DESIGN GUIDE

STOPDIGGING!
THE GROUND SCREW FOR SOLID FOUNDATIONS

Lightweight Structures

CONTENTS

Version 1.0. October 2020.

1. GENERAL

1.1 PURPOSE

This guide provides directions for designing a STOPDIGGING! ground screw system without the need for specific engineering.

Projects fall within the scope of this guide are those where the STOPDIGGING! design criteria is based on foundation system for a lightweight structure; it must be single storey, with a timber or light weight steel frame, light weight wall and roof cladding systems and be subject to snow loadings no greater than 1kPa, and live loads no greater than 2kPa.

Use of the STOPDIGGING! ground screw system for all other building projects require a specific engineering or structural assessment and soil testing.

1.2 SKILLS REQUIRED

This guide is intended for use by licensed building (or deemed) practitioners, licensed to the applicable class.

1.3 IMPORTANT DOCUMENTS

This guide must be read in conjunction with:

› Product pass™

- STOPDIGGING! Ground Screw pass™
- STOPDIGGING! Ground Screw System Lightweight Structures pass™ for lightweight structures not requiring specific design.

pass

MORE INFO

See www.thebuildingbusiness.co.nz/stopdigging/pass for controlled versions.

› Technical Documents

- STOPDIGGING! Specification Guide
- STOPDIGGING! Design Guide
- Specific design in accordance with Cook Costello. [07/08/2020] STOPDIGGING! Ground Screw Specification Revision 2, where applicable.

MORE INFO

See www.stopdiggin.co.nz/stopdigging for controlled versions.

1.4 DESCRIPTION

The STOPDIGGING! ground screw system is a proprietary foundation system that can be used as an alternative to traditional foundation piles and strip footings as defined in NZS 3604:2011.

STOPDIGGING! ground screws are mechanically installed into soil to a depth at which the required resistance is achieved. The screws can be installed without disturbance or damage to the ground. Concrete is not required.

STOPDIGGING! ground screws are made of steel that complies with ISO 630 FE360A– High Tensile Steel for Structural Purposes and are manufactured with a hot-dipped galvanised coating that achieves an average of 125 µm zinc cover. The STOPDIGGING! ground screws are classified as category HDG900 (900g/m^{2}).

STOPDIGGING! ground screws are supplied in various screw diameters with extensions, adapters and connection brackets. Specification of diameter, adapter and connection brackets are determined by soil conditions and fixing requirements. The screws are reusable and recyclable.

2. DESIGN PROCESS

1 STRUCTURE AND GROUND CONDITIONS ASSESSMENT

A STOPDIGGING! ground screw system can be designed using this guide if

- the structure is a lightweight building within the specified scope, and
- the ground conditions are suitable.

Establish the building is a lightweight structure

A lightweight structure is a structure with a roof mass not exceeding 20 kg/m2 and a wall cladding mass not exceeding 30 kg/m2.

Lightweight structures include:

- sheds (timber or lightweight steel)
- utility buildings
- domestic self-contained dwellings with a floor load of up to 1.5 kPa, as described in Table 1.2 of NZS 3604:2011
- ground level decks with a deck load of up to 2.0 kPa, as described in Table 1.2 of NZS 3604:2011
- snow loads up to 1kPa.

The STOPDIGGING! ground screw system requires specific engineering design if the expected mass of the structure falls outside these parameters.

Check the ground conditions are suitable

The following soils fall within the scope of this guide:

- soils with a pH level > 4 (as a general rule loams, pumice and clay soils have a pH of greater than 5)
- soils with a resistivity of > 1000 ohms-cm (as a general rule loams, pumice and clay soils have a resistivity of greater than 1000 ohms-cm)
- fill material, where a certificate of suitability has been issued under NZS 4431:1989.

The following soil conditions fall outside the scope of this guide, and specific engineering design is required:

- organic topsoil
- peat soil
- soft, very soft or highly weathered clay
- geothermally affected soils
- fill material, except where a certificate of suitability has been issued under NZS 4431:1989

Where specific design is required, refer to Cook Costello. [07/08/2020] STOPDIGGING! Ground Screw Specification Revision 2. Project Number 13759.

2 STOPDIGGING GROUND SCREW SYSTEM DESIGN

The STOPDIGGING! ground screw system can be used as a substitute for NZS 3604:2011 timber pile foundations with a timber subfloor.

Where designing on sloping ground, the maximum height of the screw above ground must not exceed 900 mm unless varied by specific engineering design.

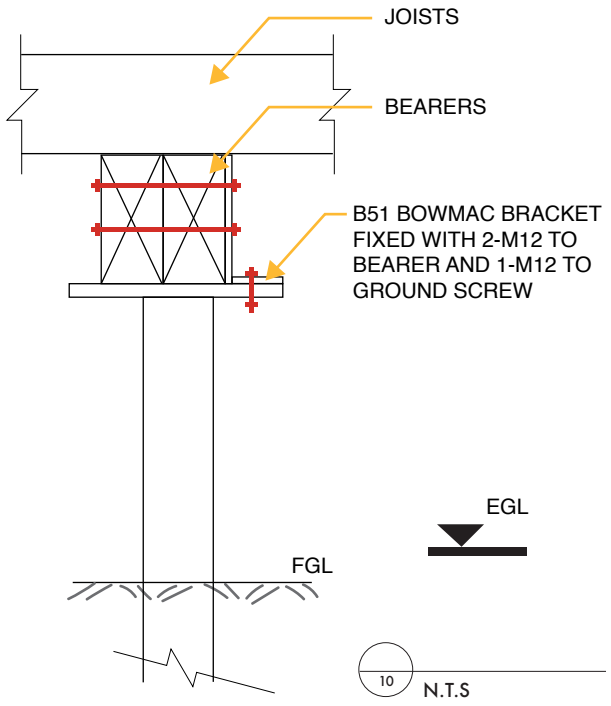
Design the subfloor

Design the subfloor in accordance with Acceptable Solution B1/AS1 using sections 6 and 7 of NZS 3604:2011.

Select the required bearers and joists for the subfloor design using the NZS 3604:2011 bearer and joist selection tables for size and spacing. For bearer tables, refer to NZS 3604:2011 Table 6.4 and Table A6.4. For joist tables, refer to NZS 3604:2011 Table 7.1.

Alternatively, if the subfloor has already been designed, for example, as part of a kitset, confirm the subfloor design is adequate for the intended building work.

Typical subfloor details are as follows:



Determine bracing demand

Calculate the total load and bracing demand for the structure.

Use Table 5.8 of NZS 3604: 2011 to establish cladding weight, roof slope and subfloor structure. Table 5.8 gives the multiplication factor for the appropriate earthquake zone and subsoil classification. If no soil classification is available for the site, use soil class E to obtain the multiplication factor[1]. For wind demand, refer to Table 5.5 of NZS 3604:2011. For earthquake demand, refer to Table 5.9 of NZS 3604:2011.

Create bracing layout

The bracing units need to be distributed over the subfloor in bracing lines. The following applies:

- Bracing lines must be at no more than 5.0 m spacings.
- Bracing units must, as far as possible, be evenly distributed along lines of bracing.
- Bracing lines in perimeter foundation and subfloor framing, or internal lines parallel to these (refer to paragraph 5.5.2.1 of NZS 3604:2011) require not less than the greater of:
  - 100 bracing units
  - 50 % of the total bracing demand divided by the number of bracing lines in the direction being considered (along or across).

The screw brace system can be used where additional sub floor bracing, greater than the specified screw pile BU rating, is required.

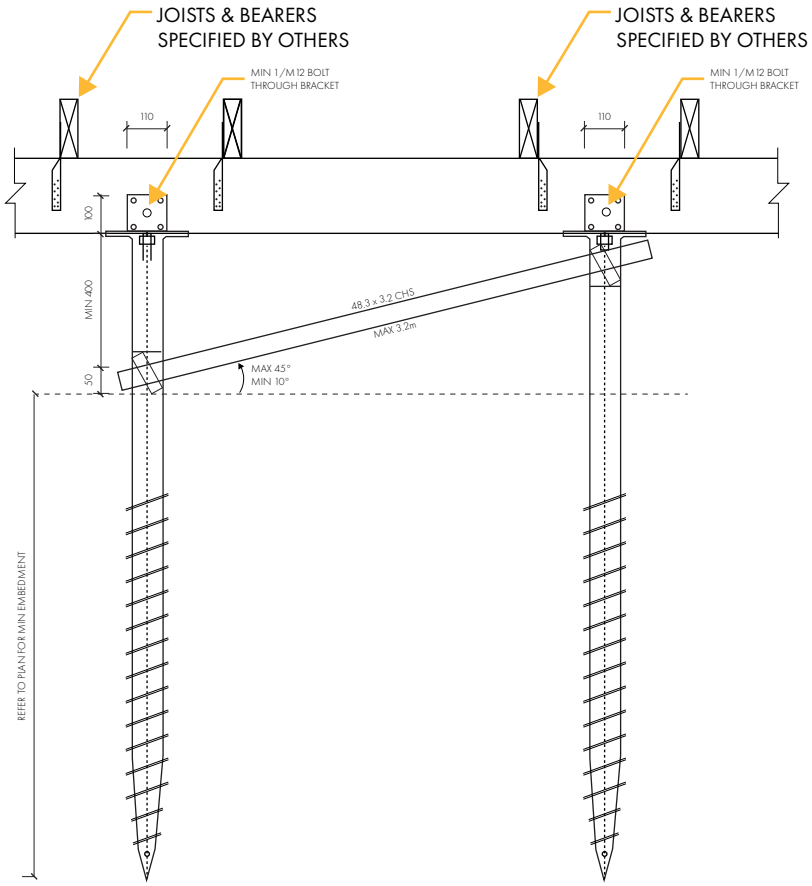
The screw brace system must be:

- 48.3 CHS Grade 250 tube.
- A maximum length of 3.2 m.
- At an angle between 10° and 45° from horizontal.

1 BRANZ. (August/September 2011). *Deck Bracing Design*. BUILD 125.

- Connected to two ground screws with a maximum ground screw spacing of 1100 mm. If a wider spacing is required, the bracing element can be connected to a ground screw and bearer in one direction and a ground screw and floor joist in the orthogonal direction. The floor joist must be fixed using a 6 kN (120 BUs) fixing between joist and bearer at both ends of the joist. The bracing element must be connected to the joist/bearer with an M12 bolt, connected as per Section 6.9 and figures 6.9 and 6.10k of NZS 3604:2011.
- In accordance with Figure 6.8 of NZS 3604:2011 for offset connections (limited to 150 mm). The SHS can be connected to the ground screw 100 mm above ground level, using a swivel clamp coupler.

TYPICAL GROUND SCREW BRACE DETAIL



Select appropriate screw type for the application and calculated load

Select the appropriate ground screw for the application and calculated bracing load using the following tables.

STOPDIGGING! beam screw

Beam screw (mm/Ø)	Thickness (mm)	Load kN	Uplift kPa	BU value (horizontal)
SGU 95Ø x 580 mm	5	2.5	1.7	10
SGU 95Ø x 680 mm	5	2.5	1.7	10
SGU 95Ø x 865 mm	5	6.0	4.5	50
SGU 95Ø x 1000 mm	5	10.5	5.5	70
SGU 95Ø x 1200 mm	5	12.5	6.5	90

STOPDIGGING! post screw

Post screw (mm/Ø)	Thickness (mm)	Load kN	Uplift kPa	BU value (horizontal)
SGS 70Ø x 935 mm	5	8.0	5.0	60
SGS 95Ø x 935 mm	5	8.0	5.0	60
SGS 70Ø x 1200 mm	5	12.5	6.5	90
SGS 95Ø x 1200 mm	5	12.5	6.5	90

STOPDIGGING! adapter screw

Adapter screws are to be used in conjunction with beam brackets SGE70 and SGE95.

Adapter screw (mm/Ø)	Thickness (mm)	Load kPa	Uplift kPa	BU value (horizontal)
SGC 76Ø X 865 mm	4	13.5	7.0	70
SGC 76Ø X 1200 mm	4	25.0	12.5	120
SGC 76Ø X 1600 mm	4	35.0	21.5	170
SGC 76Ø X 2000 mm	4	45.0	41.5	230
SGC 76Ø X 2500 mm	4	55.0	41.5	290
SGP 76Ø X 580 mm	4	2.5	1.7	10
SGP 76Ø X 865 mm	4	6.0	4.5	50
SGP 76Ø X 1200 mm	4	12.5	6.5	90

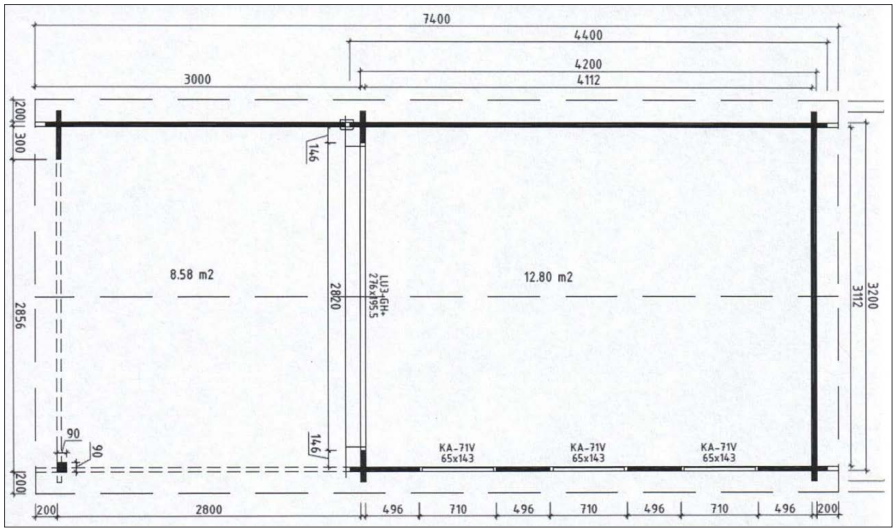
Note:

1. Irrespective of the bracing system (i.e., one screw, bearer or joist) the maximum bracing value to be claimed is:
   - 120 BU for earthquake
   - 160 BU for wind.
2. Where BU ≥ 120, the adapter screw may be used to create a subfloor brace pile.

3. APPENDIX 1

3.1 STOPDIGGING GROUND SCREW WORKED EXAMPLE

Proposed building work



Wind zone: very high

Design process

Confirm lightweight structure

- Lightweight timber wall and metal roof, single storey building, 30 m2 total floor area, subfloor to NZS 3604:2011.

Determine bracing requirements

- Floor loadings @ 1.5 kPa
- Deck load (covered porch) @ 2.0 kPa
- Assumed "Good ground" ULS 300 kPa bearing capacity
- Wind bracing demand for subfloor NZS 3604: 2011
- Average ground to apex- 4.0 m
- Roof height above eaves- 1.0
  - 60 BUs across
  - 70 BUs along
- Multiply factor of 1.3 for very high wind zone
- Required subfloor bracing requirement for very high wind zone
  - 78 BUs across
  - 91 BUs along
- Screw piles supporting floor and wall NZS 3604: 2011 Table 6.2
- Span of joist 1.65 m
- Maximum loaded dimension 2.4 m
- Screw centres 1.3 m
- Loaded dimension of joists 1.9 m

Confirm soil type

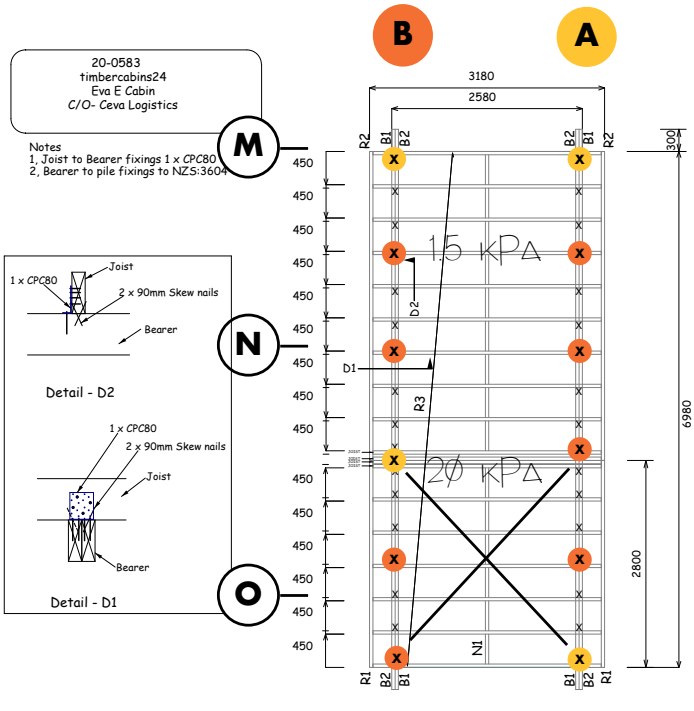
Clay, therefore, pH likely to be >5 and resistivity >1000 ohms-cm.

EXAMPLE:
Create bracing plan

A = SGC 76Ø x 865 (4)
B = SCS 70Ø x 935 (8)

A = 120 BU's x 4 = 480 BU's
B = 60 BU's x 8 = 480 BU's
} Both directions

Bearer 140 x 70



NZS 3604: 2011
Table 5.5

AV ground to apex- 4.0 m

Roof height above eaves- 1.0 m

V/H Mulitply x 1.2
E/H Mulitply x 1.6

Akarana timbers FTMA NEW ZEALAND
28 TRUGOOD DRIVE, EAST TAMAKI PH: (09) 253 9010 FAX: (09)274 7353

V/H Wind Zone REQUIRED

78 Bu's Across
91 Bu's Along

Stop Digging Screw Piles A B = 480

480 BU's in both directions

ACHIEVED

Select STOPDIGGING! ground screw

STOPDIGGING! beam screw

Location A

Adapter screw	Thickness (mm)	Load kN	Uplift kPa	BU value (horizontal)
SGC 76Ø X 865 mm	4	13.5	7.0	70
SGC 76Ø X 1200 mm	4	25.0	12.5	120 (able to be used as a subfloor anchor pile)
SGC 76Ø X 1600 mm	4	35.0	21.5	170 (able to be used as a subfloor anchor pile)
Braced screw piles system (consisting of one screw, bearer or joists)	120 BU for earthquake 160 BU for wind			

Location B

Post screw	Thickness (mm)	Load kN	Uplift kPa	BU value (horizontal)
SGS 70Ø x 935 mm	5	8.0	5.0	60
SGS 95Ø x 935 mm	5	8.0	5.0	60
SGS 70Ø x 1200 mm	5	12.5	6.5	90
SGS 95Ø x 1200 mm	5	12.5	6.5	90

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See www.stopdigging.co.nz for current version.

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