NEW ZEALAND GEOTECHNICAL SOCIETY INC
www.nzgs.org

NZGS GEOTECHNICAL ENGINEERING BASICS
SHALLOW FOUNDATIONS

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PRELIMINARY

Shallow foundations
- Where embedment depth is less than 5 times the width of the foundation (B1/VM4)
- A shallow founding layer is identified
- Support a structure through its design life
  – SLS, ULS and High WT conditions
- NZS1170 provides guidance on ULS and SLS earthquake performance requirements
- Building Code B1/VM4
- MBIE / NZGS Module 4

Desktop Site Assessment
- Historical Imagery (eg. Retrolens)
- GNS New Zealand Geology Web Map
  – Faults & Underlying Geology
- Council hazard and service maps
- New Zealand Geotechnical Database (NZGD)
- Local council archive search

Proposed Site Development
- Building Type: Residential or Commercial
- Rigid or Flexible (Tolerance to deformations)
- Building loads (Compression, tension, lateral)
- Site cut to fill plan
- Building importance level and design life.

Site Assessment and Ground Investigation
- Greenfield or Brownfield
- Underground services and collaboration with asset owners if required
- H&S risk assessment
- Topography / Geomorphology
- Water outlets / flow paths / water features
- Ground Investigations
  – MBIE / NZGS Module 2
  – NZ Ground Investigation Specification
- Construct ground model from site data
- Refer to NZGS Ground Model poster

DESIGN CONSIDERATIONS

Settlement
- Static (immediate and long-term)
- Total and differential
  – Avoid constructing on different geological formations
  – For acceptance of settlements, collaborate with the structural engineer
- Refer to NZGS Static Settlement Poster

Liquefaction
- Vertical Settlements and Subsidence
- Lateral Spread
  – Overall horizontal movement of ground
- Lateral Stretch
  – Overall lateral stretching beneath a building
- MBIE / NZGS Module 4
- Refer to NZGS Liquefaction and Lateral Spread poster

Soil Expansivity
- Can affect foundations by shrinking and swelling which bends or removes support from foundations
- NZS 3604:2011

Bearing Capacity
- MBIE / NZGS Module 4
- Building Code B1/VM4

Loading
- MBIE / NZGS Module 1
- NZS 1170.5:2004
- Building Code B1/VM4

Rocking / Overturning / Sliding
- Building Code B1/VM4

FOUNDATION TYPES

Perimeter Foundation
- Load distributed to building perimeter

Slab on ground
- Concrete slab with footings embedded to good ground

Mat Foundation
- Thick concrete slab with no footings, spreading the load through the slab

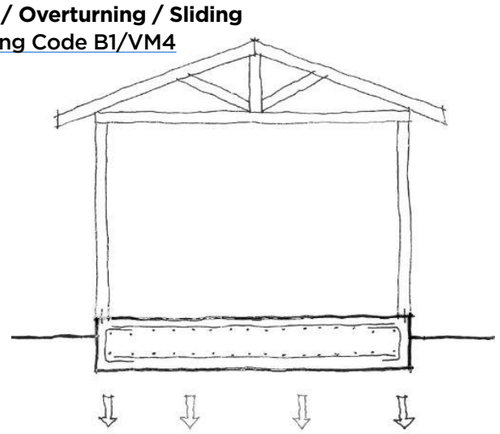
Waffle Foundations
- Ribbed with polystyrene inserts to increase strength and distribute load across ground surface
- Allows for construction on softer ground

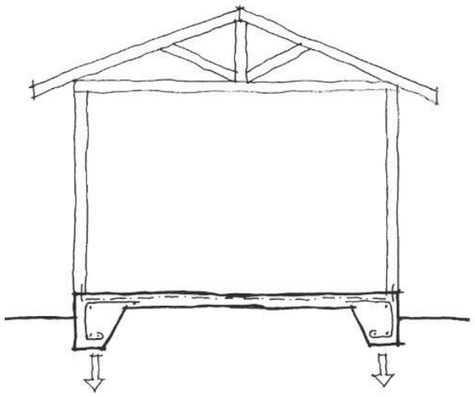
Ground improvement beneath foundations
- Canterbury Residential Technical Guidance, (2012)
- MBIE / NZGS Module 5

DESIGN REQUIREMENTS

Ground Conditions
- Identify a bearing layer at shallow depth capable of providing support for building loads *or*
- Construct well-engineered ground improvements
- Bearing layer must be capable of bridging over underlying liquefiable soils without 'punch through'
  – Thickness is relative to weight of building and building form
- The bearing layer should be continuous across the site to provide uniform support to the building footprint
- Where the bearing layer overlies liquefiable soils, the foundation system should be capable of spanning pockets of lost support from pore water penetration into the layer

Foundation Conditions
- Concrete mat of raft foundations should be capable of resisting the high pore-water pressures caused by liquefaction at depth
- Shallow foundations should be well-tied together
- Consider safety in design
- MBIE / NZGS Module 4





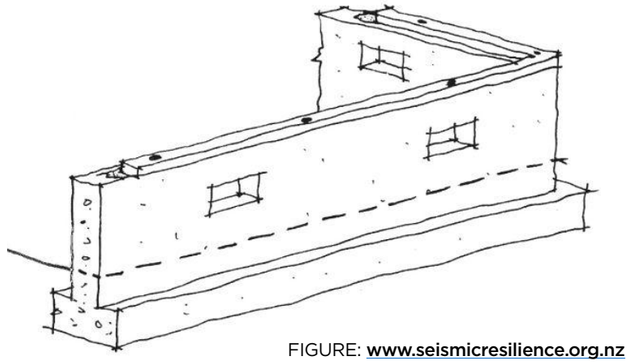


FIGURE: www.seismicresilience.org.nz