearing capacity of the ground will need to be identified to confirm that the ground is strong enough to support the weight of the granny flat.

A shallow ground investigation using a Scala Penetrometer (as outlined in NZS 4402 and referenced in NZS 3604) will be required regardless of whether previous site information exists.

Scala penetrometer testing (supported by hand auger) shall be used to demonstrate that adequate soil strength is present to a minimum depth of 3 m (below existing ground level). This does not require excavation to that depth.

The depth of the shallow geotechnical investigations should typically:

- extend a minimum of 1.0 m into natural ground
- extend a minimum of 1.0 m below the zone of influence of the proposed foundation system and at least twice the footing width
- enable visual assessment and confirmation of the soil type and strength/density.

1 NZS 4402:1986 Methods of testing soils for civil engineering purposes

Find guidance on depths for a shallow ground investigation in section 2.4.4.1 of MBIE's Geotechnical investigations for earthquake engineering – Earthquake geotechnical engineering practice.

Investigation for granny flats should typically be undertaken using a combination of hand auger and Scala Penetrometer testing. Where ground conditions are complex or results are inconclusive, additional or alternative investigation methods may be required.

3.5.4 Groundwater level and site drainage

Collecting information about the groundwater level and drainage characteristics of a site is important as a high water table can affect soil stability. Surface water issues caused by poor drainage characteristics can lead to water pooling around or under the foundation, which can:

- weaken the supporting soil
- cause erosion
- compromise the stability and durability of the foundation design.

Site drainage shall be considered as part of the early design to accommodate the adverse effect this may bring so that it does not materially alter the boundary conditions set out as per this guidance.

3.5.4.1 Storm water and wastewater

Poorly designed stormwater or wastewater discharge may adversely affect ground conditions both on-site and off-site, including reducing ground strength or causing instability. Designers must ensure discharge does not compromise foundation performance.

3.5.5 Locating underground services

The location of underground services such as water, wastewater, stormwater, power, internet, gas and other utility pipes or cables buried beneath the ground must be identified and considered when planning a foundation solution.

Building over or too close to underground services can cause serious issues. It may damage infrastructure, prevent future maintenance access, or even breach council rules where building over services is prohibited.

Identifying service locations early helps avoid costly redesigns, delays and the need to relocate services or obtain additional approvals.

Services may be indicated on council records provided with the PIM, indicated on title plans with easements or may need to be located on site.

Failure to plan around services can lead to legal complications, increased costs and in some cases significant rework.

BeforeUdig is a free national service in Aotearoa New Zealand that helps identify underground utilities such as power, gas, water and telecommunications before any digging or excavation work begins. By lodging a request online, utility companies provide maps or safety information showing where their assets are located, helping the designer plan safely.

To find out more, go to BeforeUdig

A Ground Penetrating Radar (GPR) can be used to accurately locate underground services that may not be recorded such as historic private services or undocumented ones from those collected by BeforeUdig. This is especially useful on older sites or subdivisions where service plans are incomplete, inconsistent or missing.

3.6 Undertaking a shallow ground investigation

Before choosing a foundation solution, a shallow ground investigation shall be undertaken by a suitably qualified and experienced professional (typically an LBP Builder or a Geotechnician).

The purpose of the investigation is to determine the soil type and ground conditions and confirm which foundation solutions are suitable for the site.

The investigation should be informed by available site information, such as desktop research and details in the Project Information Memorandum (PIM), to identify appropriate testing locations.

The investigation should assess soil type and ground conditions across the site. Methods and requirements for ground investigation, including soil strength testing, are set out in Section 3.5.3.

3.7 Test locations

When testing the site, plan the test locations to give the best coverage of the proposed foundation area. At least two soil tests should be completed at opposite corners of the foundation footprint. For greater confidence, a third test in the centre is recommended.

If the site is on a slope or the ground looks variable, it's best to test at every corner of the foundation area to get a reliable picture of the soil conditions.

Once the technician has completed the above tests, they will be able to provide a report that informs results in terms of soil types, its strength and suitable foundation solutions.

3.8 Limitations

Shallow ground investigations provide an indicative assessment of ground conditions and are generally sufficient where ground conditions are uniform and consistent.

Where variability exists or deeper weak layers are suspected, additional investigation may be required to confirm ground conditions.

4. Foundation types for granny flats

Foundations transfer the weight of the building and other lateral loads to the ground, keep it stable and protect it from the external environment and ground movement.

The type of foundation used will depend on the outcomes of a shallow ground investigation that confirms the type of ground the building is located upon, as well as the design of the building.

This guidance provides foundation types for buildings that meet the characteristics of a granny flat see Section 2, Characteristics of a granny flat.

Granny flats foundations generally fall into two main types:

- slab foundations built directly on to the ground
- pile foundations which will raise the granny flat off the ground.

Within these types there are both standard options (designed in accordance with NZS 3604) and the Modified Enhanced Waffle Slab using the engineering basis and details provided within this guidance.

4.1 Foundation suitability by ground condition

4.1.1 Foundations on 'good ground'

If the site is confirmed as *'good ground'* defined as per the NZS 3604 standard, then NZS 3604 provides a set of standard foundation designs that can be built.

These designs are proven, cost-effective and have been successfully deployed in homes across Aotearoa New Zealand and include:

- **concrete slab on ground** – provides a solid, low-maintenance floor for generally flat sections
- **timber piles with suspended floor** – suited to flat and gently sloping sites including where underfloor access for services is desired
- **concrete piles with suspended floor** – a more durable option in areas where timber may be less reliable.

Alternatively, the Modified Enhanced Waffle Slab identified within this guidance can also be used on sites where *'good ground'* is confirmed, provided compliance with NZS 3604 and the Building Code is achieved.

4.1.2 Foundations on ‘suitable ground’ (expansive, liquefaction-prone and low bearing soils)

Sites with applicable *soil expansivity (Class "S" and Class "M"), liquefaction prone (TC2 equivalent)* and/or *low bearing soils* typically require stronger, specifically designed foundations to manage ground movement and maintain stability. This includes expansive clays (common in parts of Auckland and Northland) and liquefiable soils (often found in coastal, riverplain or reclaimed areas) that can cause buildings to sink or tilt in a drought, or earthquake.

In these conditions, the Modified Enhanced Waffle Slab specified in this guidance may be used to provide additional support and reduce the risk of foundation movement.

The foundation types described in this section of the guidance represent the most common and reliable solutions for a granny flat. The appropriate system for the building should always be confirmed by a Licensed Building Practitioner (LBP) or engineer, based on shallow ground investigation results.

Additional foundation solutions suitable for TC2 equivalent liquefiable sites and/or soils with expansivity up to class “M” may be incorporated in future revisions of this guidance, subject to further development, assessment and validation.

4.2 Technical details for granny flat foundations

When using any of the foundation options described in this guidance, the following considerations must be applied.

- The details provided in this section are based on a representative floor plan for granny flats and should only be applied to simple house plan such as a square or rectangle.
- Site preparation must include the removal of all grass and topsoil before placing foundations. A well-graded sandy gravel aggregate that can be adequately compacted with a plate compactor (e.g. crushed AP40 or AP65 for better interlocking properties) should be used as subgrade fill beneath any new concrete slabs. The aggregate should be placed in maximum 150 mm layers compacted with (as a minimum) a plate compactor. The top 75 mm of fill should be AP40 to ensure a finer grading in contact with the damp proof membrane.
- Foundations must not sit in areas affected by waterlogging and groundwater. Drainage measures such as subsoil drains may be needed to maintain a stable base.
- The NZS 3604 ground clearances adjacent to the granny flat must be complied with.
- External service lines will need to be beyond the area of soil supporting the foundation (as detailed in G13/AS2, clause 5.6.1, figure 8).
- A damp proof membrane should be included in the design.

4.2.1 Slab foundations

A slab foundation is frequently used when designing for residential buildings due to their availability and versatility across a range of ground conditions. They involve constructing a reinforced concrete foundation directly onto the ground (either engineered or natural) which supports the weight of the dwelling and a slab that forms the floor. While they may look similar from the surface, there are different slab systems designed to suit different ground conditions.

On strong, stable soils (*'good ground'),* a standard concrete slab on ground is usually enough, but on soils that are at risk of movement or vary in strength, the Modified Enhanced Waffle Slab will be required to provide extra stability and resilience.

Foundation types suitable for a granny flat foundation include:

4.2.1.1 Concrete slab on ground (NZS 3604)

This is the one of the more common and cost-effective types of foundation systems for a granny flat.

It consists of a slab poured directly onto compacted ground. Steel mesh within the slab adds strength and minimises cracking.

The system comprises both the floor slab and the foundation, with thickened edge and internal beams designed to carry the structural loads of the building above.

This system is low maintenance and durable, performing best on stable, well drained and level sites where *'good ground'* is present.

Technical details and specifications are outlined within section 7 of [2]NZS 3604:2011 as amended by B1/AS1.

2 NZS 3604:2011 Timber Framed Buildings

4.2.1.2 Modified Enhanced Waffle Slab

This section contains information for granny flats foundations located on sites where:

- "good ground" is not achieved; and
- proposed wall cladding with a weight not exceeding 80 kilograms per square metre; and
- a Modified Enhanced Waffle Slab is considered appropriate.

There are several ground characteristics as outlined in Figure 3.1 (Granny flat foundation flowchart) which must be met for a Modified Enhanced Waffle Slab as defined in this section to be suitable. This includes:

- Moderately liquefiable ground as defined in accordance with the "Repairing and rebuilding houses affected by the Canterbury earthquakes guidance" and as below:
  - Liquefiable ground that exhibit the following conditions:

    Serviceability Limit State:
    - total vertical settlements no more than 50 mm; and
    - differential settlements no more than 25 mm over 6 m; and
    - nominal lateral stretch no more than 50 mm.

    Ultimate Limit State:
    - vertical settlements no more than 100 mm; and
    - nominal lateral stretch no more than 100 mm; or
    - L0 to L2 (Moderate) as defined in Table 5.1 of Module 3 of MBIE's Geotechnical Earthquake Engineering Guidance.
- Class "S" or Class "M" with respect to soil expansivity in accordance with Australian Standards (AS 2870 with soil parameters as defined in BRANZ Research Report SR120A – Soil Expansivity in the Auckland region).
- A minimum geotechnical ultimate limit state (ULS) bearing capacity of 200 kPa or greater within the upper 3 m of the soil profile.
- Absence of non-engineered/uncontrolled fill present below the proposed foundation footprint.

If any of the above ground characteristics are not met, then the Modified Enhanced Waffle Slab is not suitable for the granny flat foundation and specific design will be necessary.

The Modified Enhanced Waffle Slab is a concrete slab-on-grade foundation system with the following features:

- simple square or rectangular plan shapes only (i.e. not T, L or U shaped)
- 385mm deep by 100mm wide ribs at 1200mm centres in each direction
- 385mm deep by 300mm wide beam around the perimeter
- 85 mm thick slab.

Refer to Figure 4.1 for a typical Granny flat Modified Enhanced Waffle Slab foundation plan.

Figure 4.2 and Figure 4.3 Modified Enhanced Waffle Slab foundation edge details provide structural details of the Modified Enhanced Waffle Slab foundation including reinforcing requirements.

Figure 4.1 Typical plan of a Modified Enhanced Waffle Slab foundation

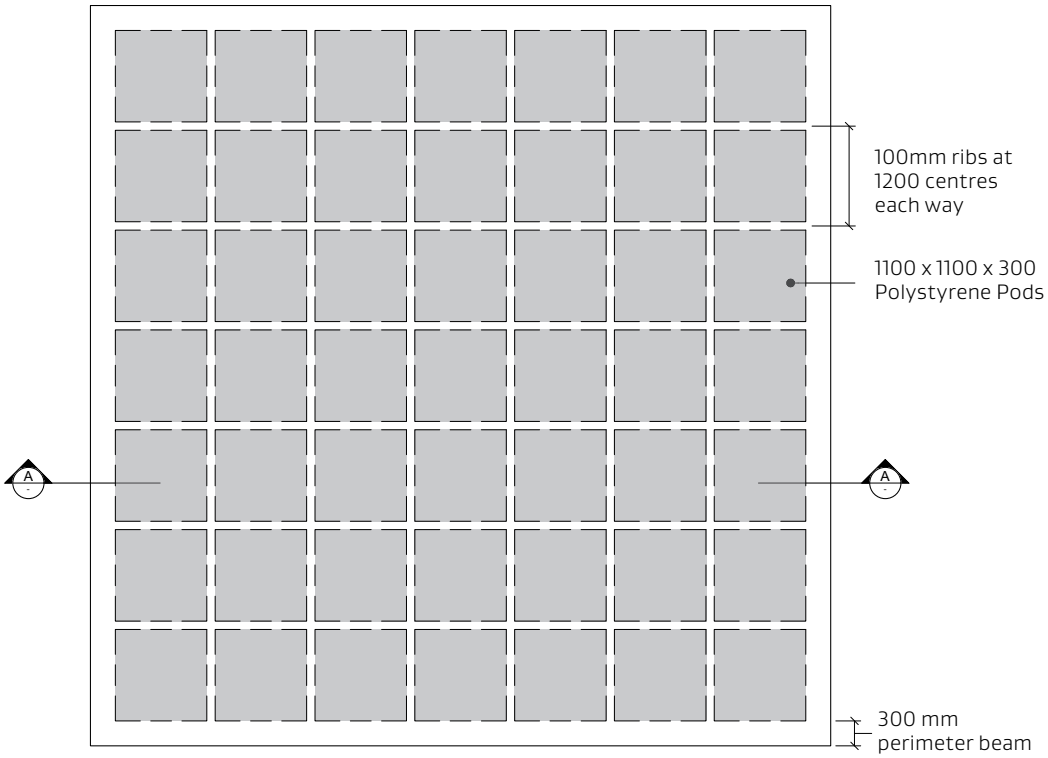


Figure 4.2 Modified Enhanced Waffle Slab foundation details

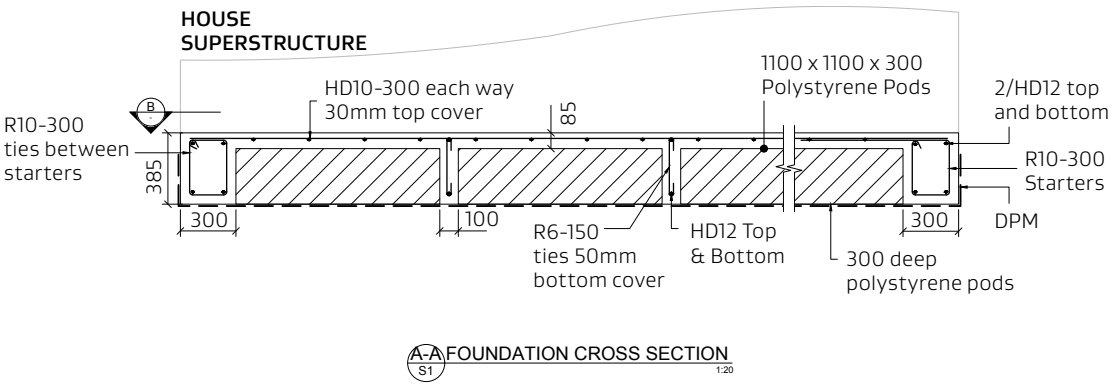
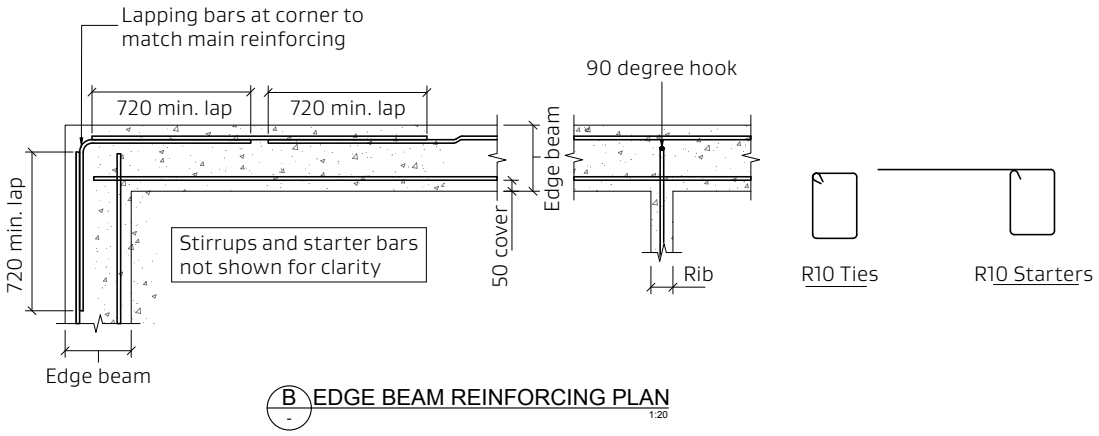


Figure 4.3 Modified Enhanced Waffle Slab foundation details



The following must be used in accordance with NZS 3604:

- finished floor levels and foundation edge construction
- granular base
- damp-proof membrane
- concrete strength
- cover to reinforcing
- reinforcing grades.

Foundation reinforcing laps lengths must be a minimum of:

- 720 mm for HD12
- 400 mm for D10
- 500 mm for R10.

Shrinkage control joints and free joints are not permissible as they introduce discontinuities and reduce slab stiffness.

The HD10-300 slab reinforcing may be substituted with SE92 mesh.

Expansive soil sites

The Australian Standard, AS 2870 Residential Slabs and Footing defines seven soil expansivity classes based on site reactivity. A Modified Enhanced Waffle Slab is restricted to use on sites which are the equivalent of Class “S” or Class “M” as defined in AS 2870.

Tree effects

Trees can remove moisture from the soil within a radius extending at least to the mature height of the tree. This causes expansive soils to shrink to varying degrees and when near dwellings lead to differential settlement occurring under foundations. The mature height of the tree must be considered in the location of trees nears granny flats. Movement of the foundations may lead to cracks in the building and door jamming.

The position of trees should be considered relative to the proposed granny flat foundation and where possible considered when defining the site expansivity class. As a minimum, granny flat foundations must be located at a distance equivalent to or more than the mature height of all nearby trees.

Liquefiable soil sites

The Modified Enhanced Waffle Slab foundation is restricted to use on sites which are moderately liquefiable. Soil categorised as moderately liquefiable (as previously defined), has a nominal land settlement potential of up to 50 mm for Serviceability Limit States events and 100 mm for Ultimate Limit State events. Additionally, nominal lateral stretch shall be less than 50 mm. Damage to the foundation is possible in a large earthquake event and may still require re-levelling.

Further dimensional limitations are placed upon granny flat foundations, when the site is liquefiable to avoid instability of the Modified Enhanced Waffle Slab. As such a minimum internal dimension of 7.5 m applies to the granny flat (i.e. an approximate internal aspect ratio of 1.25:1 and maximising the granny flat plan area).

4.2.2 Pile Foundations

These foundations increase the height of the house above the ground by supporting it on a series of piles and a subfloor framing platform, rather than sitting directly on the soil. This creates a suspended floor with a minimum crawl space underneath the house, which can be useful on gently sloping or damp sites, making it easier to access plumbing or wiring in the future.

Different pile systems are available to suit different ground conditions and site requirements. Types suitable for the granny flat foundation include:

4.2.2.1 Timber piles with suspended floor (NZS 3604)

In this design, treated timber piles are driven or concreted into *'good ground'* and timber bearers and joists are fixed above to create a raised floor structure.

The suspended floor keeps the house clear of the ground, helping to manage damp conditions, allow underfloor ventilation and provides easy access for plumbing, wiring and maintenance. This foundation type offers a simple, cost-effective solution for granny flats built on *'good ground'*, including gently sloping sites where concrete slabs are less practical and more costly.

Technical details and specifications are outlined within section 6 of [3]NZS 3604:2011 and shall comply with subsection 2.1.2 of the Building Product Specifications.

Additional pile foundation solutions suitable for TC2 equivalent liquefiable sites and/or soils with expansivity up to class "M" may be incorporated in future revisions of this guidance, subject to further development, assessment and validation.

4.2.2.2 Concrete piles with suspended floor (NZS 3604)

Concrete piles are durable vertical supports that transfer the weight of the house to *'good ground'* below.

Precast or cast-in-situ concrete piles are set into the ground with timber bearers and floor joists fixed above to create a suspended floor. This design keeps the house raised off the ground, helping manage damp sites and providing easy access for plumbing, wiring and maintenance.

Technical details and specifications are outlined within section 6 of NZS 3604:2011.

3 NZS 3604:2011 Timber Framed Buildings

5. Appendices

5.1 Glossary of terms

Table A.1: Glossary of terms for the purposes of this guidance

Term	Description
B1 Structure	Building Code clause requiring buildings to withstand loads, ground movement and other forces without collapse or deformation.
B2 Durability	Building Code clause requiring building elements to remain functional and safe for minimum prescribed periods (e.g. 50 years for foundations).
Bearing capacity	The ability of the ground to safely support the weight of a building and its foundation without excessive movement or settlement.
Builder	An LBP with the foundation or carpentry license class that is responsible for undertaking or supervising the construction of the foundation. They may also undertake a shallow ground investigation if competent and experienced to do so.
Building	Has the meaning given to it by section 7 of the Building Act.
Building Code	The New Zealand Building Code is a set of regulations under the Building Act 2004 that define performance requirements for building work in Aotearoa New Zealand.
Council	A local council (in the specific area that the granny flat will be built) that will carry out the role of a Territorial Authority (TA) in regard to a granny flat or that of a Building Consent Authority (BCA) when a consent is applied for.
Chartered Professional Engineer	A Chartered Professional Engineer (CPEng or PEngGeol) is a qualified and registered engineer who is recognised as competent to design, review and certify engineering work in Aotearoa New Zealand.
Consent exempt granny flat	A small standalone dwelling that falls within the conditions of the building consent exemption in Schedule 1A of the Building Act 2004 and a building consent is not required.
Consent exempt granny flats pathway	The pathway that can be used to design and build a granny flat without applying for a building consent (see consent exempt granny flat).
CoW	A legal document required by section 45(3) of the Building Act that records who completed or supervised the foundation design of the RBW. It shows accountability for the design but does not certify Building Code compliance.
Designer	Has the meaning given to it by section 14D(1) of the Building Act. For the purposes of this guidance includes a Licensed Building Practitioner (LBP) with a design licence, Registered Architect or Chartered Professional Engineer (CPEng) who prepares plans and specifications or advises on Building Code compliance.

Engineering basis	The engineering basis for granny flats foundations described within this guidance is that the design must bridge a length of up to 4m and cantilever a distance up to 2m of settled soil.
Expansive soils	Clay or similar soils that swell when wet and shrink when dry, posing a risk to standard foundations and excluded from the *'good ground'* definition.
Geotechnical engineer	A chartered professional or suitably qualified engineer with expertise in soil mechanics and ground stability, responsible for assessing ground conditions and designing foundations where necessary.
Geotechnical hazards	A ground-related condition or process that poses a risk to the stability, performance, or safety of structures and land. It typically arises from soil or rock behaviour under static or dynamic loads and includes phenomena such as liquefaction, slope instability, settlement, lateral spreading and ground failure during earthquakes or other events.
Geotechnician	A skilled practitioner who performs on-site ground testing (such as hand auger and Scala Penetrometer) to provide information on soil strength and composition.
Good ground	Defined in NZS 3604 as ground that can safely support buildings without significant movement.
Granny flat	An alternative name for a consent exempt small standalone dwelling. See Consent exempt granny flat.
LBP Builder	A Licensed Building Practitioner (LBP) Builder who is licensed under the Building Act to carry out or supervise restricted building work relating to the construction of a building.
LBP Designer	A Licensed Building Practitioner (LBP) Designer who is licensed under the Building Act to design or supervise the design of restricted building work.
Liquefaction-prone soils	Soils susceptible to the condition where saturated soil temporarily loses strength during seismic activity, mitigation typically requiring engineered foundation solutions
Low bearing capacity soils	Soils with a low ULS bearing capacity, between 200 and 300 kPa.
Non-engineered fill	Historic fill that has not been certified in accordance with [4]NZS 4431.
NZS 3604	NZS 3604:2011 – The New Zealand Standard for timber-framed buildings. It provides a common standard (as modified in Acceptable Solutions) for design and construction on *'good ground'*. Where referenced in this document it refers to the 2011 edition of the standard.
NZS 4402	NZS 4402:1986 – The New Zealand Standard for methods of testing soils for civil engineering purposes.
Suitable ground	When *'good ground'* is not present *'suitable ground'* for the purpose of this document includes applicable soil expansivity (Class "S" and Class "M"), liquefaction prone (TC2 equivalent) and/or low bearing soils where the ground strength is a minimum of 200 kPa ULS bearing capacity within the upper 3 m of the soil profile.

4 NZS 4431:2022 Engineered fill construction for lightweight structures

PIM	Project Information Memorandum, A council-issued document providing information about a property including site hazards, infrastructure and planning rules.
RBW	Restricted building work, critical building work that affects the primary structure or weathertightness of residential buildings, requiring supervision or completion by an LBP.
RoW	Record of Work – a form completed by an LBP to identify the RBW they carried out or supervised, providing accountability and traceability.
Scala Penetrometer test	A simple field test used to measure soil resistance and estimate bearing capacity, helping to determine if the site, where the foundation will be built, meets the *'good ground'* definition.
Shallow ground investigation	The process of collecting information about site's soil, shallow ground conditions, hazards and infrastructure to inform foundation design and compliance.
Standard foundation solutions	Those defined in NZS 3604, including timber piles, concrete piles and concrete slab on ground.
Structural engineer	A Chartered Professional Engineer (CPEng) who may provide Specific Engineering Design (SED).
Unsuitable ground conditions	For the purpose of this document Unsuitable ground is defined to include applicable soil expansivity beyond Class "M", liquefaction vulnerability of TC3 equivalence, soils with ULS bearing capacity below 200kPa and/or Soils containing peat/ organic/ non-engineered/uncontrolled fill.

5.2 Test method (hand auger and Scala Penetrometer)

5.2.1 Hand Auger

A hand auger test is a common way of investigating what lies beneath the surface of a building site. The tool itself typically has a head which is barrel-shaped, with two sharp, opposing blades designed to cut into and retrieve cohesive soils like clays and silts, holding the material securely for inspection.

This allows the tester to see how the soil changes with depth, for example, where the topsoil ends and firmer clay or gravel begins. It helps build a picture of the ground conditions that will affect the granny flat foundation choice.

The primary purpose of a hand auger test is to confirm whether there is strong stable ground close to the surface that can support a granny flat foundation and to identify less suitable conditions such as fill, organic matter or groundwater. While the auger does not measure soil strength directly it provides essential information about the type and layering of soils.

From a technical perspective, the auger (minimum diameter 50mm) is advanced in increments with samples recovered and logged at depths typically in the range of every 150–300 mm in a borehole log (reference NZS 3604 section 3.3.6).

Soil descriptions should be recorded using recognised industry guidance, such as the NZGS Field Description of Soil and Rock (2005), noting relevant characteristics including soil type, colour, consistency, structure and the presence of organics, fill or groundwater. The level of detail should be appropriate to a shallow ground investigation and does not replace site-specific geotechnical assessment where more complex ground conditions are encountered.

The test is especially useful for locating the depth at which firm natural soils are encountered. It also guides what further in-situ strength testing is needed, either with a Scala Penetrometer (for granular soils).

In combination with strength testing, hand auger results provide the basis for assessing whether a site meets the NZS 3604 definition of *'good ground'* or requires a specific foundation design.

The test typically involves:

- clear the surface vegetation and place the auger vertically
- rotate clockwise while applying downward pressure – remove the auger every 150–300 mm of penetration to recover samples
- log each depth interval in accordance with NZGS field description guidelines: record soil type, colour, consistency, structure, moisture, inclusions (e.g. organics, gravel) and groundwater if encountered
- advance until refusal (when the auger can't go further because the soil is too hard or gravelly), groundwater inflow, or target depth (minimum 1.2 m for assessing *'good ground'* as per NZS 3604 section 3.3.6)
- if in granular soils, carry out Scala Penetrometer testing adjacent to the auger hole
- enter results into a borehole log (soil profile + strength results) which becomes part of the ground investigation report for the site.

When undertaking a test, it is critical that the equipment is fit for purpose. A key check is making sure the auger head is sharp enough to cut into the ground and that the rods and handle connect securely so it drills straight.

The shape and size of the auger head should be verified against its specification as this can wear with extensive use, rods must be straight and tight to ensure vertical drilling and depth markings or measuring tape should be accurate.

The auger should be cleaned between holes to avoid contaminating samples from different depths. Worn or bent heads should be replaced rather than relied on, as they can give misleading soil profiles.

NZGS ground investigation specification guidance section 5 provides information on hand auger testing and information on how results are recorded.

5.2.2 Scala Penetrometer test

A Scala Penetrometer test, as set out in NZS 4402 section 6.5.2 and referenced in NZS 3604, is a simple and cost effective way to check soil strength. The test involves dropping a 9 kg weight to drive a cone-shaped tip into the ground and measuring how far it penetrates with each blow. The harder the soil, the fewer millimetres it penetrates per blow.

The main purpose of the Scala Penetrometer test is to assess whether the soil has enough strength to support a foundation without excessive settlement. These results show how strong or soft the soil is and help confirm the type of foundation that will be suitable for a granny flat.

In some cases, the results may indicate that standard foundations for *'good ground'* (as defined in NZS 3604) are appropriate, otherwise site specific solutions may be needed, particularly if soils are identified as being expansive, liquefaction-prone or have low bearing strength.

From a technical perspective, the Scala Penetrometer is driven into the soil in 100 mm increments and the number of blows is recorded at each depth. Results are then compared against recognised thresholds that indicate whether the ground has sufficient bearing strength.

In practice, the test will need to be undertaken alongside a hand auger, with both results recorded in a borehole log as described in NZS 3604 section 3.3.6.

The auger log provides details of soil type and layering, while the Scala gives the associated strength values at depth. Together these records give a more reliable picture of site conditions and support decisions about foundation design.

When testing the Scala test should be completed in the least disturbed soil before augering, while the auger provides the soil description to match the strength readings.

What the test typically involves:

- a steel rod with a 20 mm diameter, 60° cone tip is placed vertically on the ground
- a 9 kg weight is dropped from a height of 510 mm
- recording the number of blows per 50 mm
- the test continues until the required depth is reached or the cone meets strong resistance.

NZS 4402 provides details on soil strength tests using a Scala in section 6.5.2 and this includes two procedures which may be used.

When using a Scala it's important to check that the hammer drops smoothly and that the cone tip is sharp, not worn or blunted. Technically, the hammer must weigh exactly 9 kg, drop freely through 510 mm (NZS 4402) and the cone must meet size requirements (20 mm base, 30° tip).

Rods need to be straight, joints properly engaged and moving parts lubricated to prevent friction that could skew results. Carrying out these checks helps ensure that blow counts are accurate and that the soils strength is neither underestimated nor overestimated.

5.3 Example test scenario

https://www.nzgs.org/libraries/guideline-for-hand-held-shear-vane-test/

Example: Procedure for undertaking a hand auger and Scala Penetrometer test (granular soils)

1. **Preparation**

- review site plan: identify the proposed building footprint
- select test locations:
  - minimum of two auger and Scala tests at opposite corners of the footprint
  - better practice = three tests (two corners and one near the footprint centre) to confirm soil consistency
- equipment required:
  - hand auger with extensions and T-handle
  - depth measuring tape or rods
  - Scala Penetrometer (9 kg hammer, 510 mm drop, 20 mm cone).

2. **Testing sequence (Scala and auger together at the same location)**

- Scala on undisturbed ground:
  - start with a Scala test at the surface to approximately 1 m depth. This provides strength data in natural, undisturbed soil
- hand auger to the same depth:
  - auger down to 1 m
  - retrieve and describe the soil profile in 150–300 mm increments
  - record soil type, colour, consistency, organics/fill, moisture and groundwater
- repeat the Scala test for a further 1m (noting total testing should be carried out to no less than 3 m below ground level), to demonstrate depth coverage, but values at these depths should be treated with caution as results may be influenced by friction along the rods, which can artificially increase the blow count and reduce reliability
- repeat the auger test above to additional Scala depth achieved
- repeat both the Scala and auger test down a further 1 m to a total depth of a minimum of 3 m
- note – if the Scala or auger cannot penetrate down to a depth of 3 m, note the refusal depth on the bore log (i.e. if Scala cone will not penetrate further despite repeated hammer blows or if auger cannot advance further into the ground by hand).

3. **Logging and Reporting**

- combine auger and Scala results into a single borehole log at each test point for the site (as required by NZS 3604 section 3.3.6), this should include:
  - soil profile with depth
  - Scala blow counts with depth
  - ground water table depth or any percolation of water during drilling

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- provide a summary report (shallow ground investigation):
  - ground conditions (e.g. stiff clay below 0.3 m)
  - strength observations (e.g. Scala values exceeded ‘good ground’ threshold after 0.4 m)
  - any unsuitable layers noted (e.g. fill in top 0.2 m)
  - conclude whether the site meets the definition of ‘good ground’, otherwise identify suitable SED foundation solutions.

5.4 Example shallow ground investigation report

NZGS guidelines for a ground investigation specification include detail on the type of information that should be included in a ground investigation report. For a shallow ground investigation for a granny flat this could include:

Project and administrative information

- Project Name and Location: Identifies the project and site address.
- Log ID: Unique identifier for each borehole (e.g. AH-01).
- Start and Finish Date: Records the timeline of the investigation.
- Logged By: Name or initials of the field geologist or technician.
- Equipment used:
  - Hand auger – auger type, size, rods and depth achieved.
  - Scala Penetrometer – hammer, drop height, cone dimensions, rods, calibration details.
- Weather: Notes the conditions during the logging.
- Datum and Coordinates: Provides the reference point for the hole’s location and elevation.

Borehole details

- Depth: A column with intervals marking the distance from the ground surface.
- Graphic Log: A visual, scaled representation of the soil layers encountered.
- Material Description: A detailed written description of each soil layer. Information to include:
  - Soil Type and Classification: Describes the soil, often using the Unified Soil Classification System (e.g. silt, sandy, clay).
  - Colour: Describes the colour of the moist soil.
  - Moisture Content: Characterizes the soil as dry, moist, or wet.
  - Consistency/Relative Density: For cohesive soils like clay, describe as soft, stiff, hard, etc. For granular soils like sand, describe as loose, dense, etc.
  - Plasticity: For fine-grained soils, indicate low, medium, or high plasticity.
  - Structure: Notes any observed structure, such as layering, mottling, or fissures.
  - Minor Components: Lists any secondary components, such as trace amounts of gravel, shells, or organic material.

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- Sample Details:
  - Sample Number: A unique ID for each sample collected.
  - Sample Depth: The specific depth interval from which the sample was taken.
  - Sample Type: Specifies if it was a disturbed (grab) or undisturbed sample.
- Groundwater Information:
  - Groundwater Depth: The depth where groundwater was first encountered (note if it stabilized).
  - Groundwater Observations: Any other observations, such as the flow rate or if the hole remained dry.
- Conclusions:
  - Decision on whether *'good ground'* present or not.
  - Recommended granny flat foundation solutions.

New Zealand Government
Te Kāwanatanga o Aotearoa