SUPER SLEEPER
Composite Retaining Wall

TECHNICAL DESIGN GUIDE

ULTIMATE RETAINING WALL SOLUTION

Version SS.TDG.Sept 2024

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INTRODUCTION

Welcome to the Technical Design Guide (TDG) for the revolutionary product: the SuperSleeper Composite Retaining Wall (**SuperSleeper Super^{100TM}**) by SuperSleeper Pty Ltd.

> **Note:** SuperSleeper Pty Ltd. is consistently referred to as SuperSleeper throughout this document.

The information within this TDG is intended solely for utilisation in conjunction with Fiber-Reinforced Polymer (FRP) products that are explicitly designated and manufactured by SuperSleeper.

Purpose of the TDG

This TDG provides the knowledge and understanding necessary for the design, proper installation, thorough inspection, and maintenance of the SuperSleeper Super^{100TM}.

It covers essential topics, including but not limited to:

- **Features:** Gain insight into the innovative features that make the SuperSleeper Super^{100TM} the preferred choice for engineers, contractors, and homeowners.
- **Structural properties:** Gain knowledge about the structural properties of the SuperSleeper Super^{100TM}, such as strength, durability, and flexibility.
- **Environmental benefits:** Gain knowledge about the environmental benefits of the SuperSleeper Super^{100TM}.
- **Installation:** Get instructions to quickly and efficiently install your SuperSleeper Super^{100TM}.

About SuperSleeper

SuperSleeper is a leading manufacturer in Australia's retaining composite wall industry.

SuperSleeper has created a revolutionary product that sets a new standard for excellence. It offers a retaining wall system that outperforms traditional methods in terms of performance and durability.

The SuperSleeper Super^{100TM} is made from composite materials that are carefully engineered by registered and internationally certified chartered engineers to address the challenges associated with traditional retaining walls and deliver unparalleled strength, durability, and environmental sustainability.

Target Audience

This TDG is intended for engineers, designers, contractors, and consumers. Our aim is to provide you with the information you need to make intelligent decisions about your retaining wall project that will ultimately lead to better results.

By the end of this TDG, you will understand how the SuperSleeper Super^{100TM} can elevate your retaining wall projects, offering superior functionality and a commitment to sustainability and longevity.

SUPERSLEEPER OVERVIEW

SuperSleeper develops and manufactures a specialised series of FRP products under the trademarked name Super$^{100™}$. These products include SuperSleeper, SuperCap, SuperPost, and SuperBracket.

Super^{100TM} products are retaining wall products created from FRP, which is a composite material consisting of a polymer matrix reinforced with fibres. The chemical composition of Super^{100TM} products is specifically designed and enhanced to provide the required properties to allow engineers and contractors to choose the most trusted FRP in Australia.

SuperSleeper Super^{100TM} utilises a high-grade isophthalic polyester resin known for its exceptional corrosion and chemical resistance properties. During its manufacturing process, a UV inhibitor is incorporated, and a surface veil is applied to enhance the surface characteristics of pultruded profiles. This surface veil serves a dual role: protecting SuperSleeper Super^{100TM} from moisture and enhancing its UV radiation resistance. Consequently, the product's mechanical properties remain unchanged, ensuring consistent performance in extended end-use scenarios.

SuperSleeper Super^{100TM} is a lightweight design and versatile product that represents a significant advancement in the realm of landscaping and engineering. It is engineered to accommodate a wide range of retaining wall applications, from residential landscaping projects to large-scale commercial infrastructure endeavours.

SuperSleeper goes beyond the traditional retaining wall concept and provides an excellent alternative to conventional methods of retaining walls and other established solutions.

Advantages

In the world of retaining walls, SuperSleeper Super^{100TM} stands out as a superior choice, offering several advantages over traditional options.

Lightweight Construction:

SuperSleeper Super^{100TM} is a composite solution, making it notably lightweight and easier to handle and transport than traditional heavy retaining wall materials. This can lead to significant time and cost savings during installation.

Durability:

SuperSleeper Super^{100TM} is made from materials known for their superior durability, allowing it to withstand harsh outdoor exposure and changing weather conditions, ultimately extending its lifespan.

Long-Term Cost Savings:

SuperSleeper Super^{100TM} long-lasting durability and ability to resist wear and tear can reduce maintenance and replacement expenses over the long term.

Environmental Benefits

SuperSleeper Super100™ provides various environmental benefits, such as reducing material transportation, lowering the carbon footprint, extending longevity, ensuring compliance with environmental regulations, and achieving significant CO_2 reductions, establishing it as a standout choice for environmentally-conscious construction projects.

Reduced Material Transportation:

SuperSleeper Super100™ lightweight nature results in fewer materials needing transportation to the construction site. This leads to reduced fuel consumption, decreased greenhouse gas emissions, and less strain on road infrastructure.

Lower Carbon Footprint:

The manufacturing process of composite materials is often more energy-efficient and generates fewer carbon emissions than traditional materials such as concrete or steel.

Longevity:

SuperSleeper Super100™ durability can extend its lifespan compared to some alternative materials, resulting in fewer replacements and less waste over time, thus reducing the overall environmental impact.

Compliance with Environmental Regulations:

The use of environmentally-friendly construction materials, like SuperSleeper Super100™, can help projects meet environmental regulations and achieve sustainability goals set by local authorities or organisations.

CO_2 Reductions:

SuperSleeper Super100™ significantly contributes to environmental sustainability by minimising deforestation and emitting between 42% and 75% less CO_2 during manufacturing. With fewer pollutants generated and its lightweight composition reducing the burden on the transportation sector, this product stands out as a highly eco-friendly option compared to alternative materials.

Key Features

When it comes to retaining walls, SuperSleeper Super100™ is at the forefront of innovation, redefining standards of excellence in construction and landscaping.

Here are the key features that distinguish SuperSleeper Super100™ from other products.

- Allows fully engineered SuperSleeper Super100™ for compliance and peace of mind.
- Offers versatile design options to create stunning landscapes.
- Embraces an eco-friendly approach with local manufacturing and sustainability.
- Demonstrates proven quality with independent testing and approvals.

SECTION PROPERTIES

Universal Beam Super100TM

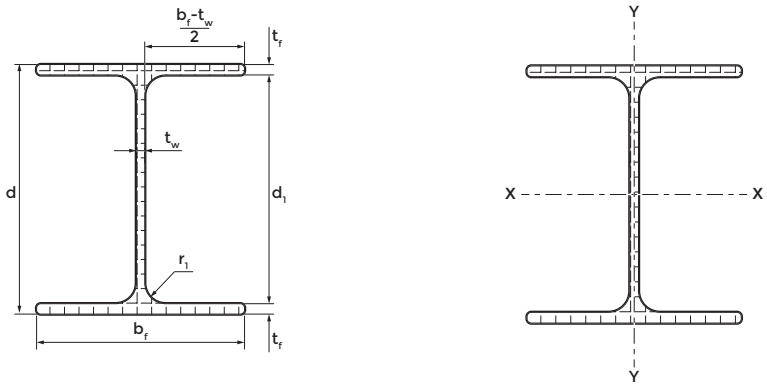

Figure 1. Dimensions and Properties of Universal Beam Super100TM

Table 1. Dimensions and Properties of Universal Beam Super100TM

Dimensions							Properties								Shear Strength FV
Designation Kg/m	Depth of Section (d) (mm)	Flange Width (b_f) (mm)	Flange Thickness (t_f) (mm)	Web Thickness (t_w) (mm)	Root Radius (r_1) (mm)	Depth between flanges (d_1) (mm)	Area (mm^2)	About X-Axis			About Y-Axis			Torsion constant	Shear kN
								Ixx ($10^6 mm^4$)	Zx ($10^3 mm^3$)	Rx (mm)	Iyy ($10^6 mm^4$)	Zy ($10^3 mm^3$)	RY (mm)	J ($10^3 mm^4$)	
120UB 3.10	120	100	5	4	10	110	1522	3.98	66.35	51.10	0.83	16.55	23.30	16.30	13.64
180UB 5	180	100	7	6.50	5	166	2500	13.10	145.58	72.40	1.17	23.42	21.60	41.10	33.45

Parallel Flange Channel (PFC) Super100TM

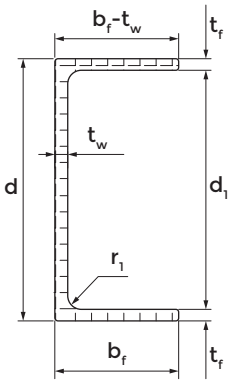

Figure 2. Dimensions and Properties of PFC Super100TM

Table 2. Dimensions and Properties of PFC Super100TM

Dimensions							Properties								Shear Strength FV
Designation Kg/m	Depth of Section (d) (mm)	Flange Width (b_f) (mm)	Flange Thickness (t_f) (mm)	Web Thickness (t_w) (mm)	Root Radius (r_1) (mm)	Depth between flanges (d_1) (mm)	Area (mm^2)	About X-Axis			About Y-Axis			Torsion constant	Shear kN
								Ixx ($10^6 mm^4$)	Zx ($10^3 mm^3$)	Rx (mm)	Iyy ($10^6 mm^4$)	Zy ($10^3 mm^3$)	RY (mm)	J ($10^3 mm^4$)	
100PFC 2.27	100	50	6	6	6	88	1141	1.69	33.85	38.50	0.26	18.00	15.10	15.00	14.14

SuperSleeper Super100™ without Stiffener

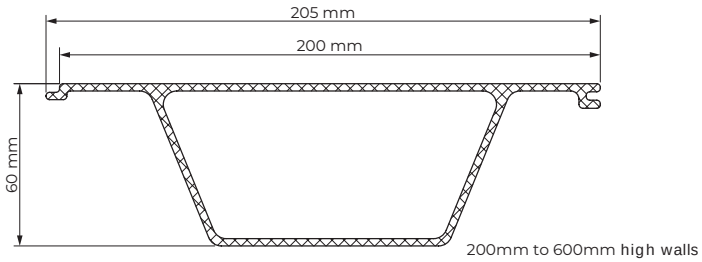

Figure 3. SuperSleeper Super100™ without Stiffener

SuperSleeper Super100™ with Stiffener

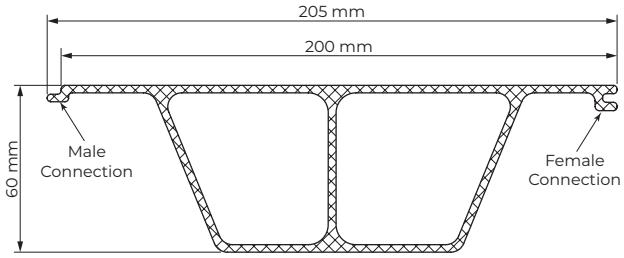

Figure 4. SuperSleeper Super100™ with Stiffener

SuperBracket Super100™

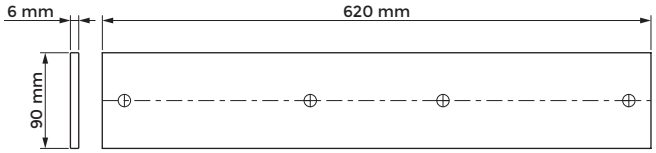

Figure 5. SuperBracket Super100™

Table 3. Dimensions of SuperBracket Super100™

Dimensions				
Designation	Depth of section	Flange Width	Flange Thickness	Area
	(m^2)	(m^2)	(m^2)	(m^2)
SuperBracket Super™100	0.62	0.09	0.006	0.0558

LOADING AND PRESSURE VALUES

Design Overview

SuperSleeper develops and manufactures a specialised series of FRP products under the trademarked name Super100™. SuperSleeper engineers precisely produce Super100™ products using a unique composite design and composition.

Engineers, designers, and consumers need to understand that, despite the potential visual similarities of FRP, their physical characteristics can exhibit significant variations due to differences in resin formulation, reinforcement quantity, and type.

Deflection often emerges as a primary design consideration due to the considerably lower modulus of elasticity in SuperSleeper Super100™ compared to steel. Additionally, SuperSleeper Super100™ has a lower shear modulus than steel, resulting in increased shear stresses that impose additional deflection on columns and sleepers in addition to the typical flexural deflections.

> **Note:** SuperPost Super100™ is consistently referred to as a column throughout this document.

SuperSleeper Super100™ can undergo changes when exposed to varying temperatures, making it particularly susceptible to degradation at elevated temperature levels. SuperSleeper should not be exposed to temperatures higher than 55°C.

The section capacities specified herein have been derived from comprehensive testing conducted within NATA-accredited testing laboratories and the Queensland University of Technology.

SuperSleeper Super100™ (Lagging)

SuperSleeper Super100™ is influenced by serviceability and its ultimate bending moment capacity. It is important for users other than engineers and contractors to seek professional guidance and to be familiar with AS4678 when deriving pressures.

SuperSleeper verifies the dimensional tolerance and visual standards during the initial production. After manufacturing, SuperSleeper continues to ascertain the modulus of elasticity and tensile strength by beam deflection and failure mechanism as part of the SuperSleeper quality assurance process.

The bending moment capacity for SuperSleeper Super100™ at lengths of 2 m and 2.4 m is restricted to the values specified in *Table 4*, as determined by NATA-accredited testing laboratories. Serviceability values documented in *Table 5* are determined based on the loadings applied to the SuperSleeper Super 100™.

SuperSleeper recommends the following maximum spans: 2.4 m for heights up to 0.6 m and 2.0 m for heights ranging from 0.6 to 1.6 m. Ultimate and serviceability load calculations must comply with AS1170.0, AS1170.2-2, and AS4678 standards. Linear interpolation between these values is an acceptable approach.

AS4678 Appendix J has been followed for both strength and serviceability considerations. A combination factor (y_c) of 0.6 has been applied for strength, and a short-term factor (y_s) of 0.7 has been used for serviceability. The wind pressure of Wu and W_s must comply with the latest AS1170.2 standards and be performed by a professional design engineer.

Note: For ease of use, SuperSleeper has provided the ultimate loading to the SuperSleeper Super[100TM] in kN/m. However, it is essential to note that, for the reviewer's consideration, the ultimate bending moment is restricted to 1.7 kN.m.

Table 4. SuperSleeper Super[100TM] Ultimate Limit State (kN/m)

SPAN (m)	kN/m
1.6	5.3
2.0	3.4
2.4	2.4

Table 5.1 SuperSleeper Super[100TM] Serviceability Limit State (mm) - 1.6m Span Sleeper

SPAN (m)	0 kN/m	0.2 kN/m	0.4 kN/m	0.6 kN/m	0.8 kN/m	1 kN/m	1.2 kN/m	1.4 kN/m	1.6 kN/m	1.8 kN/m	2 kN/m	2.2 kN/m	2.4 kN/m	2.6 kN/m	2.8 kN/m
1.6	0.0	0.8	1.6	2.5	3.3	4.1	4.9	5.7	6.6	7.4	8.2	9.0	9.9	10.7	11.5
SPAN (m)	**3.0** kN/m	**3.2** kN/m	**3.4** kN/m	**3.6** kN/m											
1.6	12.3	13.1	14.0	14.8											

Table 5.2 SuperSleeper Super[100TM] Serviceability Limit State (mm) - 2.0m & 2.4 m Span Sleeper

SPAN (m)	0 kN/m	0.2 kN/m	0.4 kN/m	0.6 kN/m	0.8 kN/m	1 kN/m	1.2 kN/m	1.4 kN/m	1.6 kN/m	1.8 kN/m	2 kN/m	2.2 kN/m	2.4 kN/m	2.6 kN/m	2.8 kN/m
2.0	0.0	2.1	4.1	6.2	8.2	10.3	12.3	14.4	16.5	18.5	20.6	22.6	24.7	26.7	28.8
2.4	0.0	4.3	8.7	13.0	17.4	21.7									

120UB (SuperPost Super[100TM])

The 120UB is limited by serviceability limits and its ultimate bending moment capacity. It is essential for users other than engineers and contractors to seek professional guidance and possess a comprehensive understanding of ultimate and serviceability loading principles during the design process.

The primary consideration during design verification is typically deflection. However, it is equally important to assess shear strength and flexural stresses.

Both flexural and shear stresses influence the cumulative deflection of the column. It is imperative to restrict the use of the calculations provided below to Super[100TM] products only, owing to variations in the material properties of FRP. These calculations are exclusively based on generated mathematical formulas based on testing conducted on the specific properties of Super[100TM].

Design Example

A cantilever column is designed to retain 1m of earth and surcharge. The following soil parameters and reduction factors have been adopted:

- Retained height = 1 m
- Column centres = 2 m
- Risk class = A (from AS4678)
- Backfill = Insitu with material reduction factors applied
- Internal friction angle = 26°
- Soil weight (Y_s) = 19 kN/m^3
- Drained cohesion c' = 3
- Surcharge (Q) = 2.5 kPa

The following loads have been calculated using the Rankine formula applied to the column (*Figure 6*). Calculate the deflection at the top of the column and section capacity based on the 120UB section properties using Super[100TM].

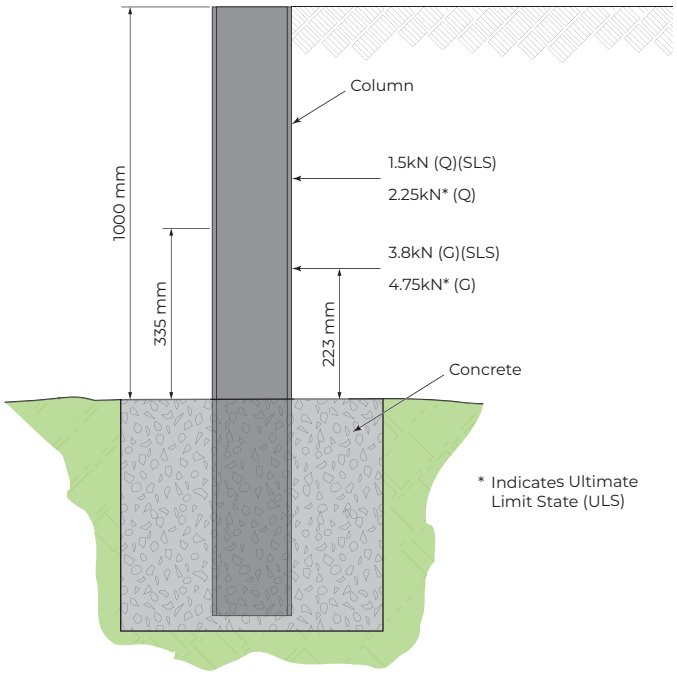

Figure 6. ULS Indication

Ixx = 3,980,000 N/mm^2

Zxx = 66,350 N/mm^2

Modulus of elasticity (E) = 11,000 N/mm^2

λ(time factor) = 0.8

Note: Point loads extrapolated from surcharge and soil pressures.

The following λ (time factor) is determined by *Table 6* in coordination with the ULS load combination.

Table 6. ULS Load Combination and Time Factor

ULS Load Combination (AS4678)	λ (time factor)
1.25 G + 1.5 Q	0.6 when Q* is storage. 0.8 when Q* is general occupancy. 1.0 when Q* is impact.
1.25 G + W_u* + Ψ_c* Q*	0.75
1.25 G + 1.0 F_{eq}* + Ψc* Q*	0.75
0.8 G + 1.5 Q*	1.0
0.8 G + W_u*	1.0
0.8 (G Ψ_c* Q*) + 1.0 F_{eq}*	1.0

* Ψ_c can be obtained from AS1170.0, W_u can be obtained from AS1170.2, F_{eq} from AS4678, and Q can be obtained from AS4678.

SuperSleeper assumes a time effect factor (λ) of 0.8 when Q is general occupancy.

Ω (Reduction factor) = 0.65

F_t (Tensile Stress) = 207 N/mm^2 (Super[100TM])

F_v (shear from properties *Table 1*) = 13.64 kN

Ultimate Limit State M_x* = 4.75 kN x 0.223 m + 2.25 kN x 0.335 m = 1.81 kN.m

Ultimate Limit State Vx* = 4.75 kN + 2.25 kN = 7.0 kN

Total Service Load V_x = 3.8 kN + 1.50 kN = 5.3 kN

120UB Super[100TM]

A. Check calculation deflection using formula 4.1.

Formula 4.1

$W_{(x)} = P(3Lx^2-x^3)/6(E1) + Px/1.2829E10^6$

$W_{(x)} = 3800(3 \times 1000 \times 223^2 - 223^3)/(6\ (11{,}000 \times 3{,}980{,}000) + 3800 \times 223/1.2829E10^6 = 2.66$ mm

$W_{(x)} = 1500\ (3 \times 1000 \times 335^2 - 335^3)/(6\ (11{,}000 \times 3{,}980{,}000) + 1750 \times 335/1.2829E10^6 = 2.10$ mm

2.66 + 2.10 = 4.7 mm

B. Check flexural and nominal strength rupture using formulas 4.2 and 4.3, respectively.

Formula 4.2

$f_{bu} = M_x{}^*/Z_{xx} = 1.81^{E6}/66{,}350 = 27.3$ N/mm^2

Formula 4.3

$\varphi.\lambda.F_t = 0.65 \times 0.8 \times 207 = 107.6$ N/mm^2 > 27.3 N/mm^2 ∴ OK

C. Check average web shear and strength using formula 4.4.

Formula 4.4

$\varphi.\lambda.F_v = 0.65 \times 0.8 \times 13.64 = 7.1$ kN > 5.3 kN ∴ OK

SuperBracket Super^{100TM}

SuperBracket Super^{100TM} is designed to support various fence types, including but not limited to timber or steel.

SuperBracket Super^{100TM} performance is influenced by its serviceability and ultimate bending moment capacity. It is essential for users other than engineers and contractors to seek professional guidance and remain well-versed in the most current edition of AS1170.2.

Engineers and designers must comprehensively understand the relevant wind loading criteria for their specific regions regarding ultimate and serviceability considerations. The wind pressure of W_u and W_s must comply with the latest AS1170.2 standards and be performed by a professional design engineer.

A reduction factor of 0.8 has been applied to the SuperBracket Super^{100TM} ultimate capacity to account for safety. Linear interpolation is an accepted method for values falling between these two figures. *Table 7* and *Figure 7* can be used for assessing deflection under serviceability and ultimate limit state loading conditions.

Table 7. SuperBracket Super^{100TM} Serviceability/Ultimate Limit State Design Capacities (kN)

Deflection (mm)	0	1	2	3	4	5	6	7	8
Load (kN)	0	0.893	1.7	2.2	3.15	4.03	4.86	5.67	6.37
Moment Capacity (kN.m)	0.00	0.32	0.61	0.79	1.13	1.45	1.75	2.04	2.29

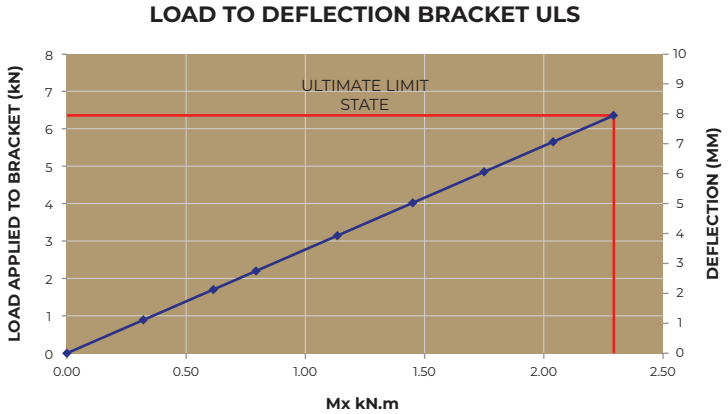

Figure 7. Load to Deflection Bracket ULS

CUTTING AND DRILLING RECOMMENDATIONS FOR SUPERSLEEPER PRODUCTS

Cutting

SuperSleeper strongly recommends using a carbide or diamond grit-edge blade when performing circular cuts with SuperSleeper Super[100TM] products. To achieve optimal results, especially in high-volume production cutting scenarios, select a diamond blade with a grit rating between 60 and 80.

Additionally, it is crucial to prioritise safety and environmental considerations during the cutting process. It is strongly advised to implement effective dust control measures to mitigate potential hazards associated with dust particles generated during cutting. This can be achieved through the use of a water suppression system or the appropriate dust inhalation equipment. These precautions protect the health of those involved in the cutting process and contribute to maintaining a cleaner and safer work environment.

Figure 8. Cutting

Drilling

SuperSleeper recommends using a standard high-speed drill bit to drill SuperSleeper Super[100TM] products. However, like all high-speed drill bits, they must be sharpened occasionally. For high-volume drilling, use a carbide-tipped drill bit.

Additionally, similar to when drilling steel or wood, SuperSleeper recommends using similar measures, such as a backing plate or lubricant for thicker plates.

Figure 9. Drilling

INSTALLATION

Safety Precautions

Safety first, when installing SuperSleeper Super100™. Adhering to these precautions will help protect engineers and workers, maintain the SuperSleeper Super100™ structure's integrity, and comply with all relevant codes and regulations.

Presented below is a list of safety precautions to be considered. It is important to note that this list is not exhaustive and is intended solely as a guide. For additional details, refer to the *"SuperSleeper Safety Data Sheet (SDS)"*.

Table 8. Safety Precautions

Safety Precaution	Description
Site Assessment and Soil Testing	Conduct a thorough site assessment to understand ground conditions and perform soil tests to determine soil properties, bearing capacity, and potential hazards such as sinkholes.
Permits and Regulations	Ensure that all necessary permits and approvals are obtained before commencing work. Familiarise yourself with local, state, and federal regulations for SuperSleeper Super100™ construction.
Protective Gear	Mandate the use of personal protective equipment (PPE) for all workers, including helmets, hearing protection where appropriate, gloves, safety glasses, and steel-toed boots.
Training and Certification	Ensure construction engineers and workers are adequately trained and certified in SuperSleeper Super100™ construction and safety protocols.
Equipment Inspection	Regularly inspect all construction equipment and machinery to ensure they are in good working order.
Emergency Response Plan	Develop and communicate an emergency response plan in case of accidents or unexpected events.
Clear Work Area	Keep the work area clear of debris, equipment, and obstacles to prevent accidents.
Excavation Safety	When excavating, exercise caution with utilities such as gas and water lines. Ensure they are marked and avoided during excavation.
Fall Protection	Implement fall protection measures for workers at heights, including guardrails, safety nets, and personal fall arrest systems.
Proper Drainage	Incorporate proper drainage solutions to prevent water buildup behind the SuperSleeper Super100™, which can affect its stability.
Load Limits and Overloading	Avoid overloading the SuperSleeper Super100™ with excessive soil, structures, and machinery beyond its designed load capacity.
Manufacturer's Guidelines	Strictly adhere to the manufacturer's instructions and specifications for the SuperSleeper Super100™ being used.
Stability Checks	Regularly monitor the stability of the SuperSleeper Super100™ during and after construction to ensure it remains secure and functional.
Weather Conditions	Stay aware of weather conditions that may impact construction and suspend work during adverse weather conditions.
Material Inspection	Inspect all materials to ensure they meet quality standards and are free from defects before using them in construction.
Communication	Maintain clear and open communication among all team members to ensure everyone is aware of potential hazards and safety measures.
Safety Signage	Install safety signage and barriers to warn workers and the public of construction areas and potential hazards.
State licence	Ensure construction and installation are undertaken by a licenced builder in accordance with the council, state, and federal regulations.

Installation of the SuperSleeper Super100TM

Foundation Holes

To commence the installation of the SuperSleeper Super100TM, start by excavating holes for the foundation and column. Prepare a concrete mixture per the engineers' guidelines and pour it into the excavated area. Once the foundation is ready, securely position the column in the foundation, ensuring it is centred and perfectly upright. Use a plumb line to verify the column's vertical alignment.

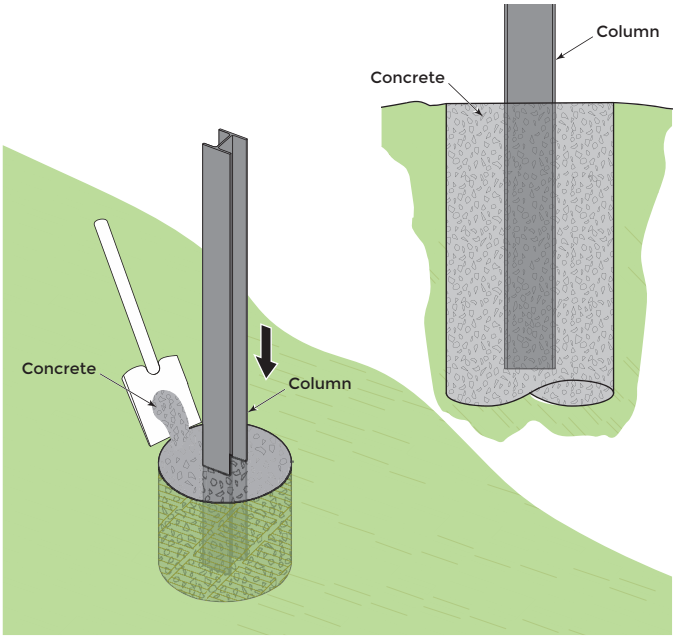

Figure 10. Foundation Holes

Installation Methods

There are two distinct installation methods available for the SuperSleeper Super100TM. The first method (See *"First Method – Bottom SuperSleeper Super100TM Installation on Concrete"*) involves placing the SuperSleeper Super100TM directly above the concrete foundation. In the second method (See *"Second Method – Installation of the Support and the Bottom SuperSleeper Super100TM"*), the support facilitates the installation of the SuperSleeper Super100TM. These methods offer versatility and adaptability, allowing customisation to meet specific project demands and design specifications.

If the ground is not level before placing the initial bottom SuperSleeper Super100TM or support, you have the option to create a concrete pad between the columns to ensure that the SuperSleeper Super100TM sits uniformly.

First Method – Bottom SuperSleeper Super100™ Installation on Concrete

To position the bottom SuperSleeper Super100™ onto the prepared concrete surface, carefully slide it between the columns. To ensure a smooth installation, it is essential to maintain a 10 mm gap between the columns and the SuperSleeper Super100™. Inadequate clearance can lead to difficulties during SuperSleeper Super100™ placement.

Use a level to verify its alignment. Ensure the SuperSleeper Super100™ is perfectly horizontal and make any necessary adjustments to achieve the desired level. Fill the area around the bottom ends of the SuperSleeper Super100™ with concrete, extending it to a length of 250 mm. Allow the concrete to cure for a minimum of 24 hours.

Alternatively, the concrete pier can be overpoured, and the SuperSleeper can be set within the concrete. The concrete must surround and engage the SuperSleeper Super100™ end up to a distance of 250 mm (*Figure 11*).

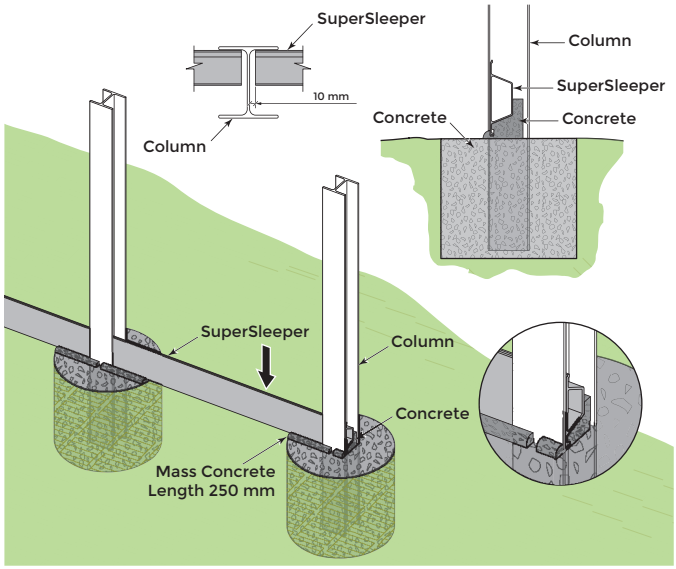

Figure 11. Bottom SuperSleeper Super100™ Installation on Concrete

Second Method – Installation of the Support and the Bottom SuperSleeper Super100™

Carefully place the female connection of the SuperSleeper Super100™ facing down and slide into the support. Use a level to verify the SuperSleeper Super100™ alignment and support position on the concrete pile. This can be completed after the concrete pile has cured onto a prepared concrete surface or during the concrete pile and post-installation. Ensure that the support is perfectly horizontal and make any necessary adjustments to achieve the desired level (*Figure 12*).

To ensure a smooth installation, it is essential to maintain a 10 mm gap between the columns and the SuperSleeper Super100™. Inadequate clearance can lead to difficulties during SuperSleeper Super100™ placement.

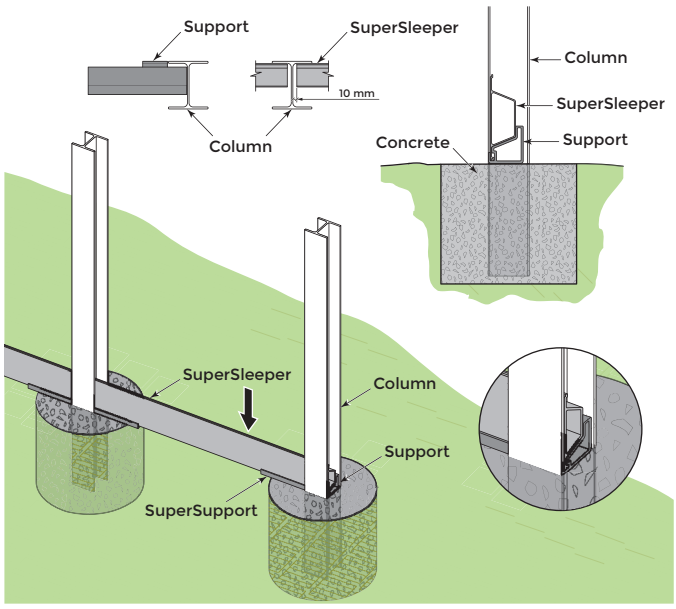

Figure 12. Installation of the Support and the Bottom SuperSleeper Super100™

Installation of the Subsequent SuperSleeper Super100TM

Install the subsequent SuperSleepers Super100TM on top of the bottom Supersleeper Super100TM and align and level them. Stack the Supersleepers Super100TM on top of each other until you reach the required height, as per the appropriate design (*Figure 13*).

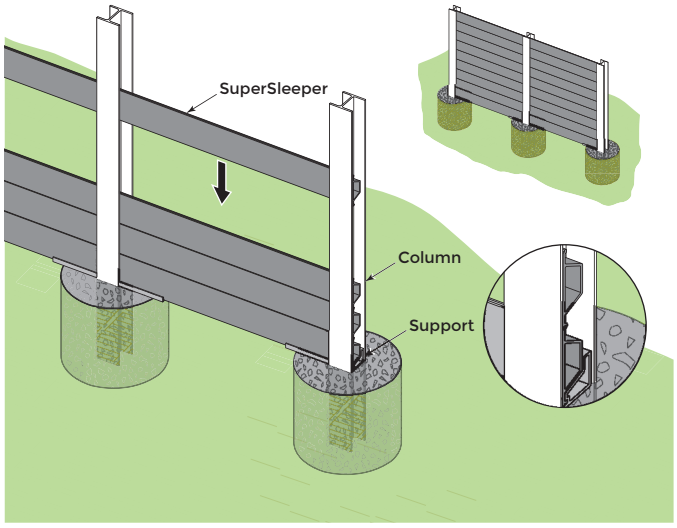

Figure 13. Installation of the Subsequent Super-Sleeper Super100TM

Installation of the Support on the Top of the SuperSleeper Super100TM

Installing support on top of the SuperSleeper Super100TM is a crucial step in ensuring the stability and structural integrity of the installed SuperSleeper Super100TM. By securing the support in this manner it effectively prevents any upward movement or deflection, thereby enhancing the overall strength and durability of the SuperSleeper Super100TM installation.

To install the support, flip it and position it on the top of the SuperSleeper Super100TM, ensuring it aligns with the SuperSleeper Super100TM while maintaining a 600 mm distance between the supports. Use a level to confirm alignment accuracy and make any necessary adjustments to achieve the desired level.

Secure the support to the SuperSleeper Super100TM using two hex-head metal teks (screws), positioning them 50 mm away from each end of the support.

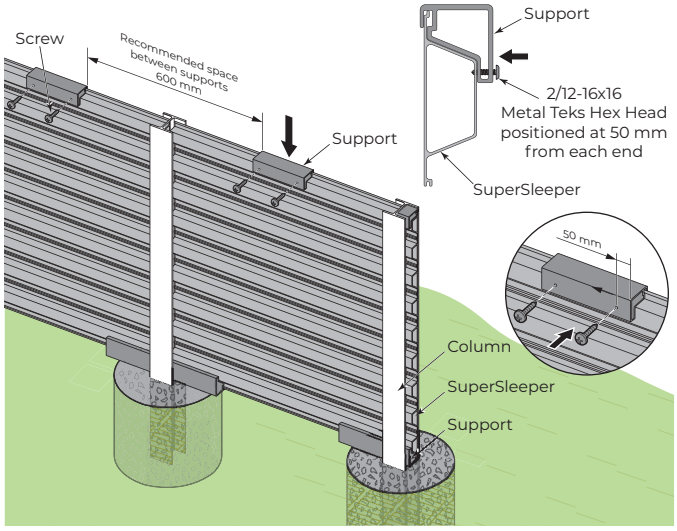

Figure 14. Installation of the Support on the Top SuperSleeper Super100TM

Installation of the SuperCap Super100TM

It's important to note that installing the SuperCap Super100TM over the support and SuperSleeper Super100TM is optional and not mandatory. Nevertheless, adding SuperCap Super100TM to the SuperSleeper Super100TM enhances its overall appearance and provides a sense of completeness in the SuperSleeper Super100TM installation.

Position the SuperCap Super100TM onto the supports, ensuring alignment accuracy with a level, and make any necessary adjustments to achieve the desired level.

Secure the SuperCap Super100TM to the column using two hex-head metal teks (screws), positioning them 50 mm away from each end of the SuperCap Super100TM.

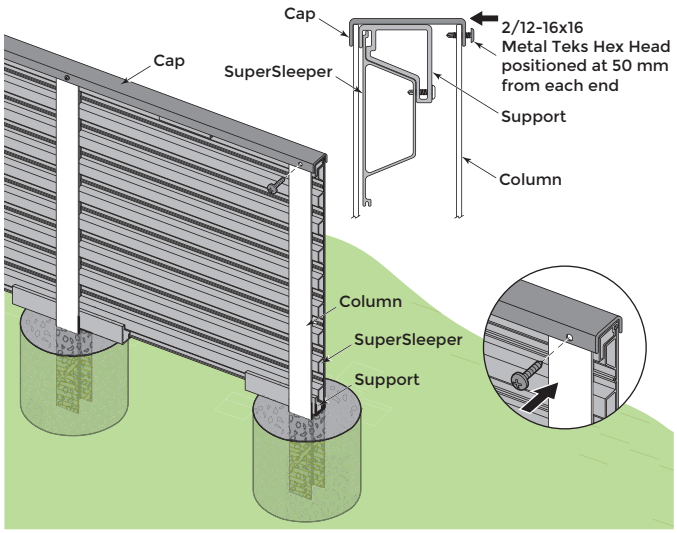

Figure 15. Installation of the SuperCap Super100TM

Installing the Drainage System

To ensure efficient water management and extend the lifespan of the SuperSleeper Super100TM, it is essential to establish a well-designed drainage system. Below, you will find the recommended drainage system.

Agg Pipe Placement

Position the AGG pipe at the base of the wall above the impervious material, ensuring its correct alignment.

Sloping AGG Pipe

Ensure the AGG pipe slopes in accordance with Australian Standards for proper water flow from the SuperSleeper Super100TM to a legal point of discharge.

Geotextile Fabric Cover

Cover the AGG pipe with geotextile fabric to prevent soil from entering the pipe.

Backfill with Soil

Backfill the area behind the SuperSleeper Super100TM with a free-draining material, compacting it in layers to ensure stability.

Clay Soil Filling

Fill the remaining space to the top of the wall with a clay soil plug.

After installation of the drainage system, regularly monitor it to confirm its proper functioning, maintaining the SuperSleeper Super100TM integrity.

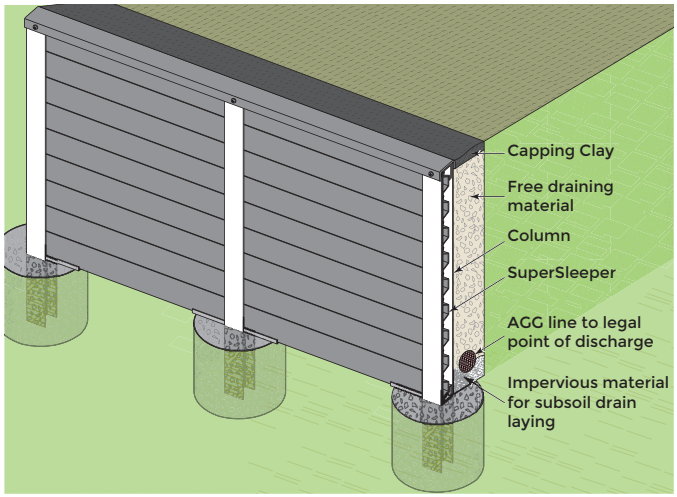

Figure 16. Installing the Drainage System

Exclusion Zone

SuperSleeper is specifically engineered to withstand transient surcharges or point loading. However, given the inherent flexible nature of soldier pile walls, SuperSleeper recommends that permanent surcharge loading not be applied to the wall.

SuperSleeper recommends implementing either an exclusion zone equal to the wall's height (*Figure 17)* or a performance-based design that avoids any additional pressures on the wall, as specified by a practicing professional, such as a structural or geotechnical engineer.

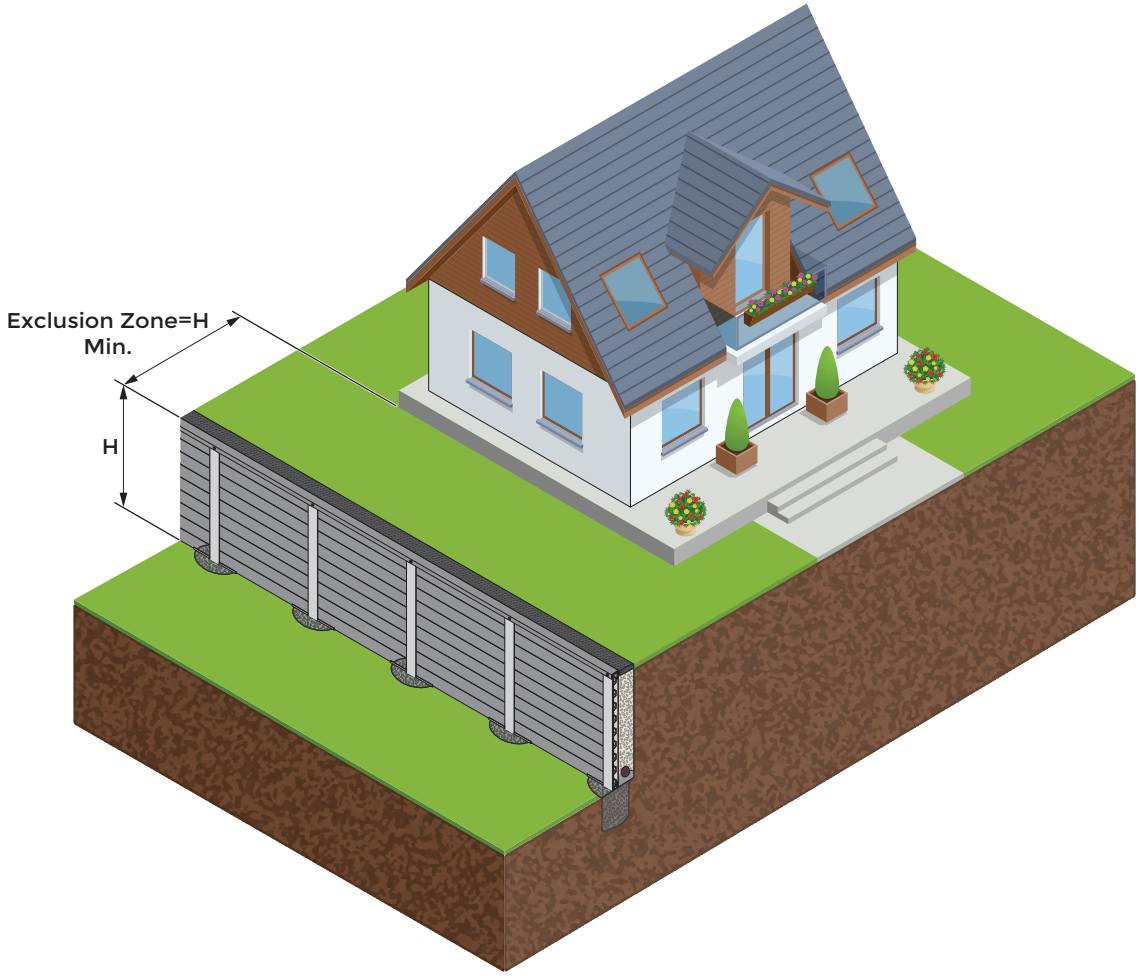

Figure 17. Exclusion Zone

INSPECTION AND MAINTENANCE

Routine Inspection

Inspection is essential to minimise safety risks from unforeseen failures. Additionally, the early identification of defects by inspection can lead to cost-effective maintenance.

SuperSleeper Super^{100TM} is susceptible to brittleness and UV damage, making regular inspections essential. Individuals can perform these inspections as outlined in *Table 9*.

Visual inspection

Visual inspection is an essential part of the SuperSleeper Super^{100TM} maintenance process. It involves a thorough examination of the SuperSleeper Super^{100TM} exterior and critical internal components to assess its condition and identify any visible signs of damage, wear, or deterioration. The frequency of inspections should be determined based on the specific environmental conditions to which the SuperSleeper Super^{100TM} is exposed.

The following guidance is provided but may be adjusted based on site conditions and the age of the SuperSleeper Super^{100TM}:

- **Biennial Inspections (Every 24 Months):** FRP structures in stable environments with minimal risk of degradation undergo inspections every two years. Stable environments include sites located more than 1 km from the shoreline, whether residential or non-residential, subject to periods of weather exposure.
- **Environmental Factors:** In corrosive or harsh environments where FRP is exposed to chemicals, UV radiation, or other factors that can accelerate degradation, inspections may be conducted more frequently to proactively identify potential issues. Enviroments such as where chemicals are used.

Defects Descriptions

Table 9. Defects Descriptions and Corrective Actions

Defect	Description	Corrective Action
Surface Discoloration	This can result from chemical reactions, exposure to heat, or erosion.	Apply UV enhancement immediately, such as a polyurethane paint or an external coating that provides UV resistance. Monitor the control area and record the degradation rate.
Powdery Surface	This occurs due to the formation of a film or barrier resulting from the interaction between the resin and the process fluid. This barrier may inhibit the ongoing rate of deterioration.	
Softening and Voids	These are characterised by small craters or pits on the surface.	
Surface Crazing	This manifests as a pattern of fine interconnected cracks that are shallow and slow-growing.	
Shrinkage Crack	These are characterised by a pattern of shallow, parallel cracks caused by thermal shrinkage.	
Blistering	This occurs when water or chemicals permeate into the laminate matrix, leading to the formation of pressure-filled pockets. Blisters typically cease to grow over time and are not considered a problem unless they result in structural laminate failure.	

Defect	Description	Corrective Action
Resin Loss	This occurs when the surface is stripped of resin. If the stripped surface appears polished, it is likely due to erosion. Conversely, if the surface appears fuzzy, it suggests that the resin may have been affected by the process fluid.	Replacement may be necessary. Consult with a SuperSleeper specialist.
Exposed Fiber	This term refers to loose fibre that remains exposed due to resin loss, inadequate resin coverage, or mechanical damage.	
Delamination	The separation of layers in the laminate is caused by a failure in the bond between the resin and reinforcement.	
Surface Wearing	This pertains to the loss of the surface slip-resistant layer, the UV surface veil, or any mechanical wear occurring on the bearing surface.	
Structural Crack	This type of crack is usually deep and results in the severing of bundles of fibres.	Consult with a structural engineer.
Deformation	Deflection, buckling, or rolling of members.	
Mechanical Damage	Chips, scratches, breaks, or cuts resulting from inadequate handling or external impacts.	
Unsafe Fasteners	Missing, loose, dislodged, deformed, unsecured clips, bolts, nuts, and pins.	Rectify immediately.

Cleaning and Stain Removal

SuperSleeper recommends using specialised FRP cleaners to prevent damage to FRP products' delicate fibres and surfaces.

For gentle stain removal, you can use a mild detergent and a soft-bristle brush. If specific chemicals are required, please get in touch with SuperSleeper technical support for guidance.

SUPERSLEEPER SUPER100TM DURABILITY AND LIFESPAN

The durability of SuperSleeper Super100TM is influenced by environmental conditions, UV exposure (including UVA, UVB, and UVC wavelengths), and exposure to corrosive elements. SuperSleeper can have a lifespan of around 60 to 100 years with proper maintenance and protection from UV rays in well-ventilated, non-corrosive environments.

Durability

FRP composites offer several advantages, including lightweight characteristics and exceptional resistance to acids, alkalis, solvents, and overall corrosion. However, prolonged exposure to outdoor UV radiation can result in the development of a chalky surface on the composite and a gradual deterioration in its condition over time.

Super100TM products allow pigments to be added to the final resin layer, which adds colour and prevents UV degradation using UV stabilisers or additives. Polyurethane and epoxy paints can further protect against degradation and beautify FRP surfaces. Acrylic lacquer, vinyl, and oil-based paints can also be effective. SuperSleeper recommends light sanding before painting and following the manufacturer's instructions.

Following the documented corrective and preventative maintenance practices (see *"Defects Descriptions"*) is essential to maintain the product's longevity and protect it against long-term UV exposure.

FAQs

What are Super100TM products made of

FRP is a composite material made of a polymer matrix reinforced with fibres. The fibres are usually glass, carbon, aramid, or basalt. Rarely other fibres such as paper, wood, boron, or asbestos have been used.

What is the weight of a SuperSleeper Super100TM?

A 2.0 m SuperSleeper Super100TM weighs less than 6 kg.

Where can I buy it?

Visit https://supersleepers.com.au/suppliers/ to find a supplier near you.

How long will the Super100TM product last?

The Super100TM product can be expected to have a lifespan ranging from 60 to 100 years, provided that the product has been installed and maintained correctly.

What are the limitations of the Super100TM product in terms of construction?

There is very little you can't do with Super100TM product; the ideal heights achieved are up to 1.6m in height. Depending on the loadings, SuperSleeper Super100TM can support even greater heights. It's important to note that all the SuperSleeper Super100TM must be professionally engineered. We recommend contacting your local council to determine any height restrictions that may require council approval.

How will it handle the Australian sun?

SuperSleeper Super100TM already contains UV-resistant properties; with additional maintenance, the product can have a lifespan of 60 to 100 years.

Will something like a Whipper Snipper damage it?

No, the product can easily withstand the impact of a Whipper Snipper and has undergone impact testing.

Does it come in any other colours?

SuperSleeper Super100TM can come in custom colours for significant orders. However, SuperSleeper Super100TM can be easily painted by preparing its surface with medium-grade sandpaper and applying exterior UV paint (no primer is required). This will also enhance the product's durability.

What environmental advantages are there?

SuperSleeper Super100TM is a more sustainable alternative, accounting for up to 75% less CO_2 emissions in manufacturing than traditional materials.

Has the product been tested?

Yes, SuperSleeper Super100TM has been independently tested by a NATA-approved laboratory and Queensland University of Technology.

Is the product better than other products on the market?

SuperSleeper Super[100TM] offers a durable, sustainable, and cost-effective solution for retaining walls. It is specifically designed to withstand long-term deflection, making it resistant to sagging and deterioration.

Can the product be used to retain soil heights over 1 m high?

Yes, SuperSleeper has produced TDGs for engineers and contractors to utilise in constructing walls exceeding 1 m in height.

Does SuperSleeper provide a Product Warranty?

SuperSleeper provides a 35-year warranty for the Super[100TM] products.

Do you provide engineering certification?

SuperSleeper does not provide engineering services for retaining walls. However, we have collaborated with experienced professional engineers who can handle our products' engineering design, certification, and construction certificate. For more information and to get in touch with these professionals, please send an email to info@supersleeper.com.au.

Does SuperSleeper provide a regional state certificate for its products, such as Form 15 (QLD)?

Yes, SuperSleeper provides state documents that reference the SuperSleeper TDG, which includes information, engineering details, and references to Australian Standards.

APPENDIX

SUPERSLEEPER SAFETY DATA SHEET (SDS)

Product and Company Identification

Product Name	Super™100
Product Type	SuperSleeper Product
Manufacturer	SuperSleeper ABN 16 650 699 675
Telephone No	+61 7 3074 9476

Hazards Identification

GHS Classification	Not applicable	Non-hazardous
GHS Signal Word GHS Pictograms	Not applicable	Non-hazardous
Hazard Statement	Not applicable	Non-hazardous
Precautionary Statement	Combustible dust concentrations may form in the air if small particles are generated during processing, handling, or other activities.	

Classification

This product meets the definition of “article” under 29 CFR 1910.1200(c). An article is defined as a manufactured item:

I. Which is formed to a specific shape or design during its manufacture,

II. which has end function(s) dependent in whole or in part upon its shape or design during end use; and

III. which, under normal conditions of use, does not release more than minimal quantities of hazardous chemicals and does not pose a physical hazard or health risk.

If you do not process the SuperSleeper products in a manner that will create enough combustible dust to create a hazard, this safety data may not apply.

Hazard Statement

This product has the potential to generate combustible dust and particulate matter during drilling, grinding, cutting, or sanding operations. Additionally, it can lead to an allergic skin reaction or eye irritation.

Precautionary Statement

Take necessary precautions to prevent inhalation of dust, fumes, gases, mist, vapours, or sprays. Additionally, wear protective gloves, appropriate clothing, eye protection, and facial protection.

Potential Acute Health Effects:

- **Inhalation:** Nuisance dust from machining may cause respiratory tract irritation.
- **Eyes:** Nuisance dust from machining may cause eye irritation.
- **Skin Contact:** No effects expected under normal use. Nuisance dust from machining may cause irritation.
- **Ingestion:** Unlikely under normal use.

Composition / Information on Ingredients

SuperSleeper products are composed of a mixture of resin, inorganic fillers, pigments, processing additives, and fibreglass reinforcement. In the manufacturing process, this mixture undergoes curing and hardening, transforming it into a solid, stable material. Proper handling, in adherence to sound industrial hygiene practices, ensures that this material is non-hazardous.

First Aid Measures

Normal usage should not pose a substantial health risk. However, dust particles generated during processing may result in irritation.

- **Eyes:** In the event of eye contact, do not rub your eyes. Instead, hold the eyelid(s) open and rinse with lukewarm, gently flowing water for at least 5 minutes or until the particle or dust is completely removed. If necessary, seek immediate medical attention.
- **Skin:** Should skin contact occur, thoroughly cleanse the affected area with soap and water.
- **Ingestion:** Ingestion of the substance is unlikely during regular use.
- **Inhalation:** If exposed to excessive levels of dust, promptly move to an area with fresh air and seek medical assistance if you experience coughing or develop other symptoms.

Fire Fighting Measures

- **Extinguishing Media:** Water fog, dry chemical, carbon dioxide, or foam.
- **Explosion Hazard:** Maintaining a clean work environment by effectively managing dust generated from cutting, grinding, or sanding activities significantly enhances workplace safety, thereby reducing the risk of potential surges.
- **Fire Fighting Procedures:** In the event of a fire, be prepared for the generation of irritating and/or toxic smoke. Wear full firefighting gear with proper respiratory protection.

Accidental Release Measures

Prevent the generation of dust during processing. Ensure that dust accumulation is avoided, as it may result in the formation of an explosive mixture when concentrations reach excessive levels.

Handling and Storage

General Procedures: Avoid contact with eyes, skin, and clothing. Wear proper gloves when handling.

Handling: Refer to NFPA 654 for additional guidance on the safe handling of combustible dust.

Exposure Controls / Personal Protection

Chemical Component	OSHA PELs (Permissible Exposure Limits for the Workplace)	ACGIH TLV's (Threshold Limit Values)
Particulate dust	TWA: 15.0 mg/m3 (total dust)	TWA: 5.0 mg/m3 (inhalable fraction)
Particulate dust	TWA: 5.0 mg/m3 (respirable fraction)	TWA: 1 fiber/cm3 (respirable fraction)

- **General Protective Measures:** Do not inhale dust.
- **Eye/Face Protection:** Wear safety goggles when processing, cutting, grinding, etc.
- **Protective Clothing:** Wear protective clothing to minimise the potential for skin contact with dust.
- **Irritation:** May occur from exposure to dust.
- **Respiratory Protection:** If respirable fibres or dust are generated, use HEPA respiratory protection. Dust may cause irritation of the mucus membranes and respiratory tract.

Physical and Chemical Properties

- **Physical State:** Solid
- **Odour:** Mild, characteristic odour
- **Colour:** Various
- **Solubility in Water:** Insoluble

Stability and Reactivity

- **Stable:** Yes, under normal operations.
- **Conditions to Avoid:** Flames with combustible dust.
- **Hazardous Decomposition Products:** May form carbon dioxide, carbon monoxide, and toxic fumes when burned.

Toxicological Information

No toxicological data is available for this product.

Ecological Information

No ecological data is available for this product.

Disposal Considerations

In its original state, this product poses no hazards. Dispose of it in landfills approved for industrial use and refer to local regulations for appropriate disposal procedures.

Transport Information

This product is not regulated as dangerous or hazardous goods for shipping.

Shipping Symbols/Placards: Not Applicable.

Regulatory Information

NFPA & HMIS Rating: Health: 0, Flammability: 1, Reactivity: 0

OSHA (29 CFR 1910.1200): See Section II of Material Safety Data Sheets (MSDS).

CERCLA RQ: This product contains the following chemical(s) which have reportable quantities:

None.

SARA 311/312: Immediate (Acute) Health Hazard: No

Delayed (Chronic) Health Hazard: No

Fire Hazard: No

Reactive Hazard: No

Sudden Release of Pressure Hazard: No

SARA 313: This product does not contain chemical(s) in concentrations, which should require reporting under SARA 313.

Other Information

Prepared By: SuperSleeper

Issue Date: November 10, 2023

Disclaimer: The information and recommendations presented in this section are deemed accurate as of the date of preparation. SuperSleeper composite material does not make any direct or indirect representations or warranties regarding the accuracy or completeness of this information. Furthermore, the company does not assume any responsibility to notify you of any subsequent modifications or corrections to this document. Given that the conditions and methods of handling, storage, use, cutting, grinding, disposal, or other applications of the product are beyond our control, SuperSleeper composite material disclaims all liability arising from the use of this product or the information provided herein.

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WARRANTY INFO:

https://supersleepers.com.au/wp-content/uploads/2023/09/SuperSleeper-Product-Warranty-Rev-0.pdf