SISCo-FC™ SYSTEM

CAPABILITIES DOCUMENT FOR PEDESTRIAN STRUCTURES

V3.3

StructuralComp™

FIBRE REINFORCED PLASTIC COMPOSITE

RECYCLED WOOD PLASTIC COMPOSITE

CoreSpan™

FIBRE REINFORCED/WOOD PLASTIC MULTI COMPOSITE

Contents

Introduction

SIS is a unique organisation focused on manufacturing and distributing sustainable and recycled products for diversified clients around the world. From recycled plastic, recycled wood plastic composites (WPC), fibreglass reinforced plastic composites (FRP) and recycled rubber through to co-extruded multi-composites and OEM manufacturing, SIS are market leaders in delivering sustainable products to customers in Civil Infrastructure, Building & Construction, Oil & Gas, Mining, Aviation, Aquaculture, Marine & Ports, Transport & Logistics and Agriculture.

Drawing on a strategic distribution capability with offices in Adelaide, Melbourne, Sydney, Brisbane, Shanghai, Shenzhen, Hong Kong and Los Angeles, SIS has manufacturing facilities in Australia, the People's Republic of China and North America. Our company is financially strong, total quality oriented, technically advanced, and customer focused. We specialise in the development and manufacture of high quality sustainable products. We utilise a holistic project management approach to ensure the best results and measured success of each project. We understand the importance of product and project planning, consultation, analysis, management, communication and support.

We have an agile business environment and utilise a global team of highly experienced developers, manufacturing facilities, builders and support crew who can best meet our client's requirements under any given circumstances. Our strategy is founded on diversification – by product, geography and market. To succeed, we have in place a workforce that reflects our values and the communities in which we operate. We recruit from our host communities, to attract high calibre people who are committed to the success of our organisation and thrive on working in high performing teams. We are committed to developing the skills and capability of our people and believe this, underpinned by our tier one resource base, is what differentiates us from our competitors.

Sustainable infrastructure is not just about new infrastructure; it is about rehabilitation, reuse or the optimisation of existing infrastructure, which is consistent with the principles of sustainability and sustainable product development, whether it be from civil infrastructure to mining sectors. This encompasses infrastructure renewal, long-term economic analysis of infrastructure, energy use and reduced infrastructure costs, the protection of existing infrastructure from environmental degradation, material selection for sustainability, quality, durability and energy conservation, minimising waste and materials, the redesign of infrastructure in light of climate change and the remediation of environmentally damaged areas of our world. Clearly, sustainable infrastructure will lead to improvements to mankind through better socio-economics. Responsible design needs to balance social, economic and environmental issues.

SIS aims to set a responsible standard of sustainable product design and manufacture for our diverse client base in both the short and the long term. We all have a significant impact on the world around us and each of us should play a part in protecting future generations. Designers, engineers and planners have a big responsibility to set standards of product design that benefit the environment and the people who live in it. SIS's aspiration is that ultimately, talking about sustainability will become superfluous, because it will be the expected.

Contact Us

HEAD OFFICE

ADELAIDE: 7-9 Streiff Road Wingfield, SA 5013
AUSTRALIA
PH: 1300 261 074
FAX: 1300 081 075
EMAIL: service@sisau.com.au
WEB: www.sisau.com.au

AUSTRALIAN NATIONAL DISTRIBUTION CENTRES

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SYDNEY

17 Jumal Place Smithfield
NSW 2164
AUSTRALIA

MELBOURNE

135 Boundary Road Laverton North
VIC 3026
AUSTRALIA

BRISBANE

1094 Lytton Road Murarrie
QLD 4172
AUSTRALIA

INTERNATIONAL OFFICES

HONG KONG

Room 102, 1st Floor The Centre Mark 287 – 299 Queen's Rd
Central Hong Kong
hongkong@sisau.com.au

SHANGHAI

RM 1001 Hua Sheng Building No. 398 Han Kou Rd 200001
Shanghai People's Republic of China
shanghai@sisau.com.au

SHENZHEN

27-3, 27th Floor
Shun Hing Square Di Wang Commercial Centre Lu Wu District
Shenzhen People's Republic of China
shenzhen@sisau.com.au

LOS ANGELES

Suite 1355230 Pacific Concourse Dr. Los Angeles CA 90045
United States of America
northamerica@sisau.com.au

Manufacturing



Products designed, manufactured and supplied by SIS embody state of the art technology and are engineered by our teams to deliver enhanced performance and sustainably effective operation for customers worldwide. All our products are manufactured to the highest industry standards, following strict quality assurance guidelines. With many employees dedicated to production, quality product and technical expertise is ensured at all times. Excellent long term relationships with our key suppliers of raw materials and components provide confidence in material quality as well as sustainable and efficient manufacturing and supply chain processes.

The close relationship with our research and development division ensures that SIS manufacturing teams can react quickly and professionally to customer needs. SIS has built a reputation based on excellent customer service, high quality manufacturing and on providing the right solution in sustainable product design and manufacturing. Continuous improvement of equipment design, materials and manufacturing technology ensures SIS maintains its capability of offering clients the latest and most commercially viable sustainable products available. SIS also works with clients to develop specific solutions to meet their unique needs through the application of research and development efforts in a partnering relationship.

We manufacture and supply products from materials that include:

- Recycled Plastic
- Recycled Plastic Panel
- Fibreglass Reinforced Plastic
- Recycled Wood Plastic Composite
- Recycled Rubber
- Aluminium / Recycled Plastic Composite

With a global network of offices and manufacturing facilities, along with projects in Africa, the Middle East, Asia, Australia and the Pacific Rim, SIS can be trusted to provide easy, efficient and seamless supply to almost all places on earth.

SISCo-FC™ Pedestrian Structures - General



SISCo-FC™ boardwalks, bridges and viewing platforms are of simple design and / or modern modulated StructuralComp™ Fibre Reinforced Plastic (FRP) and Recycled Wood Plastic Composite (WPC) construction. The team at SIS was responsible for the design, engineering and supply of Australia's first boardwalk and footbridge constructed entirely of recycled and reclaimed materials – not including fixings. Following on from this, SIS has continued to innovate when it comes to construction materials.

Our StructuralComp™ FRP, WPC and CoreSpan™ FRP WPC Multi Composite construction materials are manufactured to the highest worldwide standards using only the very latest technologies. SIS also uses only the highest grade resins and reinforcements ensuring the stakeholder a design life in excess of 75 years on any one of our structures with minimal maintenance throughout this period. This combined with patented construction methodology using only composite fixings and a world first manufacturing technique of combining StructuralComp™ FRP and WPC makes SIS a world leader in the design, construction and installation of FRP / WPC pedestrian structures. For larger free span bridges, SIS uses the most advanced composite fibre members available in the word today. These EXTREN DWB® hybrid and all-glass material configurations introduce carbon fibre to beam members, allowing clear spans never thought possible for large scale clear span bridges. (See annexure 1) Given this range of world class sustainable materials, we use the composite material that best suits the structures component. For example – we don't have to use one material for the entire structure. StructuralComp™ FRP is traditionally used for piles, bearers and joists (if required) given their high strength to weight ratio and WPC for decking and any handrail system requirements. SIS's innovative fibre composite brackets and fixings complete any structure.

All brackets are manufactured from super strength StructuralComp™ FRP, making them corrosion resistant, light weight and cost effective and are delivered to site pre drilled, making installation easier and therefore more cost effective. Another real benefit to high strength light weight composites is the ability



to be installed via helicopter. SIS's clients are using this method more and more due to its cost effectiveness and short installation times.

SIS stands by to assist in any way any stakeholder, engineer or designer when planning a SISCo-FC™ pedestrian structure project.

In our experience, the majority of pedestrian structures are installed not in sand or water, but in different and varying types of earth. The increasing awareness of human impact on our environment means boardwalks are being built in areas such as marshlands, riverbanks, mangroves and sand dunes in an effort to minimise the impact. These sites by their very nature are sensitive and construction methods need to do minimal damage during the works.

A structures ground conditions can often consist of loose silt peaty soils which have limited end bearing (load) capacity at shallow depths, this combined with corrosion protection are primary design issues for us. Except where cantilevered designs are incorporated design dead loads are generally low. Allowances for live loads vary depending on the intended use. Structure locations can also be steep, muddy or wet. All these require special installation approaches to ensure the area is not disturbed beyond a specified level. SIS's versatility and the numerous installation options allow our structures to be installed at difficult sites such as steep gradients and waterways. Consideration to the type of interface connection between the fragile environment and structure is an important consideration when assessing suitability and costs. Most SIS structures have a pier element which can be incorporated in the overall design to provide quick and cost effective methods of construction. Where designers require a different look we provide for purpose-designed connecting head bracket or plates.

When encountering poor soil conditions on a site it may be necessary to transfer the building loads to deeper more stable soils. Determining the most effective and economical solution to this problem will generally involve an investigation of the soil conditions which is typically done with geotechnical assessment. This assessment is performed to obtain data that provides the soil type, the organic layers and depth to bedrock; it can also help determine the proper depth for installing piles based on the information discovered within the geo tech report. Once the soil conditions and load requirements are known, SIS will design a structure based on the area sensitivities, client outcome requirements and also the structure and bearing strength of the soil.



SIS is head quartered in Australia, a continent surrounded by ocean meaning that so many of the projects undertaken by us require skill and expertise when designing and installing pedestrian structures in water. SIS's foundation is built on the design, construction and installation of superior sustainable materials. These materials second only to their environmental credentials will outlast and outperform the majority of alternative construction materials meaning that our composite materials are perfect for harsh marine environments. This then leaves the challenge of installation.

In general, three types of foundations are used to support marine structures: gravity-based, monopile and jacket or template structures. Driven piles continue to be the first choice for both ourselves and our clients and dominate the American and European marine structure market. Pile sizes for standard pedestrian structures, ranging from 125mm to 250mm in diameter, are driven routinely for SIS structures to depths of 8 meters or greater in a variety of geotechnical settings.

However, there are many situations where piles cannot be driven to full penetration without drilling-and-driving techniques. Pile-driving difficulties can occur due to hammers performing poorly, soil conditions leading to harder driving than expected, or encountering rock layers or boulders. If stiff clays are encountered during installation, bored piles are preferred. For different types of structures, SIS uses clever design to provide both the public and private sectors with sustainable, cost effective solutions in Australia and beyond. Our footbridges for example can be supplied in kit form - PAMS (Pre-Assembled Modular Systems) and we offer our clients sustainable materials right down to green star rated concrete and recycled rubber pads that separate the structure and abutment. Clever and innovative design also allows our structures to withstand greater than nominal flood loads. Components such as hand rails can be simply and cost effectively added to any SIS structure as per client requirements and relative Australian Standards and building codes that the structure is being built to.

SISCo-FC™ Systems Structure Design

Design Standard

All bridges and culverts are designed in accordance with the current edition of the Australian Bridge Design Code (SAAHB77). All bridges are designed for loading in accordance with the appropriate part(s) of the relevant Australian Standard. The client shall determine serviceability criteria that are not specifically listed in the mandatory performance criteria that form part of the SIS quoting documents. All structures shall be designed and constructed in accordance with relevant sections of the current edition of the codes and standards as published by Standards Australia and the Building Code of Australia. SIS designers shall maintain knowledge of all amendments and upgrades to standards and work shall conform to the standard current at the time of commission.

Design Responsibility

The SIS designer will check all stages of design for accuracy, completeness and compliance with the Brief and relevant standards. A Design Summary Sheet shall be prepared for all structures on completion of the design, and shall be included in the set of design drawings. The Design Summary Sheet is an important feature of the design as it contains a summary of all major features of the design. It is used for future checking of the structure for heavy load movements, structural alterations or if there are any major maintenance problems. The actual contents will vary depending on the size and complexity of the structure.

The main items to include on the Design Summary Sheet are:

- Details of the span configuration;
- The design cross sections used in the analysis at critical positions – e.g. support and mid-span;
- Details of the reinforcement and / or pre-stress and the section capacities at the critical sections;
- The serviceability design moments and resulting stresses at the critical sections;
- Live Load Distribution Factors for different loadings;
- Design Live Load;
- The available live load capacity at the critical sections, for use in checking heavy load movements;
- Foundation information, i.e. design bearing pressures for spread footings and design pile loads for piled foundations;

Sustainable Design Principles

SIS is committed to sustainable development and continuous improvement in environmental protection. We aim to conserve and reduce resources where possible and ensure we comply with all relevant legislation and compliance. The intention of sustainable design is to "eliminate negative environmental impact completely through skilful, sensitive design". Manifestations of sustainable design require no non-renewable resources, impact the environment minimally, and connect people with the natural environment.

Beyond the "elimination of negative environmental impact", sustainable design must create projects that are meaningful innovations that can shift behaviour. A dynamic balance between economy and society, intended to generate long-term relationships between user and object/service and finally to be respectful and mindful of the environmental and social differences.

While the practical application varies among disciplines, SIS's common principles are as follows:

- Low-impact materials: use sustainably produced or recycled materials which require little energy to process;
- Energy efficiency: use manufacturing processes and produce products which require less energy;
- Emotionally Durable Design: reducing consumption and waste of resources by increasing the durability of relationships between people and products, through design;
- Design for reuse and recycling: Products, processes, and systems should be designed for performance in a commercial 'afterlife';
- Design impact measures: complete total carbon footprint and life-cycle assessment for any resource used to give quick and accurate whole-earth estimate of impacts;
- Sustainable design standards: vigorously adhere to new methods emerging from the rapid development of what has become known as 'sustainability science' promoted by a wide variety of educational and governmental institutions;
- Biomimicry: redesigning industrial systems on biological lines ... enabling the constant reuse of materials in continuous closed cycles;
- Robust eco-design: robust design principles are always applied to any and all designs.

Pedestrian and Cycle Barriers on Bridges

SIS's design team ensures that barriers at paths accessible to pedestrians shall be fitted with protective in-fills to ensure the safety of children who may use the path. The balusters of these shall be such as to prevent children achieving access through them or getting their heads stuck. The minimum acceptable level of protection shall utilise vertical bars with maximum clear spacing of 110mm. Such bars shall be substantial enough to prevent damage by vandals. The use of horizontal elements, which may encourage climbing, shall not be permitted unless expressly asked for by the client. Barriers at paths accessible to cyclists shall be constructed in accordance with the requirements of 'Latest updates of AUSTROADS Bicycle Design code' with the inclusion or horizontal protective rail and with the standard height of 1400mm.

Boardwalks and jetties are special structures whose main purpose, in general, is recreational. They are located along Australia's waterways and as such are subject to a marine environment with its attendant consequences on maintenance and safety considerations. The presence of the water body is at once a hazard and an opportunity for access to the water. Access should therefore be convenient and safe.

Hand Rail Options

In most cases a pedestrian hand rail or kick rail system may be needed along the edge of any SISCo-FC™ structure to prevent users from falling off. The need for a hand rail is usually determined / governed by the following;

1. Relevant Australian Standards
2. Relevant Building Codes
3. Height from Ground Level
4. Angle of Structure
5. The Structures Intended Use

With the SISCo-FC™ system, hand rail detail is often left up to the stake holder to decide on design. SIS has over 13 different offerings when hand rail design is to be considered. Through smart design, all SISCo-FC™ CoreSpan™ hand rail systems are robust enough with surpass relevant standards, but are also designed so as to not have to penetrate the earth for any vertical supports. During floods, piles can catch debris and therefore must be kept to a minimum.

Tops of exposed CoreSpan™ posts are designed to allow water not to pool. For aesthetic and safety reasons, the posts are designed to never extend above the top of the handrail.

Bracing

Bracing of SISCo-FC™ system structures is only designed in once all other factors have been considered. Typically, boardwalk structures are braced from pile to pile (width ways) in a cross fashion at every set of piles. Bracing between piles (direction of travel) occurs typically every 8-10 bays.

Bracing is typically achieved by using StructuralComp™ 75mm x 10mm plate.

Anti-Crush

The use of hollow square sections as piles means that the hollow sections must be protected from crushing due to the over tightening of fixings. SIS achieves this in a very easy and cost effective way by simply installing anti-crush tubes over the bolt prior to the insertion through the pile. The pre-drilled holes in the pile accommodates the tube and the tubes are supplied at an exact length which allows for the correct amount of compression on the connection without crushing the square section.

Safety

SIS takes public open space safety seriously, and although sometimes not necessary, these additional steps can be taken in to consideration in the design phase and Safety on SISCo-FC™ Systems can be enhanced. Additional safety items may include:

- Appropriate fencing and or hand railing particularly in restricted passages or narrow sections or where the drop to the water or the depth of water exceeds 1.00m;
- Use of even, non-slip surfaces generally but especially on slopes and adjacent to unfenced edges;
- Appropriate lighting;
- Avoidance of details that would entrap a person under the structure;
- Use of appropriate warning signs that will easily be seen in the context;
- The provision of safety equipment, such as life rings with appropriate signage being provided and the equipment located near the edge;
- The provision of safety ladders where the depth of the water at the edge exceeds 1.00m with the spacing of ladders generally at 100m, (in most cases, this shall be determined in consultation with the authority with reference to the intensity of use;

Further Design Considerations

For bridges over roads and railways, SIS applies a minimum grade of 0.3% to provide for deck drainage. Bridges over streams can be level, irrespective of the length. The 'Design Life' of boardwalks and jetties shall, unless otherwise specified, be a minimum 50 years.

Maintenance Information

SIS designers shall prepare maintenance notes for any structure that contains structural components that may require cyclical maintenance.

Regular maintenance of marine structures is especially vital to minimise whole of life costs and risk and to maximise asset life:

- A regime of regular expert inspections at bi-yearly intervals is recommended for all composite structures;
- Defects should be followed up and repaired in a timely manner.

Installation Tolerances

The SISCo-FC™ System has been designed to accommodate installation tolerances in 3 key directions. These are;

1. Pile Installation:
2. Bearer Horizontal Height:
3. Joist Connection:

PILE INSTALLATION TOLLERANCES	
Pile (width of structure – the tolerance for error when installing piles)	25mm
Pile (length/direction of travel – the tolerance for error when installing piles)	40mm
Pile (height – allowance for adding plates between bearer and bracket to level bearer)	30mm

Fig. 1

StructuralComp™ FRP DIMENSIONAL TOLERANCES

ITEM	TOLERANCE (D&L=M)	
Thickness	T1 (open profiles)	T2 (closed profiles)
	Thickness<2mm,±0.15mm	Thickness<3mm, ±0.3mm
	Thickness 2mm~5mm, ±0.2mm	
	Thickness 5mm~10mm; ±0.35mm	Thickeness≥3mm,≤±10%
	Thickness≥10mm;±0.45mm	
Flatness in Transverse Direction	F<0.008*Bmm	
Profile Height and Width of Flange	B and H:±0.5% with minimum±0.2mm and maximum±0.75mm	
Angle	±1.5°	
Straightness	B OR H<50mm, D<0.0015×L²	
	B OR H≥50mm,D<0.001×L²	
	B OR H≥100mm, D<0.0005×L²	
Twist	thickness<5mm, V<1.5°/m	
	thickness≥5mm,V<1.0°/m	
Length	≤2000mm,-0 +2mm	
	>2000mm-3500mm,-0 +1‰	
	>3500mm,-0 +6.5	

Fig. 2

Engineering / Spans - StructuralComp™ FRP / WPC

There is currently no Australian Standard for the use of recycled plastic, WPC material or testing of FRP as structural elements. Companies around the world have had the WPC and FRP structural engineering properties established by a series of laboratory testing.

SIS have commissioned NATA accredited testing to undertake a number of tests using WPC and FRP samples of various sizes, in order to determine the relevant engineering properties of the material for use in design calculations. The testing has generally been undertaken in accordance with the ASTM (American Society for Testing and Materials) International standard test methods for testing of plastics. ASTM International was formally known as ASTM. The European standard EN 13706:2002 Reinforced Plastics Composites-Specifications for Pultruded Profiles is commonly used for testing FRP material. The testing has established such values as bending, compressive and tensile strengths, Young's modulus of elasticity, screw pullout capacities and thermal expansion coefficient. Tensile properties from FRP tests can be obtained as per AS 1145:2001 Determination of tensile properties of plastic materials, which is based on ISO 527.

For ultimate and serviceability design loading of structures, AS1170:2002 has been adopted. For boardwalk structures considered to be 'bridge' structures, AS5100.2 Bridge Design – Design Loads has been used for the appropriate ultimate design factors.

In the absence of specific Australian Standards for the design of WPC material as structural elements, our engineers have opted to follow the ultimate load formulae in AS1720.1 Timber Structures, for bending, compression, deflection and connection design using the material properties determined during testing. Due to the variability of timber as a natural product, the reduction factors built into the strength and deflection calculations in AS1720.1 provides a conservative design result for using the WPC material.

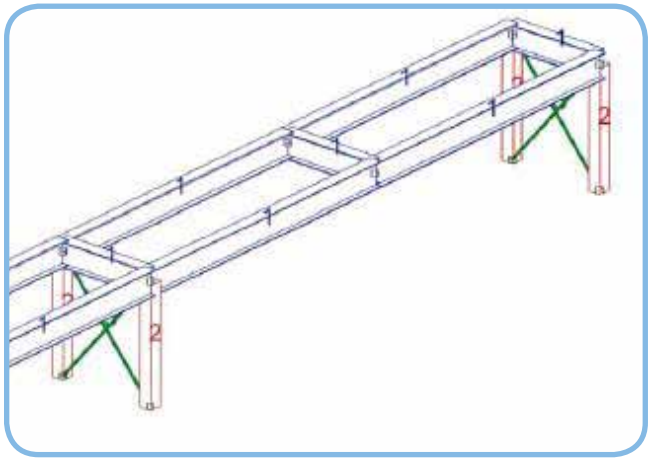


Fig. 3 - Span / Deflection Modelling. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

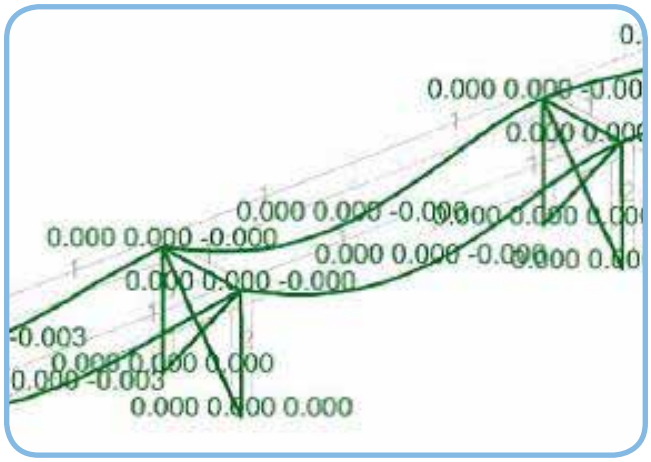


Fig. 4 - Span / Deflection Modelling. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

TYPICAL SPANS - StructuralComp™ FRP / CoreSpan™ WPC FRP

There are many permutations based on the use ≤5800mm or ≤11600mm joist members and the number of supports. When designing ultimate spans, SIS bases calculations on these sizes based on 20ft or 40ft shipping and transport. Deflection governs, so when designing the StructuralComp™ members, we have overdesigned the thickness of the beam to ensure there is less chance of brittle failure before deflection is notable.

Spans are based on the "Fixed Walkways Code" AS1657, which specifies a live load (load of people etc rather than self-weight) = 2.5 kPa (250 kg/sqm) and also the "Loadings Code As1170.1" which suggests a much higher Live Load of 4.0 kPa (400kg/sqm). A 2000mm wide structure could see crowds and in theory get to 4kPa, but it is unlikely any structure 1500mm and under would.

Also, Table 3.1 AS/NZS 1170.1:2002 has been referred to, namely C3 – areas without obstacles for moving people, not subject to wheeled vehicles – 4Kpa uniformly distributed actions.

For span charts and notes relating to spans please refer to page 54. Full connection detail can be seen on pages 51 to 62.

TYPICAL COMPONENT QUANTITIES & MEMBER CUT LIST

(For Superstructure Only)

1000mm Wide x 100000mm / (approx) Long / 1000mm from GL / Live Load 4kPa / Point Load 2kN / Joist Members Not Supported with Joist Members ≤5800mm

SISCo-FC™ Component List			
Member	Member Length	Quantity	Total Meters
StructuralComp™ 120mm x 120mm x 8mm Pile	1800mm	58	104.4
StructuralComp™ 250mm x 125mm x 12mm Bearer	1000mm	29	29
StructuralComp™ 250mm x 125mm x 12mm Joist	3600mm	56	201.6
StructuralComp™ Pile to Bearer Bracket	n/a	58	n/a
StructuralComp™ Bearer to Joist Bracket	n/a	114	n/a

Fig. 5

1000mm Wide x 100000mm (approx) Long / 1000mm from GL / Live Load 4kPa / Point Load 2kN / Joist Members Supported with Joist Members ≤11600mm

SISCo-FC™ Component List			
Member	Member Length	Quantity	Total Meters
StructuralComp™ 120mm x 120mm x 8mm Pile	1800mm	46	82.8
StructuralComp™ 250mm x 125mm x 12mm Bearer	1000mm	23	23
StructuralComp™ 250mm x 125mm x 12mm Joist	9000mm	22	198
StructuralComp™ Pile to Bearer Bracket	n/a	46	n/a
StructuralComp™ Bearer to Joist Bracket	n/a	44	n/a

Fig. 6

2000mm Wide x 100000mm / (approx) Long / 1000mm from GL / Live Load 4kPa / Point Load 2kN / Joist Members Not Supported with Joist Members ≤5800mm

SISCo-FC™ Component List			
Member	Member Length	Quantity	Total Meters
StructuralComp™ 120mm x 120mm x 8mm Pile	1800mm	54	97.2
StructuralComp™ 250mm x 125mm x 12mm Bearer	2000mm	27	54
StructuralComp™ 250mm x 125mm x 12mm Joist	3800mm	78	296
StructuralComp™ Pile to Bearer Bracket	n/a	54	n/a
StructuralComp™ Bearer to Joist Bracket	n/a	162	n/a

Fig. 7

2000mm Wide x 100000mm (approx) Long / 1000mm from GL / Live Load 4kPa / Point Load 2kN / Joist Members Supported with Joist Members ≤11600mm

SISCo-FC™ Component List			
Member	Member Length	Quantity	Total Meters
StructuralComp™ 120mm x 120mm x 8mm Pile	1800mm	44	79.2
StructuralComp™ 250mm x 125mm x 12mm Bearer	2000mm	22	44
StructuralComp™ 250mm x 125mm x 12mm Joist	9600mm	30	288
StructuralComp™ Pile to Bearer Bracket	n/a	44	n/a
StructuralComp™ Bearer to Joist Bracket	n/a	60	n/a

Fig. 8

Plastics Engineered for Strength

Refer Annexure 2 for details on FRP testing

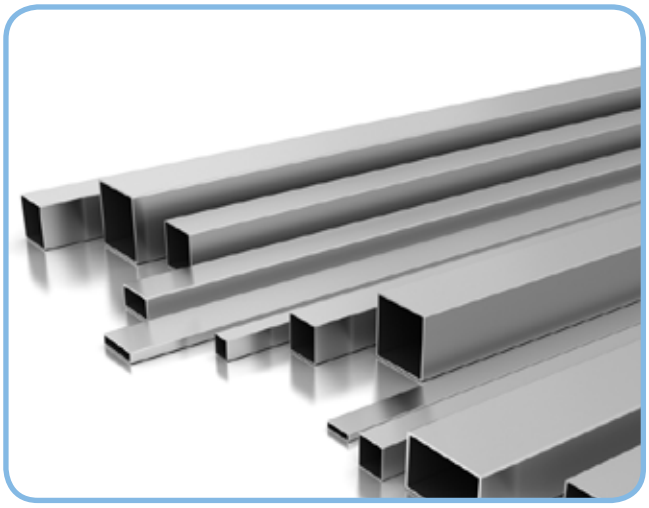
High strength plastics are usually composite plastics, meaning that they are made up of a base resin with the addition of various percentages of fiber. Some of the most common fibers are fiberglass or carbon. Many additives are sometimes mixed in with a plastic to improve its characteristics. For example, additives may cause a plastic to be UV resistant or fire retardant (UL 94 V-0). Some additives change the color of the material. Others lower a plastic´s coefficient of friction to make it suitable for use in bearing applications. While most plastics are thought of as electrical insulators, additives can also make them conductive. While all these additives are useful, the only way to achieve greater strength in plastics is to add fibers.

What does "strong" mean in the world of plastics? How are plastics evaluated for strength?

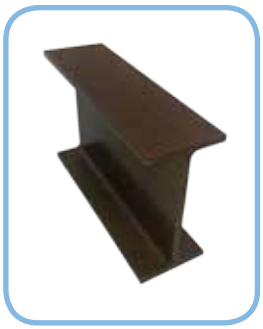
The strength of a material may be evaluated through the results of several strengh tests. ASTM International® is an international standards organization that develops and publishes voluntary consensus technical standards.* We will consider the results of tests described by their standards for ultimate tensile strength (UTS, tensile modulus (otherwise nown as "Young´s Modulus") and flexural strength.

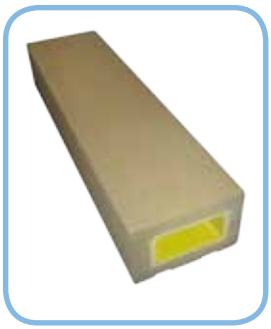
- **Tensile Strength or Ultimate Tensile Strength (UTS)** is the maximum stress a polymer can withstand without breaking while being pulled or stretched. ASTM D638
- **Tensile Modulus or Young´s Modulus** is a numerical constant that describes the elastic properties of a plastic under tension or compression from only one direction. It is a measure of stiffness. ASTM 638
- **Flexural Strength** is a material´s ability to resist deformation under load for materials that deform significantlly but do not break. Many plastics exhibit flexural strength. This number represents the load required to cause a given test sample to exhibit a 5% deformation ASTM D790
- **Izod Impact Strength (Notched)** is a single point test that measures the resistance of a material to impact. The resulting number represents the kinetic energy needed to initiate and cause the fracture of a given notched specimen of material. ASTM D256

*ISO and DIN standards are also used



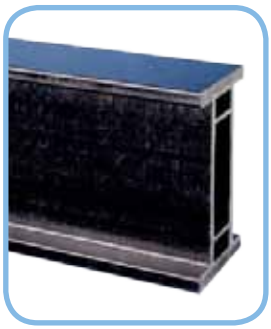
SISCo-FC™ Materials


Pultruded FRP


FRP Multi Composite


Wood Plastic Composite


Moulded FRP


EXTREN Carbon Hybrid

One of the many advantages that the SISCo-FC™ system has over other market offerings is that it is constructed entirely of composite materials. A quick summary of materials used for different components is as follows:

INDICATIVE COMPONENT MATERIALS & WEIGHTS		
Component	Component Material	Weight
Piles	StructuralComp™ FRP 120 x 120 x 8mm	6.8kg/m
250 Bearer & Joists	StructuralComp™ FRP 250 x 125 x 12mm	10.8kg/m
609 Bearer & Joists	StructuralComp™ 609 × 9.5 × 190 x 19.1mm	23.9kg/m
Large Span Joists (Clear Span Bridges)	EXTREN DWB® FRP 203mm x 152mm	16.6kg/m
Large Span Hybrid Joists (Clear Span Bridges)	EXTREN DWB® Carbon 914mm x 457mm	103kg/m
Handrail Vertical Supports	CoreSpan™ FRP / WPC 100 x 100	7.1kg/m
Handrail	CoreSpan™ FRP / WPC (Varies)	n/a
Pile to Bearer Bracket	StructuralComp™ FRP 280 x 120 x 10mm	1.3kg / unit
Bearer to Joist Bracket	StructuralComp™ FRP 165 x 172 x 12mm	1.9kg / unit
Bearer Level Adjustment Plate	StructuralComp™ FRP 280 x 120 x 5mm	0.3kg / unit
Handrail Vertical Support to Deck Connector Bracket	StructuralComp™ FRP 340 x 70 x 10mm	0.8kg/unit
Threaded Rod	StructuralComp™ FRP 25.4mm	n/a
Nut	StructuralComp™ FRP 25.4mm	0.3kg/unit
Large Span Decking	CoreSpan™ FRP / WPC (Varies)	n/a
Deck Fixing Screws	Torlon® Engineering Plastic (Varies)	n/a

Fig. 9

Material Description

StructuralComp™ FRP (Fibre Reinforced Plastic)

All SISCo-FC™ Pile, Bearer and Joist members are manufactured from FRP which is a combination of resin, reinforcements, additives and a surface veil. Only premium materials are used. Key components include;

- **Resin Type:** Premium Vinyl Ester;
- **Reinforcements:** Fiberglass Roving and E-Glass Stitched Mat 300g/m^2 – 750g/m^2;
- **Additives:** Colour pigments, UV inhibitors, Fire Retardant;
- **Surface veil:** 38g/m^2.

Roving

Roving is made up of fiberglass unidirectional filaments, which are manufactured in continuous rolls. Roving is always present in pultruded products comprising 50% to 70% of the total glass content. In addition to supplying the necessary strength to pull the profile, roving supplies the product with high tensile, flexural properties and is a big contributor to the overall section stiffness. Generally, fiberglass roving is used in pultrusion to achieve the required properties. In special structural applications where more stiffness is required, graphite roving can be used. Conversely, polyester roving may be used in applications where more flex is needed.

Mat

Continuous strand mat is the remainder of glass reinforcement used in the pultrusion process. Typically, it is 30%-50% of the total glass content. Unlike hand-laid-up or press-moulded processes that use short chopped fibres, the pultrusion process must have a multidirectional mat that has good pull strength to facilitate getting it to the die after it has been wet-out with the resin. This continuous strand mat is designed specifically for the pultrusion process and offers good wet-out characteristics, conformability to a variety of shapes, and good physical properties including the required pull strength. Generally, fiberglass continuous strand mat is used to obtain the desired transverse properties of the product. Whereas the roving ties the composite together in the longitudinal direction, the mat is responsible for tying the composite together in all directions, but mainly in the transverse direction. Although continuous strand mat is suitable for most applications, a variety of products such as woven roving, stitched roving, and woven fabrics can be used in custom applications to increase the desired transverse properties.

Surface Veil

Veils are used to enhance the surface of pultruded profiles. Most widely used today are synthetic veils. A veil is added to the outside of a profile just prior to entrance of the die. As a result, the finished profile has a resin-rich surface that aids in resistance to ultraviolet (UV) degradation and makes the profile more hand-friendly. Since the veil brings more resin to the surface and the resin is the ingredient that gives the corrosion resistance, adding the veil increases the corrosion resistance.

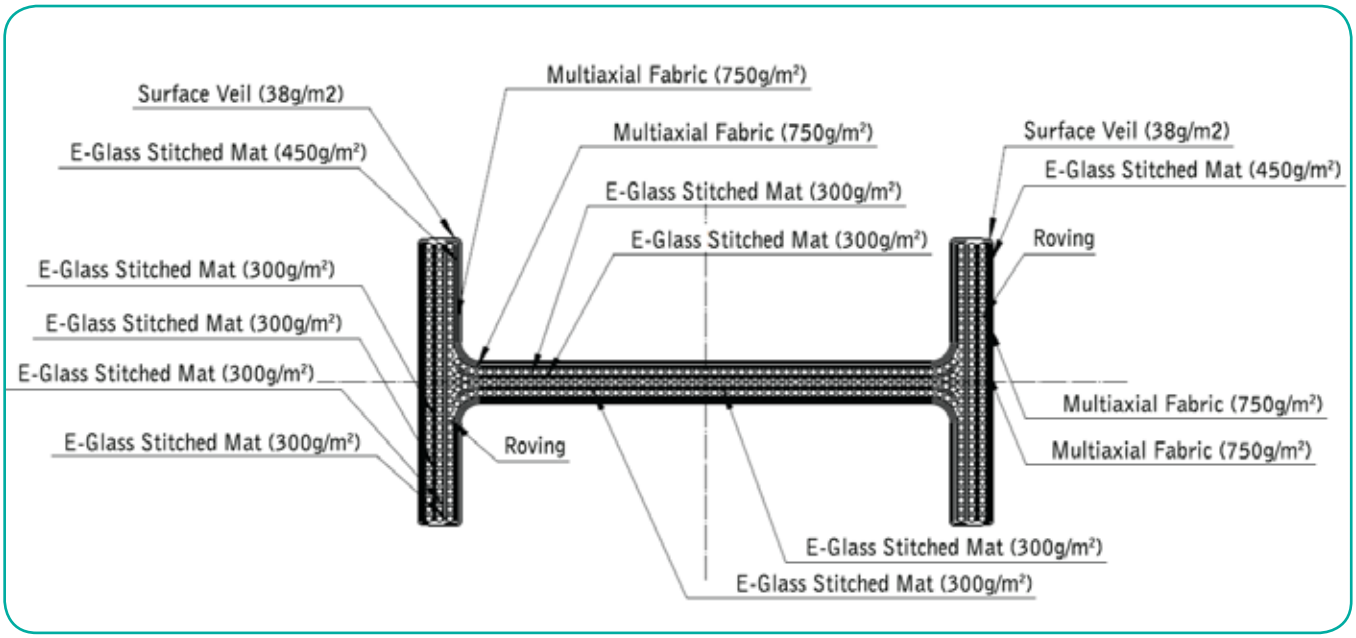


Fig. 10 - Lay Up of StructuralComp™ FRP Bearer and Joist Components. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

EXTREN DWB® (Double Web Beam)

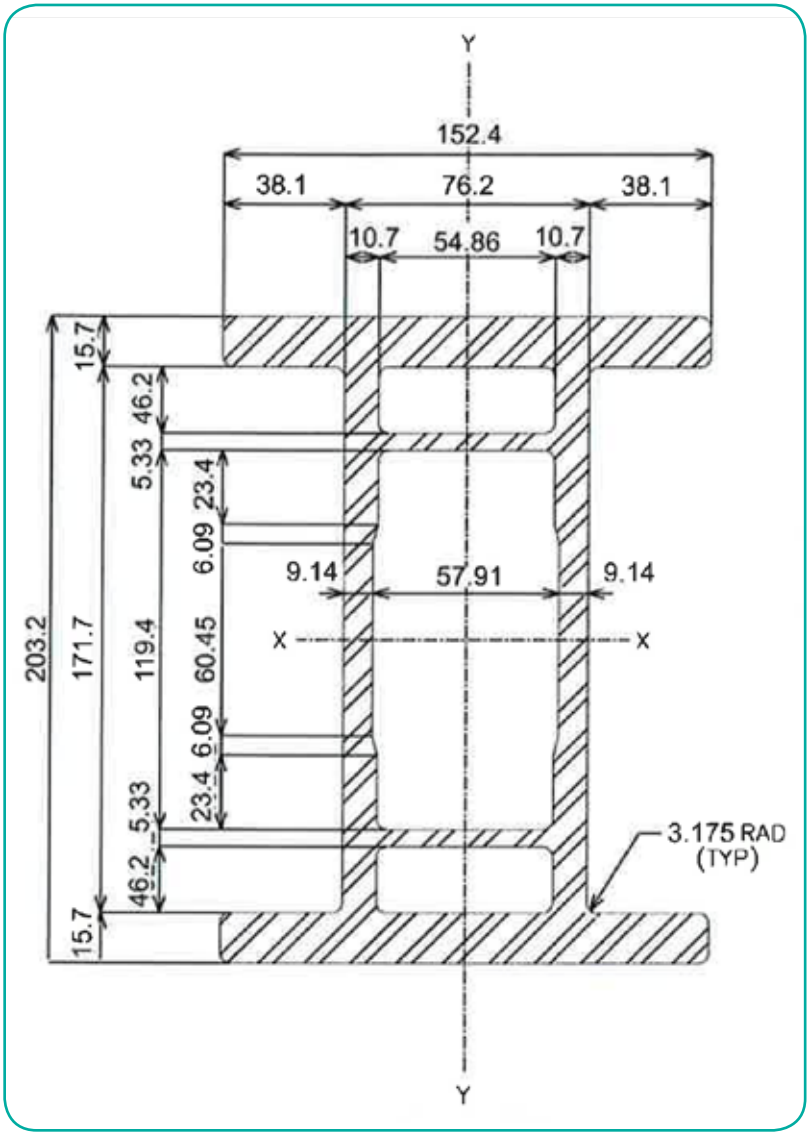
(Specified for Large Clear Span Structures)

The EXTREN DWB® (Double Web Beam) was developed with the assistance of the U.S. Department of Commerce's Advanced Technology Program (ATP). This involved a three year cooperative research and development program between Strongwell and the Advanced Technology Program.

The goal of Strongwell's ATP projects was to design, develop and produce an optimised fibre reinforced plastic (FRP) structural shape for use in heavy structures such as vehicular bridges and offshore drilling platforms. The program included the development of manufacturing processes and equipment to produce this product. The result of Strongwell's efforts is a double web beam with carbon fibre in the top and bottom flanges for increased stiffness. Additionally, the double web shape has significantly improved the lateral torsional stability of the beam. This increased stability is very significant and reduces the beam's need for lateral bracing.

SIS uses two different sizes, a 203mm x 152mm EXTREN DWB® and a 914mm x 457mm EXTREN DWB®. Both of these sizes have undergone extensive laboratory testing. The 203mm x 152mm EXTREN DWB® was installed on a short span bridge in Blacksburg, Virginia (USA), in June 1997. The 914mm x 457mm EXTREN DWB® was installed in a 11.58 metre clear span bridge on Route 601 over Dickey Creek in Sugar Grove, Virginia (USA) in September 2001.

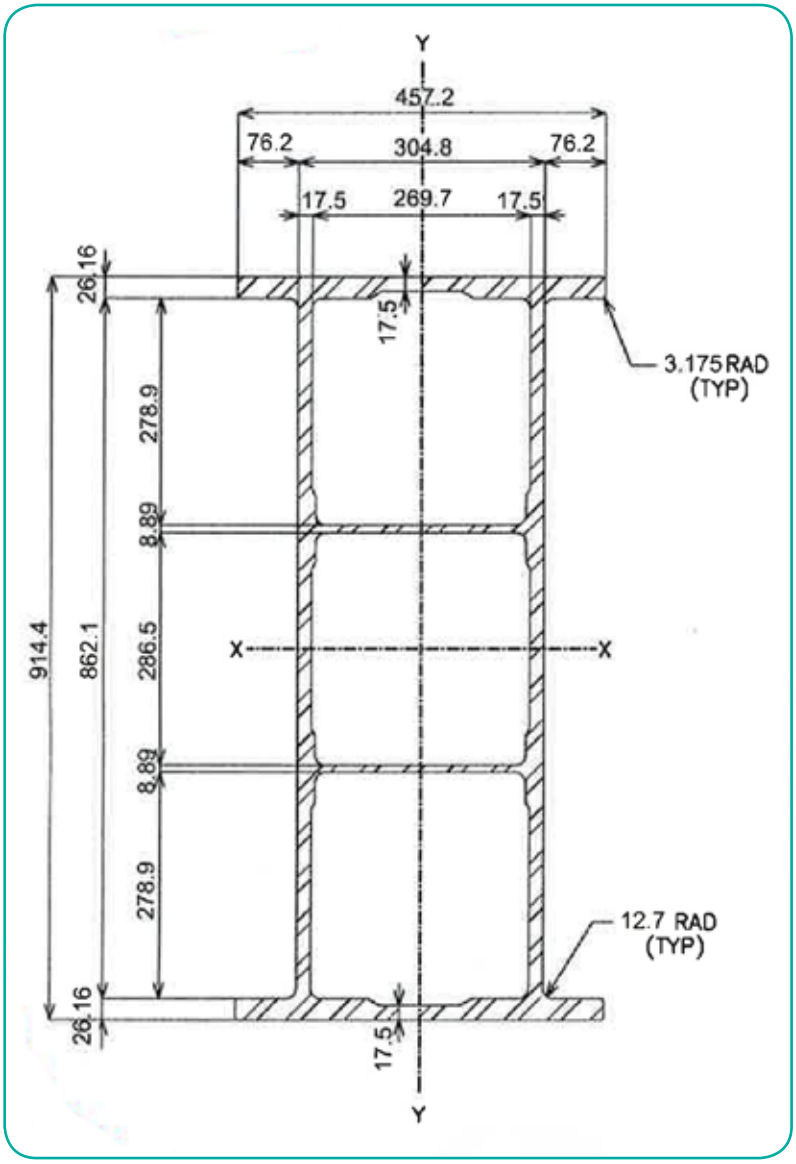
Nominal Section Properties and Dimensions (in mm) for the 203.2 mm DWB. Dimensions specified are nominal and apply for both the all-glass and hybrid forms of this beam.



NOMINAL SECTION PROPERTIES

I_{xx}	= 53,693,854 mm^4
S_{xx}	= 527,663 mm^3
r_{xx}	= 77.98 mm
A	= 8,839 mm^2
A_{2webs}	= 3,458 mm^2
$A_{2flanges}$	= 4800 mm^2
I_{yy}	= 13,236,159 mm^4
S_{yy}	= 173,703 mm^3
r_{yy}	= 38.1 mm
Weight	= 16.7 kg/m

Nominal Section Properties and Dimensions (in mm) for the 914.4 mm DWB.



NOMINAL SECTION PROPERTIES

I_{xx}	= 6.36 x 10^9 mm^4
S_{xx}	= 13,912,617 mm^3
r_{xx}	= 327.6 mm
A	= 58,839 mm^2
A_{2webs}	= 32,323 mm^2
$A_{2flanges}$	= 21,935 mm^2
I_{yy}	= 1.09 x 10^9 mm^4
S_{yy}	= 4,785,023 mm^3
r_{yy}	= 136.4 mm
Weight	= 104.2 kg/m

The EXTREN DWB® design data are the result of extensive testing and evaluation by two engineering departments of Virginia Tech – the Via Department of Civil & Environmental Engineering and the Department of Engineering Sciences and Mechanics. The availability of Virginia Tech's heavy structures laboratory and the recognised expertise of its engineering professors provided an independent third party evaluation of the EXTREN DWB®. Strongwell's mechanical testing laboratory has also created a database of coupon test properties for the EXTREN DWB® structural shape. This database enables Strongwell to compare the coupon properties of each manufactured lot of EXTREN DWB® shapes and to certify that each lot meets the performance characteristics and criteria identified in the design guide. Strongwell's certification of these properties provides structural engineers with the confidence that EXTREN DWB® structural shapes meet the performance requirements specified.

203mm x 152mm EXTREN DWB® - ALL-GLASS

The 203mm x 152mm EXTREN DWB®, all-glass beam, is a pultruded structural shape composed of four different types of E-glass reinforcements in a vinyl ester resin matrix. The all-glass laminate includes 0° longitudinal rovings, continuous strand mat, 0°/90° stitched fabric, and ±45° stitched fabric. The approximate fibre volume fraction is 55%. The DWB shape improves the apparent (or effective) modulus of elasticity and the stability of the structure under load versus traditional FRP WF or I shapes.

203mm x 152mm EXTREN DWB® - HYBRID BEAM

The 203mm x 152mm EXTREN DWB®, hybrid beam, is a pultruded structural shape composed of carbon fibre tows and four different types of glass reinforcements in a vinyl ester resin matrix. The 0° carbon tows replace some of the 0° glass rovings in the top and bottom flanges of the shape. The remainder of the laminate is identical to the all-glass beam. The carbon tows improve the apparent (or effective) modulus of elasticity at least 30% versus the all-glass beam. The approximate fibre volume is 55% (including glass and carbon).

914mm x 457mm EXTREN DWB® - HYBRID BEAM

The 914mm x 457mm EXTREN DWB® is only produced as a hybrid beam. It is a pultruded structural shape composed of carbon fibre tows in the top and bottom flanges and the same four types of E-glass reinforcements as the 914mm x 457mm in a vinyl ester resin matrix throughout the entire structural shape. The carbon tows improve the apparent (or effective) modulus of elasticity. The approximate fibre volume is 55% (including glass and carbon) and the shape weighs 104 kg's per metre. The 914mm x 457mm EXTREN DWB® was specifically designed for use in vehicular bridges.

CORESPAN™ Wood Plastic Composite / Fibre Reinforced Plastic Composite Multi Extrusion

The denomination 'wood-plastic composites', WPC, is used to designate materials or products made of one or more natural fibres or flours and a polymer or a mixture of polymers. SIS's choice of natural fibres and flours come from wood and

our polymers (recycled) are polypropylene (PP) and polyethylene (PE).

SIS's research and development into WPC ingredients, manufacturing processes and products is always ongoing, it is false to assume that it is just waste wood and a kind of polymer mixed together and pressed through an extrusion die or into the cavity of an injection mould. Our innovative, state of the art WPC compounds are well advanced. We have a large investment in intellectual property associated with wood conditioning, treatment, stabilization of various polymers as well as crucial additives and processing. Our composite formula's brings together the best qualities of wood and plastic to create a superior alternative to wood:

- Plastic shields the wood from moisture and insect damage, preventing rotting and splintering;
- Wood protects the plastic from UV damage while providing a natural, attractive look and feel.

The result is sustainable timber alternative products that require only periodic cleaning to remain sound for many years, therefore eliminating the need for sanding, staining or painting. It will not rot or deteriorate due to harsh weather or insects and is splinter-free and has excellent traction, even when wet. It contains no toxic chemicals or preservatives. WPC resists damage from moisture and sunlight, making it the natural choice for aquatic and marine environments.

FRP (Fibre Reinforced Plastic) FR-4/G10 – Threaded Rods

FR-4 is again a composite material made up of woven fiberglass cloth and an epoxy resin. This combination gives the laminate good strength to weight ratios. Typical physical and electrical properties of FR-4 are expressed by LW (length wise, wrap yarn direction), and CW (cross wise, fill yarn direction). LW and CW refer to fibre orientations that are perpendicular to each other.

StructuralComp™ FRP FR-4 plastic fasteners are flame resistant. Flame resistant means that the parts are self- extinguishing. With near zero water absorption, FR-4 plastic fasteners retain their high mechanical strength and electrical insulating qualities in both dry and humid condition

Torlon® (PAI)-Torlon® polyamide-imide (PAI) – Deck to Joist Fasteners

Torlon® is a high strength plastic with the highest strength and stiffness of any plastic up to 275°C (525°F). It has outstanding resistance to wear, creep, and chemicals, including strong acids and most organic chemicals, and is ideally suited for severe service environments.

Torlon is typically used to make aircraft hardware and fasteners, mechanical and structural components, transmission and power train components and is the chosen material for deck to joist fixings in the SISCo-FC™ System.

TYPICAL PROPERTIES OF FRP THREADED ROD / NUTS

StructuralComp™ threaded rod and nuts are manufactured using premium vinyl-ester resin containing UV inhibitors. The properties listed on the following page are the result of the ASTM test method indicated.

Connection Fixings Tensile Strength Property Comparison

Tensile Strength Property Comparison		
Material	Mpa	PSI
FR-4	310	44,960
PARA (50% glass-filled)	230	33,358
TPU (40% glass-filled)	186	29,977
Magnesium	225	32,633
Brass	250	36,259
Zinc Alloy	280	40,610
Aluminum (6061-0 Temper)	125	18,000
Steel	330	47,862

Fig. 11

Properties of StructuralComp™ FRP Threaded Rod

Properties ASTM Units Value	19.0mm	25.4mm
Ultimate Transverse Shear B-565 (Double Shear) - NM	59,600	106,750
Longitudinal Compressive Strength D-695 MPa	344	344
Flexural Strength D-790 MPa	482	482
Flexural Modulus D-790 GPa	17.2	17.2
Water Absorption (24 hr. immersion) D-570 - % Max	0.8	0.8
Longitudinal Coefficient of Thermal Expansion D-696 10-6 mm/mm/°C	11	11
Ultimate Thread Shear Using FRP Nut - NM	17,790	36,470
Ultimate Torque Strength fibreglass nut lubricated with SAE 10W30 motor oil - NM	67	149
Rod Weight - Kg/m	0.447	0.789
Nut Weight - Grams	27.2	63.6
Nut Dimensions – mm. (square) x mm. (thick)	31.5 x 20.8	41.4 x 27.9

Fig. 12

History of FRP in Construction

Fibre Reinforced Plastic (FRP) composites with fibres / fabrics bonded together with the help of organic polymers (resin system) are being referred to as materials of the 21st century because of many inherent advantages.

Composites can be three to five times stronger, two to three times stiffer and three to four times lighter than metals such as steel and aluminium. In addition, composites are dimensionally stable, aesthetically pleasing and cost effective with better durability and lower maintenance than the conventional materials. In the United States of America, FRP composites applications to civil infrastructure started in the form of marine structures, piers, tanks and pilings for military requirement. Since then, major field implementations of FRP composites have taken place in bridges, roads, marine structures and retrofitting of structures.

In the last decade, significant efforts have been made to develop and implement design guidelines, construction and maintenance standards and specifications for FRP including standardised test methods. Various researchers and organisations have been contributing to cover a wide variety of applications. Large volume usage of FRP's in civil infrastructure is drawing increased interest including field evaluation and development of design and construction specifications.

The construction in the early 1990s of experimental and demonstration structures using FRP composites in addition to the recent advances in guide specifications has revealed the potential increase in structural efficiency and economic viability using FRP components and systems. In addition to providing a greater understanding on the FRP composite design, optimisation, reliability and manufacturing feasibility, the research and development efforts have been resulting in extensive field implementations and an opportunity to collect field data to develop better design and construction guidelines.

In addition to superior thermo-mechanical properties, FRP composites have many advantages over conventional materials. These advantages are gradually being utilised in the construction industry for infrastructure applications. Some of the marine and waterway applications will greatly benefit by the use of FRP's in terms of high strength, stiffness, corrosion resistance, ease of installation, simple repair methods, excellent durability, long service life and lower life cycle costs.

FRP is now being used in the construction of many different projects, like this helicopter landing platform

Don't Let This Happen to You

The Cape Cod National Seashore's Red Maple Swamp Trail, a winding boardwalk that meanders just inches above water most of the year, is a popular destination for walkers in all seasons. But when sections of the boardwalk collapsed due to rotting timber posts, park officials had to close it and now are waiting for word on whether they will get the $200,000 for repairs. Although the park resurfaced the structure over 12 years ago with recycled plastic decking, there wasn't money to replace the timber posts and beams that support the walkway, hence now the collapse.

LIFECYCLE COSTS – TIMBER vs. StructuralComp™ FRP

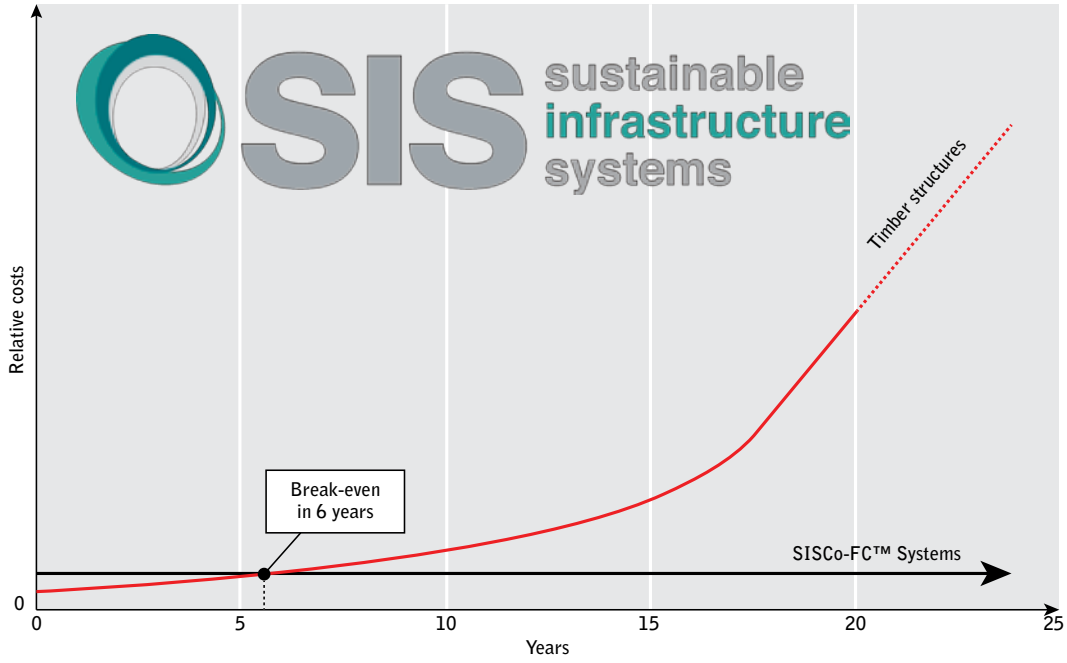


Fig. 13 - SISCo-FCTM Systems cost far less during the lifetime of a structure because they need little if any maintenance. Real comparisons with timber structures show the break-even point is just six years, sometimes far less. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd

ENERGY CONSUPTION IN CONSTRUCTION

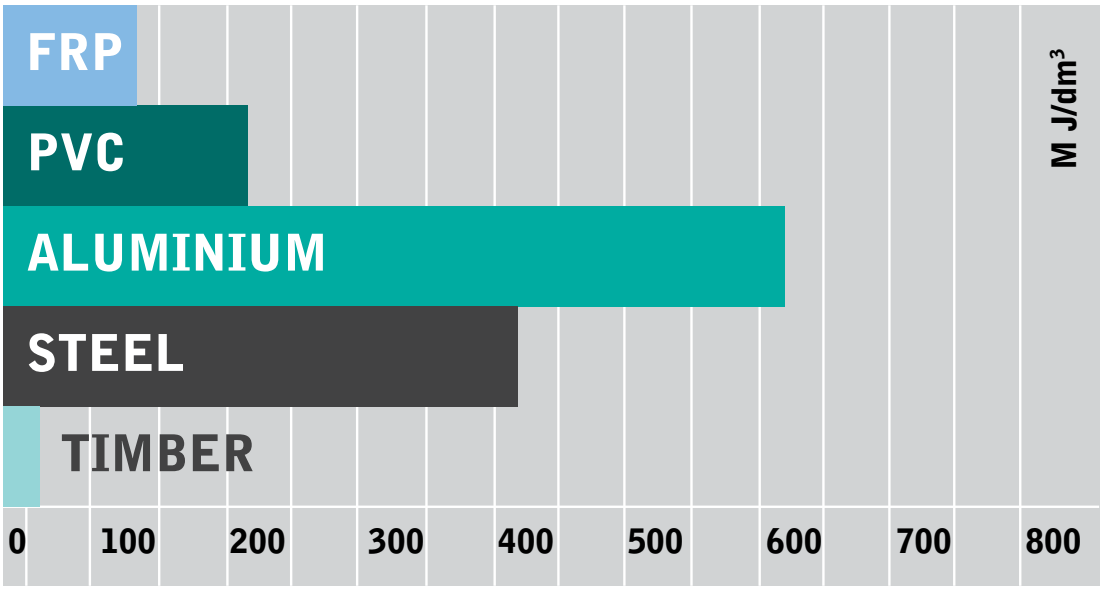


Fig. 14. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd

MERIT COMPARISON AND RATINGS FOR StructuralComp™ FRP AND STEEL

Property (parameter)	Merit/Advantage (Rating)		Rating Scale
	FRP	Steel	
Strength/stiffness	4-5	4	1: Very Low 2: Low 3: Medium 4: High 5: Very High
Weight	5	2	
Corrosion resistance / Enviromental Durability	4-5	3	
Ease of field construction	5	3-4	
Ease of repair	4-5	3-5	
Fire	3-5	4	
Transportation / handling	5	3	
Toughness	4	4	
Acceptance	2-3	5	
Maintenance	5	3	

Fig. 15

NOTE: Higher Rating Indicated Better Desirability of Material

Fixing Methodology

Refer Annexure 1 for further details on fixings

FRP Bolt Fixings

FRP / Torlon® Other Fixings

Moulded FRP

FIXINGS	
Connection	Method
Ground to Pile	1. Bolt to concrete pad 2. Pile drive 3. Piers natural back fill or concrete
Pile to Bearer	Bolted (FRP) with Bracket (FRP)
Bearer to Joist – Continuous (over)	Bolted (FRP)
Bearer to Joist - Terminates	Bolted (FRP) with Bracket (FRP)
Handrail Vertical Support to Deck	Bolted (FRP) with Bracket (FRP)
Handrail to Handrail Vertical Support	Torlon® Screw Fix with Bracket (FRP)
Handrail Infill to Handrail Vertical Supports	Torlon® Screw Fix with Bracket (FRP)
DDA Compliant Offset Handrail to Handrail Vertical Supports	Bolted (FRP) with Bracket (FRP)
Handrail Vertical Support to Deck Connector Bracket	Bolted (FRP) with Bracket (FRP)
Large Span Deck to Joist	Torlon® Screw Fix
Open / Closed Grating to Joist	Torlon® Screw Fix with Bracket (FRP)

Fig. 16

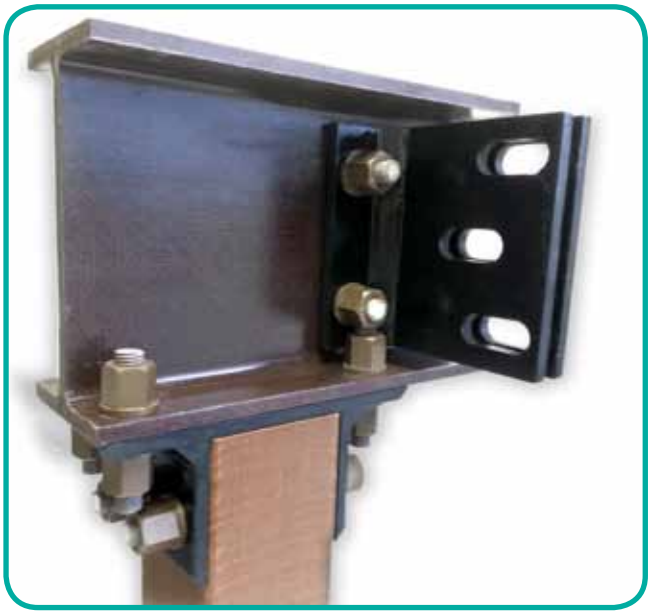
StructuralComp™ Super Structure Brackets

The connection system designed and developed by SIS is world class. This fully composite system is manufactured entirely from StructuralComp™ Fibre Reinforced Plastic Composite and therefore guarantees the stakeholder a superior, sustainable and maintenance free structure for 75 years plus. Through clever design, this system is lighter and even stronger than other alternatives – and with every component arriving to site pre-drilled, it is one of the quickest to install also.

SISCo-FC™ CONNECTION IMAGES

SISCo-FC™ Pile to Bearer Bracket 1

SISCo-FC™ Pile to Bearer Bracket 2



SISCo-FC™ Bearer to Joist Bracket 1

SISCo-FC™ Bearer to Joist Bracket 2

Superstructure Connection Detail

Exploded Typical Base Detail - Pile DrivenSISCo-FC™ Pile to Bearer Bracket 2

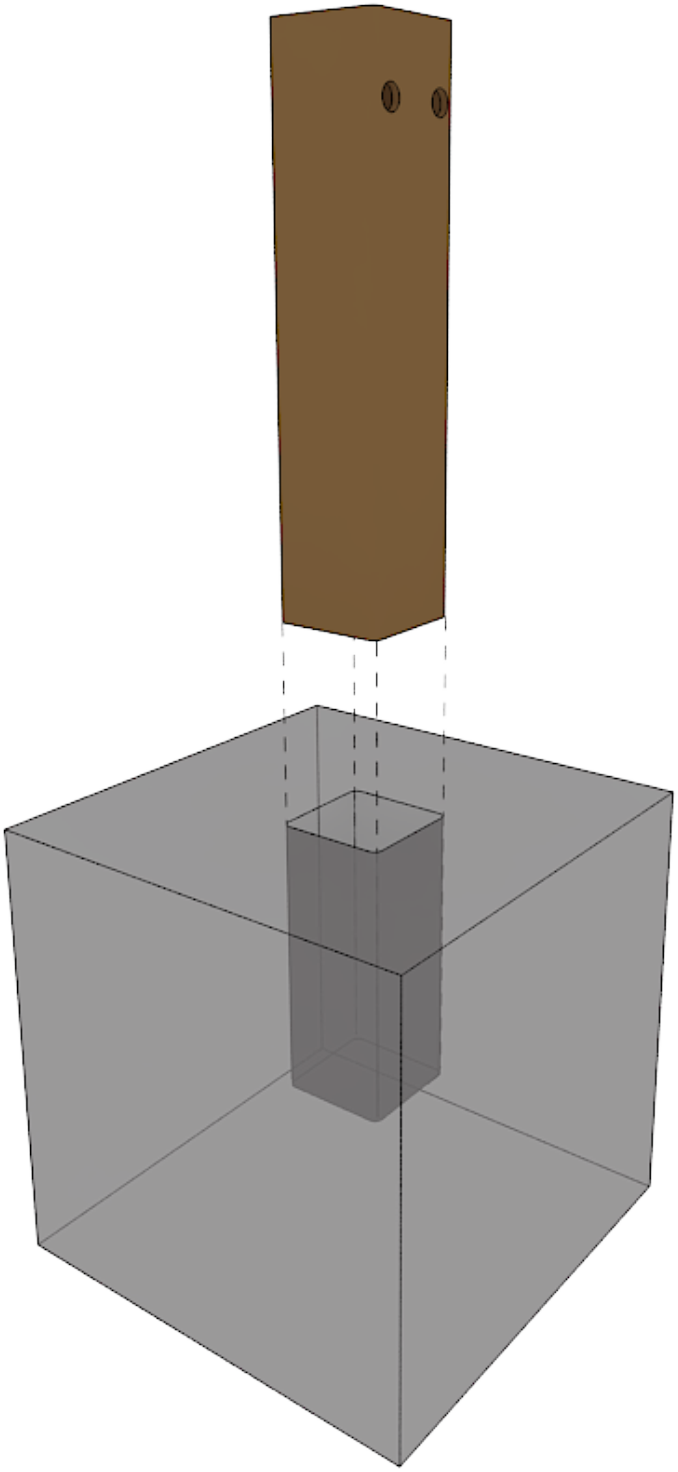


Fig.17. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Typical Base Detail - Pile Driven

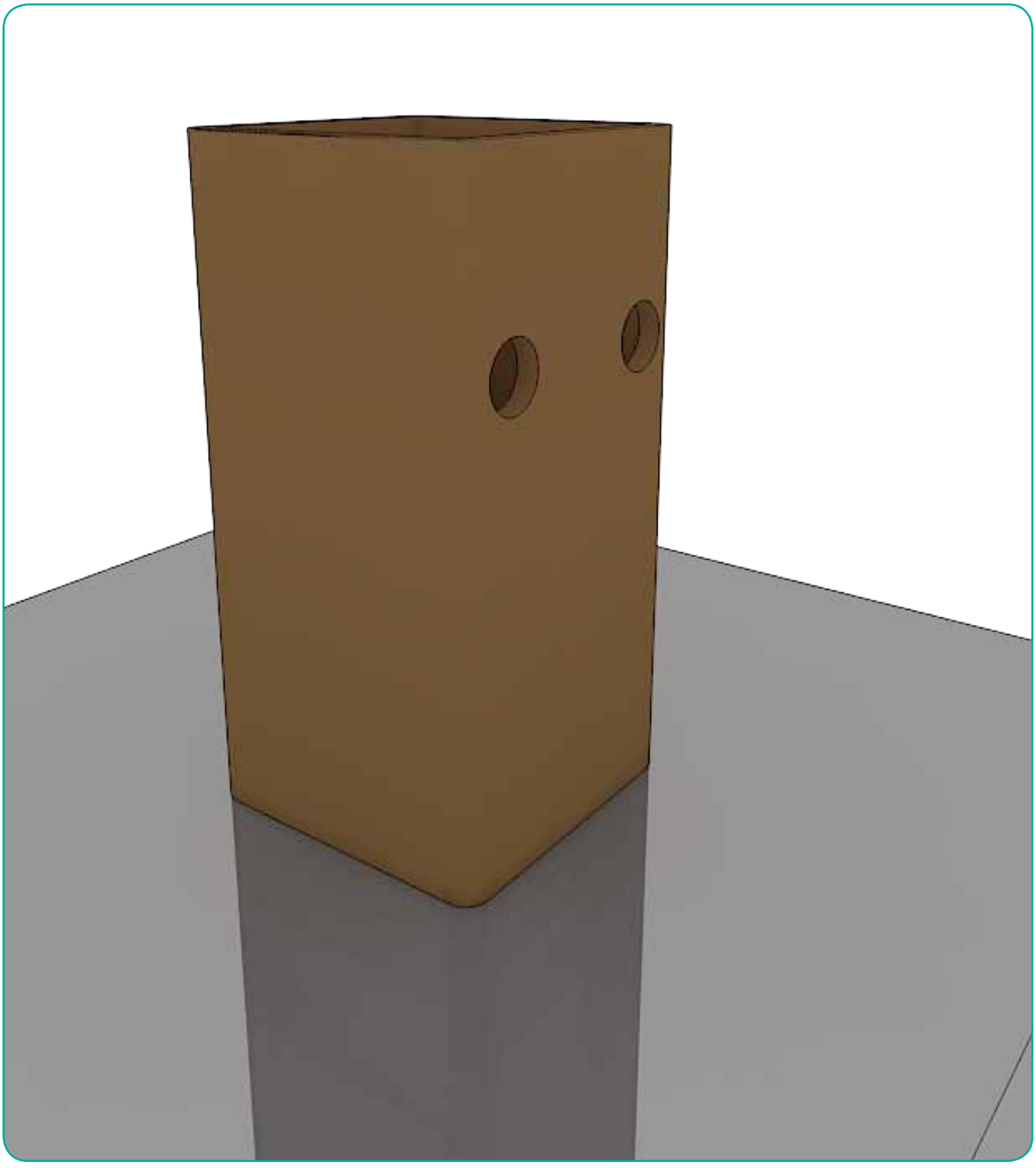


Fig. 18. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Exploded Typical Base Detail - Bolted

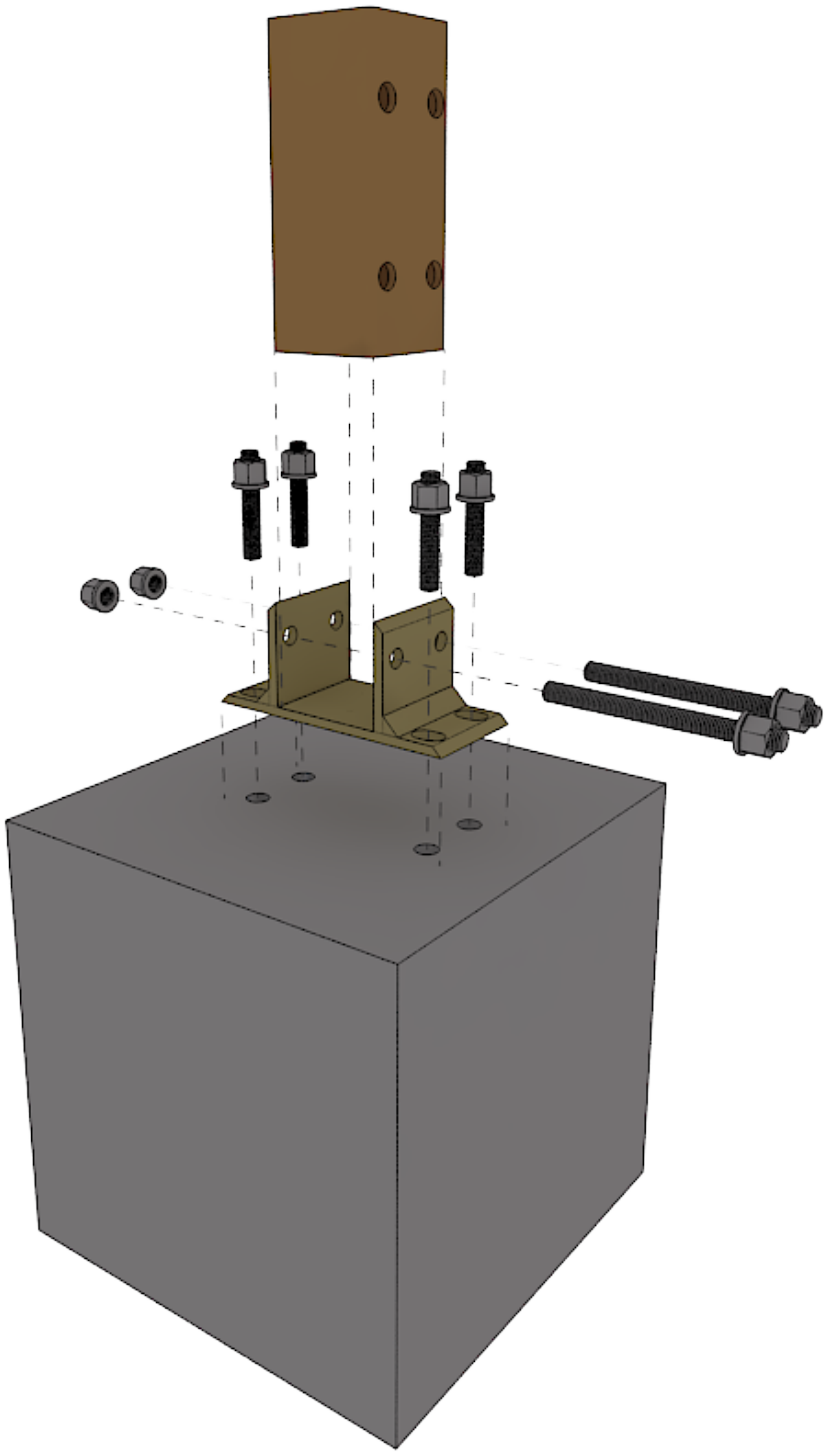


Fig. 19. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Exploded Typical Base Detail - Bolted

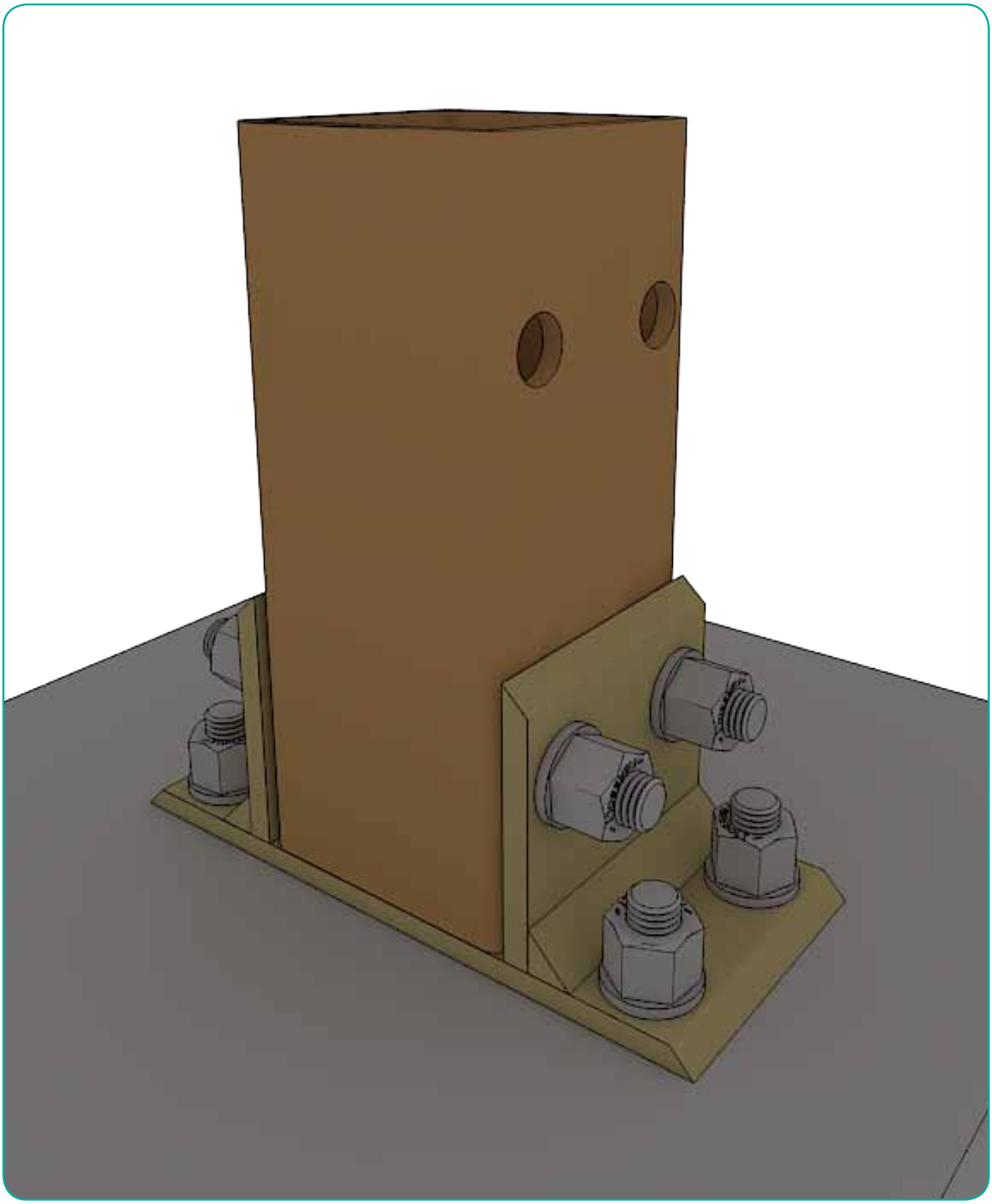


Fig. 20. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Exploded Typical Pile to Bearer Detail

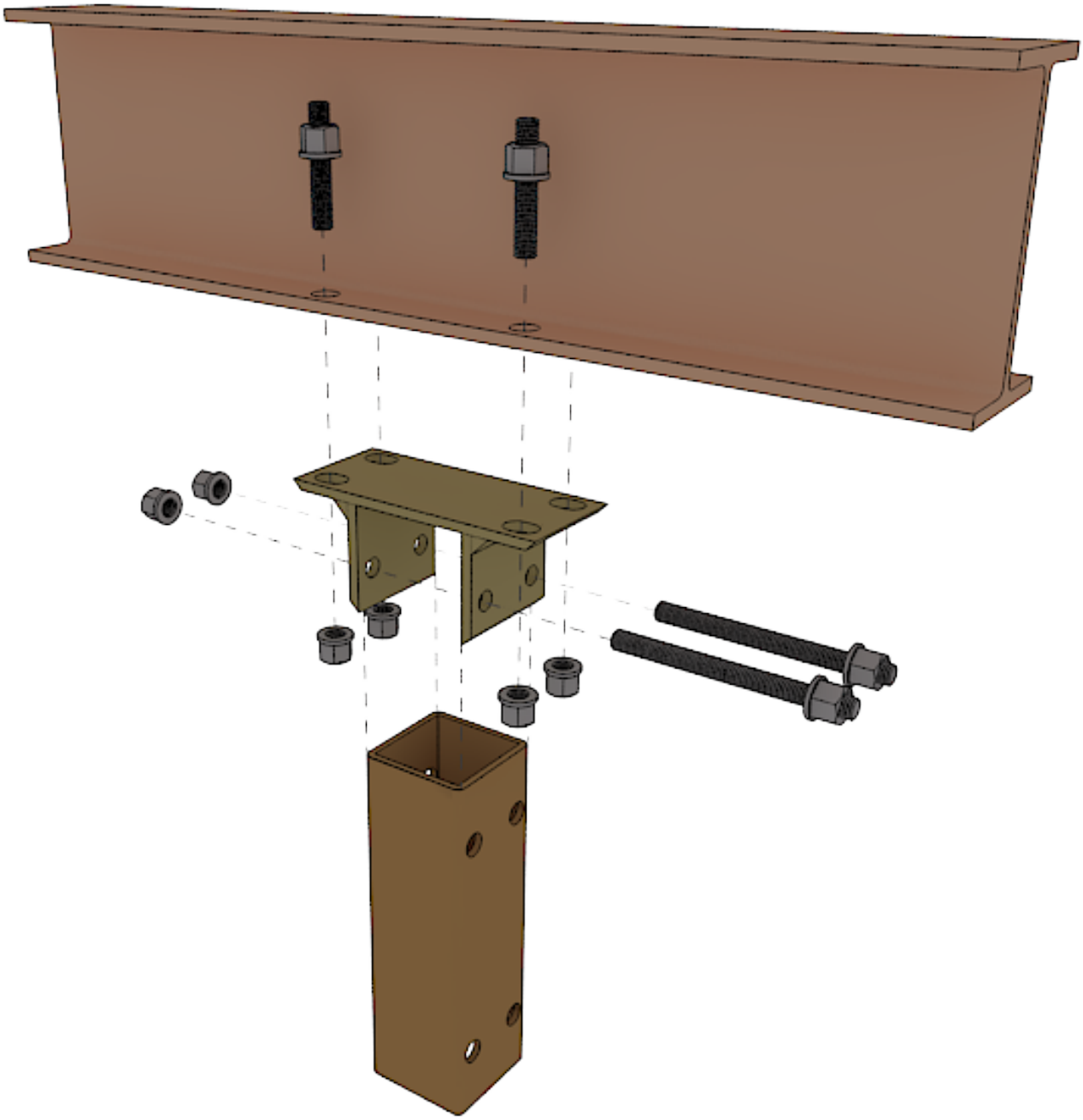


Fig. 21. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Typical Pile to Bearer Detail

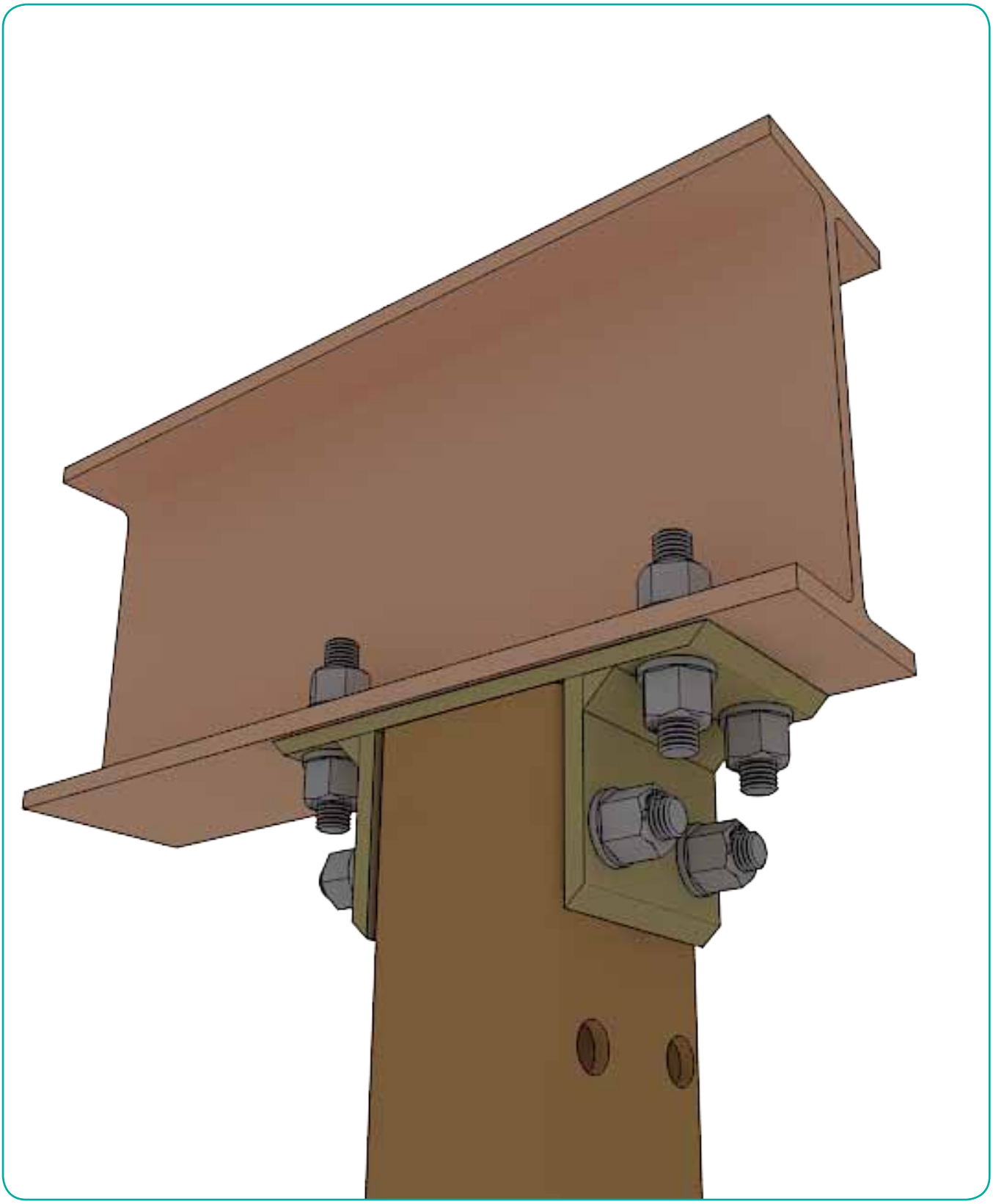


Fig. 22. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Exploded Typical Bearer to Joist

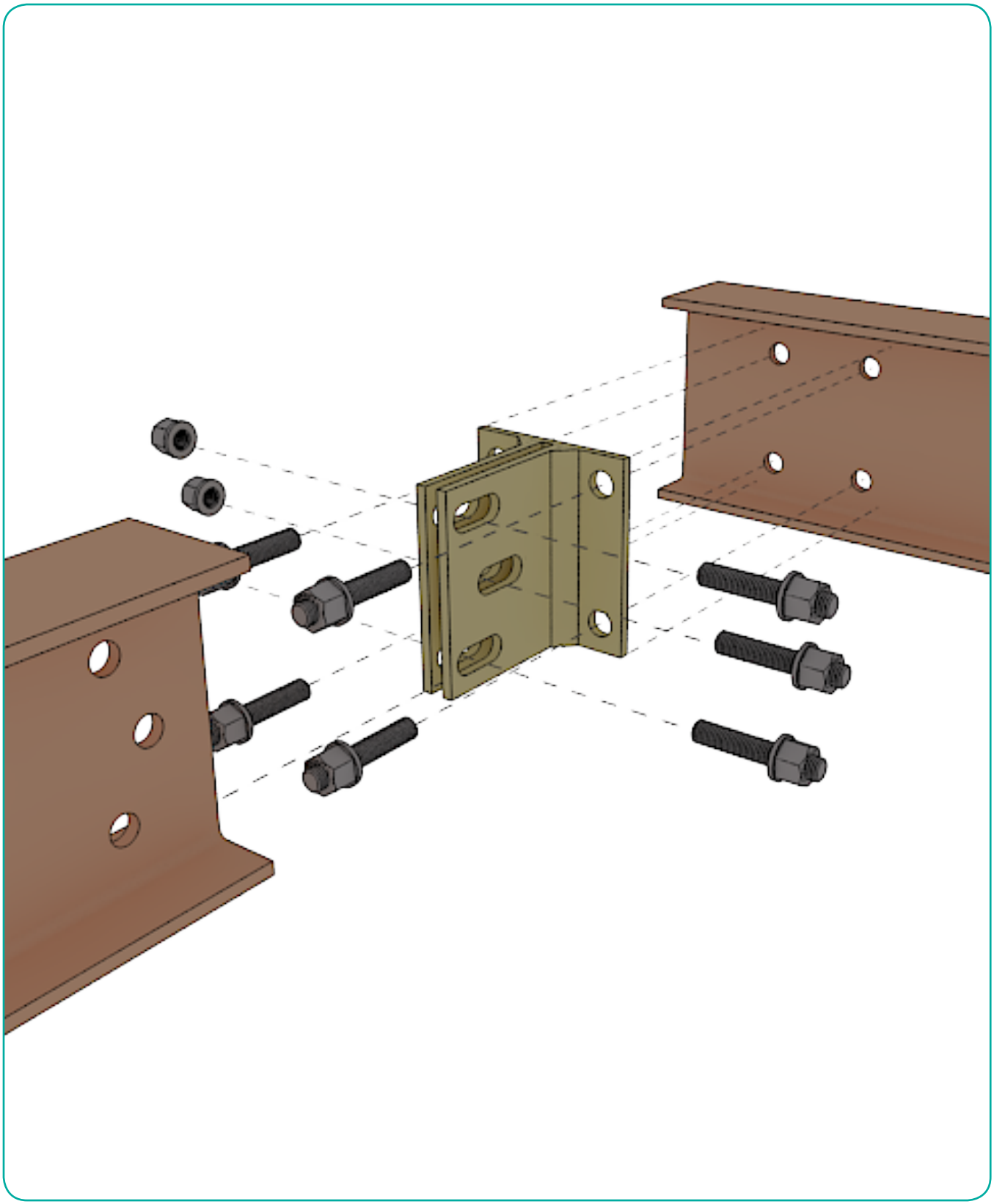


Fig. 23. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Typical Bearer to Joist

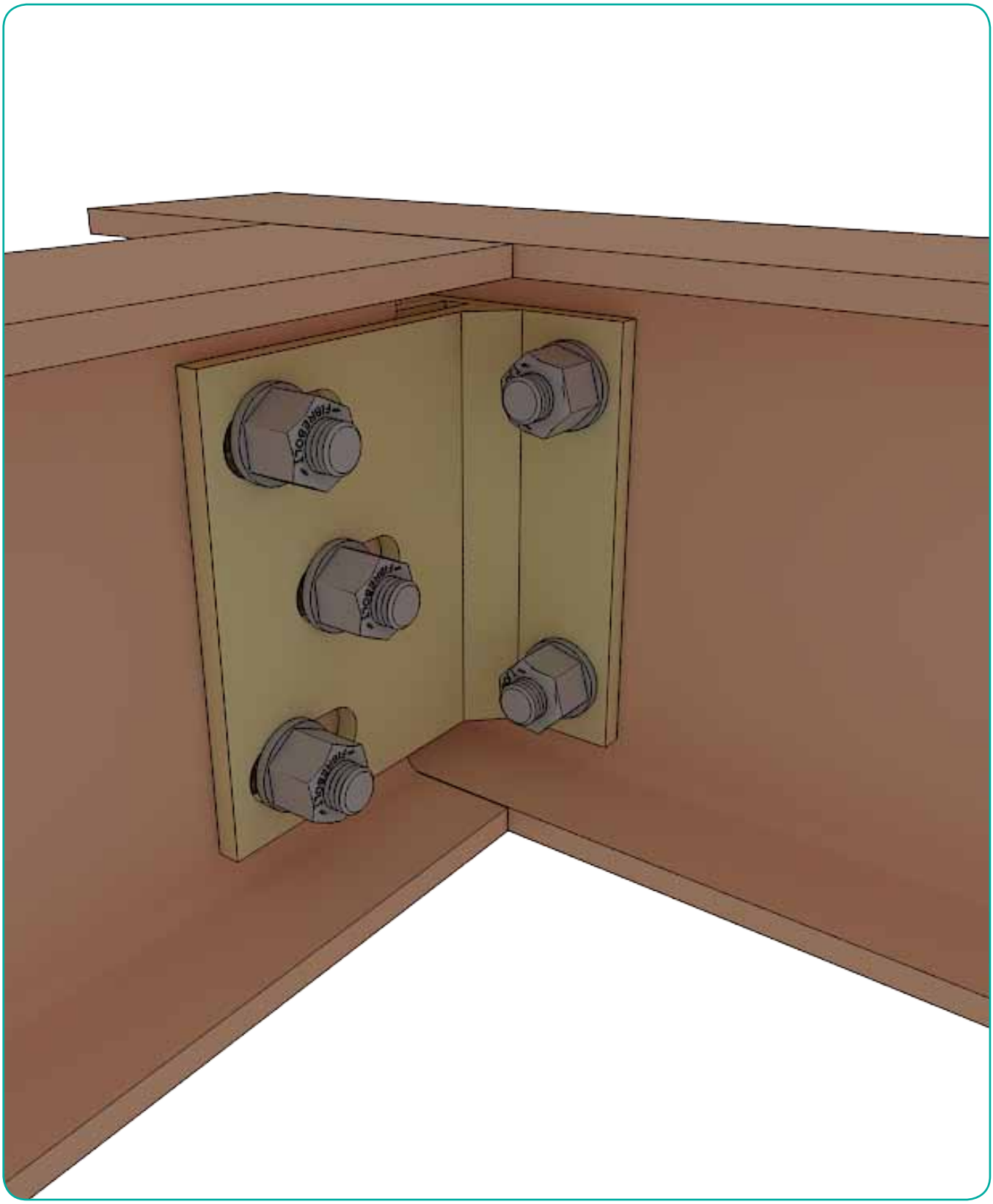


Fig. 24. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Exploded Typical Joist over Bearer

Fig. 25. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Typical Joist over Bearer

Fig. 26. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Exploded Typical Base to Pile - Pile to Bearer Assembly

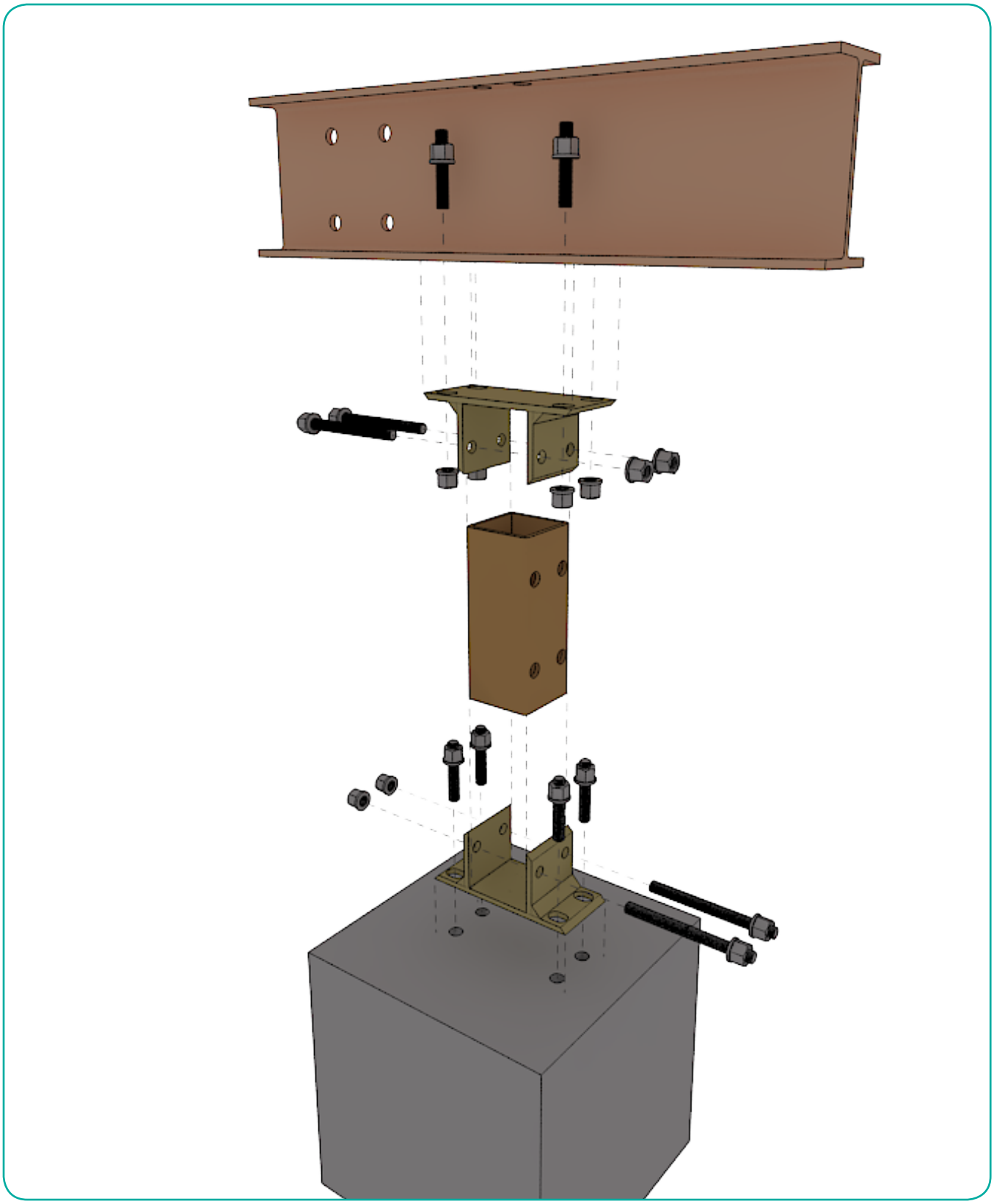


Fig. 27. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Exploded Typical Assembly

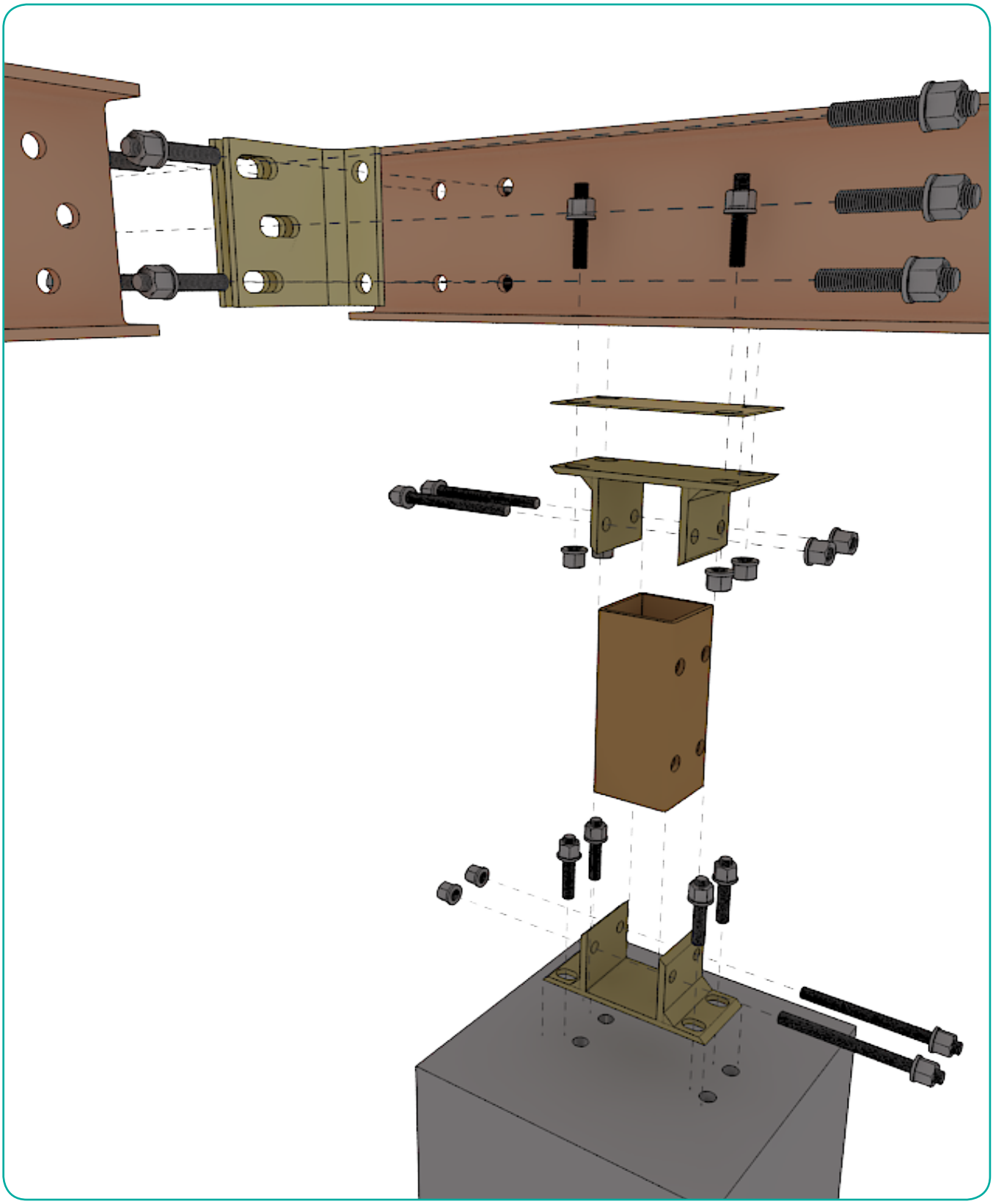


Fig. 28. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Typical Assembly

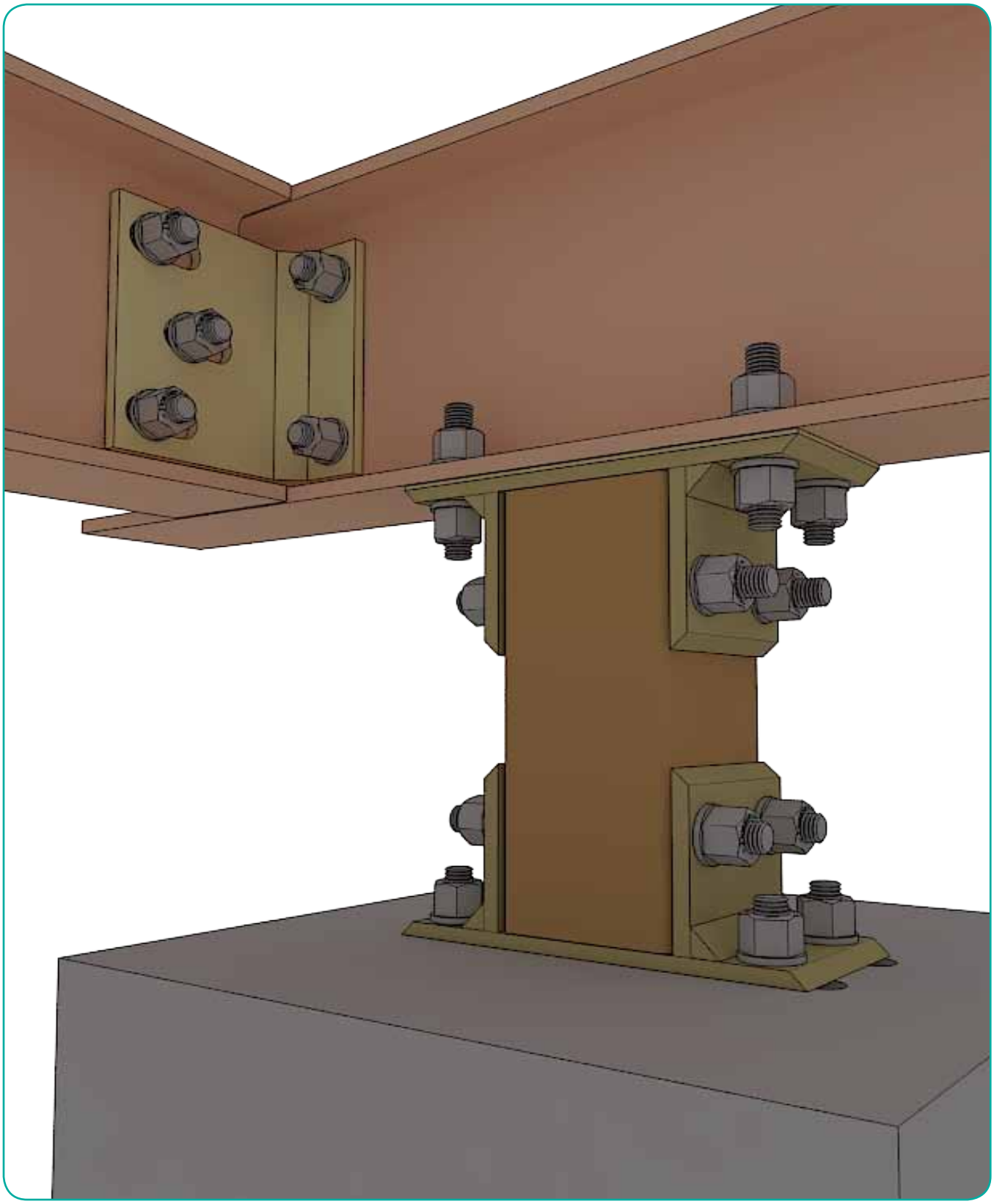


Fig. 29. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Typical Base Plate with Grout & Brace

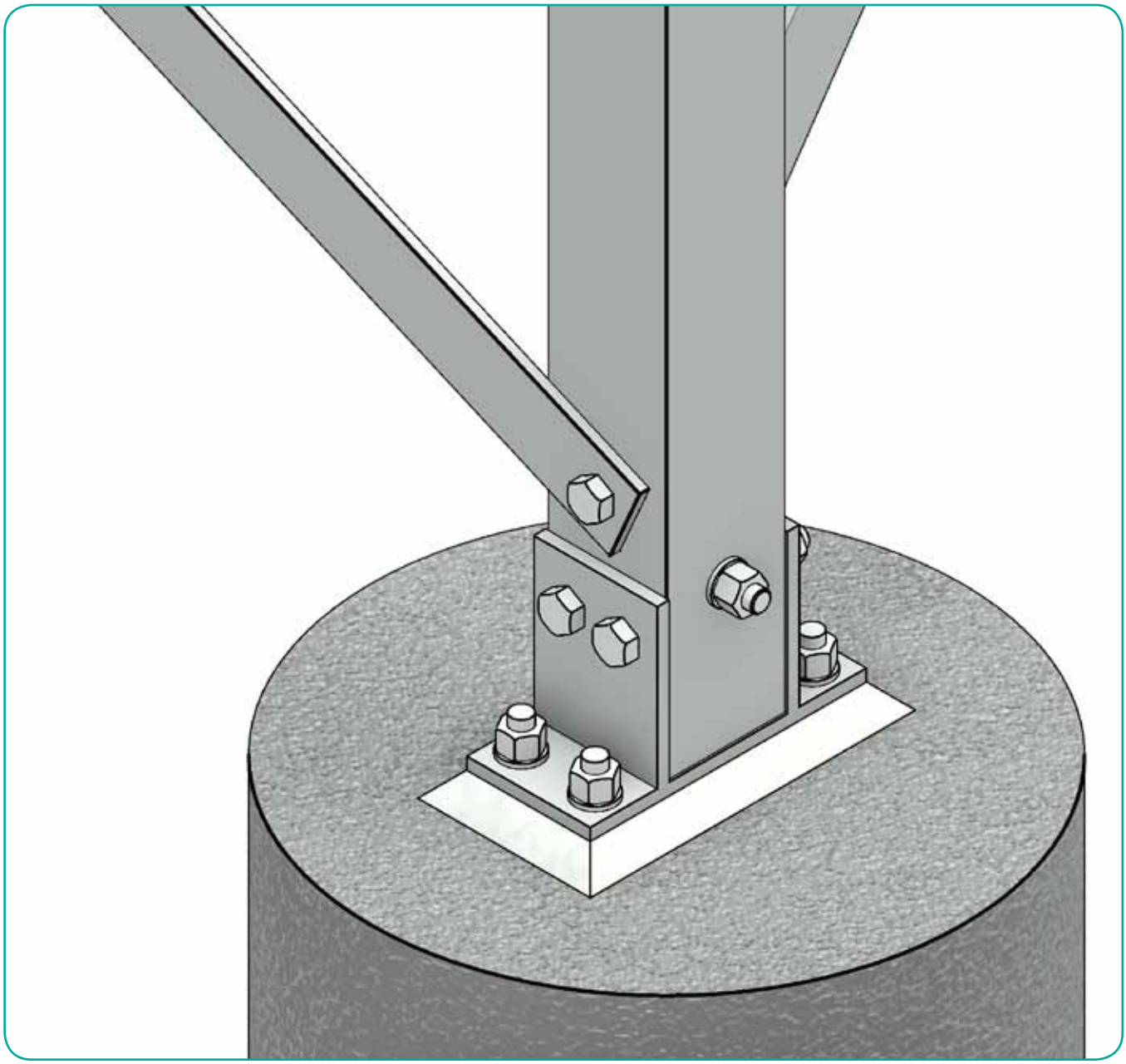


Fig. 30. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Typical Cap Plate & Brace

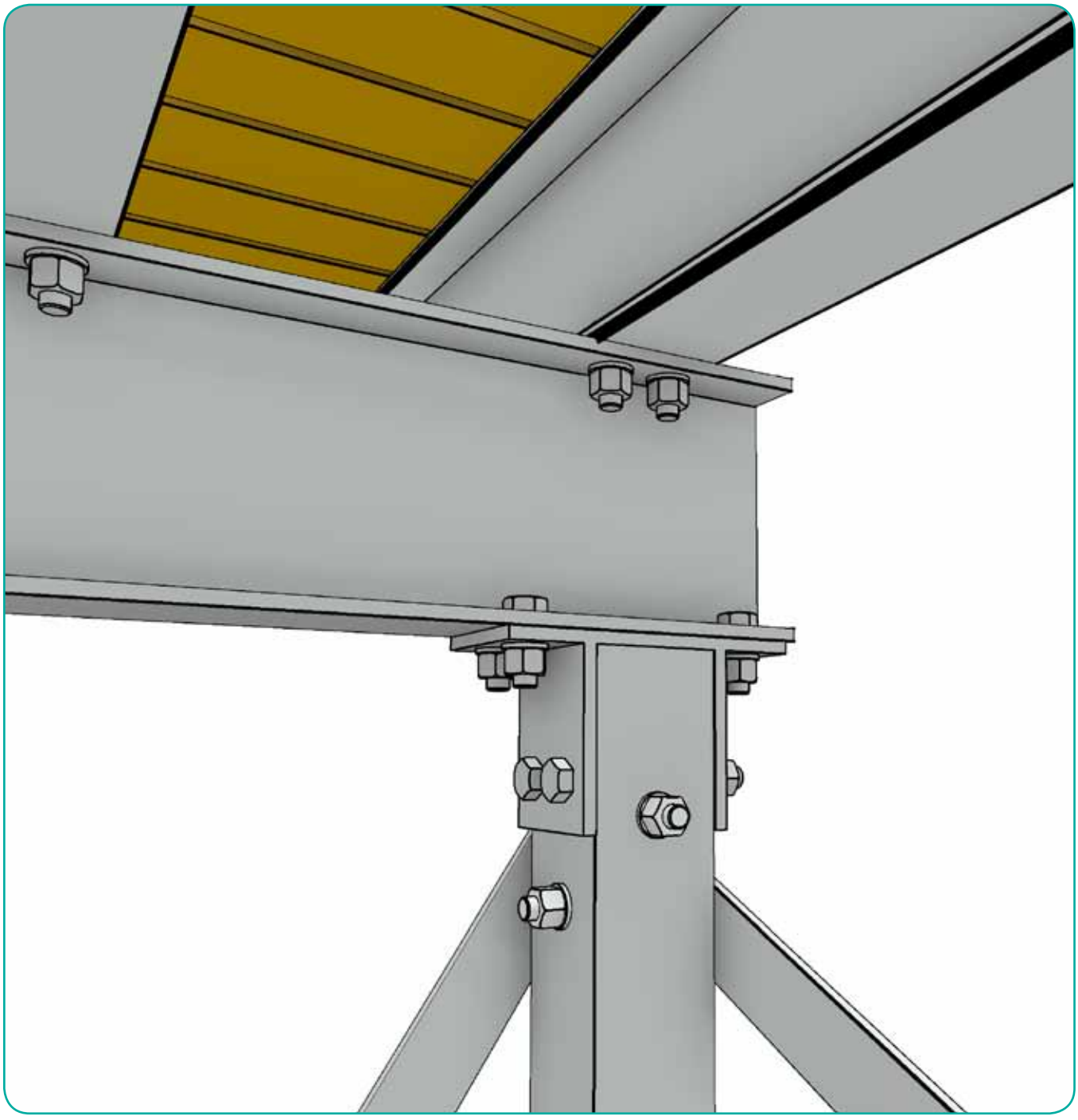


Fig. 31. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Typical Handrail Stanchion Connection

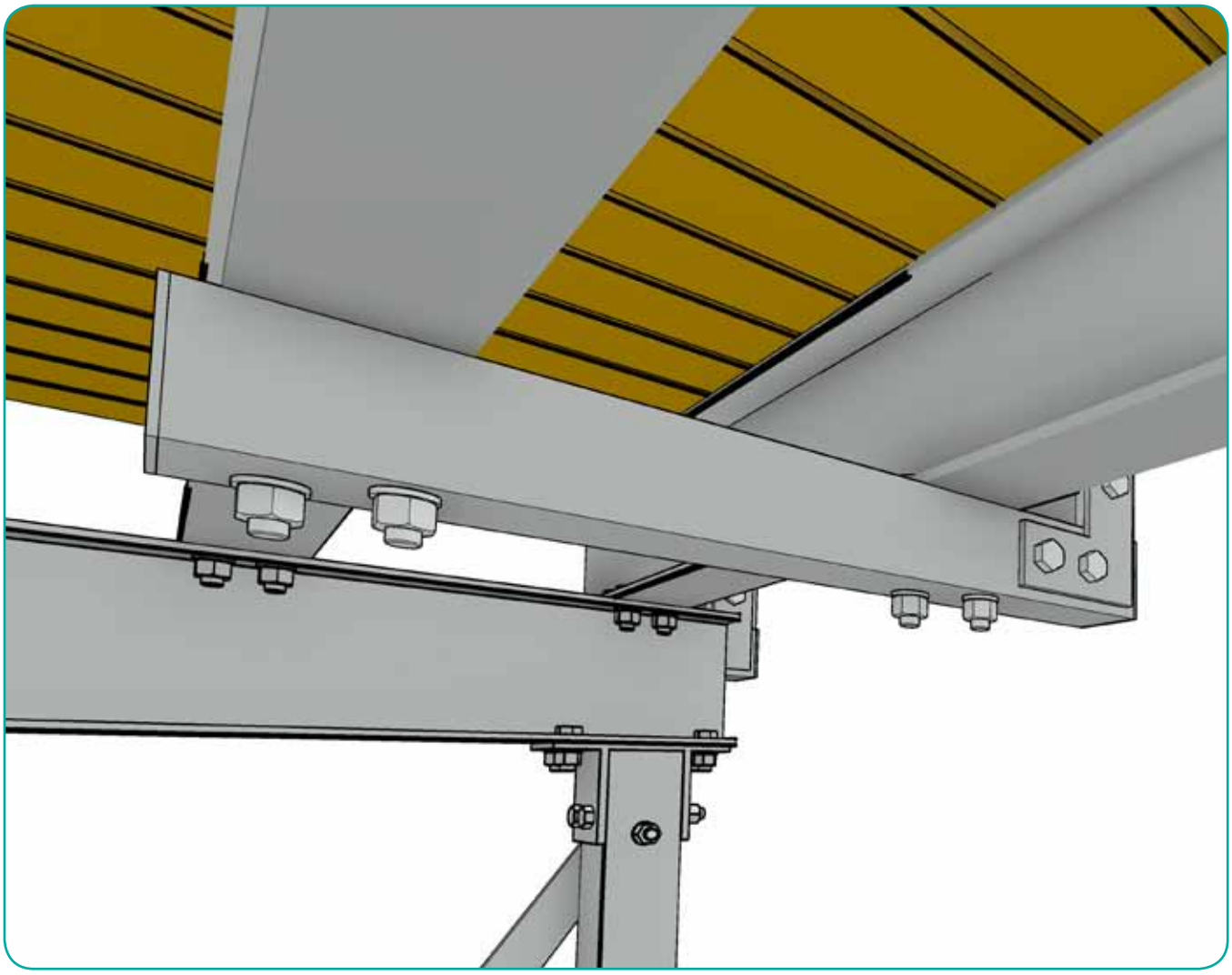


Fig. 32. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Typical Handrail Stanchions

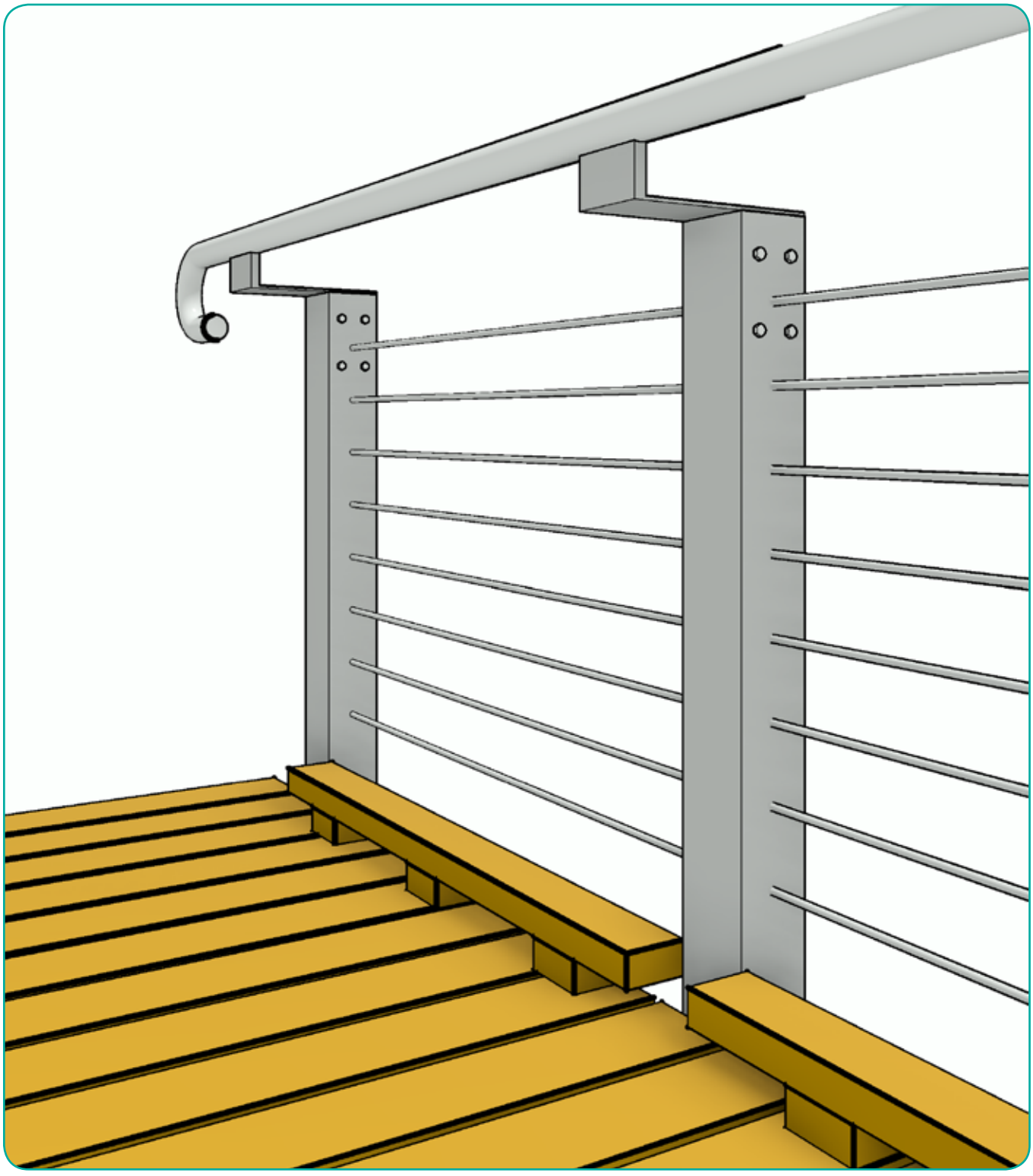


Fig. 33. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Typical Bridge Abutment

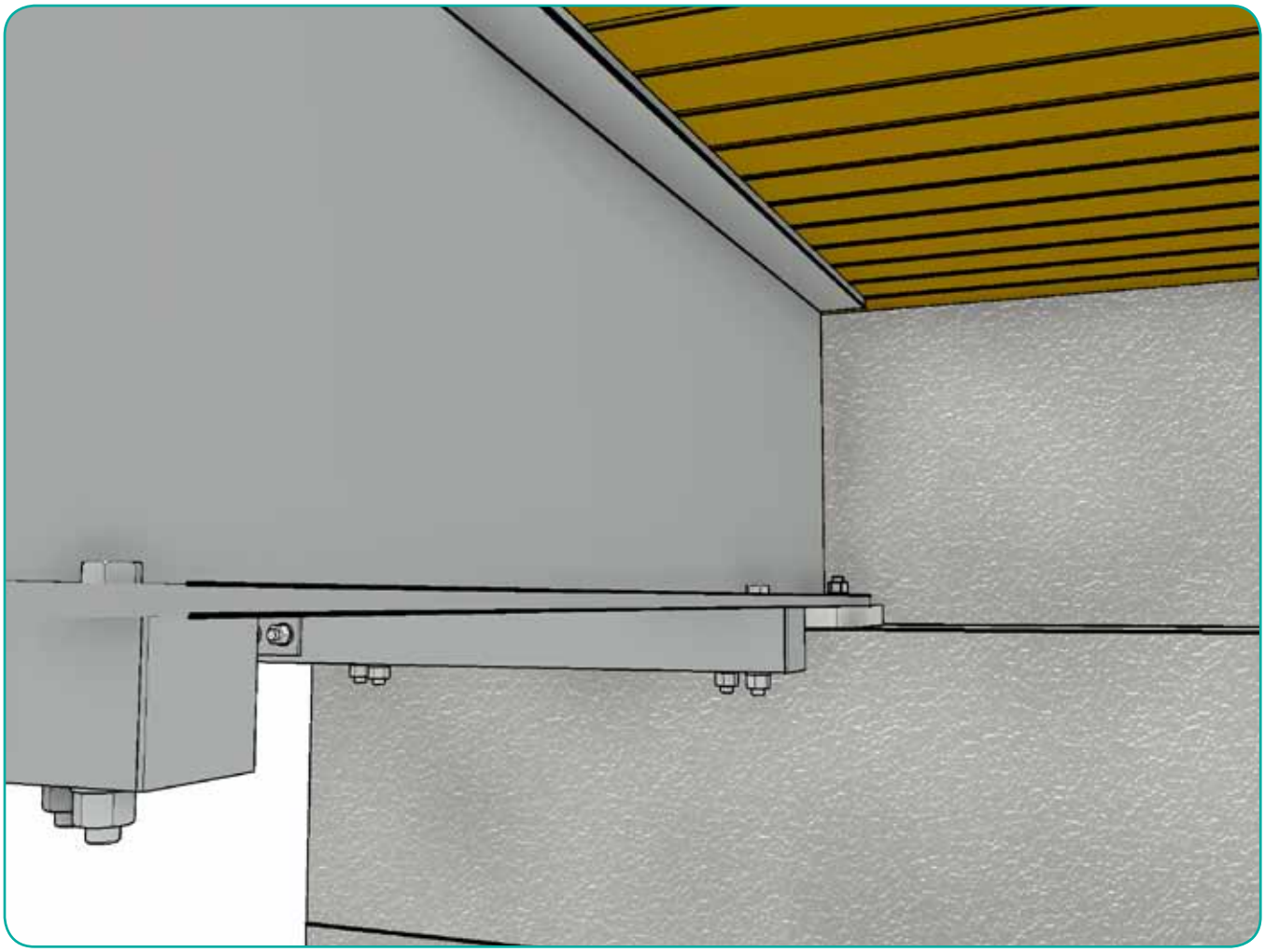


Fig. 34. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Typical 3600mm Wide Bridge & Abutment

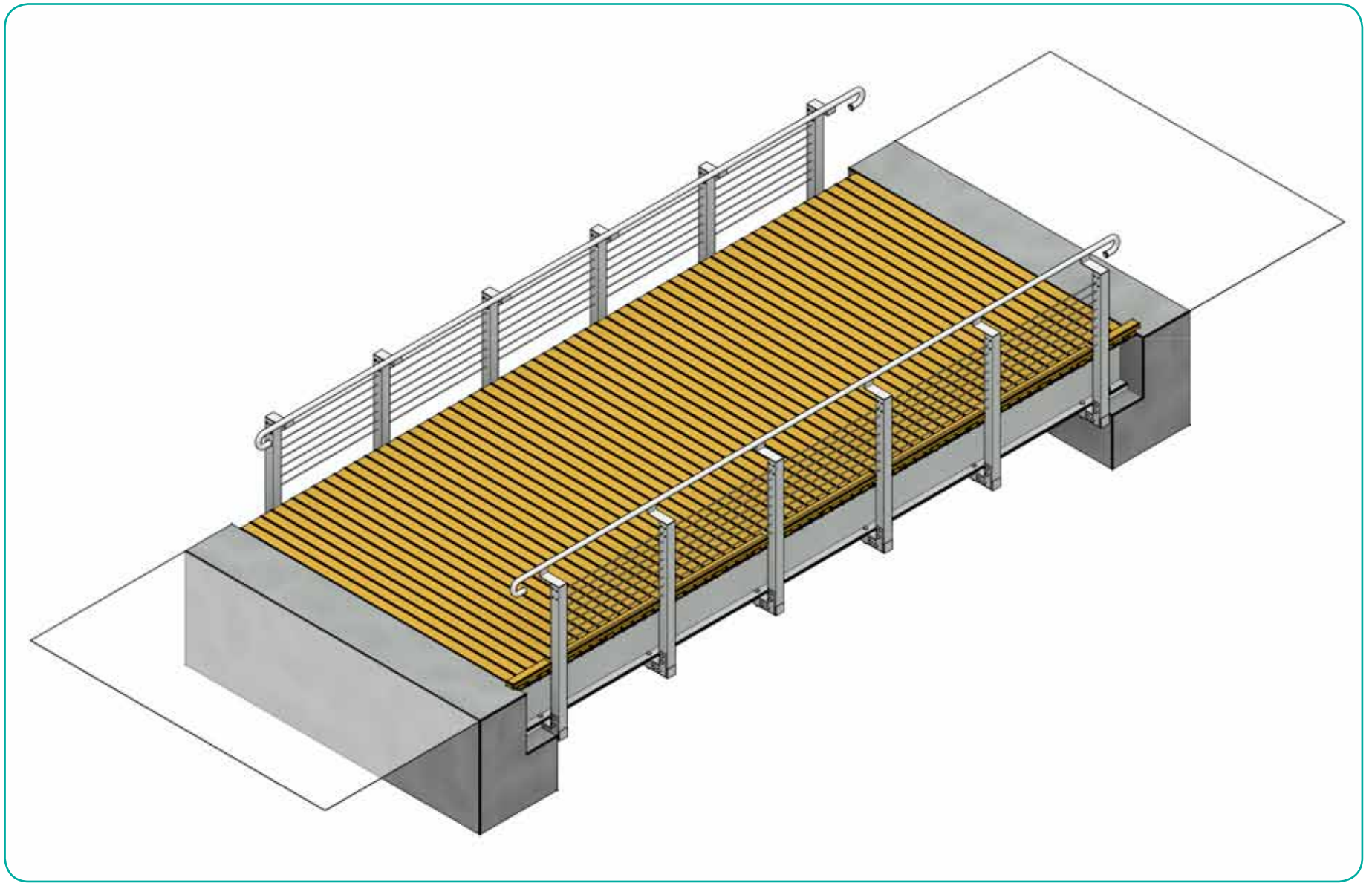


Fig. 35. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Typical 3600mm Wide Boardwalk Section

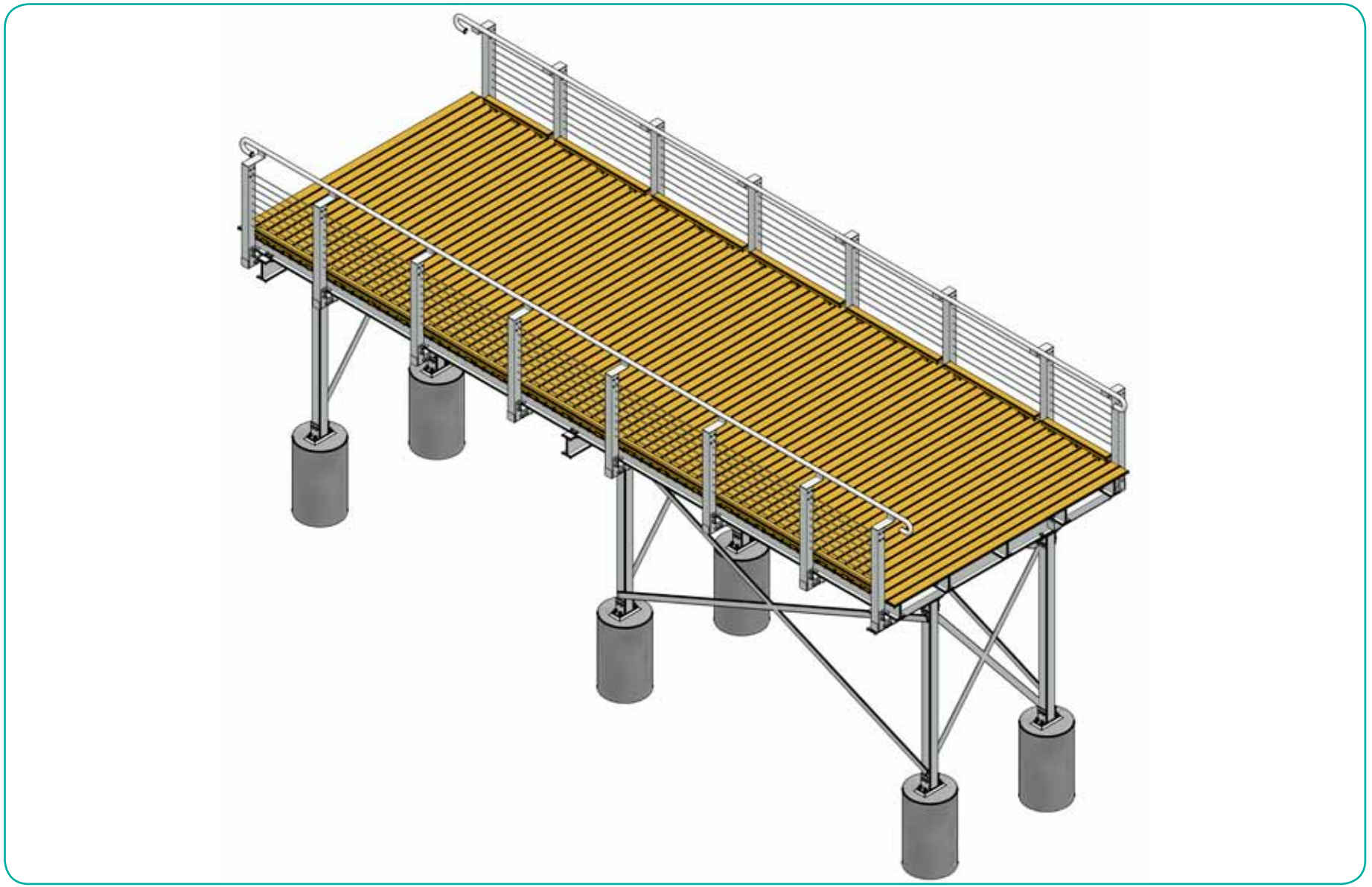


Fig. 36. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Typical 1800mm Wide Boardwalk Section

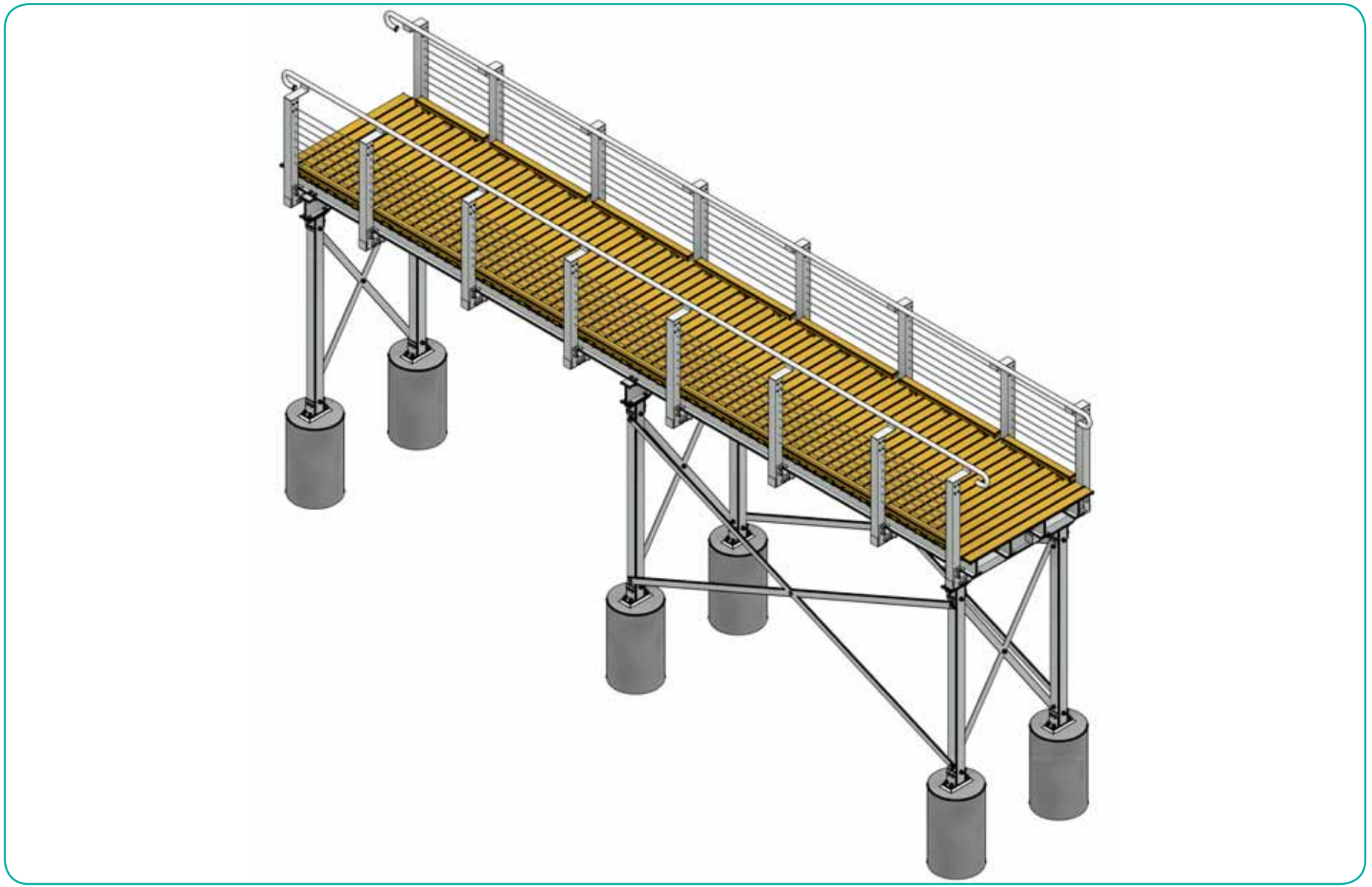
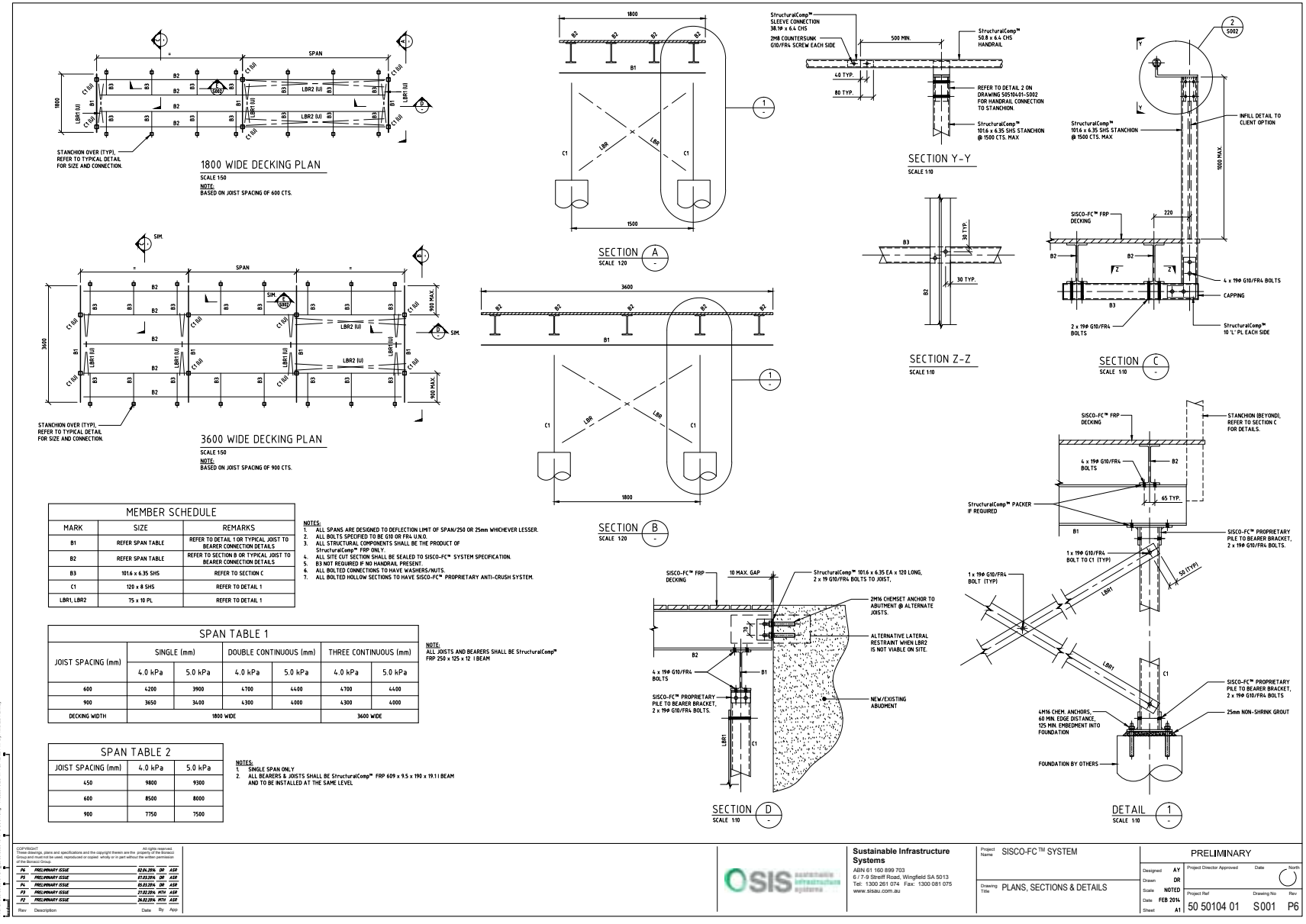


Fig. 37. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Typical Detail



MEMBER SCHEDULE		
MARK	SIZE	REMARKS
B1	REFER SPAN TABLE	REFER TO DETAIL 1 OR TYPICAL JOIST TO BEARER CONNECTION DETAILS
B2	REFER SPAN TABLE	REFER TO SECTION B OR TYPICAL JOIST TO BEARER CONNECTION DETAILS
B3	101.6 x 6.35 SHS	REFER TO SECTION C
C1	120 x 8 SHS	REFER TO DETAIL 1
LBR1, LBR2	75 x 10 PL	REFER TO DETAIL 1

NOTES:
1. ALL SPANS ARE DESIGNED TO DEFLECTION LIMIT OF SPAN/250 OR 25mm WHICHEVER LESSER.
2. ALL BOLTS SPECIFIED TO BE G10 OR FR4 U.N.O.
3. ALL STRUCTURAL COMPONENTS SHALL BE THE PRODUCT OF StructuralComp™ FRP ONLY.
4. ALL SITE CUT SECTION SHALL BE SEALED TO SISCO-FC™ SYSTEM SPECIFICATION.
5. B3 NOT REQUIRED IF NO HANDRAIL PRESENT.
6. ALL BOLTED CONNECTIONS TO HAVE WASHERS/NUTS.
7. ALL BOLTED HOLLOW SECTIONS TO HAVE SISCO-FC™ PROPRIETARY ANTI-CRUSH SYSTEM.

SPAN TABLE 1						
JOIST SPACING (mm)	SINGLE (mm)		DOUBLE CONTINUOUS (mm)		THREE CONTINUOUS (mm)	
	4.0 kPa	5.0 kPa	4.0 kPa	5.0 kPa	4.0 kPa	5.0 kPa
600	4200	3900	4700	4400	4700	4400
900	3650	3400	4300	4000	4300	4000
DECKING WIDTH	1800 WIDE				3600 WIDE	

NOTE:
ALL JOISTS AND BEARERS SHALL BE StructuralComp™ FRP 250 x 125 x 12 I BEAM

SPAN TABLE 2		
JOIST SPACING (mm)	4.0 kPa	5.0 kPa
450	9800	9300
600	8500	8000
900	7750	7500

NOTES:
1. SINGLE SPAN ONLY
2. ALL BEARERS & JOISTS SHALL BE StructuralComp™ FRP 609 x 9.5 x 190 x 19.1 I BEAM AND TO BE INSTALLED AT THE SAME LEVEL

Rev	Description	Date	By	App
P6	PRELIMINARY ISSUE	02.04.2014	DR	ASP
P5	PRELIMINARY ISSUE	07.03.2014	DR	ASP
P4	PRELIMINARY ISSUE	03.03.2014	DR	ASP
P3	PRELIMINARY ISSUE	27.02.2014	MTH	ASP
P2	PRELIMINARY ISSUE	26.02.2014	MTH	ASP

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6 / 7-9 Streiff Road, Wingfield SA 5013
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Project Name: SISCO-FC™ SYSTEM
Drawing Title: PLANS, SECTIONS & DETAILS

PRELIMINARY

Designed	AY	Project Director Approved	Date
Drawn	DR		
Scale	NOTED		
Date	FEB 2014	Project Ref	Drawing No / Rev
Sheet	A1	50 50104 01	S001 P6

Fig. 38. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Typical Detail

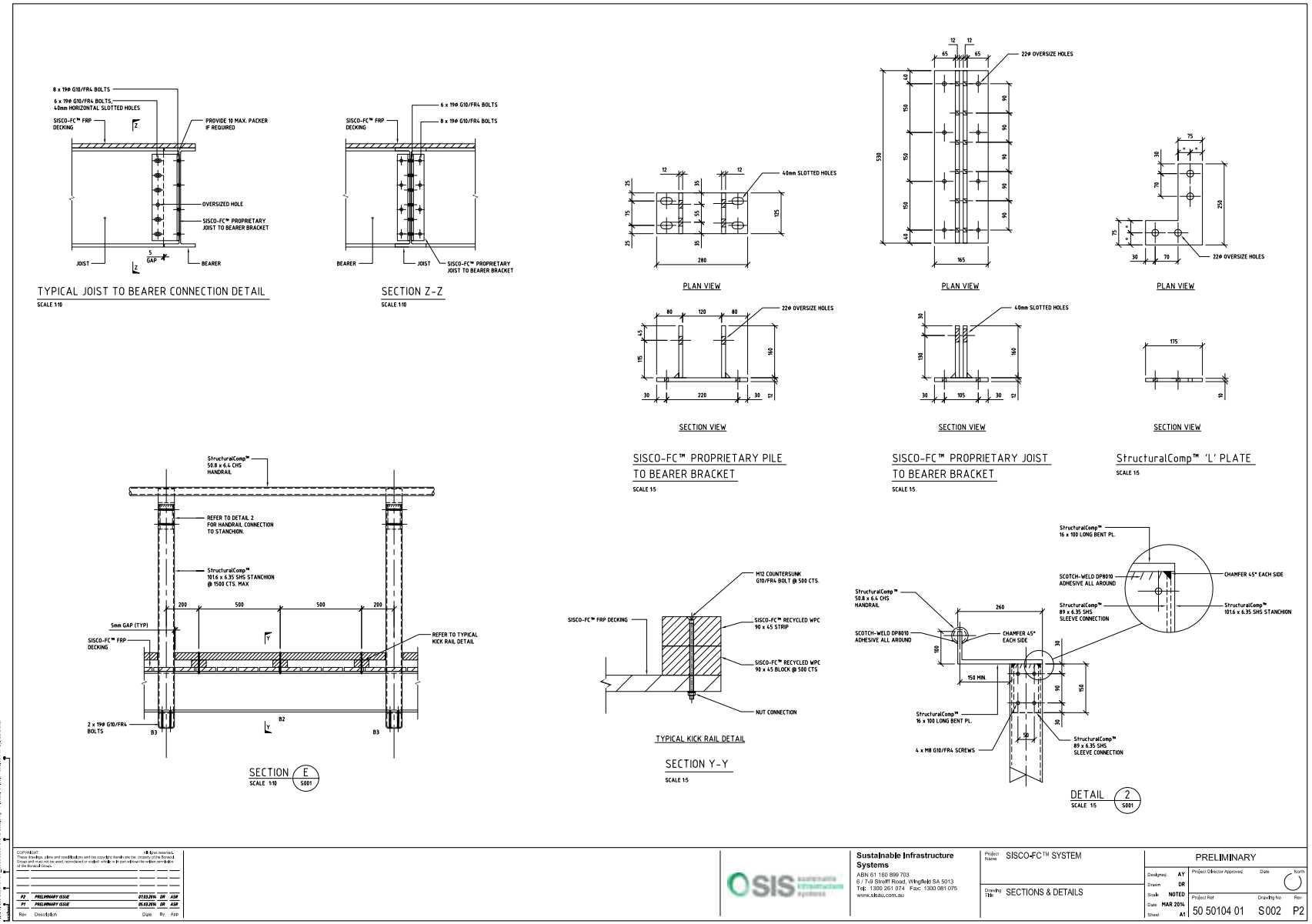

Fig. 39. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Typical Detail - (Expanded)

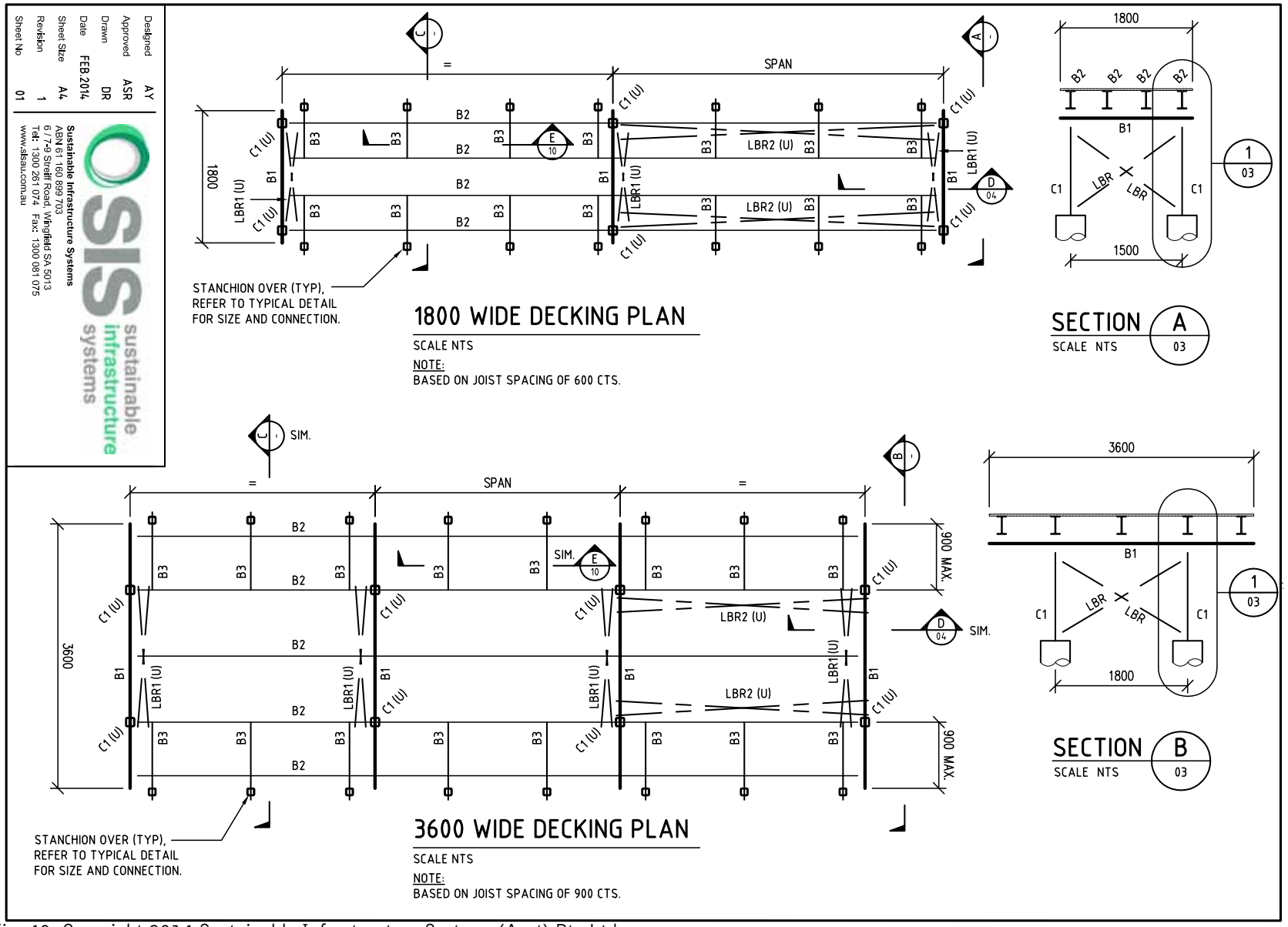

Fig. 40. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

MEMBER SCHEDULE		
MARK	SIZE	REMARKS
B1	REFER SPAN TABLE	REFER TO DETAIL 1 OR TYPICAL JOIST TO BEARER CONNECTION DETAILS
B2	REFER SPAN TABLE	REFER TO SECTION B OR TYPICAL JOIST TO BEARER CONNECTION DETAILS
B3	101.6 x 6.35 SHS	REFER TO SECTION C
C1	120 x 8 SHS	REFER TO DETAIL 1
LBR1, LBR2	75 x 10 PL	REFER TO DETAIL 1

NOTES:
1. ALL SPANS ARE DESIGNED TO DEFLECTION LIMIT OF SPAN/250 OR 25mm WHICH EVER LESSER.
2. ALL BOLTS SPECIFIED TO BE G10 OR FR4 U.N.O.
3. ALL STRUCTURAL COMPONENTS SHALL BE THE PRODUCT OF StructuralComp™ FRP ONLY.
4. ALL SITE CUT SECTION SHALL BE SEALED TO SISCO-FC™ SYSTEM SPECIFICATION.
5. B3 NOT REQUIRED IF NO HANDRAIL PRESENT.
6. ALL BOLTED CONNECTIONS TO HAVE WASHERS/NUTS.
7. ALL BOLTED HOLLOW SECTIONS TO HAVE SISCO-FC™ PROPRIETARY ANTI-CRUSH SYSTEM.

SPAN TABLE 1						
JOIST SPACING (mm)	SINGLE (mm)		DOUBLE CONTINUOUS (mm)		THREE CONTINUOUS (mm)	
	4.0 kPa	5.0 kPa	4.0 kPa	5.0 kPa	4.0 kPa	5.0 kPa
600	4200	3900	4700	4400	4700	4400
900	3650	3400	4300	4000	4300	4000
DECKING WIDTH	1800 WIDE				3600 WIDE	

NOTE: ALL JOIST AND BEARER SHALL BE StructuralComp™ FRP 250 x 125 x 12 I BEAM

SPAN TABLE 2		
JOIST SPACING (mm)	4.0 kPa	5.0 kPa
450	9800	9300
600	8500	8000
900	7750	7500

NOTES:
1. SINGLE SPAN ONLY
2. BEARER & JOIST SHALL BE IN StructuralComp™ FRP 609 x 9.5 x 190 x 19.1 I BEAM TO BE INSTALLED AT THE SAME LEVEL

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Approved	ASR
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Revision	1
Sheet No	02

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Fig. 41.

Typical Detail - (Expanded)

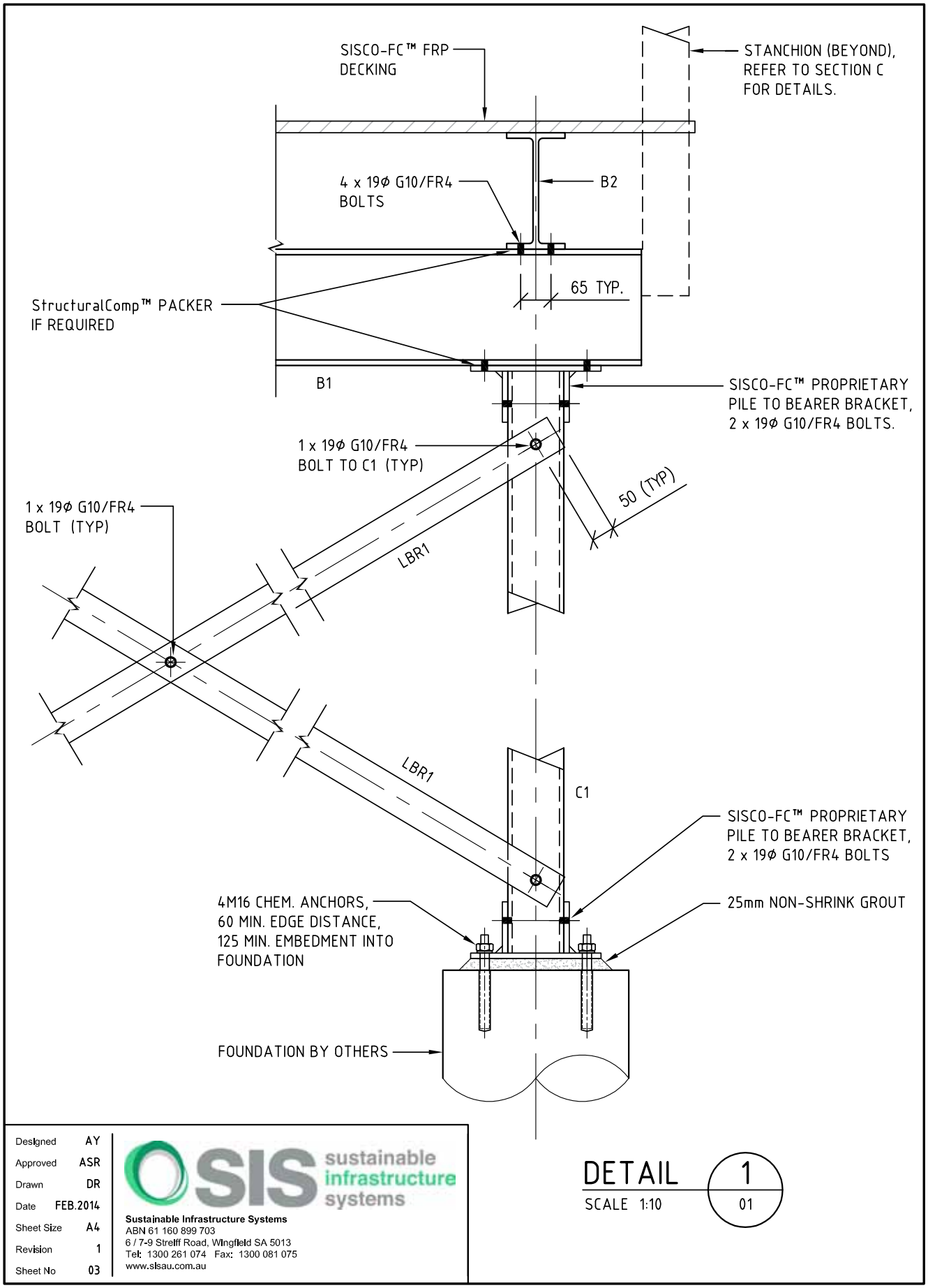
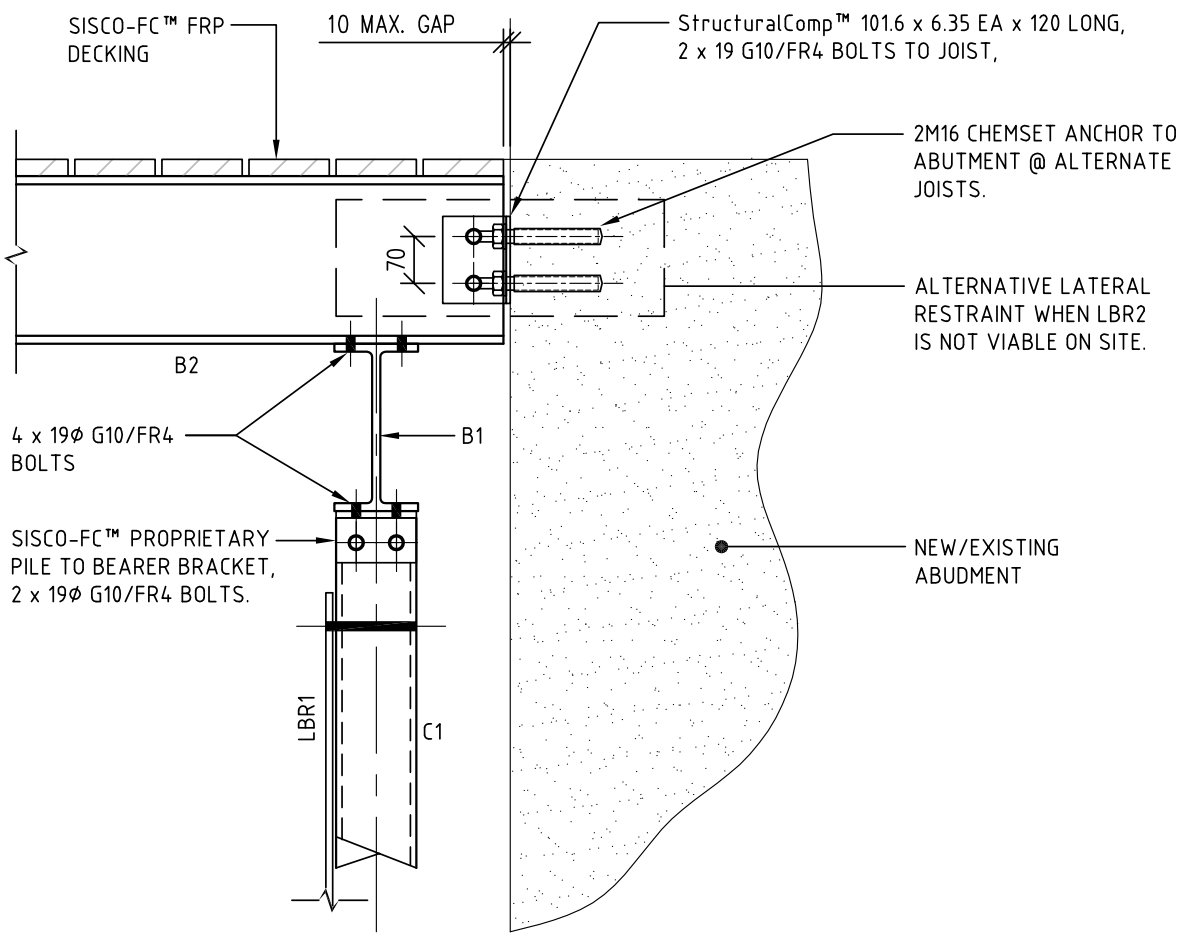


Fig. 42. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Typical Detail - (Expanded)



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Revision	1
Sheet No	04

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Fig. 43.

Typical Detail - (Expanded)

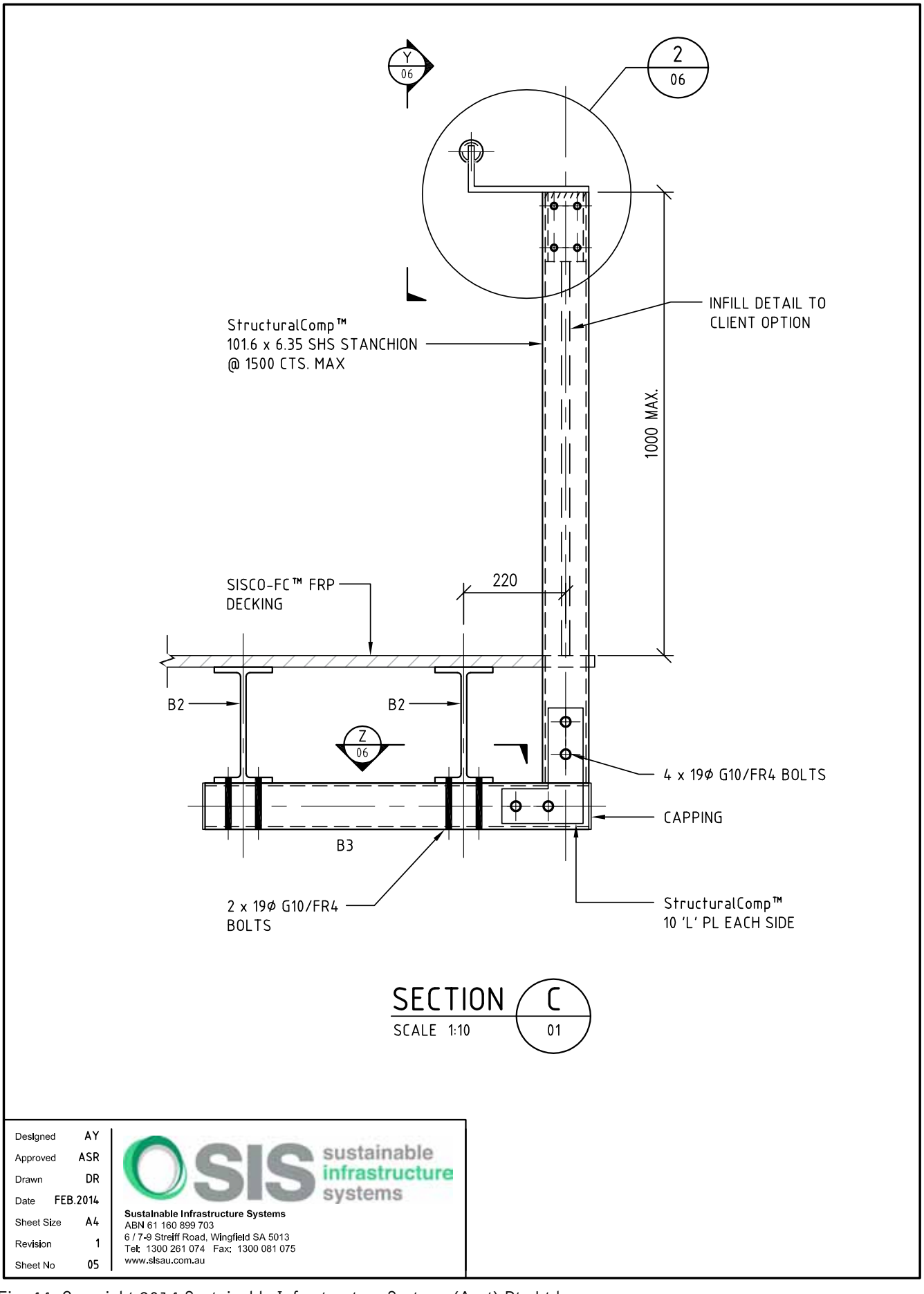


Fig. 44. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Typical Detail - (Expanded)

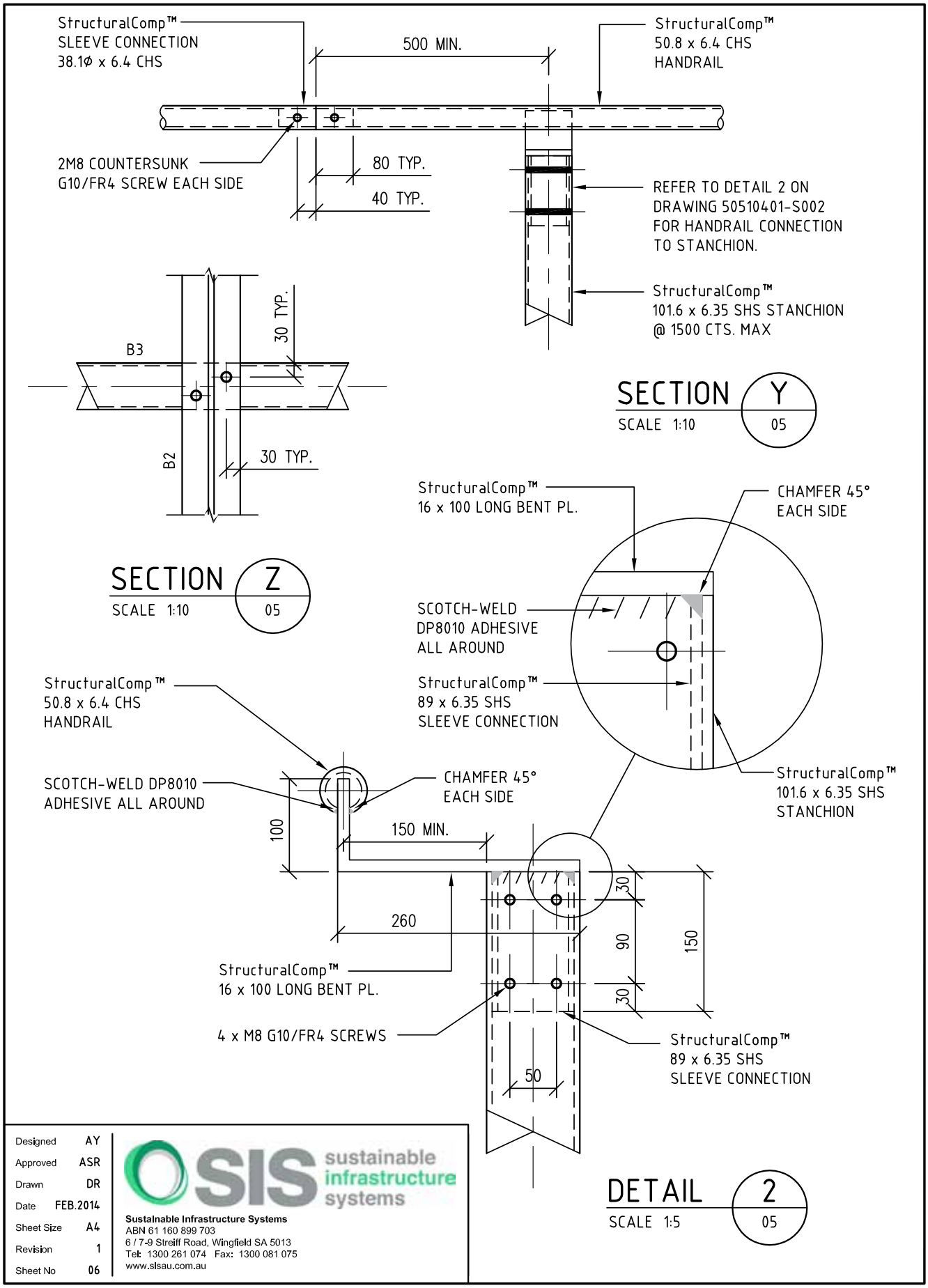
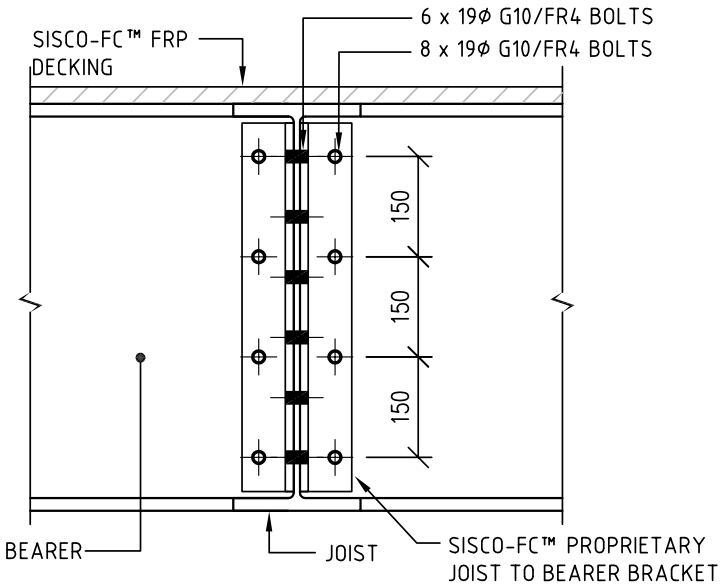


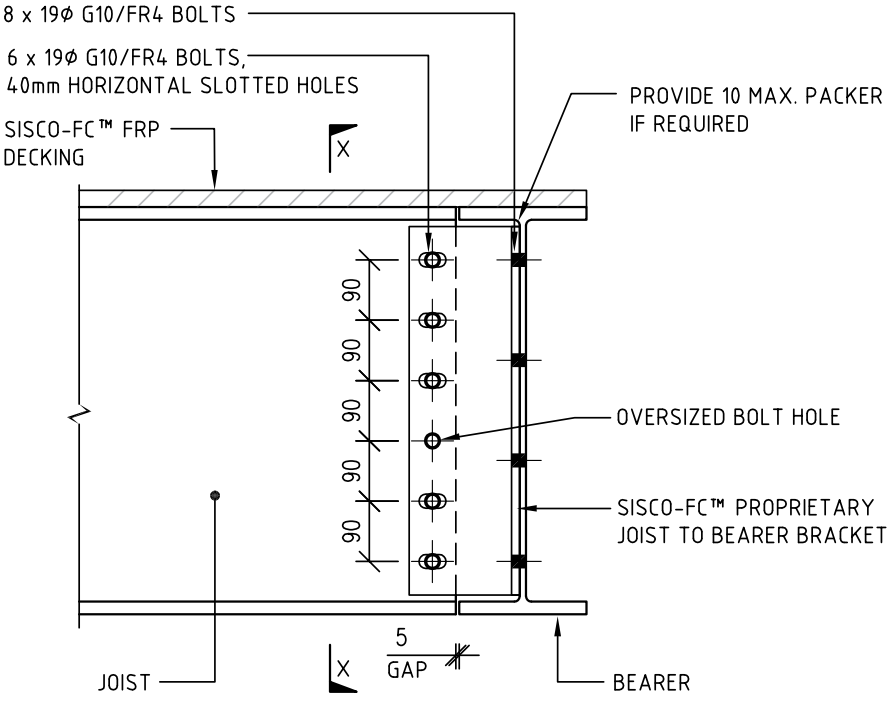
Fig. 45. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Typical Detail - (Expanded)



SECTION X-X

SCALE 1:10



TYPICAL JOIST TO BEARER CONNECTION DETAIL

SCALE 1:10

Designed	AY
Approved	ASR
Drawn	DR
Date	FEB.2014
Sheet Size	A4
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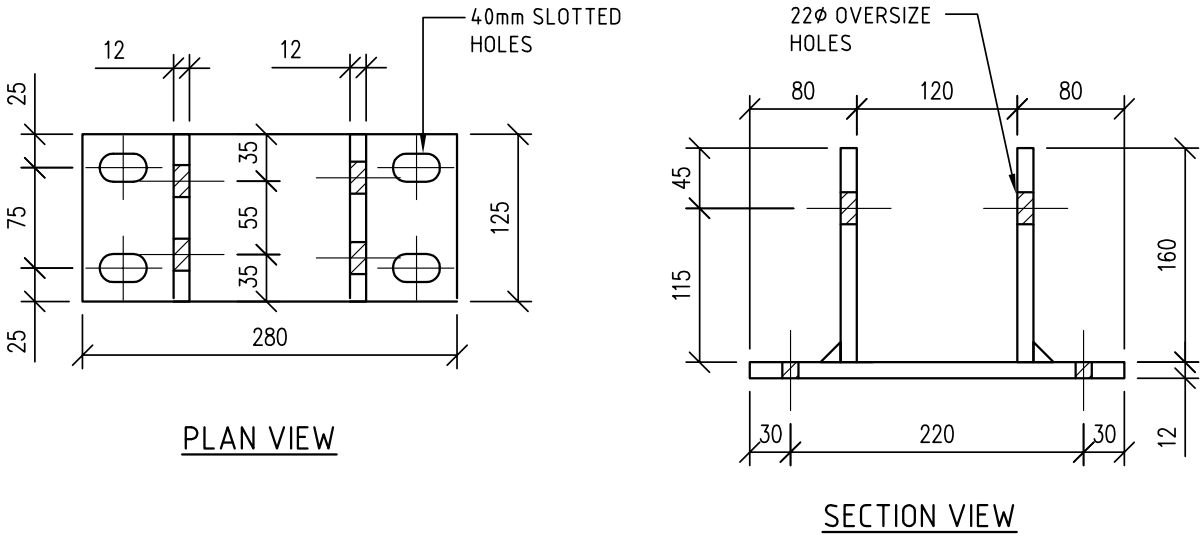
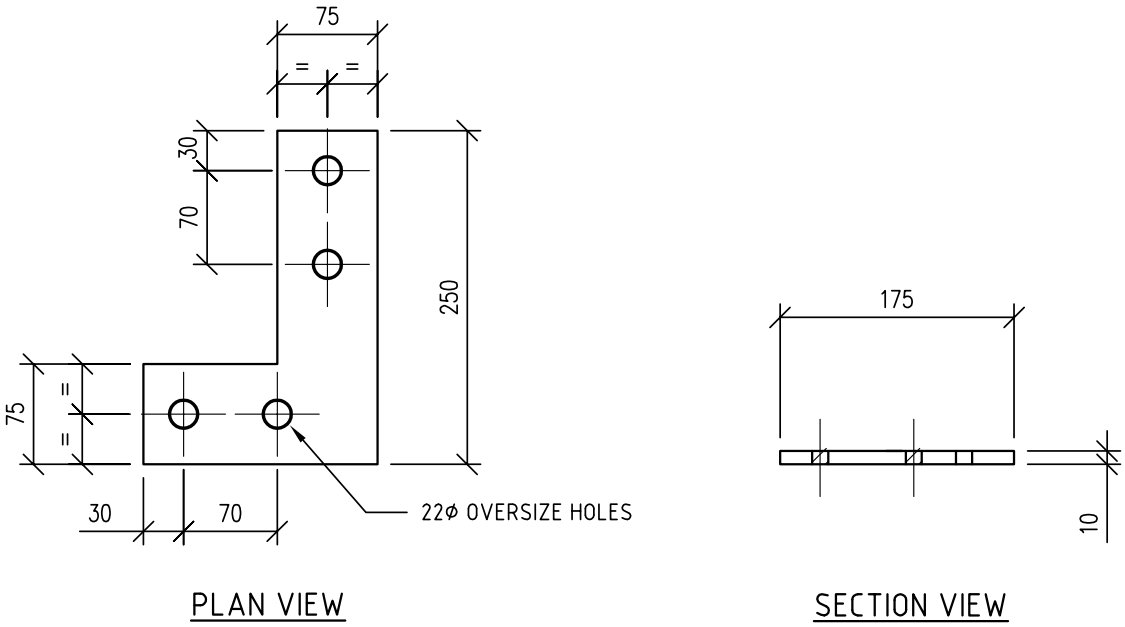
Fig. 46.

Typical Detail - (Expanded)



SISCO-FC™ PROPRIETARY PILE TO BEARER BRACKET

SCALE 1:5



StructuralComp™ 'L' PLATE

SCALE 1:5

Designed	AY
Approved	ASR
Drawn	DR
Date	FEB.2014
Sheet Size	A4
Revision	1
Sheet No	08

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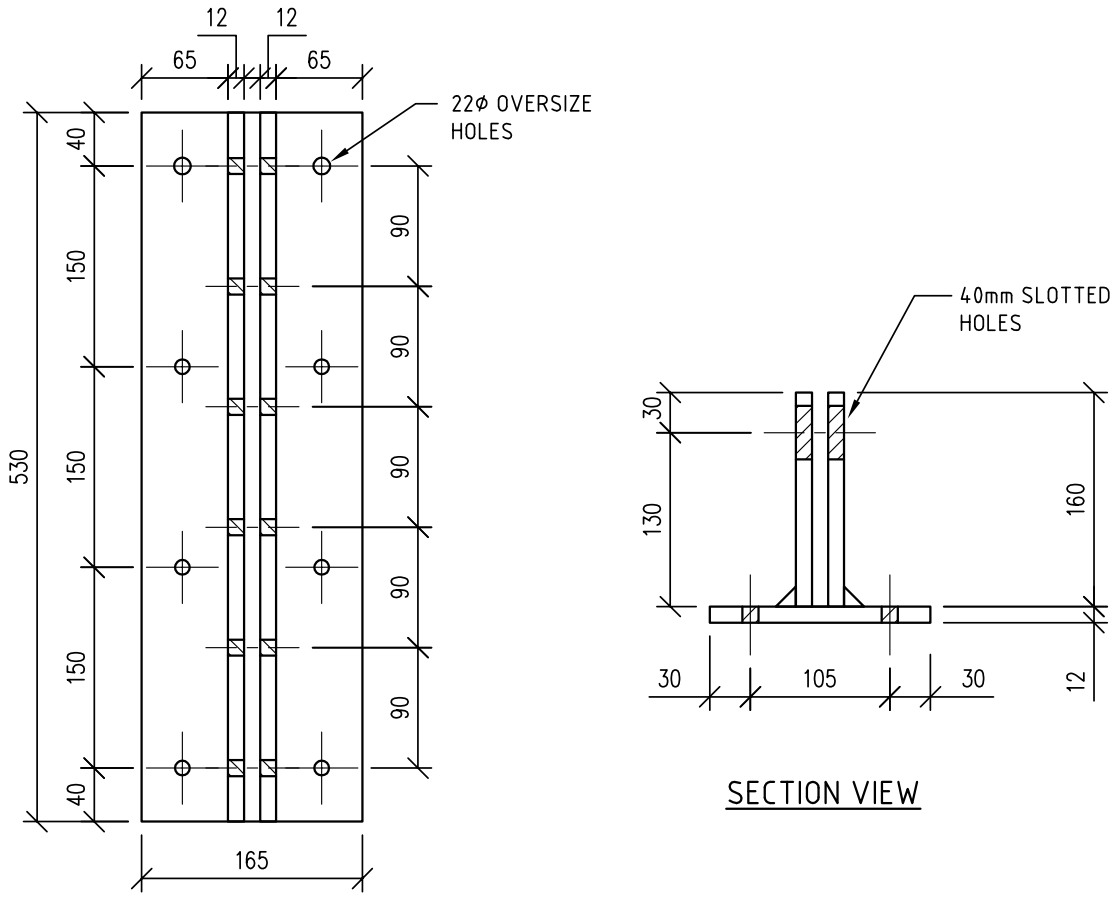
Fig. 47.

Typical Detail - (Expanded)



SISCO-FC™ PROPRIETARY JOIST TO BEARER BRACKET

SCALE 1:5

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Sheet No	09

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Fig. 48. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

Typical Detail - (Expanded)

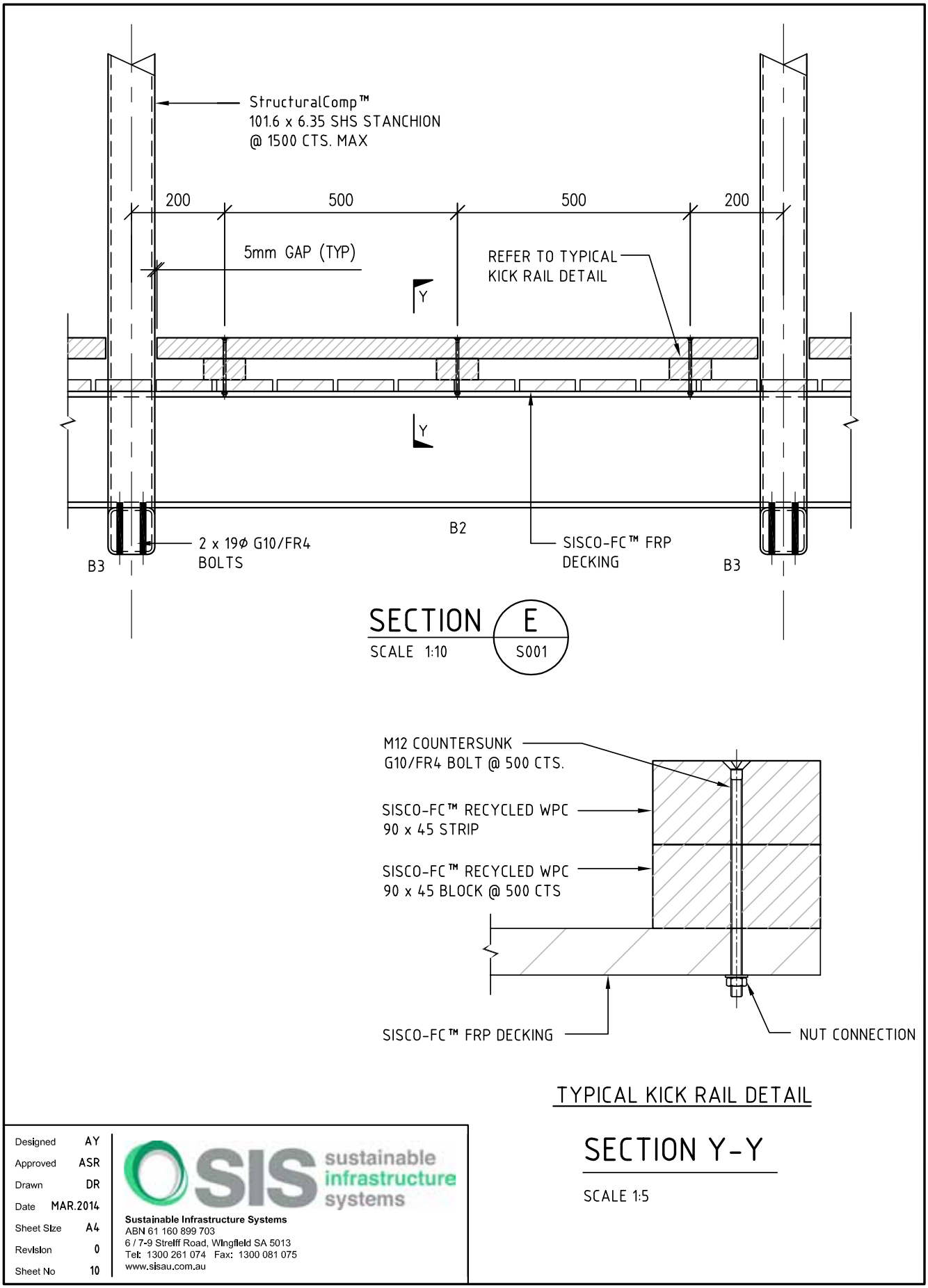


Fig. 49. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.

SISCo-FC™ WPC Decking / FRP Decking & Grating Options

StructuralComp™ FRP GRATING – Colour Options

FIBRE REINFORCED PLASTIC COMPOSITE GRATING – COLOUR OPTIONS						
Dark Grey	Standard Grey	Light Grey	Blue	Green	Yellow	Orange

Fig. 48

StructuralComp™ FRP GRATING – Surface Options

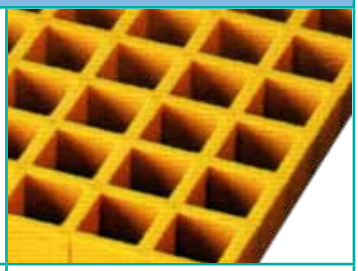
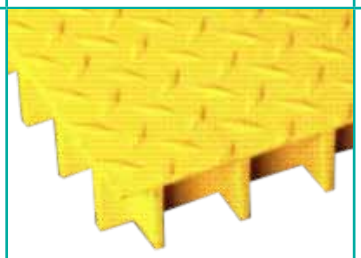
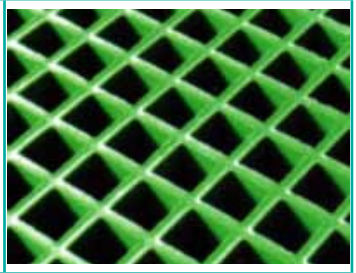
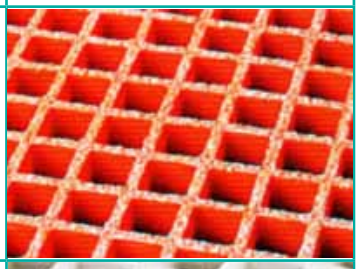
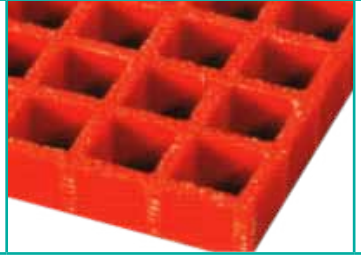
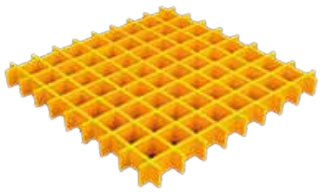
FIBRE REINFORCED PLASTIC COMPOSITE GRATING – SURFACE OPTIONS			
Smooth Cover		Pool Grit	
Checker Plate Cover		Meniscus	
Grit Cover		Grit	
Anti Abrasive Grit		Smooth	

Fig. 50

StructuralComp™ FRP Grating – Profile Options

GRATING OPTION 1		
Weight (kg/m²)	Web Thickness	Void Ratio (%)
21.2	8mm	78
Panel Size Options (WxL)	Mesh Size	Height
1220mm x 3660mm 1220mm x 2440mm 915mm x 3050mm	50 x 50mm	50mm



Concentrated Point Load & Deflection Data – Open (Without Top)

Load (kg)	Span (mm)										
	450	600	750	900	1050	1200	1500	1800	2100	2400	2700
Deflection (mm)											
150	0.30	0.55	0.80	1.23	1.81	2.62	4.45	7.52	11.47	15.28	23.00
200	0.39	0.73	1.08	1.59	2.40	3.45	5.87	9.75	15.27	21.86	
250	0.48	0.87	1.29	2.00	3.08	4.30	7.44	12.17	19.27		
300	0.55	1.06	1.54	2.39	3.66	5.16	8.84	14.83			
400	0.72	1.37	2.06	3.25	4.85	6.86	11.72				
600	1.07	1.99	3.11	4.80	7.22	10.19					
800	1.38	2.65	4.14	6.48	9.55						
1000	1.70	3.34	4.95	7.60							

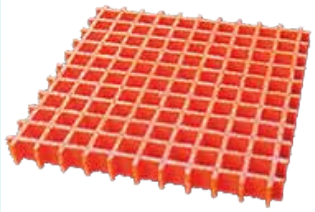
Concentrated Point Load & Deflection Data – Closed (With 3mm Top)

Load (kg)	Span (mm)										
		600	750	900	1100	1200	1500	1800	2100	2400	2700
Deflection (mm)											
100		0.36	0.53	0.65	0.79	1.01	1.98	2.97	4.42	6.63	9.58
150		0.55	0.83	1.03	1.18	1.56	2.99	4.59	6.67	10.17	14.52
200		0.67	1.05	1.30	1.64	2.02	4.07	6.08	9.06	13.79	
250		0.78	1.26	1.60	2.04	2.50	4.92	7.77	11.32		
300		0.89	1.45	1.91	2.42	3.01	5.89	9.39			
400		1.09	1.78	2.40	3.17	3.89	7.79	12.55			
600		1.46	2.48	3.39	4.59	5.77	11.60				
800		1.84	3.21	4.35	5.99	7.55					

Fig. 51

StructuralComp™ FRP Grating – Profile Options

GRATING OPTION 2		
Weight (kg/m²)	Web Thickness	Void Ratio (%)
18.5	7mm	70
Panel Size Options (WxL)	Mesh Size	Height
915mm x 3050mm 1000mm x 2000mm 1000mm x 3000mm 1000mm x 4038mm 1220mm x 3660mm 1220mm x 2440mm	38 x 38mm	38mm

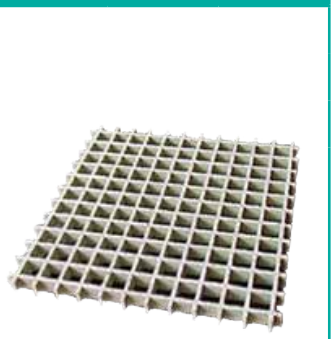


Concentrated Point Load & Deflection Data - Open (Without Top)											
Load (kg)	Span (mm)										
	450	600	750	900	1050	1200	1500	1800	2100	2400	2700
Deflection (mm)											
100	0.32	0.66	1.04	1.54	2.28	2.95	5.28	8.48	13.64	18.93	
150	0.47	0.90	1.47	2.22	3.21	4.37	7.86	12.88	20.66		
200	0.59	1.15	1.92	2.92	4.25	5.68	10.57	17.51			
250	0.69	1.42	2.33	3.69	5.21	7.18	13.06				
300	0.80	1.69	2.77	4.34	6.18	8.58					
400	0.99	2.18	3.64	5.65	8.15	11.44					
600	1.42	3.16	5.35	8.32							
800	1.84	4.16	6.20								

Concentrated Point Load & Deflection Data – Closed (With 3mm Top)											
Load (kg)	Span (mm)										
		450	600	750	900	1100	1200	1500	1800	2100	2400
Deflection (mm)											
100		0.33	0.38	0.68	0.94	1.30	1.80	3.36	5.63	8.63	12.54
150		0.44	0.61	1.01	1.38	1.95	2.72	5.11	8.39	12.90	
200		0.56	0.80	1.35	1.89	2.58	3.50	7.02	11.50		
250		0.65	1.01	1.65	2.39	3.28	4.46	8.79			
300		0.76	1.23	1.97	2.88	3.92	5.38	10.69			
400		0.94	1.58	2.61	3.77	5.16	7.08	14.02			
600		1.33	2.27	3.84	5.52	7.72	10.80				
800		1.70	2.98	5.07	7.32	10.37					

Fig. 52

StructuralComp™ FRP Grating – Profile Options

GRATING OPTION 3			
Weight (kg/m²)	Web Thickness	Void Ratio (%)	
13	7mm	70	
Panel Size Options (WxL)	Mesh Size	Height	
915mm x 3050mm 1000mm x 2000mm 1000mm x 3000mm 1000mm x 4038mm 1220mm x 3660mm 1220mm x 2440mm	38 x 38mm	25mm	

Concentrated Point Load & Deflection Data - Open (Without Top)								
Load (kg)	Span (mm)							
	300	450	600	750	900	1050	1200	
Deflection (mm)								
100	0.61	1.28	2.29	3.39	4.96	7.12	10.72	
150	0.83	1.90	3.52	5.21	7.95			
200	0.95	2.52	4.71	7.09				
250	1.23	3.08	5.96					
300	1.47	3.64						
400	1.68	4.45						
500	1.83							

Concentrated Point Load & Deflection Data – Closed (With 3mm Top)									
Load (kg)	Span (mm)								
	300	450	600	750	900	1100	1200	1500	1800
Deflection (mm)									
100	0.67	0.88	1.23	1.79	2.43	3.47	4.42	8.69	15.33
150	0.86	1.15	1.74	2.44	3.50	5.27	6.85	13.28	
200	0.98	1.41	2.27	3.28	4.73	7.01	8.96		
250	1.10	1.65	2.73	4.11	5.71	8.65	11.65		
300	1.21	1.90	3.24	4.99	6.91	10.52			
400	1.39	2.38	4.20	6.53	9.09				
600	1.74	3.30	6.02						
800	2.12								

Fig. 53

CoreSpan™ WPC / FRP Decking & WPC Decking

All Recycled Wood Plastic Composite decking is provided in project lengths, meaning very little on-site cutting and therefore wastage. In most cases, decking is also provided pre-drilled with oversize countersunk holes to prevent this from being done on site. The only exception to this is where a SISCo-FC™ system may have curves and therefore boards are provided without holes to allow for accurate on-site drilling.

CoreSpan™ WPC / FRP DECKING & WPC Decking – Colour Options

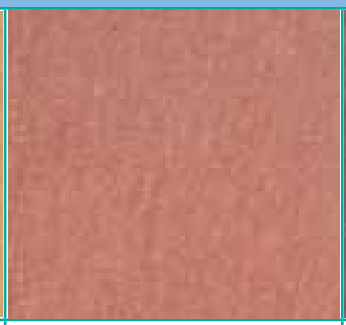
WPC Decking – COLOUR OPTIONS			
			
Ash Grey	Copper	Desert Red	Saddle Brown

Fig. 54

CoreSpan™ WPC / FRP MULTI COMPOSITE DECKING			
Weight	Height	Width	
6.7(kg/m)	40mm	200mm	
Fixing Options			
Screw Fix (with pre-drilling)		YES	
Screw Fix (without pre-drilling)		NO	
Hidden Fixing System		YES	
Maximum Span	Maximum Cantilever	Slip Ratings	Fire Rating
1200mm	300mm	W (TBC) R12 (TBC)	BAL (TBC)

Fig. 55



WPC DECKING OPTION 1			
Weight	Height	Width	
4.2	25mm	140mm	
Fixing Options			
Screw Fix (with pre-drilling)		YES	
Screw Fix (without pre-drilling)		NO	
Hidden Fixing System		YES	
Maximum Span	Maximum Cantilever	Slip Ratings	Fire Rating
450mm	150mm	(W (TBC) R12 (TBC)	BAL (TBC)

Fig. 56

WPC DECKING OPTION 2			
Weight	Height	Width	
5.5	30mm	140mm	
Fixing Options			
Screw Fix (with pre-drilling)		YES	
Screw Fix (without pre-drilling)		NO	
Hidden Fixing System		YES	
Maximum Span	Maximum Cantilever	Slip Ratings	Fire Rating
550mm	200mm	W (TBC) R12 (TBC)	BAL (TBC)

Fig. 57

Please contact SIS on either 1300 261 074 or service@sisau.com.au to request product samples of any of the above grating or decking options.

Project Management & Installation



Client demand for a 'turnkey solution' for their sustainable infrastructure needs has given rise to our installation division in recent years. You may choose SIS for just material manufacture and supply, or installation as well – the choice is yours. Our installation team is well established, reputable and award-winning in Australia. We have acquired significant experience, undertaking a wide range of design and construction projects across Australia, including rural and remote locations. We provide a professional, quality service in commercial construction, with all works completed with integrity and professionalism.

SIS's Installation team along with our Director of Civil Operations has completed hundreds of projects across Australia with values ranging from $300,000 to $6,000,000. This area of SIS has been growing steadily over the last six years to meet the growing demand of our diverse client base. Having consistently demonstrated a strong work ethic, quality and commitment to all works we undertake, SIS is trusted on an Australian national level to carry out an ever growing variety of works requiring innovation and a sustainable outlook.

We understand the importance of meeting milestones and completion dates, and strive to achieve all agreed requirements. We are committed to building relationships with our clients, which has ensured our growth and an award-winning reputation as quality civil installation company. 'When costing a project we not only consider the materials, manpower and equipment required, but also the safety of personnel and visitors to the site. A price cannot be put on injury or loss of life, which is why we invest considerable resources into ensuring the safety of everyone involved in our projects.

Our experience and broad skill-set give us the expertise required to complete challenges such as restricted time-frames and remote locations. We have extensive experience in:

- Construction only
- Fixed lump sum contracts
- Construction Management
- Project Management
- Design and Construction contracts

We have proven mobilisation capabilities and understand what is required to install in remote and rural locations, such as national parks. We select and build relationships with contractors that

understand the complications involved in working outside of any metropolitan area. We believe the key to building in remote and rural locations is sequential planning. During pre-construction, we conduct scheduling meetings with proven service contractors, including electrical, plumbing, mechanical and fire, to discuss lead times and the methodology to transport materials and construct in a distant location.

Our team has successfully mobilised projects within one to one and half weeks, a rare feat in our industry, and have the proven know-how to deliver large-scale projects Australia wide. Once the installation and any additional civil works has been completed, a formal handover process takes place between the client and our project manager. Unless an ongoing maintenance contract is held with SIS, this is the final stage of the project life-cycle in terms of delivery to the client.

INSTALLATION & CONSTRUCTION AWARDS

The team at SIS prides itself on surpassing expectations in every way, from design and manufacturing through to installation and hand-over.

Our installation team has been awarded the 2009 Master Builders Association – Building Excellence Award and also the 2012 Master Builders Association – Commercial/ Industrial Building up to $1m.

MANAGEMENT SYSTEMS

Sustainable Infrastructures Systems (Aust.) Pty Ltd is environmentally, quality and customer service focused and this, plus exceptional safety standards and environmental diligence, is demonstrated through our Management Systems. We are committed to following the Quality Assurance initiatives stipulated in the standard ISO 9001:2008 and to its continuous improvement.

Our goal is to provide the highest quality service and products to surpass the needs and expectations of our clients and stakeholders. SIS is committed to manufacturing and construction excellence. To achieve this we continually identify, set, measure and review our quality objectives. We have developed and implemented written procedures to ensure our capability for consistently providing a quality service that;

- Exceeds our customer's needs;
- Meets the requirements of applicable legislation;
- Allows us to operate with increased effectiveness and efficiency with the overall aim of continually improving our business systems.

A Quality Management Plan is produced for every project undertaken by SIS (using template QMP 04.1) to act as an interface between client's requirements and the SIS Quality Management System. This Quality Management Plan is provided to our client at project commencement and includes;

- Information about the project;
- Communication channels between the client and SIS;
- The Quality Assurance responsibilities;
- Reference to the Quality System;
- Purchasing initiatives;
- Commitments to service;
- Commitments to care for client's property;
- Initiatives for accuracy;
- Control of Non Conformance;
- A customised Inspection Test Plan;
- Sign off and commitment.

ENVIRONMENTAL MANAGEMENT SYSTEM

Our Environmental Management Implementation Plan (EMP) has been developed to ensure full and complete compliance with any statutory and regulatory environmental obligations. It is our policy to meet these environmental management requirements and to exceed current industry

best practice where possible. All supply and install contracts are managed in accordance with our Environmental Management System together with plans and procedures provided by clients. From an operational perspective, this includes identifying and assessing all potential environmental hazards from onsite at the quotation stage, and again immediately prior to undertaking works using the Risk Assessment of the Daily Job Sheet.

The aim of SIS is to whilst any project installation, minimise our impact on the environment throughout project activities including;

- To ensure that the quality of surface water leaving the site is acceptable during the construction phase;
- To minimise negative impacts on any significant, protected or natural areas of vegetation on or adjacent to the site, and to comply with native vegetation conditions;
- To identify, assess and control risk arising from erosion and sediment generated from operations carried out by SIS;
- To minimise any dust and nuisance noise emissions;
- To be aware of;

1. The potential for the contamination of the site;
2. The potential for environmental impact of wastes generated on site;
3. The impacts arising from site activities on items or areas of cultural heritage significance.

OCCUPATIONAL HEALTH & SAFETY MANAGEMENT SYSTEM

SIS management recognises their absolute responsibility in ensuring the health and safety of every employee, contractor, visitor and 'other' person within the business and adopts a risk management strategy in the planning, implementation and management of its operations so as to minimise potential safety hazards and environmental impact. Employees are trained and empowered to recognise, identify and report potential safety hazards and potential environmental impact.

We are committed to maintaining the highest possible standards of health, safety and wellbeing for employees, contractors and visitors across all operations.

The success of our business is dependent on the capability, commitment and productivity of our employees and our sub-contractors. We aim to operate safely, efficiently and to be the preferred supply and install company within the sectors in which we operate.

Sustainable Infrastructure Systems (Aust) Pty Ltd:

- Complies with Occupational Health and Safety Act and associated statutory requirements;
- Maintains a safety culture within the company;
- Is regarded as pro-active and committed to OHS&W
- Has a target of zero injuries or illness due to work

SIS has an ongoing commitment to provide safe systems of work to ensure that, as far as reasonably practicable, a safe working environment is maintained and by providing this Management System, SIS defines the mechanisms to ensure compliance from management and employees directly by SIS and also via subcontractors.

The Hazard Management process should be part of everyday activities on construction sites and associated activities. To ensure an adequate focus on potential hazards, some purposeful attention should be directed towards hazard identification.

Typical Project Timelines

The following page outlines a typical project timeline for a 100 lineal metre SISCo-FC™ boardwalk.

The timeline is displayed in two sections, Contract Start Up and Project Mobilisation.

Each section consists of the following:

SUBMISSION & DOCUMENTATION

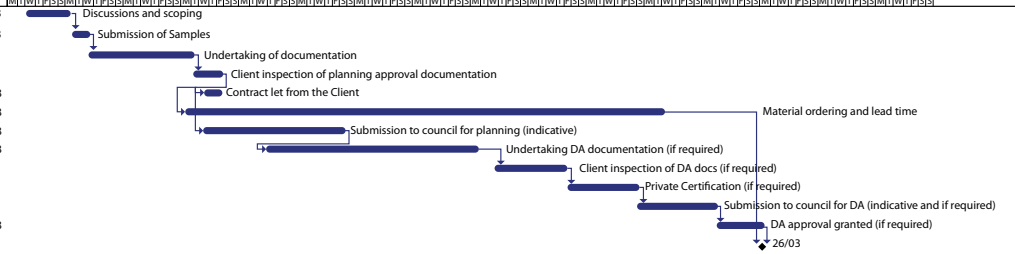
- Discussions and Scoping
- Submission of Samples
- Undertaking of Documentation
- Client inspection of planning approval documentations
- Contract let from Client
- Material ordering and Lead time
- Submission to Council for Planning (indicative)
- Undertaking DA documentation (if required)
- Client inspection of DA docs (if required)
- Private Certification (if required)
- Submission to coundil for DA (indicative and if required)
- DA approval granted (if required)
- Finalisation of Construction Administration

PROJECT MOBILISATION

- Site Establishment
- Safety Inductions and Site Awareness
- Site surveying and setout of piers
- Site works to boardwalk and surround
- Boring of piers to footings
- Hold Point - Engineers inspection of pier holes
- Installation of reinforcement to footings
- Hold Point - Engineers Inspection of Reinforcement
- Installation of concrete to piers
- Installation of boardwalk posts and brackets with hold down bolts
- Mobilisation of crane to site
- Installation of bearers to required centres
- Installation of joists to structure
- Hold Point - SIS inspection by Senior Management of Structural framing and s
- Installation of grating to boardwalk
- Installation of hand rail and kick rails
- Landscaping to boardwalk area, including installation of verges
- Hold Point - Defects Inspection by SIS and Client
- Project Finalization

SIS – Indicative Program – 100m Boardwalk and 1m from GL at 2m in width – Administration

ID	Task Name	Duration	Start	Finish
1	SIS – Boardwalk Construction 100m long x 2m wide x 1m of the ground surface	59 days	Thu 3/01/13	Tue 25/06/13
2	Contract Start up	59 days	Thu 3/01/13	Tue 25/06/13
3	Discussions and scoping	3 days	Thu 3/01/13	Wed 3/04/13
4	Submission of Samples	2 days	Tue 8/01/13	Fri 5/04/13
5	Undertaking of documentation	8 days	Thu 10/01/13	Thu 11/04/13
6	Client inspection of planning approval documentation	3 days	Tue 22/01/13	Thu 18/04/13
7	Contract let from the Client	2 days	Wed 23/01/13	Thu 25/04/13
8	Material ordering and lead time	40 days	Mon 21/01/13	Thu 25/04/13
9	Submission to council for planning (indicative)	12 days	Wed 23/01/13	Wed 1/05/13
10	Undertaking DA documentation (if required)	18 days	Wed 30/01/13	Wed 1/05/13
11	Client inspection of DA docs (if required)	6 days	Mon 25/02/13	Wed 8/05/13
12	Private Certification (if required)	6 days	Tue 5/03/13	Thu 16/05/13
13	Submission to council for DA (indicative and if required)	7 days	Wed 13/03/13	Fri 17/05/13
14	DA approval granted (if required)	3 days	Fri 22/03/13	Fri 24/05/13
15	Finalisation of Construction administration	0 days	Tue 26/03/13	Tue 4/06/13

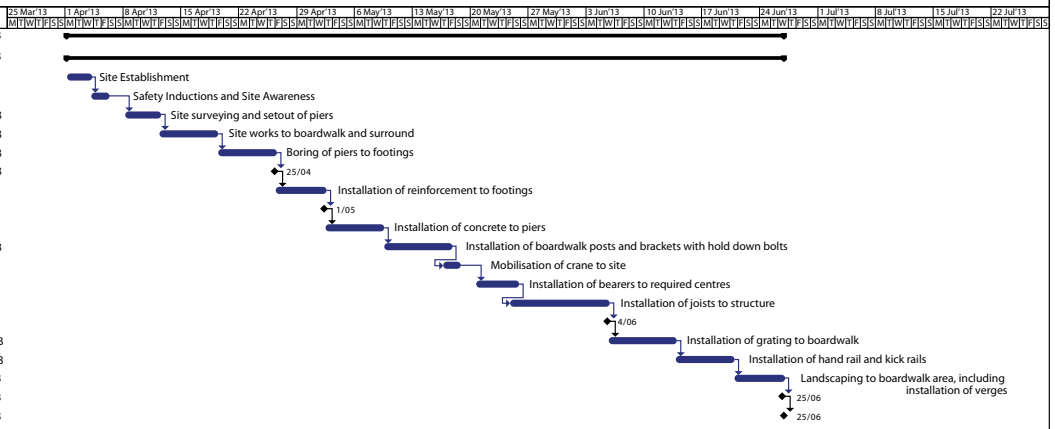


Project: SIS Indicative Program - Constr
Date: 1st Jan 2013

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

SIS – Indicative Program – 100m Boardwalk and 1m from GL at 2m in width – Construction

ID	Task Name	Duration	Start	Finish
1	SIS – Boardwalk Construction 100m long x 2m wide x 1m of the ground surface	62 days	Mon 1/04/13	Tue 25/06/13
2	Project Mobilisation	62 days	Mon 1/04/13	Tue 25/06/13
3	Site Establishment	3 days	Mon 1/04/13	Wed 3/04/13
4	Safety Inductions and Site Awareness	2 days	Thu 4/04/13	Fri 5/04/13
5	Site surveying and setout of piers	4 days	Mon 8/04/13	Thu 11/04/13
6	Site works to boardwalk and surround	5 days	Fri 12/04/13	Thu 18/04/13
7	Boring of piers to footings	5 days	Fri 19/04/13	Thu 25/04/13
8	Hold Point – Engineers inspection of pier holes	0 days	Thu 25/04/13	Thu 25/04/13
9	Installation of reinforcement to footings	4 days	Fri 26/04/13	Wed 1/05/13
10	Hold Point - Engineers inspection of Reinforcement	0 days	Wed 1/05/13	Wed 1/05/13
11	Installation of concrete to piers	5 days	Thu 2/05/13	Wed 8/05/13
12	Installation of boardwalk posts and brackets with hold down bolts	6 days	Thu 9/05/13	Thu 16/05/13
13	Mobilisation of crane to site	2 days	Thu 16/05/13	Fri 17/05/13
14	Installation of bearers to required centres	5 days	Mon 20/05/13	Fri 24/05/13
15	Installation of joists to structure	8 days	Fri 24/05/13	Tue 4/06/13
16	Hold Point – SIS inspection by Senior Management of Structural framing and signoff	0 days	Tue 4/06/13	Tue 4/06/13
17	Installation of grating to boardwalk	6 days	Wed 5/06/13	Wed 12/06/13
18	Installation of hand rail and kick rails	5 days	Thu 13/06/13	Wed 19/06/13
19	Landscaping to boardwalk area, including installation of verges	4 days	Thu 20/06/13	Tue 25/06/13
20	Hold Point – Defects Inspection by SIS and Client	0 days	Tue 25/06/13	Tue 25/06/13
21	Project Finalization	0 days	Tue 25/06/13	Tue 25/06/13



Project: SIS Indicative Program - Constr
Date: 1st Jan 2013

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

Fig. 58. Copyright 2014 Sustainable Infrastructure Systems (Aust) Pty Ltd.58

Pricing

Listed below is INDICATIVE PRICING only. Please contact SIS for quantity / project pricing. Pricing is ex Adelaide. For larger projects or stocking orders freight can be quoted to any Australian capital city. All pricing is quoted in $AUD

NOTE: For pricing on EXTREN DWB® hybrid and all-glass members contact SIS.

INDICATIVE PRICING		
CODE	COMPONENT	PRICE ex GST
SIS-FCS-250JB-0000	250 Joist / Bearer - StructuralComp™ I Beam 250mm x 125mm x 12mm	$127.50/m
SIS-FCS-609JB-0000	609 Joist / Bearer - StructuralComp™ I Beam 609mm x 9.5mm x 190mm x 19.1mm	$236.20/m
SIS-FCS-PILE-0000	Piles - StructuralComp™ SHS 120mm x 120mm x 8mm	$62.45/m
SIS-FCS-BRACE-0000	Brace - StructuralComp™ Plate 75mm x 10mm	$4.85/m
SIS-FCS-HRHS-0000	Handrail Horizontal Support - StructuralComp™ SHS 101.6mm x 6.35mm	$49.18/m
SIS-FCS-HRS-0000	Handrail Stanchion - StructuralComp™ SHS 101.6mm x 6.35mm	$49.18/m
SIS-FCS-HR-0000	Handrail - StructuralComp™ CHS 50.8mm x 6.4mm	$7.43/m
SIS-FCS-BKT-1	Pile to Bearer / Footing Bracket - StructuralComp™ 125mm x 172mm x 280mm x 12mm	$22.09ea
SIS-FCS-BKT-2	Joist to Bearer Bracket - StructuralComp™ 530mm x 172mm x 165mm x 12mm	$56.12ea
SIS-FCS-BKT-3	Handrail Horizontal Support to Handrail Stanchion Bracket - StructuralComp™ 175mm x 250mm x 10mm	$8.22ea
SIS-FCS-BKT-4	Handrail to Handrail Stanchion Bracket - StructuralComp™ 16mm x 100mm x 166mm	$7.60ea
SIS-FCS-CPNT-1	Capping (Handrail Horizontal Support) - Recycled Plastic Insert Cap (Flush)	$1.88ea
SIS-FCS-CPNT-2	In Plain Joist to Bearer Packer - StructuralComp™ 165mm x 530mm x 10mm	$7.10ea
SIS-FCS-CPNT-3	Pile to Bearer Packer - StructuralComp™ 280mm x 125mm x 5mm	$5.90ea
SIS-FCS-CPNT-4	Handrail Internal Connection Sleeve - StructuralComp™ 38.1mm x 6.4mm CHS (160mm)	$1.03ea
SIS-FCS-CPNT-5	Anti-Crush Tubes - StructuralComp™ 21.8mm x 2.4mm x 119mm CHS	$1.22ea
SIS-FCS-CPNT-6	Handrail Adhesive - SCOTCHWELD DP8010	TBA

INDICATIVE PRICING		
CODE	COMPONENT	PRICE ex GST
SIS-FCS-CPNT-7	FRP Sealent	TBA
SIS-FCS-CPNT-8	Non Shrink Grout	TBA
SIS-FCS-CPNT-9	Superstructure Bolted Connection Fixings - G10/FR4 19mm Bolts / Washers / Nuts	$8.15ea
SIS-FCS-CPNT-10	Pile to Footing Bracket Fixings (to Footing) - M16 Chem Anchors	TBA
SIS-FCS-CPNT-11	Kickrail to Deck Fixings - G10/FR4 M12 Countersunk Bolt / Nut / Washer (Hex Head)	$3.18ea
SIS-FCS-CPNT-12	Handrail Internal Sleeve Fixing - G10/FR4 M8 Countersunk Screws	$2.33ea
SIS-FCS-CPNT-13	Handrail to Handrail Stanchion Bracket Fixing - G10/FR4 M8 Screws	$2.33ea
SIS-FCS-COC-1	Large Span Decking - CoreSpan™ FRP/WPC 200mm x 40mm Large Span Decking	$25.70/m
SIS-FCS-COC-2	WPC Decking Option 1 - Recycled WPC 140mm x 25mm	$12.01/m
SIS-FCS-COC-3	WPC Decking Option 2 - Recycled WPC 140mm x 30mm	$15.90/m
SIS-FCS-COC-4	FRP Grating Option 1 - StructuralComp™ FRP 50mm x 50mm x 50mm Grating	$89.90sq/m
SIS-FCS-COC-5	FRP Grating Option 1 With Top - StructuralComp™ FRP 50mm x 50mm x 50mm Grating with 3mm Top	$101.12sq/m
SIS-FCS-COC-6	FRP Grating Option 2 - StructuralComp™ FRP 38mm x 38mm x 38mm Grating	$72.30sq/m
SIS-FCS-COC-7	FRP Grating Option 2 With Top - StructuralComp™ FRP 38mm x 38mm x 38mm Grating with 3mm Top	$78.60sq/m
SIS-FCS-COC-8	FRP Grating Option 3 - StructuralComp™ FRP 38mm x 38mm x 25mm Grating	$61.80sq/m
SIS-FCS-COC-9	FRP Grating Option 3 With Top - StructuralComp™ FRP 38mm x 38mm x 25mm Grating with 3mm Top	$68.22sq/m
SIS-FCS-COC-10	Handrail Infill Option 1 - Stainless Steel Wire	TBA
SIS-FCS-COC-11	Handrail Infill Option 2 - Vertical Aluminium Panel	TBA
SIS-FCS-COC-12	Handrail Infill Option 3 - Vertical Recycled WPC Panel	TBA
SIS-FCS-COC-13	Kick Rail - Recycled WPC 90mm x 45mm	$9.89/m
SIS-FCS-COC-14	Kick Rail Blocks - Recycled WPC 90mm x 45mmx 100mm	$1.22ea

Fig. 59

Component Lead Times

(Project Quantities Delivered to any Australian Capital City Metro Area)

AVAILABILITY		
Component	Weeks From Date of Order	Stocked
Piles	8	N
Bearers	8	N
Joists	8	N
Handrail Vertical Supports	8	N
Handrail	8	N
Pile to Bearer Bracket	1	Y
Bearer to Joist Bracket	1	Y
Bearer Level Adjustment Plate	1	Y
Handrail Vertical Support to Deck Connector Bracket	1	Y
Threaded Rod	1	Y
Nut	1	Y
Large Span Decking	8	N
WPC Decking (all options)	8	N
FRP Grating (all options)	8	N
Deck Fixing Screws	1	Y

Fig. 60

How to Specify

CODE	DRAWING MARK / REFERENCE	MEMBERS	PARTICULARS
SIS-FCS-250JB-0000	B2	250 Joist / Bearer	StructuralComp™ I Beam 250mm x 125mm x 12mm
SIS-FCS-609JB-0000	B2	609 Joist / Bearer	StructuralComp™ I Beam 609mm x 9.5mm x 190mm x 19.1mm
SIS-FCS-PILE-0000	C1	Piles	StructuralComp™ SHS 120mm x 120mm x 8mm
SIS-FCS-BRACE-0000	LBR1, LBR2	Brace	StructuralComp™ Plate 75mm x 10mm
SIS-FCS-HRHS-0000	B3	Handrail Horizontal Support	StructuralComp™ SHS 101.6mm x 6.35mm
SIS-FCS-HRS-0000	Stanchion	Handrail Stanchion	StructuralComp™ SHS 101.6mm x 6.35mm
SIS-FCS-HR-0000	Handrail	Handrail	StructuralComp™ CHS 50.8mm x 6.4mm
CODE	**DRAWING MARK / REFERENCE**	**BRACKETS**	**PARTICULARS**
SIS-FCS-BKT-1	Pile to Bearer / Footing Bracket	Pile to Bearer / Footing Bracket	StructuralComp™ 125mm x 172mm x 280mm x 12mm
SIS-FCS-BKT-2	Joist to Bearer Bracket	Joist to Bearer Bracket	StructuralComp™ 530mm x 172mm x 165mm x 12mm
SIS-FCS-BKT-3	10LPL	Handrail Horizontal Support to Handrail Stanchion Bracket	StructuralComp™ 175mm x 250mm x 10mm
SIS-FCS-BKT-4	16x100 Long Bent PL	Handrail to Handrail Stanchion Bracket	StructuralComp™ 16mm x 100mm x 166mm
CODE	**DRAWING MARK / REFERENCE**	**COMPONENTS & FIXINGS**	**PARTICULARS**
SIS-FCS-CPNT-1	Capping	Capping (Handrail Horizontal Support)	Recycled Plastic Insert Cap (Flush)
SIS-FCS-CPNT-2	10 Max Packer	In Plain Joist to Bearer Packer	StructuralComp™ 165mm x 530mm x 10mm
SIS-FCS-CPNT-3	Packer	Pile to Bearer Packer	StructuralComp™ 280mm x 125mm x 5mm

CODE	DRAWING MARK / REFERENCE	COMPONENTS & FIXINGS	PARTICULARS
SIS-FCS-CPNT-4	Sleeve Connection	Handrail Internal Connection Sleeve	StructuralComp™ 38.1mm x 6.4mm CHS (160mm)
SIS-FCS-CPNT-5	Proprietary Anti-Crush System	Anti-Crush Tubes	StructuralComp™ 21.8mm x 2.4mm x 119mm CHS
SIS-FCS-CPNT-6	Scotchweld DP8010 Adhesive	Handrail Adhesive	Scotchweld DP8010 Adhesive
SIS-FCS-CPNT-7	FRP Sealent	FRP Sealent	TBA
SIS-FCS-CPNT-8	25mm Non Shrink Grout	Non Shrink Grout	TBA
SIS-FCS-CPNT-9	19Ø G10/FR4 Bolts	Superstructure Bolted Connection Fixings	G10/FR4 19mm Bolts / Washers / Nuts
SIS-FCS-CPNT-10	M16 Chem Anchors	Pile to Footing Bracket Fixings (to Footing)	M16 Chem Anchors
SIS-FCS-CPNT-11	M12 Countersunk G10/FR4 Bolts	Kickrail to Deck Fixings	G10/FR4 M12 Countersunk Bolt / Nut / Washer (Hex Head)
SIS-FCS-CPNT-12	2 x M8 Countersunk Screw Each Side	Handrail Internal Sleeve Fixing	G10/FR4 M8 Countersunk Screws
SIS-FCS-CPNT-13	4 x M8 G10/FR4 Screws	Handrail to Handrail Stanchion Bracket Fixing	G10/FR4 M8 Screws
CODE	**DRAWING MARK / REFERENCE**	**CLIENT OPTIONED COMPONENTS**	**PARTICULARS**
SIS-FCS-COC-1		Large Span Decking	CoreSpan™ FRP/WPC 200mm x 40mm Large Span Decking
SIS-FCS-COC-2		WPC Decking Option 1	Recycled WPC 140mm x 25mm
SIS-FCS-COC-3		WPC Decking Option 2	Recycled WPC 140mm x 30mm
SIS-FCS-COC-4		FRP Grating Option 1	StructuralComp™ FRP 50mm x 50mm x 50mm Grating

CODE	DRAWING MARK / REFERENCE	CLIENT OPTIONED COMPONENTS	PARTICULARS
SIS-FCS-COC-5		FRP Grating Option 1 With Top	StructuralComp™ FRP 50mm x 50mm x 50mm Grating with 3mm Top
SIS-FCS-COC-6		FRP Grating Option 2	StructuralComp™ FRP 38mm x 38mm x 38mm Grating
SIS-FCS-COC-7		FRP Grating Option 2 With Top	StructuralComp™ FRP 38mm x 38mm x 38mm Grating with 3mm Top
SIS-FCS-COC-8		FRP Grating Option 3	StructuralComp™ FRP 38mm x 38mm x 25mm Grating
SIS-FCS-COC-9		FRP Grating Option 3 With Top	StructuralComp™ FRP 38mm x 38mm x 25mm Grating with 3mm Top
SIS-FCS-COC-10		Handrail Infill Option 1	Stainless Steel Wire
SIS-FCS-COC-11		Handrail Infill Option 2	Vertical Aluminium Panel
SIS-FCS-COC-12		Handrail Infill Option 3	Vertical Recycled WPC Panel
SIS-FCS-COC-13		Kick Rail	Recycled WPC 90mm x 45mm
SIS-FCS-COC-14		Kick Rail Blocks	Recycled WPC 90mm x 45mmx 100mm

Fig. 61

*NOTE: Bolt set includes bolt, nut and 2 x washers
*NOTE: SIS-FCS-BSA is used at Pile to Bearer Bracket (to bearer only) and Joist to Bearer (All)
*NOTE: Items not specified on this table are due to design options – i.e. handrail components

Component Example Specification Code

COMPONENT EXAMPLE SPECIFICATION CODE

SIS-FCS-COMP-A

=SIS (Manufacturer) – FCS (Fibre Composite System) – COMP (Component) – A (Pile to Bearer Bracket)

MEMBER EXAMPLE SPECIFICATION CODE

SIS-FCS-PILE-3500

=SIS (Manufacturer) – FCS (Fibre Composite System) – PILE (Member) – 3500 (3500mm in Length)

WPC DECKING EXAMPLE SPECIFICATION CODE

SIS-FCS-CD-A-2500-COPPER

=SIS (Manufacturer) – FCS (Fibre Composite System) – CD (WPC Decking) – 2500 (2500mm in Length) – COPPER (Colour)

GRATING EXAMPLE SPECIFICATION CODE

SIS-FCS-CG-A-1220-2440-YELLOW

=SIS (Manufacturer) – FCS (Fibre Composite System) – CG (Grating) – 1220-2440 (Panel Size) – Yellow (Colour)

GRATING (WITH TOP) EXAMPLE SPECIFICATION CODE

SIS-FCS-CG-A-1220-2440-T-GRIT-YELLOW

=SIS (Manufacturer) – FCS (Fibre Composite System) – CG (Grating) – 1220-2440 (Panel Size) - (Top) – GRIT (Surface Finish of Top) - Yellow (Colour) -

Transport & Logistics

SIS uses the cost effectiveness of manufacturing its StructuralComp™ FRP Pile / Bearer / Joist components in Asia, therefore we provide details below on container quantities for these members in both 20 foot and 40 foot containers. StructuralComp™ FRP Pile / Bearer / Joist components can be packed loose, or on steel stillages. Consideration in to member packing must be made in reference to how materials will be handled once they get to site, or a depot.

There are many benefits associated with container transporting. Just some of these include the ability to deliver a container to any Australian capital city port, therefore eliminating expensive long haul road transport. Also, a container can be left on site during construction allowing for the safe storage of materials. Lengths shown below are optimum lengths for container transport and will vary due to project dimentions.

CONTAINER QUANTITIES		
Component	40 Foot	20 Foot
StructuralComp™ FRP Pile (5800mm)	630	325
StructuralComp™ FRP Bearer / Joist (5800mm)	396	256
StructuralComp™ FRP Bearer / Joist (11600mm)	128	N/A

Fig. 62

NOTE: For container quantities on EXTREN DWB® hybrid and all-glass members contact SIS.

FRP structures are light weight meaning transport costs are low, and craning and transportation via helicopter for pre-assembled modules is possible.

Other Products From Sustainable Infrastructure Systems

Picture	SIS Product Code	WPC Hollow Rectangular Profiles
	SIS-WPC-51H30-1000	Extruded Hollow Rectangular Profile, 51mm x 30mm
	SIS-WPC-85H50-1000	Extruded Hollow Rectangular Profile, 85mm x 50mm
	SIS-WPC-89H25-1000	Extruded Hollow Rectangular Profile, 89mm x 25mm
	SIS-WPC-100H30-1000	Extruded Hollow Rectangular Profile, 100mm x 30mm
	SIS-WPC-100H50-1000	Extruded Hollow Rectangular Profile, 100mm x 50mm
	SIS-WPC-145H22-1000	Extruded Hollow Rectangular Profile, 145mm x 22mm
	SIS-WPC-180H80-1000	Extruded Hollow Rectangular Profile, 180mm x 80mm
	SIS-WPC-160H60-1000	Extruded Hollow Rectangular Profile, 160mm x 60mm
	SIS-WPC-200H60-1000	Extruded Hollow Rectangular Profile, 200mm x 60mm

Fig. 63

Picture	SIS Product Code	WPC Solid Rectangular Sections
	SIS-WPC-70S16-1000	Extruded Solid Rectangular Profile, 70mm x 16mm
	SIS-WPC-140S10-1000	Extruded Solid Rectangular Profile, 140mm x 10mm
	SIS-WPC-140S20-1000	Extruded Solid Rectangular Profile, 140mm x 20mm
	SIS-WPC-140S30-1000	Extruded Solid Rectangular Profile, 140mm x 30mm
	SIS-WPC-147S16-1000	Extruded Solid Rectangular Profile, 147mm x 16mm
	SIS-WPC-250S20-1000	Extruded Solid Rectangular Profile, 250mm x 20mm
	SIS-WPC-298S16-1000	Extruded Solid Rectangular Profile, 298mm x 16mm

Fig. 64

Picture	SIS Product Code	WPC Hollow Square Sections
	SIS-WPC-51H51-1000	Extruded Hollow Square Profile, 51mm x 51mm
	SIS-WPC-60H60-1000	Extruded Hollow Square Profile, 60mm x 60mm
	SIS-WPC-70H70-1000	Extruded Hollow Square Profile, 70mm x 70mm
	SIS-WPC-90H90-1000	Extruded Hollow Square Profile, 90mm x 900mm
	SIS-WPC-100H100-1000	Extruded Hollow Square Profile, 100mm x 100mm
	SIS-WPC-120H120-1000	Extruded Hollow Square Profile, 120mm x 120mm
	SIS-WPC-150H150-1000	Extruded Hollow Square Profile, 150mm x 150mm
	SIS-WPC-200H200-1000	Extruded Hollow Square Profile, 200mm x 200mm

Fig. 65

Picture	SIS Product Code	WPC Solid Decking
	SIS-WPC-140S25-1000	Extruded Solid Decking Profile, 140mm x 25mm
	SIS-WPC-140S30-1000	Extruded Solid Decking Profile, 140mm x 30mm

Fig. 66

Picture	SIS Product Code	WPC Hollow Decking
	SIS-WPC-100H25 -1000	Extruded Hollow Decking Profile, 100mm x 25mm

Fig. 67

Picture	SIS Product Code	WPC Accessories
	SIS-WPC-AC-AC01	Plastic Hidden System Fixing Clip for WPC Decking
	SIS-WPC-AC-AC03	Stainless Steel Start Clip for WPC Decking

Fig. 68

Picture	SIS Product Code	CoreSpan™ Co-Extruded WPC / FRP
	SIS-CEWPC-100x50-1000	CoreSpan™ Co-Extruded Profile, 100mm x 50mm (WPC / FRP Section 50x25x3)
	SIS-CEWPC-140x40-1000	CoreSpan™ Co-Extruded Profile, 140mm x 40mm (WPC / FRP Section 100x20x3)
	SIS-CEWPC-120x120- 1000	CoreSpan™ Co-Extruded Profile, 120mm x 120mm (WPC / FRP Section 90x90x3)
	SIS-CEWPC-140x90-1000	CoreSpan™ Co-Extruded Profile, 140mm x 90mm (WPC / FRP Section 100x50x3)
	SIS-CEWPC-70R-1000	CoreSpan™ Co-Extruded Profile, 70mm Round (WPC / FRP Section 42x3)
	SIS-CEWPC-90R-1000	CoreSpan™ Co-Extruded Profile, 90mm Round (WPC / FRP Section 59x3)
	SIS-CEWPC-120R-1000	CoreSpan™ Co-Extruded Profile, 120mm Round (WPC / FRP Section 48x3)
	SIS-CEWPC-150R-1000	CoreSpan™ Co-Extruded Profile, 150mm Round (WPC / FRP Section 88x3)

Fig. 69

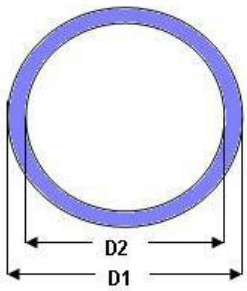
Picture	SIS Product Code	StructuralComp™ FRP Hollow Round Tubes
	SIS-FRP-RH-A1	Pultruded Hollow Round Profile, 19mm OD, 14mm ID
	SIS-FRP-RH-A2	Pultruded Hollow Round Profile, 25.4mm OD, 20.5mm ID
	SIS-FRP-RH-A3	Pultruded Hollow Round Profile, 25.4mm OD, 18.4mm ID
	SIS-FRP-RH-A4	Pultruded Hollow Round Profile, 28mm OD, 24mm ID
	SIS-FRP-RH-A5	Pultruded Hollow Round Profile, 31mm OD, 25mm ID
	SIS-FRP-RH-A6	Pultruded Hollow Round Profile, 32mm OD, 27.5mm ID
	SIS-FRP-RH-A7	Pultruded Hollow Round Profile, 32mm OD, 26mm ID
	SIS-FRP-RH-A8	Pultruded Hollow Round Profile, 33.7mm OD, 27.7mm ID
	SIS-FRP-RH-A9	Pultruded Hollow Round Profile, 39mm OD, 34mm ID
	SIS-FRP-RH-A10	Pultruded Hollow Round Profile, 45mm OD, 35mm ID

Fig. 70

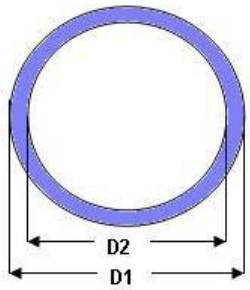
	SIS-FRP-RH-A11	Pultruded Hollow Round Profile, 50mm OD, 42mm ID
	SIS-FRP-RH-A12	Pultruded Hollow Round Profile, 75mm OD, 67mm ID
	SIS-FRP-RH-A13	Pultruded Hollow Round Profile, 110mm OD, 90mm ID

Fig. 71

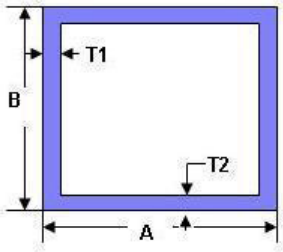
Picture	SIS Product Code	StructuralComp™ FRP Square Hollow Sections
	SIS-FRP-SH-B1	Pultruded Hollow Square Profile, 25.4mm x 25.4mm, 2mm Wall Thickness
	SIS-FRP-SH-B2	Pultruded Hollow Square Profile, 25.4mm x 25.4mm, 3.2mm Wall Thickness
	SIS-FRP-SH-B3	Pultruded Hollow Square Profile, 38mm x 38mm, 4mm Wall Thickness
	SIS-FRP-SH-B4	Pultruded Hollow Square Profile, 41.4mm x 41.4mm, 4.2mm Wall Thickness
	SIS-FRP-SH-B5	Pultruded Hollow Square Profile, 50mm x 50mm, 4mm Wall Thickness
	SIS-FRP-SH-B6	Pultruded Hollow Square Profile, 50mm x 50mm, 5mm Wall Thickness
	SIS-FRP-SH-B7	Pultruded Hollow Square Profile, 50mm x 50mm, 6mm Wall Thickness
	SIS-FRP-SH-B8	Pultruded Hollow Square Profile, 50.8mm x 50.8mm, 6.35mm Wall Thickness
	SIS-FRP-SH-B9	Pultruded Hollow Square Profile, 75mm x 75mm, 6mm Wall Thickness
	SIS-FRP-SH-B10	Pultruded Hollow Square Profile, 76.2mm x 76.2mm, 6.35mm Wall Thickness
	SIS-FRP-SH-B11	Pultruded Hollow Square Profile, 80mm x 80mm, 6mm Wall Thickness
	SIS-FRP-SH-B12	Pultruded Hollow Square Profile, 100mm x 100mm, 8mm Wall Thickness
	SIS-FRP-SH-B13	Pultruded Hollow Square Profile, 120mm x 120mm, 8mm Wall Thickness
	SIS-FRP-SH-B14	Pultruded Hollow Square Profile, 150mm x 150mm, 8mm Wall Thickness

Fig. 72

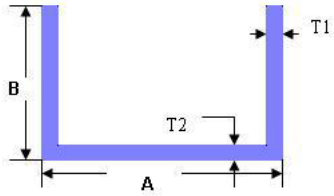
Picture	SIS Product Code	StructuralComp™ FRP C Channel Sections
	SIS-FRP-CC-C1	Pultruded C-Channel Profile, 50mm x 30mm, 5mm & 5mm Wall Thickness
	SIS-FRP-CC-C2	Pultruded C-Channel Profile, 52mm x 30mm, 5mm & 5mm Wall Thickness
	SIS-FRP-CC-C3	Pultruded C-Channel Profile, 57mm x 60mm, 3mm & 3mm Wall Thickness
	SIS-FRP-CC-C4	Pultruded C-Channel Profile, 60mm x 50mm, 5mm & 5mm Wall Thickness
	SIS-FRP-CC-C5	Pultruded C-Channel Profile, 70mm x 26mm, 4mm & 3mm Wall Thickness
	SIS-FRP-CC-C6	Pultruded C-Channel Profile, 79mm x 28.5mm, 3mm & 3mm Wall Thickness
	SIS-FRP-CC-C7	Pultruded C-Channel Profile, 84mm x 30mm, 5.5mm & 5.5mm Wall Thickness
	SIS-FRP-CC-C8	Pultruded C-Channel Profile, 100mm x 35mm, 5mm & 5mm Wall Thickness
	SIS-FRP-CC-C9	Pultruded C-Channel Profile, 100mm x 50mm, 6mm & 6mm Wall Thickness
	SIS-FRP-CC-C10	Pultruded C-Channel Profile, 101.6mm x 35mm, 4.8mm & 4.8mm Wall Thickness
	SIS-FRP-CC-C11	Pultruded C-Channel Profile, 150mm x 50mm, 6mm & 6mm Wall Thickness
	SIS-FRP-CC-C12	Pultruded C-Channel Profile, 150mm x 40mm, 10mm & 10mm Wall Thickness
	SIS-FRP-CC-C13	Pultruded C-Channel Profile, 152.4mm x 42mm, 6.35mm & 6.35mm Wall Thickness
	SIS-FRP-CC-C14	Pultruded C-Channel Profile, 152.4mm x 42mm, 9.5mm & 9.5mm Wall Thickness
	SIS-FRP-CC-C15	Pultruded C-Channel Profile, 200mm x 50mm, 10mm & 10mm Wall Thickness
	SIS-FRP-CC-C16	Pultruded C-Channel Profile, 203.2mm x 56mm, 9.5mm & 9.5mm Wall Thickness
	SIS-FRP-CC-C17	Pultruded C-Channel Profile, 250mm x 70mm, 12mm & 12mm Wall Thickness

Fig. 73

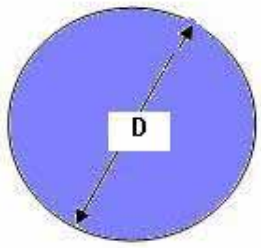
Picture	SIS Product Code	StructuralComp™ FRP Solid Round Sections
	SIS-FRP-RS-D1	Pultruded Solid Round Profile, 6mm Diameter
	SIS-FRP-RS-D2	Pultruded Solid Round Profile, 7.9mm Diameter
	SIS-FRP-RS-D3	Pultruded Solid Round Profile, 10mm Diameter
	SIS-FRP-RS-D4	Pultruded Solid Round Profile, 12.7mm Diameter
	SIS-FRP-RS-D5	Pultruded Solid Round Profile, 14mm Diameter
	SIS-FRP-RS-D6	Pultruded Solid Round Profile, 18mm Diameter
	SIS-FRP-RS-D7	Pultruded Solid Round Profile, 19mm Diameter
	SIS-FRP-RS-D8	Pultruded Solid Round Profile, 22mm Diameter
	SIS-FRP-RS-D9	Pultruded Solid Round Profile, 23.7mm Diameter
	SIS-FRP-RS-D10	Pultruded Solid Round Profile, 25mm Diameter
	SIS-FRP-RS-D11	Pultruded Solid Round Profile, 28mm Diameter
	SIS-FRP-RS-D12	Pultruded Solid Round Profile, 30mm Diameter
	SIS-FRP-RS-D13	Pultruded Solid Round Profile, 32mm Diameter

Fig. 74

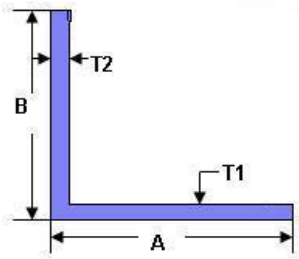
Picture	SIS Product Code	StructuralComp™ FRP Right Angle Sections
	SIS-FRP-RA-E1	Pultruded Right Angle Profile, 40mm x 40mm, 4mm & 4mm Wall Thickness
	SIS-FRP-RA-E2	Pultruded Right Angle Profile, 50mm x 50mm, 5mm & 5mm Wall Thickness
	SIS-FRP-RA-E3	Pultruded Right Angle Profile, 75mm x 75mm, 6mm & 6mm Wall Thickness
	SIS-FRP-RA-E4	Pultruded Right Angle Profile, 76.2mm x 76.2mm, 6.4mm & 6.4mm Wall Thickness
	SIS-FRP-RA-E5	Pultruded Right Angle Profile, 76.2mm x 76.2mm, 8mm & 8mm Wall Thickness

Fig. 75

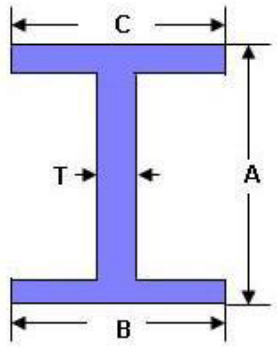
Picture	SIS Product Code	StructuralComp™ FRP I Beams
	SIS-FRP-IB-F1	Pultruded I Beam Profile, 25mm Height, 15mm & 15mm Width, 4mm Wall Thickness
	SIS-FRP-IB-F2	Pultruded I Beam Profile, 25mm Height, 15mm & 40mm Width, 4mm Wall Thickness
	SIS-FRP-IB-F3	Pultruded I Beam Profile, 38mm Height, 15mm & 15mm Width, 3.4mm Wall Thickness
	SIS-FRP-IB-F4	Pultruded I Beam Profile, 38mm Height, 15mm & 15mm Width, 4mm Wall Thickness
	SIS-FRP-IB-F5	Pultruded I Beam Profile, 50.8mm Height, 15mm & 25.4mm Width, 4mm Wall Thickness
	SIS-FRP-IB-F6	Pultruded I Beam Profile, 50.8mm Height, 50.8mm & 50.8mm Width, 4.2mm Wall Thickness
	SIS-FRP-IB-F7	Pultruded I Beam Profile, 58mm Height, 15mm & 15mm Width, 5mm Wall Thickness
	SIS-FRP-IB-F8	Pultruded I Beam Profile, 76.2mm Height, 76.2mm & 76.2mm Width, 6.35mm Wall Thickness
	SIS-FRP-IB-F9	Pultruded I Beam Profile, 101.6mm Height, 50.8mm & 50.8mm Width, 6.35mm Wall Thickness
	SIS-FRP-IB-F10	Pultruded I Beam Profile, 152.4mm Height, 76.2mm & 76.2mm Width, 6.35mm Wall Thickness
	SIS-FRP-IB-F11	Pultruded I Beam Profile, 200mm Height, 100mm & 100mm Width, 10mm Wall Thickness
	SIS-FRP-IB-F12	Pultruded I Beam Profile, 250mm Height, 125mm & 125mm Width, 12mm Wall Thickness

Fig. 76

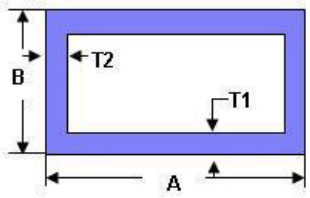
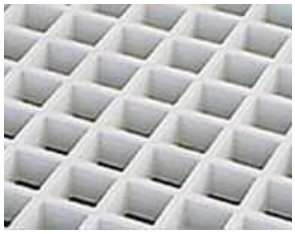
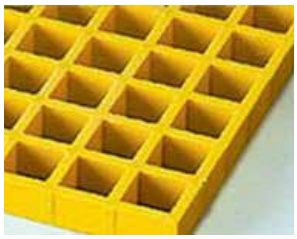
Picture	SIS Product Code	StructuralComp™ FRP Rectangular Sections
	SIS-FRP-RECH-G1	Pultruded Hollow Rectangular Profile, 38.1mm x 25.4mm, 2mm Wall Thickness
	SIS-FRP-RECH-G2	Pultruded Hollow Rectangular Profile, 42mm x 20mm, 2mm Wall Thickness
	SIS-FRP-RECH-G3	Pultruded Hollow Rectangular Profile, 76mm x 26mm, 3mm Wall Thickness
	SIS-FRP-RECH-G4	Pultruded Hollow Rectangular Profile, 80mm x 50mm, 5mm Wall Thickness
	SIS-FRP-RECH-G5	Pultruded Hollow Rectangular Profile, 117.5mm x 92.1mm, 4.8mm Wall Thickness
	SIS-FRP-RECH-G6	Pultruded Hollow Rectangular Profile, 150mm x 100mm, 8mm Wall Thickness
	SIS-FRP-RECH-G7	Pultruded Hollow Rectangular Profile, 190.5mm x 101.6mm, 9.5mm Wall Thickness
	SIS-FRP-RECH-G8	Pultruded Hollow Rectangular Profile, 228mm x 152mm, 6mm Wall Thickness

Fig. 77

Picture	SIS Product Code	StructuralComp™ FRP Moulded Grating
		1220mm x 3600mm or 1220mm x 2440 or 915mm x 3050mm Sheets
	SIS-FRP-GR-H1	Moulded FRP Grating, 38mm x 38mm Mesh, 25mm Height
	SIS-FRP-GR-H2	Moulded FRP Grating, 25mm x 100mm Mesh, 25mm Height
	SIS-FRP-GR-H3	Moulded FRP Grating, 38mm x 38mm Mesh, 38mm Height
		1525mm x 3965mm or 1525mm x 3660mm x 1525mm x 3050mm Sheets
	SIS-FRP-GR-H4	Moulded FRP Grating, 38mm x 38mm Mesh, 25mm Height
		1220mm x 3660mm Sheets
	SIS-FRP-GR-H5	Moulded FRP Grating, 25mm x 100mm Mesh, 38mm Height
	SIS-FRP-GR-H6	Moulded FRP Grating, 25mm x 152mm Mesh, 38mm Height
	SIS-FRP-GR-H7	Moulded FRP Grating, 38mm x 150mm Mesh, 38mm Height

		1220mm x 3600mm or 1220mm x 2440 or 915mm x 3050mm Sheets
	SIS-FRP-GR-H8	Moulded FRP Grating, 50mm x 50mm Mesh, 50mm Height
		1220mm x 3660mm Sheets
	SIS-FRP-GR-H9	Moulded FRP Grating, 50mm x 50mm Mesh, 13mm Height
	SIS-FRP-GR-H10	Moulded FRP Grating, 38mm x 38mm Mesh, 25mm Height
		580mm x 3050mm or 580mm x 3660 Sheets
	SIS-FRP-GR-H11	Moulded FRP Grating, 38mm x 152mm Mesh, 38mm Height
		1247mm x 3087mm or 1007mm x 3007mm Sheets
	SIS-FRP-GR-H12	Moulded FRP Grating, 40mm x 40mm Mesh, 25mm Height
		1009mm x 3007mm Sheets
	SIS-FRP-GR-H13	Moulded FRP Grating, 25mm x 100mm Mesh, 25mm Height
		1009mm x 3307mm Sheets
	SIS-FRP-GR-H14	Moulded FRP Grating, 100mm x 25mm Mesh, 25mm Height
		1247mm x 3087mm Sheets
	SIS-FRP-GR-H15	Moulded FRP Grating, 40mm x 40mm Mesh, 40mm Height
		1247mm x 4047mm or 1007mm x 3007mm Sheets
	SIS-FRP-GR-H16	Moulded FRP Grating, 40mm x 40mm Mesh, 40mm Height
		1007mm x 4047mm Sheets
	SIS-FRP-GR-H17	Moulded FRP Grating, 40mm x 40mm Mesh, 40mm Height
		1000mm x 4038mm or 1000mm x 3000mm or 1000mm x 2000mm Sheets
	SIS-FRP-GR-H18	Moulded FRP Grating, 38mm x 38mm Mesh, 25mm Height
	SIS-FRP-GR-H19	Moulded FRP Grating, 38mm x 38mm Mesh, 30mm Height

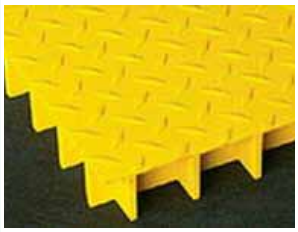
	SIS-FRP-GR-H20	Moulded FRP Grating, 38mm x 38mm Mesh, 30mm Height
		1413mm x 4000mm Sheets
	SIS-FRP-GR-H21	Moulded FRP Grating, 38mm x 38mm - 12mm x 12mm Mesh, 32mm Height
		1000mm x 4050mm or 1000mm x 3000mm or 1000mm x 2000mm Sheets
	SIS-FRP-GR-H22	Moulded FRP Grating, 52mm x 52mm - 19mm x 19mm Mesh, 32mm Height
	SIS-FRP-GR-H23	Moulded FRP Grating, 52mm x 52mm - 19mm x 19mm Mesh, 38mm Height
	SIS-FRP-GR-H24	Moulded FRP Grating, 52mm x 52mm - 18mm x 18mm Mesh, 52mm Height
	SIS-FRP-GR-H25	Moulded FRP Grating, 52mm x 52mm - 18mm x 18mm Mesh, 55mm Height
		1000mm x 4038mm Sheets
	SIS-FRP-GR-H26	Moulded FRP Grating, 38mm x 38mm - 8mm x 8mm Mesh, 30mm Height
		1220mm x 3660mm or 1220mm x 2440mm or 915mm x 3050mm Sheets
	SIS-FRP-GR-H27	Moulded FRP Grating, 50mm x 50mm - 18mm x 18mm Mesh, 32mm Height

Fig. 78

Picture	SIS Product Code	StructuralComp™ FRP Threaded Rod
	SIS-FRP-FBTR-A-1000	FRP Threaded Rod, 9.52mm Diameter x 1220mm Length - 15 Pieces Per Pack
	SIS-FRP-FBTR-B-1000	FRP Threaded Rod, 12.70mm Diameter x 1220mm Length - 10 Pieces Per Pack
	SIS-FRP-FBTR-C-1000	FRP Threaded Rod, 15.87mm Diameter x 1220mm Length - 10 Pieces Per Pack
	SIS-FRP-FBTR-D-1000	FRP Threaded Rod, 19.05mm Diameter x 1220mm Length - 6 Pieces Per Pack
	SIS-FRP-FBTR-E-1000	FRP Threaded Rod, 25.40mm Diameter x 1220mm Length - 4 Pieces Per Pack
	SIS Product Code	**StructuralComp™ FRP Hex Nuts**
	SIS-FRP-FBN-A	FRP Hex Nuts, 9.52 ID - 100 Pieces Per Pack
	SIS-FRP-FBN-B	FRP Hex Nuts, 12.70 ID - 100 Pieces Per Pack
	SIS-FRP-FBN-C	FRP Hex Nuts, 15.87 ID - 100 Pieces Per Pack
	SIS-FRP-FBN-D	FRP Hex Nuts, 19.05 ID - 25 Pieces Per Pack
	SIS-FRP-FBN-E	FRP Hex Nuts, 25.40 ID - 25 Pieces Per Pack

Fig. 79

Picture	SIS Product Code	Recycled Plastic Flat Sheet
		Black
	SIS-PP-6BL	Recycled Plastic Flat sheet, 1220mm x 2440mm - 6mm Thickness
	SIS-PP-8BL	Recycled Plastic Flat sheet, 1220mm x 2440mm - 8mm Thickness
	SIS-PP-10BL	Recycled Plastic Flat sheet, 1220mm x 2440mm - 10mm Thickness
	SIS-PP-12BL	Recycled Plastic Flat sheet, 1220mm x 2440mm - 12mm Thickness
	SIS-PP-15BL	Recycled Plastic Flat sheet, 1220mm x 2440mm - 15mm Thickness
	SIS-PP-19BL	Recycled Plastic Flat sheet, 1220mm x 2440mm - 19mm Thickness
	SIS-PP-25BL	Recycled Plastic Flat sheet, 1220mm x 2440mm - 25mm Thickness
		Colours - Blue, Beige, Green, Oyster Grey, Orange, Red, Yellow, Off White - Orange Peel Finish
	SIS-PP-6COL-(Colour)	Recycled Plastic Flat sheet, 1220mm x 2440mm - 6mm Thickness
	SIS-PP-10COL-(Colour)	Recycled Plastic Flat sheet, 1220mm x 2440mm - 10mm Thickness
	SIS-PP-12COL-(Colour)	Recycled Plastic Flat sheet, 1220mm x 2440mm - 12mm Thickness
	SIS-PP-15COL-(Colour)	Recycled Plastic Flat sheet, 1220mm x 2440mm - 15mm Thickness
	SIS-PP-19COL-(Colour)	Recycled Plastic Flat sheet, 1220mm x 2440mm - 19mm Thickness
	SIS-PP-25COL-(Colour)	Recycled Plastic Flat sheet, 1220mm x 2440mm - 25mm Thickness
		Charcoal - Commercial Stipple Finish
	SIS-PP-10-CH-ST	Recycled Plastic Flat sheet, 1220mm x 2440mm - 10mm Thickness
	SIS-PP-10-CH-ST	Recycled Plastic Flat sheet, 1220mm x 2440mm - 15mm Thickness
	SIS-PP-10-CH-ST	Recycled Plastic Flat sheet, 1220mm x 2440mm - 19mm Thickness

Fig. 80

Picture	SIS Product Code	Aluminium Plastic Composite Panel
	SIS-APCP-3PE-A	Aluminium Plastic Composite Panel, 3mm Thickness, Aluminium Layers .12mm Thick
	SIS-APCP-3PE-B	Aluminium Plastic Composite Panel, 3mm Thickness, Aluminium Layers .15mm Thick
	SIS-APCP-3PE-C	Aluminium Plastic Composite Panel, 3mm Thickness, Aluminium Layers .18mm Thick
	SIS-APCP-3PE-D	Aluminium Plastic Composite Panel, 3mm Thickness, Aluminium Layers .21mm Thick
	SIS-APCP-4PE-A	Aluminium Plastic Composite Panel, 4mm Thickness, Aluminium Layers .12mm Thick
	SIS-APCP-4PE-B	Aluminium Plastic Composite Panel, 4mm Thickness, Aluminium Layers .15mm Thick
	SIS-APCP-4PE-C	Aluminium Plastic Composite Panel, 4mm Thickness, Aluminium Layers .18mm Thick
	SIS-APCP-4PE-D	Aluminium Plastic Composite Panel, 4mm Thickness, Aluminium Layers .21mm Thick
	SIS-APCP-4PE-E	Aluminium Plastic Composite Panel, 4mm Thickness, Aluminium Layers .25mm Thick
	SIS-APCP-4PE-F	Aluminium Plastic Composite Panel, 4mm Thickness, Aluminium Layers .30mm Thick
	SIS-APCP-4PE-G	Aluminium Plastic Composite Panel, 4mm Thickness, Aluminium Layers .35mm Thick
	SIS-APCP-4PE-H	Aluminium Plastic Composite Panel, 4mm Thickness, Aluminium Layers .40mm Thick
	SIS-APCP-4PE-I	Aluminium Plastic Composite Panel, 4mm Thickness, Aluminium Layers .45mm Thick
	SIS-APCP-4PE-J	Aluminium Plastic Composite Panel, 4mm Thickness, Aluminium Layers .50mm Thick

Fig. 81

Picture	SIS Product Code	Recycled Rubber Products
	SIS-RR-A	Moulded Recycled Rubber Fender
	SIS-RR-B	Moulded Recycled Rubber Fender
	SIS-RR-C	Moulded Recycled Rubber Fender
	SIS-RR-D	Moulded Recycled Rubber Fender
	SIS-RR-E	Moulded Recycled Rubber Fender
	SIS-RR-F	Moulded Recycled Rubber Fender
	SIS-RR-G	Moulded Recycled Rubber Fender
	SIS-RR-H	Moulded Recycled Rubber Fender

Fig. 82

PRICE NOTE FOR PRODUCTS BELOW

SIS offers container pricing on products below - contact us for further information

Picture	SIS Product Code	Recycled Plastic Flat Sheet
	SIS-RR-BLD	Moulded Recycled Rubber / Recycled Plastic Traffic Bollard - 1150mm x Ø25mm
	SIS-RR-TC	Moulded Recycled Rubber / Recycled Plastic Traffic Cone - 750mm
	SIS-RR-PA	Recycled Rubber Parking Aid - 1650mm x 140mm x 100mm
	SIS-RR-SH	Recycled Rubber Speed Humps - 500mm x 350mm x 50mm Black / Yellow Section

Fig. 83

SIS Product FAQs

General

1. What is SIS StructuralComp™ FRP?

StructuralComp™ FRP is Fibre Reinforced Polymer (plastic) that is reinforced with glass or carbon fibre. The primary function of fibre reinforcement is to carry load along the length of the fibre and to provide strength and stiffness in one direction. SIS StructuralComp™ FRP represents a class of materials that falls into a category referred to as composite materials. Composite materials consist of two or more materials that retain their respective chemical and physical characteristics when combined together.

2. Why is StructuralComp™ FRP better than traditional construction materials?

StructuralComp™ FRP composites are different from traditional construction materials like steel or aluminium. StructuralComp™ FRP composites are anisotropic (properties apparent in the direction of applied load) whereas steel or aluminium is isotropic (uniform properties in all directions, independent of applied load). Therefore StructuralComp™ FRP composites properties are directional, meaning that the best mechanical properties are in the direction of the fibre placement.

3. What is StructuralComp™ FRP's environmental impact?

StructuralComp™ FRP is environmentally friendly as FRP products produce fewer air and water emissions, consumes less energy and emits less greenhouse gas, leading to both a reduced environmental impact and a lower carbon footprint. Since FRP does not corrode or deteriorate, it can be recycled. More importantly, however, virgin production of FRP usually has less environmental impact than even recycling alternate materials, such as steel and aluminium.

Pricing

4. How does StructuralComp™ FRP compare to steel in price?

StructuralComp™ FRP materials are generally more expensive than steel when comparing material costs. However, when factoring in installation, handling, transportation and other associated expenses, the total installed cost of FRP is more competitive to steel.

5. How does StructuralComp™ FRP compare to stainless steel in price?

StructuralComp™ FRP materials are normally less than the cost of stainless steel.

6. How does StructuralComp™ FRP compare to wood in price?

StructuralComp™ FRP materials cannot compete with wood on price alone. Customers considering using FRP in place of wood should evaluate the strength, rot resistance and overall performance requirements for the application and choose the best material accordingly.

7. What information is needed to get a StructuralComp™ design and cost estimate for a bridge?

A: SIS just needs bridge size, load requirements and support spacing to provide an initial design (depth, weight) and cost (+/- 10%). If the

support spacing is undecided, we will provide an engineered solution.

Technical

8. Can SIS provide certified drawings by an Engineer?

A: Yes. We have in-house engineers in Australia to certify all drawings we provide. SIS also has a worldwide network of engineering companies for international projects.

9. Does StructuralComp™ FRP corrode?

StructuralComp™ FRP does not corrode - FRP structural products are corrosion resistant to almost all chemicals. In many structural applications where wood rots and metals corrode, FRP products will last indefinitely with little or no maintenance. The applications can be as diverse as water parks, water and sewage plants and coastal areas, in fact anywhere where water (either salt water or fresh water) is present, or where corrosive chemical solutions and or vapours are present. FRP is used extensively in processing and chemical plants. Pultruded FRP products will endure an extremely long life with very little maintenance.

10. How strong is StructuralComp™ FRP?

Generally speaking, StructuralComp™ structural shapes have a high strength-to-weight ratio and kilos for kilo are stronger than steel longitudinally. FRP products distribute impact loads to prevent surface damage even in sub-zero temperatures and will not permanently deform under impact. Engineers and Designers in the future will use StructuralComp™ FRP to design and build what was virtually impossible before FRP.

11. How heavy is StructuralComp™ FRP?

StructuralComp™ FRP materials are lightweight. Generally on an equal volume basis, pultruded FRP will weigh only 25% of the weight of steel and 70% of the weight of aluminium. This feature can significantly impact installation costs, reduce the risk for injury and result in less structural support from foundations or supporting structures.

12. Is StructuralComp™ electrically safe?

Yes, StructuralComp™ FRP is extremely low in electrical conductivity. Nonconductive products provide significant safety benefits in many applications such as those found in electrical switch board rooms and sub stations.

13. Is StructuralComp™ FRP thermally conductive?

StructuralComp™ FRP has a low 'U' value and is low in thermal conductivity and FRP products do not expand or contract like metals. This feature can provide a significant degree of thermal insulation. It also can be a safety feature. For example, if one part of an FRP product is extremely hot, individuals who touch the structure away from the heat source won't be burned.

14. Is StructuralComp™ FRP compatible with Wi-Fi?

StructuralComp™ FRP is EMI / RFI Transparent - material that is transparent to radar and radio waves. This feature can benefit applications such as Wi-Fi, antenna and cellular shielding. FRP products are suitable for communication installations and server rooms.

15. Is StructuralComp™ FRP flammable?

StructuralComp™ FRP is fire resistant and can be provided with a fire resistant additive that virtually eliminates the flame and smoke components from the polymer. StructuralComp™ FRP fire retardant will comply with AS 1530.4, BS 1979 and ASTM E-84 and ASTM D-635.

StructuralComp™ FRP can be used in buildings with confidence. We manufacture many different products that are suitable for use where there is a calculated fire risk.

16. How does StructuralComp™ FRP compare to steel in strength?

Please contact SIS customer service for a comparison data sheet.

17. How does StructuralComp™ FRP compare to wood in strength?

Please contact SIS customer service for a comparison data sheet.

18. How does StructuralComp™ FRP handle hot and cold temperatures?

Temperatures must be taken into consideration during the structural design process. Refer to the SIS Design Manual for a chart showing changes in mechanical properties as the temperatures reach 50 degrees Celsius and higher. Cold temperatures are generally of little concern unless below -40 degrees Celsius.

19. What is the service life of StructuralComp™ FRP materials?

The service life of any particular product depends on the application in which it is installed. Generally speaking, StructuralComp™ service life is beyond 40 years.

20. Does StructuralComp™ FRP have UV protection?

The resins, coatings, and wear surfaces that we utilize are extremely resistant to UV rays. These materials are designed specifically for direct sunlight exposure.

21.How do I fabricate StructuralComp™ FRP products?

StructuralComp™ FRP products can be cut, drilled, and otherwise fabricated using standard carpenter's tools. Carbide blades and drill bits are recommended to facilitate the task and extend the life of the blade or bit.

22. Can SIS provide pre-engineered and fabricated materials?

Yes, SIS has in-house engineers, estimators, drafters and fabrication services available. The SIS Design Manual is available to assist external engineers in the design/built process.

Transport

23. How are my StructuralComp™ FRP products delivered?

SIS has distribution facilities in all Australian capital cities. SIS FRP products are manufactured in North America and China. We can therefore land your orders into the closest sea port in Australia to your project at much better rates than trucking the product around Australia. This also applies to international deliveries.

Lead Times

24. What is your lead time?

Lead times vary; stocked items typically have a lead time of 48 hours or less. If the item is not stocked, please contact Customer Service to inquire about its lead time.

Australian Head Office
abn 61160899703
a 6/7-9 Streiff Road, Wingfield SA 5013
t +1300 26 10 74 f +1300 08 10 75
service@sisau.com.au
sisau.com.au

sydney
17 Jumal Place
Smithfield
NSW 2164
Australia

melbourne
135 Boundary Road
Laverton North
Victoria 3026
Australia

brisbane
1094 Lytton Road
Murarrie
Queensland 4172
Australia

hong kong
Room 102, 1st Floor
The Centre Mark
287 - 299 Queen´s Rd
Central Hong Kong

shanghai
RM 1001A
Hua Sheng Building
No.398 Han Kou Road
200001 Shanghai
People´s Republic of China

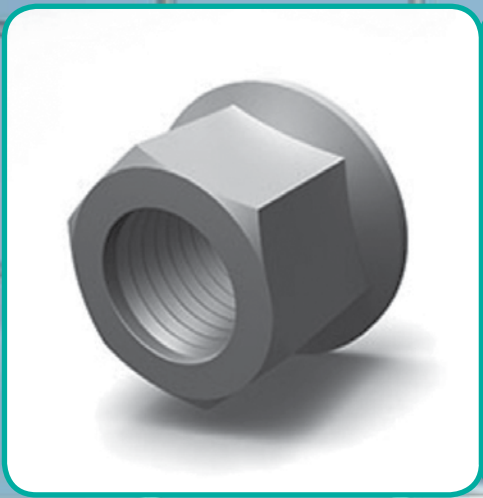
shenzhen
27-3, 27th Floor
Shun Hing Square
Di Wang Commercial Centre
Lu Wu District, Shenzhen
People´s Republic of China

los angeles
Suite 135
5230 Pacific Concourse Dr.
Los Angeles
CA 90045
United States

Annexure 1

sustainable infrastructure systems

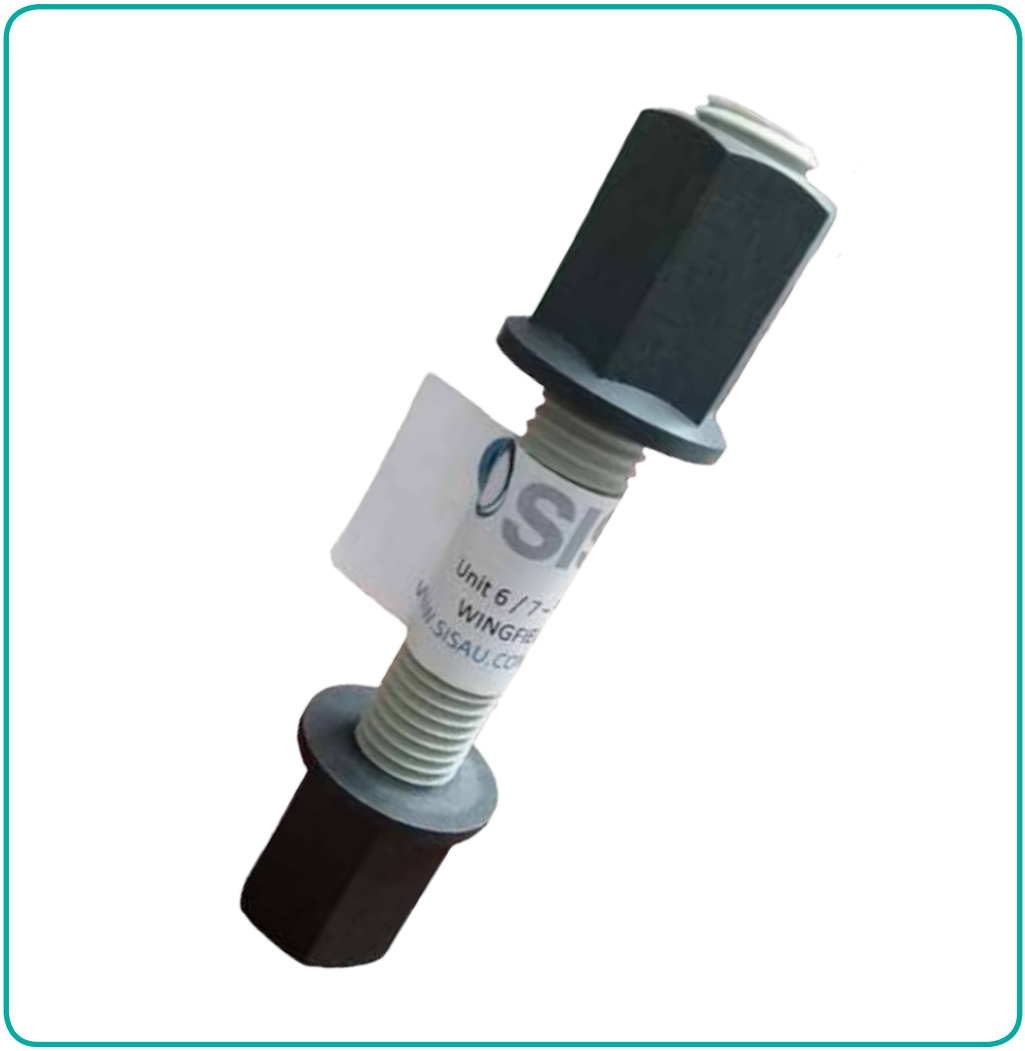
Threaded Rod & Flanged Hex Nuts
Part #SIS-TR Part #SIS-FHN



Innovative Projects call for Innovative Fixings

SISCo-FC™ SYSTEM
COMPOSITE FIXINGS

V4.3 - Release Date 01.03.14



TRADE MARKS

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PATENTS / PATENTS PENDING

Parts of the SISCo-FC™ System are protected by either patents or patents pending. Individual components are protected by either patents or patents pending. Fixing methodology is protected by patents or patents pending.

All SISCo-FC™ System composite fixings are manufactured in the United States of America

SISCo-FC™ Composite Threaded Rod & Flanged Hex Nuts

Most common hardware fixings are available from SIS in various composites, although it is our threaded rod and nuts that continues to replace more traditional materials throughout Australia, North America and Europe than any other product. SISCo-FC™ threaded rod is manufactured using only premium grade vinyl ester (VE) resins and UV inhibitors. Pultrusion results in the production and supply of one of the world's strongest and most durable fixing products available today.

SISCo-FC™ Flanged Hex Nuts are manufactured from Isoplast 40% long glass fibre engineering thermoplastic polyurethane resin via a wind out moulding process. These resins are high strength, chemical resistant resins that combine the toughness and dimensional stability of amorphous resins with the chemical resistance of crystalline materials.

Features of SISCo-FC™ Flanged Hex Nuts and Threaded Rod Are:

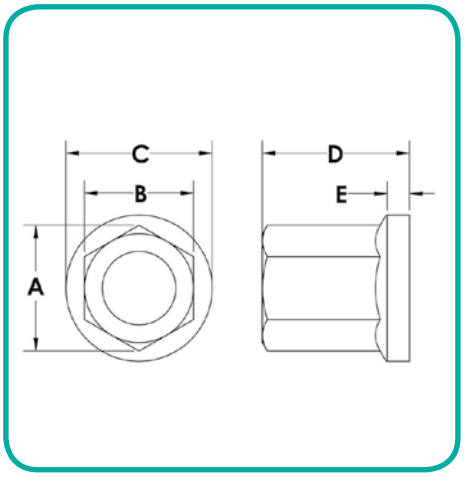
1) High Strength
2) Corrosion Resistant to Many Chemicals
3) Light Weight – Weighs Nearly 80% Less than Steel
4) Electrically Non Conductive
5) Non Metallic
6) Provides a Lower Life Cycle Cost
7) Non Leaching
8) Dimensionally Stable

Sizes Available - Threaded Rod

SIS CODE	DIAMETER	THREAD	LENGTH
SIS-FC-TR-A	3/8 (9.5mm)	16 UNC	Up to 8ft (2.4m)
SIS-FC-TR-B	1/2 (12.7mm)	13 UNC	Up to 8ft (2.4m)
SIS-FC-TR-C	5/8 (15.9mm)	11 UNC	Up to 8ft (2.4m)
SIS-FC-TR-D	3/4 (19.0mm)	10 UNC	Up to 8ft (2.4m)
SIS-FC-TR-E	1 (25.4mm)	8 UNC	Up to 8ft (2.4m)

Sizes Available – Flanged Hex Nuts

SIS CODE	TO SUIT DIAMETER	THREAD	COLOUR	NUT SIZE (mm) Refer Diagram				
				A	B	C	D	E
SIS-FC-FHN-A	3/8 (9.5mm)	16 UNC	Grey	16.1	14.1	19.1	19.1	3.0
SIS-FC-FHN-B	1/2 (12.7mm)	13 UNC	Grey	21.4	18.5	25.5	21.7	3.0
SIS-FC-FHN-C	5/8 (15.9mm)	11 UNC	Grey	26.7	23.4	31.8	31.0	3.3
SIS-FC-FHN-D	3/4 (19.0mm)	10 UNC	Grey	32.6	28.5	38.1	40.4	3.3
SIS-FC-FHN-E	1 (25.4mm)	8 UNC	Grey	44.5	37.5	50.8	44.5	4.8



Weights

		3/8 - 16	1/2 - 13	5/8 - 11	3/4 - 10	1 – 8
ITEM	UNIT	9.5mm	12.7mm	15.9mm	19.0mm	25.4mm
Threaded Rod	Kg / m	0.104	0.119	0.297	0.447	0.789
Hex Nut	Grams	4.5	9.1	18.1	27.2	63.6

Installation Tips for SISCo-FC™ Threaded Rods & Flanged Hex Nuts

It is important when using engineered reinforced thermoplastic nuts with vinyl ester fiberglass threaded rod that the following guidelines are followed:

1) The bearing faces of the nuts must be parallel to the surface being joined
2) Threaded rod should be lubricated with a light spray of silicone or a light oil
3) When tightening nuts ensure that a socket wrench is used and ensure full contact with the wrench and nut face is achieved
4) If the nut is to remain in the locked position permanently, the nut / rod interface should be coated with an adhesive resin
5) A torque wrench should be used when tightening nuts – see table below for maximum installation torque.

Ultimate Torque Table

SIZE	ULTIMATE TORQUE STRENGTH	MAXIMUM TORQUE
3/8 (9.5mm)	10.84Nm	5.42Nm
1/2 (12.7mm)	24.40Nm	12.20Nm
5/8 (15.9mm)	47.45Nm	23.72Nm
3/4 (19.0mm)	67.71Nm	33.85Nm
1 (25.4mm)	149.14Nm	74.57Nm

Typical Properties of SISCo-FC™ Threaded Rod & Nuts

			Value (Diameter – Threads Per Inch)				
			3/8 - 16	1/2 - 13	5/8 - 11	3/4 - 10	1 – 8
PROPERTIES	ASTM	UNITS	9.5mm	12.7mm	15.9mm	19.0mm	25.4mm
Ultimate Transverse Shear (Double Shear)	B-565	N	18,680	30,240	44,480	59,600	106,750
Longitudinal Compressive Strength	D-695	MPa	344	344	344	344	344
Flexural Strength	D-790	MPa	482	482	482	482	482
Flexural Modulus	D-790	GPa	17.2	17.2	17.2	17.2	17.2
Flammability	D-635	Self Extinguishing For All					
Fire Retardant	E-84	Class 1					
Water Absorption (24hr Immersion)	D-570	% Max.	0.8	0.8	0.8	0.8	0.8
Longitudinal Coefficient of Thermal Expansion	D-696	10-6 mm/ mm/ C°	11	11	11	11	11
Ultimate Thread Shear (Fiberglass Nut)	----	N	5,337	10,670	16,010	17,790	36,470
Ultimate Torque Strength (Fiberglass Nut)	----	N/M	10	21	47	67	149

Typical Properties of 101 LGF40 BLK Engineering Thermoplastic Polyurethane Resin (Nuts – Raw Form)

PROPERTIES	ASTM	UNITS	VALUE
Mould Shrinkage	D-955	mm/mm	0.001
Water Absorption (24hrs @ 23°c)	D-570	%	0
Specific Gravity	D-792	1.51	No.
Tensile Strength at Yield	D-638	MPa	186
Tensile Strength at Break	D-638	MPa	186
Elongation at Yield	D-638	%	2
Elongation at Break	D-638	%	2
Tensile Modulus	D-638	MPa	10,000
Flexural Strength	D-790	MPa	248
Flexural Modulus	D-790	MPa	9,600
Izod Impact Strength (Notched, 23°c)	D-256	J/m	320
Izod Impact Strength (Notched, -40°c)	D-256	J/m	320
Vicat Temperature	D-1525	°C	186
Coefficient of Linear Thermal Expansion	D-696	10-5 mm/mm/°C	1.4

Typical Properties of Glass Reinforced Vinyl Ester (Threaded Rod – Raw Form)

PROPERTIES	ASTM	UNITS	VALUE
Barcol Hardness	D-2583	----	45
Tensile Strength, Ultimate (Lengthwise)	D-638	207	MPa
Tensile Strength, Ultimate (Crosswise)	D-638	48.3	MPa
Tensile Modulus (Lengthwise)	D-638	17.2	GPa
Tensile Modulus (Crosswise)	D-638	5.52	GPa
Flexural Modulus (Lengthwise)	D-790	12.4	GPa
Flexural Modulus (Crosswise)	D-790	5.52	GPa
Flexural Strength (Lengthwise)	D-790	207	MPa
Flexural Strength (Crosswise)	D-790	68.9	MPa
Compressive Strength (Lengthwise)	D-635	207	MPa
Compressive Strength (Crosswise)	D-635	103	MPa
Compressive Modulus (Lengthwise)	D-635	17.2	GPa
Compressive Modulus (Crosswise)	D-635	6.89	GPa
Shear Modulus	----	3.1	GPa
Shear Strength (Punch Shear)	D-732	68.9	MPa
Shear Strength (Short Beam Shear)	D-2344	31	MPa
Izod Impact, Notched (Lengthwise)	D-256	13.3	J/cm
Izod Impact, Notched (Crosswise)	D-256	2.14	J/cm
Dielectric Constant (Perpendicular to Laminate Face)	D-150	5	60 Hz
Dielectric Strength (Perpendicular to Laminate Face)	D-149	7.87	kV/mm
Dielectric Strength (Lengthwise)	D-149	1.38	kV/mm
Arc Resistance (Lengthwise)	D-495	120	Sec
Flame Spread Index (Tunnel Test)	E-84	Max 25	----
Flammability	D-635	Non Burning	
Density	D-792	1.72-1.94	g/cc
Water Absorption	24hrs, ASTM	Max 0.45%	

Pricing & Specification Codes for Threaded Rod & Flanged Hex Nuts

Note: The pricing below is LIST PRICE only and excludes GST. Please contact SIS for pricing and availability.

Note: Threaded Rod comes in a maximum length of 8ft (2.43m)

SIS CODE	UNIT	SIZE	THREAD	UNIT QUANTITY	LIST PRICE
SIS-FC-TR-A	4ft Rod	3/8 (9.5mm)	16 UNC	1 - 199	$23.98
SIS-FC-TR-A	4ft Rod	3/8 (9.5mm)	16 UNC	200 - 399	$22.96
SIS-FC-TR-A	4 ft Rod	3/8 (9.5mm)	16 UNC	400 - 1999	$20.40
SIS-FC-TR-A	4 ft Rod	3/8 (9.5mm)	16 UNC	1999+	$18.56
SIS-FC-TR-B	4ft Rod	1/2 (12.7mm)	13 UNC	1 - 199	$27.12
SIS-FC-TR-B	4ft Rod	1/2 (12.7mm)	13 UNC	200 - 399	$25.04
SIS-FC-TR-B	4 ft Rod	1/2 (12.7mm)	13 UNC	400 - 1999	$23.84
SIS-FC-TR-B	4 ft Rod	1/2 (12.7mm)	13 UNC	1999+	$21.44
SIS-FC-TR-C	4ft Rod	5/8 (15.9mm)	11 UNC	1 - 199	$28.11
SIS-FC-TR-C	4ft Rod	5/8 (15.9mm)	11 UNC	200 - 399	$26.40
SIS-FC-TR-C	4 ft Rod	5/8 (15.9mm)	11 UNC	400 - 1999	$25.20
SIS-FC-TR-C	4 ft Rod	5/8 (15.9mm)	11 UNC	1999+	$22.80
SIS-FC-TR-D	4ft Rod	3/4 (19.0mm)	10 UNC	1 - 199	$32.40
SIS-FC-TR-D	4ft Rod	3/4 (19.0mm)	10 UNC	200 - 399	$31.12
SIS-FC-TR-D	4 ft Rod	3/4 (19.0mm)	10 UNC	400 - 1999	$30.24
SIS-FC-TR-D	4 ft Rod	3/4 (19.0mm)	10 UNC	1999+	$29.12
SIS-FC-TR-E	4ft Rod	1 (25.4mm)	8 UNC	1 - 199	$47.80
SIS-FC-TR-E	4ft Rod	1 (25.4mm)	8 UNC	200 - 399	$45.36
SIS-FC-TR-E	4 ft Rod	1 (25.4mm)	8 UNC	400 - 1999	$42.56

SIS CODE	UNIT	SIZE	THREAD	UNIT QUANTITY	LIST PRICE
SIS-FC-TR-E	4 ft Rod	1 (25.4mm)	8 UNC	1999+	$39.76
SIS-FHN-A	Nut	3/8 (9.5mm)	16 UNC	1 - 249	$1.42
SIS-FHN-A	Nut	3/8 (9.5mm)	16 UNC	250 - 499	$1.24
SIS-FHN-A	Nut	3/8 (9.5mm)	16 UNC	500 - 999	$0.96
SIS-FHN-A	Nut	3/8 (9.5mm)	16 UNC	1000+	$0.88
SIS-FHN-B	Nut	1/2 (12.7mm)	13 UNC	1 - 249	$2.64
SIS-FHN-B	Nut	1/2 (12.7mm)	13 UNC	250 - 499	$1.88
SIS-FHN-B	Nut	1/2 (12.7mm)	13 UNC	500 - 999	$1.51
SIS-FHN-B	Nut	1/2 (12.7mm)	13 UNC	1000+	$1.39
SIS-FHN-C	Nut	5/8 (15.9mm)	11 UNC	1 - 249	$2.72
SIS-FHN-C	Nut	5/8 (15.9mm)	11 UNC	250 - 499	$2.30
SIS-FHN-C	Nut	5/8 (15.9mm)	11 UNC	500 - 999	$1.80
SIS-FHN-C	Nut	5/8 (15.9mm)	11 UNC	1000+	$1.57
SIS-FHN-D	Nut	3/4 (19.0mm)	10 UNC	1 - 249	$2.98
SIS-FHN-D	Nut	3/4 (19.0mm)	10 UNC	250 - 499	$2.67
SIS-FHN-D	Nut	3/4 (19.0mm)	10 UNC	500 - 999	$2.53
SIS-FHN-D	Nut	3/4 (19.0mm)	10 UNC	1000+	$2.39
SIS-FHN-E	Nut	1 (25.4mm)	8 UNC	1 - 249	$4.98
SIS-FHN-E	Nut	1 (25.4mm)	8 UNC	250 - 499	$4.59
SIS-FHN-E	Nut	1 (25.4mm)	8 UNC	500 - 999	$3.96
SIS-FHN-E	Nut	1 (25.4mm)	8 UNC	1000+	$3.55

About SISCo-FC™ Engineered Plastic Fixings

PLASTICS ENGINEERED FOR STRENGTH: For over 18 years, our people have been working with plastics to make them lighter, stronger and more cost effective. Now, the pinnacle of the advancements in plastic engineering is right here in the range of engineered plastic alternatives for any industry.

High strength plastics are usually composite plastics, meaning that they are made up of a base resin with the addition of various percentages of fibre. Some of the most common fibers now used are fiberglass or carbon. Many additives are sometimes mixed in with plastic to improve its characteristics. For example, some additives may cause a plastic to be UV resistant or fire resistant while others may change its colour or lower a plastics coefficient of friction to make it useful in bearing applications. While most plastics are thought of as electrical insulators, additives can also make them conductive. While all these additives are useful, the only way to achieve greater strength in plastics is to add fibers.

What does strong mean in the world of plastics and how do we evaluate plastics for strength?

The strength of a material may be evaluated through the results of several strength tests. ASTM International® is an international standards organisation that develops and publishes voluntary consensus technical standards. SIS considers the results of tests described by their standards for ultimate tensile strength (UTS), tensile modulus (otherwise known as Young's Modulus) and flexural strength.

Tensile Strength or Ultimate Tensile Strength (UTS) is the maximum stress a polymer can withstand without breaking while being pulled or stretched – ASTM D638

Tensile Modulus or Young's Modulus is a numerical constant that describes the elastic properties of a plastic under tension or compression from only one direction It is a measure of stiffness – ASTM 638

Flexural Strength is a material's ability to resist deformation under load. Many plastics exhibit flexural strength. This number represents the load required to cause a given test sample to exhibit a 5% deformation or strain of its outer surface – ASTM D790

Izod Impact Strength (Notched) is a single point test that measures the resistance of a material to impact. The resulting number represents the kinetic energy needed to initiate and cause the fracture of a given notched specimen of material – ASTM D256

High Strength Plastics Reference Chart

MATERIAL	TENSILE STRENGTH (MPa)	TENSILE MODULUS (MPa)	FLEXURAL MODULUS (MPa)	IZOD IMPACT STRENGTH (J/m)
G10 / FR4	310	LW: 24131 CW: 20684	LW: 400 CW: 345	641
Nylon 6/6 30% Glass Filled	155	8274	179	107
PAI Unfilled	152	4480	241	123
PAI 30 % Glass Filled	221	14500	333	80
PAI 30% Carbon Filled	221	16500	350	48
PARA 30% Glass Filled	190	11500	360	70
PARA 30% Carbon Filled	250	26000	285	59
PEEK 30% Glass Filled	165	8963	193	96
PEEK 30% Carbon Filled	138	7584	172	55
PC 20% Glass Filled	110	2206	131	107
PEI 30% Glass Filled	138	6205	207	107
POM 30% Glass Filled	110	9653	165	40
PPS 30% Glass Filled	152	13100	200	90
PPS 30% Carbon Filled	193	25512	269	31
TPU 40% Glass Filled	186	12000	310	427

Why Do We Add Fibers to Already Strong Plastics?

Here are some examples of performance increasing when we have added glass or carbon fibers to already strong plastics. Other benefits of these materials are also mentioned.

All values are expressed in MPa.

G10/FR4: This material is made of woven fiberglass cloth and an epoxy resin. It can be made as either a laminate or through a moulding process. G10/FR4 has a tensile strength (UTS) of 310, which makes it stronger than structural steel at 276 and is one of the strongest plastic materials available. Because G10/FR4 is anisotropic or directionally dependent, it has both LW (Length Wise) and CW (Cross Wise) values for tensile modulus and flexural modulus. Additionally, G10/FR4 is fire resistant, UV resistant and water proof.

Polyamide Nylon 6/6, 30% Glass Filled: Perhaps the best known composite plastic. Unfilled Nylon 6/6 has a tensile strength of 82 but adding 30% glass fiber increases this to 155. Additionally the tensile modulus or Young's Modulus goes from 2558 unfilled to 8274 for 30% glass filled. The flexural strength for the unfilled grade is 103 compared to 179 for 30% glass filled. Grades are also available that are fire and UV resistant and also resistant to organic solvents such as petrol and kerosene. Nylon 6/6 30% glass filled offers increased strength for relatively low cost.

Polyarylamide, PARA 30% Glass Filled & PARA 30% Carbon Filled: This polymer is not commonly sold in an unfilled grade. It can be fibre filled up to 60% with glass, carbon and mineral fibers or a combination thereof. PARA 30% glass filled has a tensile strength (UTS) of 190 and PARA carbon filled is 250. The tensile modulus for 30% glass filled is 11500 while for 30% carbon fibre it is 26000 (ISO527-2). Flexural strength for the 2 grades are 360 and 285 respectively. PARA has a high quality surface finish and can be painted and chromed for high end applications.

Polyamide Imide, PAI Unfilled, PARI 30% Glass Filled & 30% Carbon Filled: PAI is one of the few polymers that has significant strength in the unfilled grade. The UTS of unfilled PAI is 152 while the UTS of both the 30% glass filled and the 30% carbon filled increases to 221. The tensile modulus or stiffness of unfilled PAI is 480 but this increases to 14500 for PAI 30% glass filled and 16500 for PAI 30% carbon filled. Flexural strength is 241 for the unfilled grade and 333 for the PAI 30% glass filled and 350 for PAI 30% carbon filled grade. This makes polyamide imide the strongest thermoplastic currently available.

Polycarbonate (PC) 20% Glass Filled: Polycarbonate is not one of the strongest composites, however, if the characteristics of PC are required and more strength than the unfilled grade will provide are necessary, the 20% glass filled composite may be the answer. Tensile strength of the unfilled grade is 69 and increases to 110 with the addition of 20% glass fibre. Stiffness (tensile modulus) almost triples at 2206 for the unfilled grade to 5929 for the 20% glass composite. The ability for the material to avoid deformation under load (flexural strength) goes from 90 to 131. Unfilled PC is optically clear as well as UV resistant.

Polyetherimide (PEI 30% Glass Filled): Unfilled PEI has a tensile strength of 115 but the strength of PEI goes up when 30% glass is added to 138. Tensile modulus (stiffness) is 3309 for the unfilled grade but almost doubles to 6205 for the 30% glass filled composite. Flexural strength increases from 138 to 207 and the flexural modulus of 3447 for the unfilled resin increases to 6550 for 30% glass filled. PEI is also microwave clear, has high heat resistance and good chemical resistance. It is also fire resistant and virtually smoke free.

Tensile Strength Comparison

MATERIAL	MPa
Brass (Grade C3600)	345
Steel	330
FR-4/G-10	310
Zinc Alloy	280
Aluminium (Grade 6463-T6)	241
PARA (50% glass-filled)	230
Magnesium (Grade HK31A-T6)	225
TPU (40% glass-filled)	186

Materials

SISCo-FC™ fixings are precision machined and moulded plastic fasteners and components produced in a wide range of plastic materials from commodity to exotic. The following is a selection of plastic materials that are regularly used to process our state of the art fixing components:

ABS

Acrylonitrile Butadiene Styrene mechanical properties are good for impact resistance even in low temperatures. The material is stiff and the properties are kept over a wide temperature range. The hardness and stiffness for ABS is lower than for PS and PVC. The chemical resistance for ABS is relatively good and it is not affected by water, non organic salts or acids. The material will dissolve in aldehyde, ketone, ester and some chlorinated hydrocarbons.

Delrin©

(Acetal, Celcon ©) – Polyoxymethylene (POM) displays good impact resistance, dimensional stability and outstanding surface hardness due to their high degree of crystallinity. They have high dielectric strength and are resistant to many solvents. They also exhibit negligible water absorption. Typical applications include roller bearings, gears, reels, counters, control cams, valves, and pump parts.

Engage ©

Ethylene alpha-olefin copolymer bridges the gap between plastics and rubber properties. Key performance benefits include toughness, flexibility, light weight, high clarity and UV stability. It resists low temperature brittleness and can be engineered to offer specific levels of flexibility to meet a range of technical requirements.

G10/FR4

G10/FR4 material has superior mechanical properties, particularly it's extremely high strength and high dimensional stability over temperature which allows it to hold details of threads and thin features for demanding insulation applications. G10/FR4 offers excellent chemical resistance and electrical properties under dry and humid conditions and features high flexural, impact and mechanical strength and bond strength at temperatures up to 140°c.

Halar © (ECTFE)

Ethylene-Chlorotrifluorethylene copolymer exhibits better mechanical properties than many other fluoroplastics. But like other fluoroplastics,

its flame retardation, chemical resistance and low dielectric constant remain constant over a wide temperature range. These qualities make it suitable for use in such products as electrical insulation, monofilament, tank linings, housings and electrical components. It may be usefully employed at temperatures from the cryogenic range to about 160°c.

Isoplast™

Impastmodified urethane resins are high tensile strength, chemically resistant resins originally developed for medical use. They are available in long glass fibre-filled grades. Isoplast combines the toughness and dimensional stability of amorphous resins with the chemical resistance of crystalline materials. The long fibre reinforced grades are strong enough to replace some metals in load bearing applications.

IXEF

1521 is a 50% glass-fibre reinforced, fire resistant polyarylaminde which exhibits high strength and stiffness, outstanding surface gloss and excellent creep resistance. The compounds in this family are characterised by creep resistance at high stress levels, high flow, low and slow moisture pickup and excellent dimensional stability. IXEF 1521□s glass transition temperature of approximately 85°c offers remarkable rigidity for a polymeric material and its combination of properties makes the material an excellent candidate for metal replacement in many market areas.

LCP

Vectra® Liquid Crystal Polymer grades offer advantages over metal, thermosets and other thermoplastics materials. Advantages include excellent chemical and hydrolytic stability, corrosion resistance, thermal stability and dimensional stability. Additional good properties include creep resistance at elevated temperatures, high strength and high continuous use temperatures, very high abrasion resistance and excellent electrical insulation properties. All grades have UL 94 V-0 flammability ratings and most grades have low smoke ratings.

Lexan® (PC)

Polycarbonate exhibits the highest impact strength over a range of temperatures from -30°c to 135°c. It is fine for all precision parts or where transparency is desired. Its water-clear transmittance (89%) makes it excellent for visors or guards. It shows good creep resistance and has a temperature-independent dielectric constant, as well as good insulating properties.

Nylon 6/6

All grades possess roughness and resiliency and have high fatigue strength. Resistance to oils and hydrocarbon solvents is also good. Almost all formulations are also self-extinguishing and retain stable mechanical properties at temperatures from -32°c to above 110°c. They are widely used for gears and many other moving parts due to their excellent abrasion and impact resistance. Glass-filled Nylon has improvements over un-filled Nylon including higher strength and tensile strength.

PCTFE (Kel-F)

Polychlorotrifluoroethylene is highly transparent. It also exhibits good electrical properties, and is resistant to most common solvents at room temperature. Kel-F is a fluorochemical product which offers the unique combination of physical and mechanical properties, chemical resistance and near zero moisture absorption. PCTFE has a temperature range of -200°c to +200°c. It also has extremely low out gassing making it well suited for use in aerospace and flight applications. Compression, impact and tensile strength are high over a wide temperature range.

PEEK, T-series

Based on VICTREX®® PEEKTM polymer and Celazole® polybenzimidazole (PBI) and offering excellent mechanical performance. The TU-60 grade is unfilled, unreinforced PEEK/PBI blend suitable for high performance in high temperature and high-strength applications. TF-60V is glass-reinforced for even greater rigidity and dimensional stability while maintaining

many of the useful characteristics of the unfilled grade. The glass reinforcement yields a product with an exceptional strength-to-weight ratio and increased tensile strength.

PEEK,30% Glass-Filled

Has an increase in flexural modules and a reduction in expansion rate. This grade is ideal for structural applications that require improved strength, stiffness or stability, especially at temperatures above 150°c.

PEEK-HT (High Temperature)

Is a unique high performance polymer for applications requiring superior high-temperature resistance. With a glass transition temperature of 155°c and a melting temperature of 353°c, this semi-crystalline, unreinforced polymer offers all the key characteristics of standard PEEK including toughness, strength and chemical resistance.

Polyethylene (PE)

Because of its flexibility at low temperatures, excellent electrical resistance and low dielectric constant, Polyethylene is unique. PE's self-lubricating properties also make it ideal for applications such as rollers, skids and other end-uses which call for a non-stick, low-friction material. PE is available in a wide range of densities and formulations.

Polypropylene (PP)

Has good impact resistance and structural rigidity and t is unaffected by any solvent at room temperatures. It has excellent insulating properties and is extremely lightweight. Its high fatigue strength makes it a top choice under cyclic loading conditions.

RADEL © A-200

Is a polyethersulfone resin offering high heat deflection temperatures, excellent toughness and dimensional stability and superior resistance to steam, boiling water and mineral acids. Other desirable properties include thermal stability, creep resistance and inherent flame resistance. This medium viscosity grade can be used for either extrusion or injection moulding.

RADEL © AG-330

Is a 30% glass fibre reinforced polyethersulfone compound. Adding glass fibre to Radel A-300 polyethersulfone substantially increases the rigidity, tensile strength, creep resistance, dimensional stability and chemical resistance of the material while maintaining most of its other basic characteristics. The combination of structural properties and cost effectiveness makes this resin an attractive alternative to metals in many engineering applications. Radel AG-330 is an opaque gray material in its natural form and may be readily coloured.

RADEL© R-5000, R-5100 NT15, R-5500

Are polyphenylsulfone resins offering exceptional hydrolytic stability, and toughness that is superior to other commercially available, high-temperature engineering resins. They offer high deflection temperatures and outstanding resistance to environmental stress cracking. The polymer is inherently fire resistant and also has excellent thermal stability and good electrical properties. Radel R-5000 resin is a transparent injection moulding grade. R-5100 NT15 is an opaque general purpose injection moulding grade and R-5500 is a transparent extrusion grade.

Rexolite

Is one of the best dielectric materials known with a dissipation factor 200 times better than nylon. In contrast with other high temperature, ultrahigh frequency dielectrics, Rexolite has the rigidity and ability to resist deformation under load. These characteristics are extremely important where assembled insulators must withstand compression without yielding and loosening over long periods of time.

Rexolite 1422

Has a combination of good physical and excellent electrical properties including low and stable dielectric constant. These properties make this material suitable for precision components.

Chemical Resistance & Plastics

Not all plastics hold up well in extreme environments. Engineers needs to be sure that fasteners will last as long as the rest of the materials used. While you should always conduct testing to ensure that you make the right material for your specific application, there are certain chemical resistant plastics which tend to hold up well in most environments. In order to guide you in the right direction, we've put together a list of the top four commonly used chemical resistant plastics.

1) Kynar® (PVDF)

PVDF resins are used in the power, renewable energies and chemical processing industries for their excellent resistance to temperature and harsh chemicals. PVDF is also used in the pharmaceutical, medical, food & beverage and semiconductor industries for its high purity and availability in a multitude of forms. PVDF is also one of the most popular chemical resistant plastics in the mining, plating and metal preparation industries. This popularity is due to PVDF's resistance to hot acids of a wide range of concentrations. PVDF is also used in the automotive and architectural markets for its chemical resistance and excellent resistance to UV degradation and extreme weather conditions.

2) PEEK

PEEK exhibits excellent mechanical and thermal properties, creep resistance at high temperatures, very low flammability, hydrolysis resistance and radiation resistance. These properties make PEEK a preferred product in the aerospace, automotive, telephonic, and chemical processing industries. PEEK is used for wear and load bearing applications such as valve seats, pump gears, and compressor valve plates.

3) PVC

Due to its wide use as indoor and in-ground wastewater piping, thousands and thousands of tons of PVC are produced every year, making PVC the third most produced plastic. PVC is extensively used in construction as it is more effective than traditional materials such as copper, steel or timber. PVC can be made softer and more pliable with the addition of plasticisers. In this form, it is used in clothing and upholstery. PVC's status as a chemical resistant plastic makes it an ideal material for window and door frames, insulation on electric cables, outdoor signs, sporting equipment, medical tubing, flooring, green houses and outdoor playgrounds.

4) CPVC

CPVC resin is made by the chlorination of PVC resin and is used primarily to produce piping. CPVC shares many properties with PVC, including low conductivity and excellent corrosion resistance at room temperatures. The extra chlorine in its structure also makes it more corrosion resistant than PVC. Whereas PVC begins to soften at temperatures over 60°c, CPVC is useful to temperatures of 82°c. Like PVC, CPVC is fire resistant, is readily workable and can be used in hot water pipes, chlorine pipes, sulphuric acid pipes, and high-pressure electric cable sheaths.

Other SISCo-FC™ Composite Fixings Available

Australian Head Office
abn 61160899703
a 6/7-9 Streiff Road, Wingfield SA 5013
t +1300 26 10 74 f +1300 08 10 75
service@sisau.com.au
sisau.com.au

sydney
17 Jumal Place
Smithfield
NSW 2164
Australia

melbourne
135 Boundary Road
Laverton North
Victoria 3026
Australia

brisbane
1094 Lytton Road
Murarrie
Queensland 4172
Australia

hong kong
Room 102, 1st Floor
The Centre Mark
287 - 299 Queen´s Rd
Central Hong Kong

shanghai
RM 1001A
Hua Sheng Building
No.398 Han Kou Road
200001 Shanghai
People´s Republic of China

shenzhen
27-3, 27th Floor
Shun Hing Square
Di Wang Commercial Centre
Lu Wu District, Shenzhen
People´s Republic of China

los angeles
Suite 135
5230 Pacific Concourse Dr.
Los Angeles
CA 90045
United States

Annexure 2

sustainable infrastructure systems

SISCo-FC™ SYSTEM

Testing of SISCo-FC™ FRP Members

V 3.7 - Release Date 19.07.13

Contents

Testing of SISCo-FC™ FRP Members

Weathering

Property loss is experienced in Fire Retardant (FR), Polyester, and Vinylester Fiberglass pultrusion when exposed to continuous high temperatures. The loss of properties is considered during the designing stages. The following table shows the percentage of propertreteon at certain continuous temperatures.

	Temperature	FR/Polyester	Vinylester
Ultimate Stress	37°C	85%	90%
	51°C	70%	80%
	65°C	50%	80%
	79%C	Not Recommended	75%
	93°C	Not Recommended	50%
	Temperature	**FR/Polyester**	**Vinylester**
Modulus of Elasticity	37°C	100%	100%
	51°C	90%	95%
	65°C	85%	90%
	79%C	Not Recommended	88%
	93°C	Not Recommended	85%

After exposure to outdoor weathering, almost all plastics undergo some degradation in surface appearance.

The surface of pultrusions typically have good water and ambient temperature resistance, but are attacked by ultraviolet light.

Ultraviolet light is the light spectrum 290 to 400 nanometers. The light has higher energy and can significantly degrade polymers by breaking chemical bonds or starting chemical reactions that lead to polymer degradation. Fire retardant polyester formulations, which contain a halogen, are typically more susceptible to ultraviolet light degradation, due to the halogen additive. Ultraviolet light will cause the surface of the pultrusion to fade (yellow) and lose gloss. Over a longer period of time, fiberglass closest to the surface will be exposed. This condition is known as fiberbloom. Physical Properties are not affected by this surface degradation.

SIS adds a UV stabilizer to our resin mix formulation. This slows the affects of UV degradation. We also incorporate a layer of polyester veil directly to the surface of the pultrusion during processing. This veil gives a resin rich surface and acts as a barrier between the surface and the top layer of fiberglass reinforcement. Pigments used in our resin formulations also slow the effects of weathering.

Typical Coupon Properties

Below are test results for typical properties of SIS structural fiberglass profiles (Standard, Fire Retardant, & Vinylester shapes). Properties are derived per the ASTM test method shown. Synthetic surfacing veil and ultraviolet inhibitors are standard.

Mechanichal Properties	ASTM	Units	Value
Tensile Stress, LW	D-638	MPa	206.9
Tensile Stress, CW	D-638	MPa	48.2
Tensile Modulus, LW	D-638	GPa	17.2
Tensile Modulus, CW	D-638	GPa	5.5
Compressive Stress, LW	D-695	MPa	206.8
Compressive Stress, CW	D-695	MPa	103.4
Compressive Modulus, LW	D-695	GPa	17.2
Compressive Modulus, CW	D-695	GPa	6.9
Flexural Stress, LW	D-790	MPa	206.8
Flexural Stress, CW	D-790	MPa	68.9
Flexural Modulus, LW	D-790	GPa	12.4
Flexural Modulus, CW	D-790	GPa	5.5
Modulus of Elasticity, E	Full Section	GPa	19.3
Shear Modulus	--	GPa	3.1
Short Beam Shear	D-2344	MPa	31.0
Punch Shear	D-732	MPa	68.9
Notched Izod Impact, LW	D-256	J/mm	1.33
Notched Izod Impact, CW	D-256	J/mm	.21
Physical Properties	**ASTM**	**Units**	**Value**
Barcol Hardness	D-2583	--	45
24 Hour Water Absorbtion	D-570	% max	0.45
Density	D-792	g/cc	1.72-1.94
Coefficient of Thermal Expansion, LW	D-696	10^6cm./cm.°C	12
Electrical Properties	**ASTM**	**Units**	**Value**
Arc Resistance, LW	D-495	seconds	120
Dielectric Strength, LW	D-149	kv./mm	1.37
Dielectric Strength, PF	D-149	volts/mil	200
Dielectric Constant, PV	D-150	@60hs	5
Fire Retardant Polyester and Fire Retardant Vinylester Structural Profiles:			
Flammability Properties	**ASTM**	**Value**	
Tunnel Test	E-84	25 max.	
Flammability	D-635	Nonburning	
LW: Lengthwise CW: Crosswise PF: Perpendicular to Laminate Face			

Allowable Uniform Load Tables

Full section 3-point bending tests were conducted on SIS H-Beams, I-Beams, Channels and Square Tubes. The allowable uniform load tables were generated using these tests results as well as the formulas, properties, and assumtions listed below. Formulas for critical bucking and lateral-torsional buckling are developed from theory presented in Chapter 6 and 7 of the ASCE Structural Plastics Design Manual*.

Notation

A	area of web (mm.^{2})
b	flange width (mm.)
b_c	channel flange minus thickness (mm.)
b_h	1/2 of flange width (mm.)
E	modulus of elasticity (lbs.mm.^{2})
f_b	actual flexural stress (lbs.mm.^{2})
F_b	maximum allowable flexural stress (GPa)
F_{aCB}	maximum allowable buckling stress (MPa)
F_{aLTB}	maximum allowable lateral-torsional buckling stress (MPa)
f_v	actual shear stress (MPa)
F_v	maximum allowable shear stress (MPa)
G	shear modulus (GPa)
I	moment of inertia (mm.^{4})
J	torsion constant (mm.^{4})
L	length of span (mm.)
M	maximum moment (N.-m.)
S_x	section modulus (mm.^{3})
t	flange thickness (mm.)
V	vertical shear force (N.)
w	unifom load (N./m.)
v_L	poission´s ratio (longitudinal)
v_r	poission´s ratio (tranverse)

Assumptions

Beam simply supported at both ends

Uniformly distributed load

Load is applied permendicular to major axis

Part weight has been deducted in tables

Safety factor of 3.0 for both ultimate material flexural and shear stress and 2.5 for buckling stresses

*ASCE Manuals and reports on Engineering Practice No. 63, Structural Plastics Design Manual Volumes 1 &2, 1984

Properties / Allowables

$E = 19.3$ GPa

$G = 3.1$ GPa

$F_b = 68.9$ MPa

$F_v = 10.3$ MPa

Formulas

$$\Delta = \frac{5wL^4}{384EI} + \frac{wL^2}{8A_wG}$$

$$f_h = \frac{M}{S_x}$$

$$f_h = \frac{V}{A_w}$$

Allowable Critical Bucking Stress for laterally supported WF and I Beams

$$F_{aCB} = \frac{\pi^2}{b_h^2 t}\left[.935\sqrt{\left(\frac{Et^3}{12\lambda}\right)\left(\frac{v_T Et^3}{12\lambda}\right)} - (.656)\left(\frac{v_T Et^2}{12\lambda}\right) + (2.082)\left(\frac{Gt^3}{12}\right)\right]/2.5$$

$$\lambda = (1 - v_L v_T)$$

Allowable Lateral-Torsional Buckling Stress for laterally unsupported I Beams

$$F_{aLTB} = \left[\frac{C\pi}{S(KL)}\sqrt{EI_yGJ + \frac{d^2\pi^2E^2 - I_y^2}{(4)(KL)^2}}\right]/2.5$$

$C = 1.13$ and $K = 1.0$ for uniform load simple beam*

Allowable Critical Buckling Stress for Channels laterally supported to eliminated warping and twist

$$F_{aCB} = G(t/b_c)^2/2.5$$

Allowable Bending Stress for Square Tube ($b/t <= 16$)

$$F_b = 68.94 \text{ Mpa.}$$

*ASCE Manuals and reports on Engineering Practice No. 63, Structural Plastics Design Manual Volumes 1 &2, 1984

254mm x 127mm x 12.7mm I-BEAM

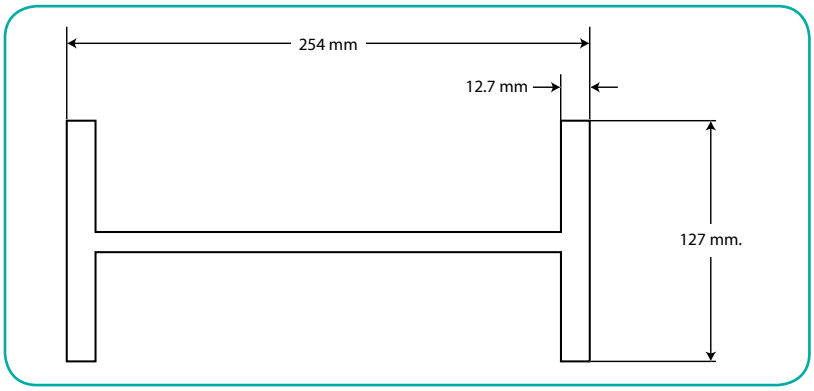
Allowable Uniform Load (N/m.)
Laterally Supported

Aw = 2903 mm.^{2} Wt. = 10.71 kg/m.

I = 59641801 mm.^{4} S = 469653 mm.^{3}

Span m	No Lateral Support	Laterally Supported						
		Maximum Load		Deflection				
	Max. Load			L/100	L/150	L/180	L/240	L/360
2.13	21472	28040	F_y	----	----	----	24542	16326
2.44	13050	245522	F_y	----	----	23879	17883	11887
2.74	8452	21786	F_y	----	21429	17840	13354	8868
3.05	5752	19597	F_y	----	16363	13618	10188	6757
3.35	4070	17806	F_y	----	12733	10594	7919	5244
3.66	2973	16313	F_y	15165	10075	8378	6258	4137
3.96	2228	15050	F_y	12187	8090	6724	5017	3309
4.27	1705	13968	F_y	9924	6581	3466	4073	2681
4.57	1327	1228	F_b	8175	5415	4495	3345	2195
4.57	1048	10786	F_b	6806	4502	3734	2774	1815
5.18	837	9542	F_b	5719	3777	3130	2322	1513
5.49	675	8500	F_b	4846	3196	2645	1958	1270
5.79	548	7618	F_b	4137	2723	2252	1663	1073
6.10	448	6865	F_b	355	2336	1929	1421	912
6.40	367	6217	F_b	3076	2016	1662	1221	779
6.71	301	5656	F_b	2676	1749	1441	1054	667
7.01	247	5165	F_b	2339	1525	1253	913	574
7.32	247	4735	F_b	2055	1335	1095	795	495
7.62	165	4356	F_b	1812	1173	960	694	428

The part weight has been deducted in the above table.



609.6mm x 9.5mm x 190.5mm x 19.1mm I-BEAM

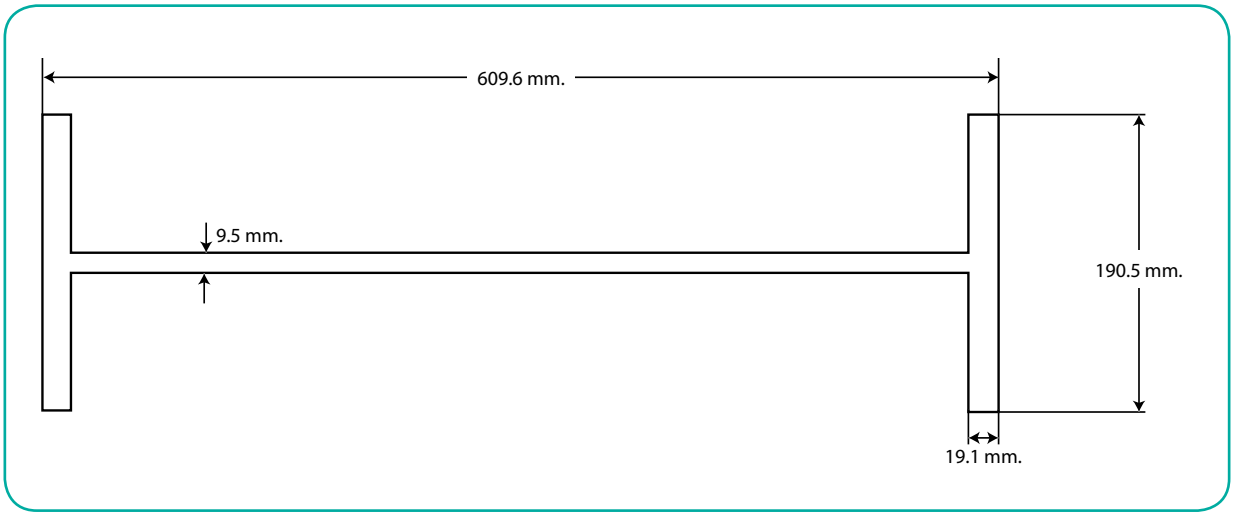
Allowable Uniform Load (N/m.)
Laterally Supported

Aw = 5445 mm.^{2} Wt. = 22.62 kg/m.

I = 78126686 mm.^{4} S = 2563265 mm.^{3}

Span m	No Lateral Support	Laterally Supported						
		Maximum Load		Deflection				
	Max. Load			L/100	L/150	L/180	L/240	L/360
3.05	36730	36730	F_y	----	----	----	----	35335
3.35	33371	33371	F_y	----	----	----	----	29887
3.66	24071	30571	F_y	----	----	----	----	25450
3.96	17569	28203	F_y	----	----	----	----	21804
4.27	13127	26172	F_y	----	----	----	----	18782
4.57	10006	24413	F_y	----	----	----	----	16262
4.88	7760	22873	F_y	----	----	----	21330	14146
5.18	6108	21514	F_y	----	----	----	18651	12360
5.49	4870	20307	F_y	----	----	----	16378	10844
5.79	3926	19226	F_y	----	----	----	14439	9552
6.10	3196	18254	F_y	----	----	17111	12778	8445
6.40	2624	17374	F_y	----	----	15205	11348	7492
6.71	2170	16574	F_y	----	16314	13558	10113	6668
7.01	1806	15844	F_y	----	14598	12128	9041	5953
7.32	1511	15174	F_y	----	13104	10883	8107	5331

The part weight has been deducted in the above table.



609.6mm x 9.5mm x 190.5mm x 19.1mm I-BEAM - continued

Allowable Uniform Load (N/m.)

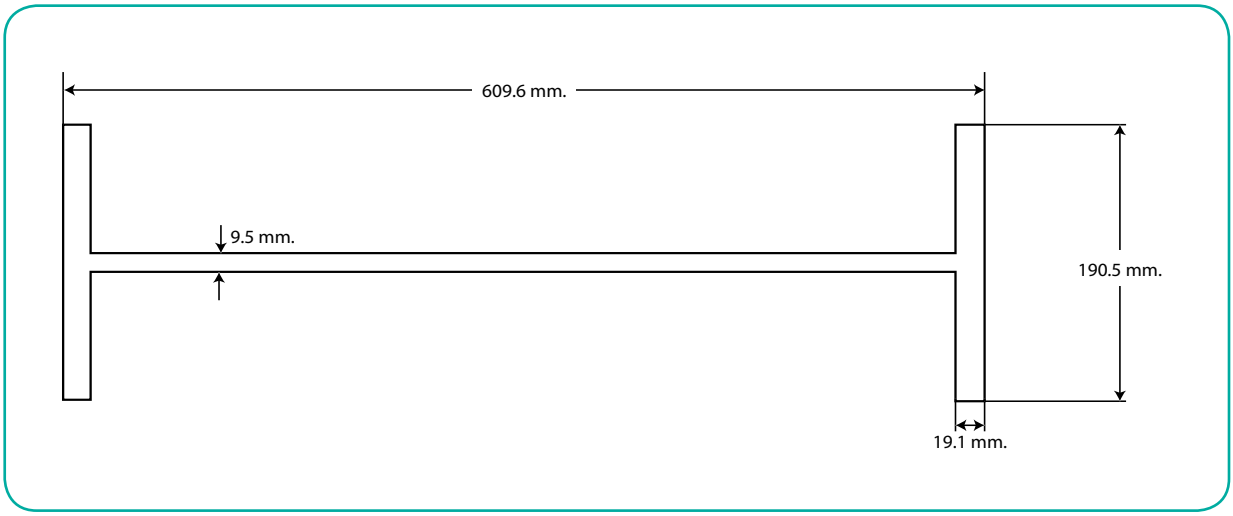
Laterally Supported

A_w = 5445mm.^{2} Wt. = 22.62kg/m.

I = 781266386mm.^{4} S = 2563265mm.^{3}

Span m	No Lateral Support	Laterally Supported						
		Maximum Load		Deflection				
	Max. Load			L/100	L/150	L/180	L/240	L/360
7.62	1269	14559	F_y	----	1179	9794	7290	4786
7.92	106	13990	F_y	----	10651	8839	6574	4309
83.23	903	13464	F_y	----	9641	7997	5943	3888
8.53	764	12975	F_y	----	8749	7254	5385	3516
8.84	647	12520	F_y	12049	7959	6596	4891	3187
9.14	547	12095	F_y	10996	7256	6010	4452	2894
9.45	462	11698	F_y	10056	6630	5488	4061	2633
9.75	389	11326	F_y	9216	6070	5022	3711	2400
10.06	325	10976	F_y	8463	5568	4603	3397	2191
10.36	271	10646	F_y	7787	5117	4227	3115	2003
10.67	223	10336	F_y	7177	4711	3889	2861	1834
10.97	181	10043	F_y	6627	4344	3583	2632	1681
11.28	144	9765	F_y	6129	4012	3306	2424	1542
11.58	112	9502	F_y	567	3711	3055	2236	1417
11.89	83	9253	F_y	5267	3437	2827	2065	1303
12.19	58	9016	F_y	4893	3188	2620	1909	1199

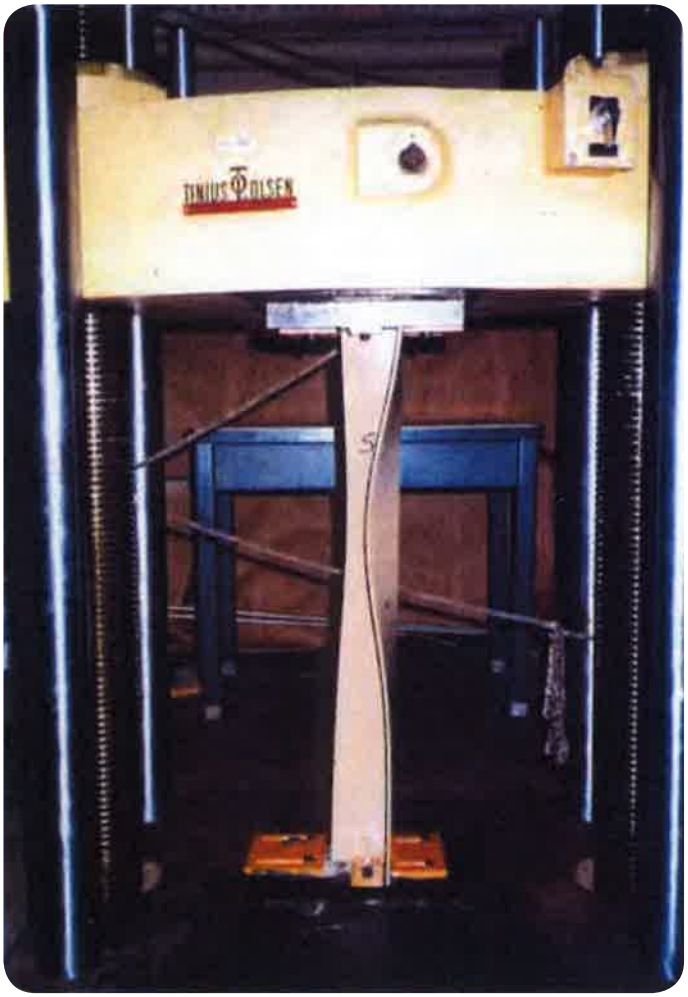
The part weight has been deducted in the above table.



Full section column testing

Ultimate stress vs. slenderness ratio curves were developed from the testing. The curves developed are based on the Euler Buckling Stress Equation $\left[\pi^2 E / \left(\frac{K}{r}\right)^2\right]$ and a straight line transition from Euler Buckling to ultimate stress. The allowable concentric axial load tables were generated from these curves.

The tables are based on a safety factor of three.

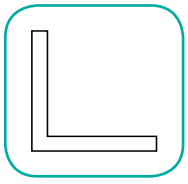


Columns Tables

Allowable Concentric Axial Stresses and Loads

Notation

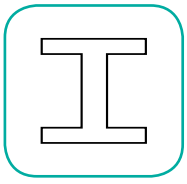
A	area (mm.^{2})
b	width of flange/leg/wall (mm.)
t	thickness of flange (mm.)
r	minimum radius gyration (mm.)
l	length (mm.)
K	effective column length factor
F_a	allowable column concentric axial stress (Mpa)
P_a	allowable column centric axial load (N.)



Angle

Maximum allowable stress:

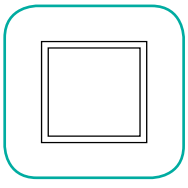
b/t = 6	41.3MPa
b/t = 8	33.5MPa
b/t = 10.7	24.1MPa
b/t = 12	19.5MPa
b/t = 16	12.6MPa



WF- & I-Beam

Maximum allowable stress:

b/t ≤ 12	68.9MPa
b/t = 13.3	68.9MPa
b/t = 16	50.5MPa
b/t = 20	32.3MPa
b/t = 21.3	28.4MPa
b/t = 24	22.4MPa
b/t = 26.7	18.1MPa



Square Tube (1/4" wall)

Maximum allowable stress:

b/t ≤ 16	68.9MPa

50.8mm x 50.8mm x 6.4mm Angle

Allowable Concentric Axial Stresses and Loads

$A = 593.5mm.^2$

$r = 9.65mm.$

$b/t = 8$

Effective Length (m.)	Kl r	F_a (kPa)	P_a (N)
0.30	31.6	24207	14368
0.46	47.4	19550	11604
0.61	63.2	14892	8839
0.76	78.9	10234	6075
0.91	94.7	7077	4200
1.07	110.5	5199	3086
1.22	126.3	3981	2363
1.37	142.1	3145	1867
1.52	157.9	2548	1512
1.68	173.7	2105	1250
1.83	189.5	1769	1050

76.2mm x 76.2mm x 6.4mm Angle

Allowable Concentric Axial Stresses and Loads

$A = 916mm.^2$

$r = 14.99mm.$

$b/t = 12$

Effective Length (m.)	Kl r	F_a (kPa)	P_a (N)
0.30	20.3	16852	15438
0.46	30.5	15511	14210
0.61	40.7	14171	12982
0.76	50.8	12830	11754
0.91	61.0	11490	10526
1.07	71.2	10149	9298
1.22	81.4	8809	8070
1.37	91.5	7468	6842
1.52	101.7	6141	5626
1.68	111.9	5075	4650
1.83	122.0	4265	3907
1.98	132.2	3634	3329
2.13	142.4	3133	2871
2.29	152.5	2729	2501
2.44	162.7	2399	2198
2.59	172.9	2125	1947
2.74	183.1	1895	1736
2.90	193.2	1701	1559

76.2mm x 76.2mm x 9.5mm Angle

Allowable Concentric Axial Stresses and Loads

A = 1348.4mm.^{2}

r = 14.99mm.

b/t = 8

Effective Length (m.)	Kl r	F_a (kPa)	P_a (N)
0.30	20.3	27523	37111
0.46	30.5	24523	33066
0.61	40.7	21523	29021
0.76	50.8	18523	29021
0.91	61.0	15523	20932
1.07	71.2	12524	16887
1.22	81.4	9596	12939
1.37	91.5	7582	10223
1.52	101.7	6141	8281
1.68	111.9	5075	6844
1.83	122.0	4265	5751
1.98	132.2	3634	4900
2.13	142.4	3133	4225
2.29	152.5	2729	3680
2.44	162.7	2399	3235
2.59	172.9	2125	2865
2.74	183.1	1895	2556
2.90	193.2	1701	2294

76.2mm x 76.2mm x 12.7mm Angle

Allowable Concentric Axial Stresses and Loads

$A = 1741.9mm.^2$

$r = 14.99mm.$

$b/t = 6$

Effective Length (m.)	Kl r	F_a (kPa)	P_a (N)
0.30	20.3	33326	58051
0.46	30.5	29304	51046
0.61	40.7	25283	44041
0.76	50.8	21262	37036
0.91	61.0	17059	29716
1.07	71.2	12533	21832
1.22	81.4	9596	16715
1.37	91.5	7582	13207
1.52	101.7	6141	10698
1.68	111.9	5075	8841
1.83	122.0	4265	7429
1.98	132.2	3634	6330
2.13	142.4	3133	5458
2.29	152.5	2729	4755
2.44	162.7	2399	4179
2.59	172.9	2125	3702
2.74	183.1	1895	3302
2.90	193.2	1701	2963

Allowable Concentric Axial Stresses and Loads

A = 1225.8mm.^{2}

r = 20.32mm.

b/t = 16

Effective Length (m.)	Kl r	F_a (kPa)	P_a (N)
0.30	15.0	11610	14381
0.46	22.5	11095	13744
0.61	30.0	10581	13107
0.76	37.5	10067	12470
0.91	45.0	9553	11833
1.07	52.5	9039	11196
1.22	60.0	8524	10559
1.37	67.5	8010	9922
1.52	75.0	7496	9285
1.68	82.5	6982	8648
1.83	90.0	6467	8011
1.98	97.5	5953	7374
2.13	105.0	5439	6737
2.29	112.5	4925	6100
2.44	120.0	4411	5463
2.59	127.5	3907	4840
2.74	135.0	3485	4317
2.90	142.5	3128	3874
3.05	150.0	2823	3497

101.6mm x 101.6mm x 9.5mm Angle

Allowable Concentric Axial Stresses and Loads

A = 1832.3mm.^{2}

r = 20.07mm.

b/t = 10.7

Effective Length (m.)	Kl r	F_a (kPa)	P_a (N)
0.30	15.2	21388	39188
0.46	22.8	20013	36668
0.61	30.4	18637	34148
0.76	38.0	17262	31628
0.91	45.6	15887	29108
1.07	53.2	14511	26588
1.22	60.8	13136	24068
1.37	68.4	11761	21549
1.52	75.9	10385	19029
1.68	83.5	9010	16509
1.83	91.1	7646	14010
1.98	98.7	6515	11937
2.13	106.3	5618	10293
2.29	113.9	4894	8966
2.44	121.5	4301	7881
2.59	129.1	3810	6981
2.74	136.7	3398	6227
2.90	144.3	3050	5588
3.05	151.9	2753	5044
3.20	159.5	2497	4575
3.35	167.1	2275	4168
3.51	174.7	2081	3814
3.66	182.3	1912	3502
3.81	189.9	1762	3228

101.6mm x 101.6mm x 12.7mm Angle

Allowable Concentric Axial Stresses and Loads

$A = 2387.1mm.^2$

$r = 19.81mm.$

$b/t = 8$

Effective Length (m.)	Kl r	F_a (kPa)	P_a (N)
0.30	15.4	28984	69188
0.46	23.1	26715	63771
0.61	30.8	24446	58355
0.76	38.5	22177	52938
0.91	46.1	19908	47522
1.07	53.8	17639	42105
1.22	61.5	15370	36689
1.37	69.2	13101	31272
1.52	76.9	10831	25856
1.68	84.6	8871	21175
1.83	92.3	7454	17793
1.98	100.0	6351	15161
2.13	107.7	5476	13072
2.29	115.4	4770	11388
2.44	123.1	4193	10009
2.59	130.8	3714	8866
2.74	138.5	3313	7908
2.90	146.2	2973	7098
3.05	153.8	2683	6406
3.20	161.5	2434	5810
3.35	169.2	2218	5294
3.51	176.9	2029	4843
3.66	184.6	1863	4448

101.6mm x 101.6mm x 9.5mm Angle

Allowable Concentric Axial Stresses and Loads

A = 3503.22mm.^{2}

r = 37.59mm.

b/t = 10.7

Effective Length (m.)	Kl r	F_a (kPa)	P_a (N)
0.30	8.1	61859	216707
0.46	12.2	58315	204291
0.61	16.2	54771	191875
0.76	20.3	51227	179459
0.91	24.3	47683	167043
1.07	28.4	44139	154628
1.22	32.4	40595	142212
1.37	36.5	37050	129796
1.52	40.5	33506	117380
1.68	44.6	29962	104964
1.83	48.6	26418	92548
1.98	52.7	22866	80105
2.13	56.8	19716	69070
2.29	60.8	17175	60168
2.44	64.9	15095	52882
2.59	68.9	13372	46843
2.74	73.0	11927	41783
2.90	77.0	10705	37501
3.05	81.1	9661	33844
3.20	85.1	8763	30698

Effective Length (m.)	Kl r	F_a (kPa)	P_a (N)
3.35	89.21	7985	27971
3.51	93.2	7305	25591
3.66	97.3	6709	23503
3.81	101.4	6183	21660
3.96	105.4	5717	20026
4.12	109.5	5301	18570
4.27	113.5	4929	17268
4.42	117.6	4595	16097
4.57	121.6	4294	15042
4.72	125.7	4021	14087
4.88	129.7	3774	13220
5.03	133.8	3549	12431
5.18	137.8	3343	11711
5.33	141.9	3155	11051
5.49	145.9	2982	10446
5.64	150.0	2823	9889
5.79	154.1	2676	9375
5.94	158.1	2541	8901
6.10	162.2	2415	8461

152.4mm x 153.4mm x 9.5mm Angle

Allowable Concentric Axial Stresses and Loads

$A = 5335.47mm.^2$

$r = 58.17mm.$

$b/t = 16$

Effective Length (m.)	Kl r	F_a (kPa)	P_a (N)
0.30	5.2	51967	277266
0.46	7.9	50371	268753
0.61	10.5	48775	260239
0.76	13.1	47179	251725
0.91	15.7	45584	243211
1.07	18.3	43988	234697
1.22	21.0	42392	226183
1.37	23.6	40797	217669
1.52	26.2	39201	209155
1.68	28.8	37605	200641
1.83	31.4	36009	192127
1.98	34.1	34414	183613
2.13	36.7	32818	175099
2.29	39.3	31222	166585
2.44	41.9	29626	158071
2.59	44.5	28031	149557
2.74	47.2	26435	141043
2.90	49.8	24839	132529
3.05	52.4	23129	123407
3.20	55.0	20979	111934

Effective Length (m.)	Kl r	F_a (kPa)	P_a (N)
3.35	57.6	19115	10198
3.51	60.3	17489	9331
3.66	62.9	16962	8569
3.81	65.5	14803	7898
3.96	68.1	13686	7302
4.12	70.7	12691	6771
4.27	73.4	11801	6296
4.42	76.0	11001	5869
4.57	78.6	10280	5484
4.72	81.2	9627	5136
4.88	83.8	9035	4820
5.03	86.5	8496	4532
5.18	89.1	8003	42701
5.33	91.7	7552	40290
5.49	94.3	6758	38089
5.64	96.9	6758	36057
5.79	99.6	6407	34185
5.94	102.2	6083	32454
6.10	104.8	5782	30852

101.6mm x 101.6mm x 9.5mm Square Tube

Allowable Concentric Axial Stresses and Loads

A = 3503.22mm.^{2}

r = 37.59mm.

b/t = 10.7

Effective Length (m.)	Kl r	F_a (kPa)	P_a (N)
0.30	8.1	61859	216707
0.46	12.2	58315	204291
0.61	16.2	54771	191875
0.76	20.3	51227	179459
0.91	24.3	47683	167043
1.07	28.4	44139	154628
1.22	32.4	40595	226183
1.37	36.5	37050	29796
1.52	40.5	33506	117380
1.68	44.6	29962	104964
1.83	48.6	26418	92548
1.98	52.7	22866	80105
2.13	56.8	19716	69070
2.29	60.8	17175	60168
2.44	64.9	15095	52882
2.59	68.9	13372	46843
2.74	73.0	11927	41783
2.90	77.0	10705	37501
3.05	81.1	9661	33844
3.20	85.1	8763	30698

Effective Length (m.)	Kl r	F_a (kPa)	P_a (N)
3.35	89.2	785	27971
3.51	93.2	7305	2591
3.66	97.3	6709	23503
3.81	101.4	6183	21660
3.96	105.4	5717	20026
4.12	109.5	5301	18570
4.27	113.5	4929	17268
4.42	117.6	4595	16097
4.57	121.6	4294	15042
4.72	125.7	4021	14087
4.88	129.7	3773	13220
5.03	133.8	3549	12431
5.18	137.8	3343	11711
5.33	141.9	3155	11051
5.49	145.9	2982	10446
5.64	150.0	2823	9889
5.79	1541	2676	9372
5.94	158.1	2541	8901
6.10	162.2	2415	8461

152.4mm x 153.4mm x 9.5mm Square Tube

Allowable Concentric Axial Stresses and Loads

$A = 5335.47mm.^2$

$r = 58.17mm.$

$b/t = 16$

Effective Length (m.)	Kl r	F_a (kPa)	P_a (N)
0.30	5.2	51967	277266
0.46	7.9	50371	268753
0.61	10.5	48775	260239
0.76	13.1	47179	251725
0.91	15.7	45584	243211
1.07	18.3	43988	234697
1.22	21.0	42392	226183
1.37	23.6	40797	217669
1.52	26.2	39201	209155
1.68	28.8	37605	200641
1.83	31.4	36009	192127
1.98	34.1	34414	183613
2.13	36.7	32818	175099
2.29	39.3	31222	166585
2.44	41.9	29626	158071
2.59	44.5	28031	149557
2.74	47.2	26435	141043
2.90	49.8	24839	132529
3.05	52.4	23129	123407
3.20	55.0	20979	111934

Effective Length (m.)	Kl r	F_a (kPa)	P_a (N)
3.35	57.6	19115	10198
3.51	60.3	17489	9331
3.66	62.9	16962	8569
3.81	65.5	14803	7898
3.96	68.1	13686	7302
4.12	70.7	12691	6771
4.27	73.4	11801	6296
4.42	76.0	11001	5869
4.57	78.6	10280	5484
4.72	81.2	9627	5136
4.88	83.8	9035	4820
5.03	86.5	8496	4532
5.18	89.1	8003	42701
5.33	91.7	7552	40290
5.49	94.3	6758	38089
5.64	96.9	6758	36057
5.79	99.6	6407	34185
5.94	102.2	6083	32454
6.10	104.8	5782	30852

Corrosion Guide

The data in this corrosion guide is based on field service performance, laboratory testing and extrapolated values from our resin manufacturers' recommendations. Data shown is intended as a guide only. It is recommended that for a specific application, testing be done in the actual chemical environment. The following conditions will effect the suitability of a specific resin laminate:

- Periodic changes in temperature
- Changes in chemical concentrations
- Exposure to vapor only
- Exposure to intermitent splashes and spills
- Load bearing or non-load bearing requirements
- Temperature spikes
- Combinations of chemicals
- Exposure to frequent splashes and spills
- Frequency of maintenance wash down

Chemical Environment	Maximum Recomended Service Temperatures °C	
	Vinylester	Polyester
Acetic Acid, to 10%	76	26
Acetic Acid to 50%	81	NR
Acetic Acid, Glacial	NR	NR
Acetone	NR	NR
Aluminum Chloride	76	49
Aluminum Hydroxide	60	49
Aluminum Nitrate	60	49
Aluminum Sulfate	76	49
Aluminum Chloride	76	49
Ammonium Hydroxide, 5%	60	NR
Ammonium Nitrate, to 50%	76	49
Ammonium Nitrate, Saturated	76	NR
Ammonium Persulfate, to 25%	69	32
Ammonium Phosphate	76	49
Ammonium Sulfate	76	49
Amyl Alcohol	26	NR
Barium Carbonate	76	49
Barium Chloride	76	49
Barium Sulfate	76	49
Benzene	NR	NR
Benzene Sulfonic Acid 50%	43	NR
Benzoic Acid	76	49
Benzyl Alcohol	NR	NR
Borax	76	49
Brinc (Sodium Chloride Sol.)	76	49
Bromine, Liquid or Vapor	NR	NR
Ethyl Alcohol	NR	NR
Ethylene Glycol	76	49

Chemical Environment	Maximum Recomended Service Temperatures °C	
	Vinylester	Polyester
Butyl Acetate	NR	NR
Butyl Alcohol	26	NR
Calcium Carbonate	76	49
Calcium Hydroxide	60	49
Calcium Hypochlorite	49	NR
Calcium Nitrate	76	49
Calcium Sulfate	76	49
Carbon Disulfide	NR	NR
Carbon Monoxide Gas	76	60
Carbon Dioxide Gas	76	60
Carbon Tetrachloride	20	NR
Liquid or Vapor	43	NR
Chlorine, Dry Gas	76	NR
Chlorine, Wet Gas	76	NR
Chlorine Water	60	NR
Chloroform	60	NR
Chromic Acid, to 5%	43	NR
Chromous Sulfate	60	49
Citric Acid	76	49
Copper Chloride	76	76
Copper Cyanide	76	76
Copper Nitrate	76	76
Crude Oil, Sour	76	76
Cyclohexane, Liquid and Vapor	76	NR
Diesel Fuel	60	32
Ethyl Acetate	NR	NR
Phosphoric Acid, Vapor	76	49
Potassium Aluminum Sulfate	76	49

Chemical Environment	Maximum Recomended Service Temperatures °C	
	Vinylester	Polyester
Fatty Acids	76	26
Ferric Chloride	76	43
Ferric Sulfate	76	43
Formaldehyde	43	NR
Fuel Oil	60	26
Gasoline, Aviation and Ethyl	60	26
Glucose	76	37
Glycerine	76	37
Hexane	49	32
Hydraulic Fluid (Glycol Based)	60	NR
Hydraulic Fluid Skydraul	60	NR
Hydrobromic Acid	43	NR
Hydrochloric Acid, up to 15%	60	26
Hyrochloric Acid, Concentrated	43	NR
Hydrogen Bromide, Dry Gas	60	26
Hydrogen Bromine, Wet Gas	60	NR
Hydrogen Chloride, Dry Gas	76	26
Hydrogen Chloride, Wet Gas	76	26
Hydrogen Fluoride, Sol or Vapor	NR	NR
Hydrogen Peroxide, to 10%	43	NR
Hydrogen Sulfide, Dry Gas	60	26
Hydrogen Sulfide, Wet Gas	60	26
Isopropyl Alcohol	26	NR
JP-4	60	26
Kerosene	60	43

Chemical Environment	Maximum Recomended Service Temperatures °C	
	Vinylester	Polyester
Lactic Acid	76	49
Lead Acetate	76	49
Linseed Oil	76	37
Lithium Chloride	76	49
Magnesium Carbonate	76	49
Magnesium Chloride	76	49
Magnesium Hydroxide	76	37
Magnesium Nitrate	76	49
Magnesium Sulfate	76	49
Mercuric Chloride	76	49
Mercuric Metal	76	49
Methyl Ethyl Ketone	NR	NR
Mineral Oil	76	49
Monochlorobenzene	NR	NR
Naphtha	60	49
Nickel Chloride	76	49
Nitric Acid, to 5%	43	37
Nitric Acid, Concentrated	NR	NR
Nitric Acid, Vapor	60	37
Oleic Acid	76	49
Oxalic Acid	76	49
Paper Mill Liquor	37	37
Phenol Solution or Vapor	NR	NR
Phosporic Acid	76	37
Phosphoric Acid, Salts thereof	76	49

Chemical Environment	Maximum Recomended Service Temperatures °C	
	Vinylester	Polyester
Potassium Bicarbonate	43	37
Potassium Carbonate, to 10%	110	NR
Potassium Chloride	76	49
Potassium Hydroxide	60	NR
Potassium Nitrate	76	49
Potassium Sulfate	76	49
Propylene Glycol	76	49
Sodium Acetate	76	49
Sodium Benzoate	60	49
Sodium Bicarbonate	60	49
Sodium Bisulfate	76	49
Sodium Bisulfite	76	49
Sodium Borate	76	49
Sodium Bromide	76	49
Sodium Carbonate, to 10%	60	20
Sodium Chloride	76	49
Sodium Cyanide	76	49
Sodium Dichromate	76	49
Sodium Di-Phosphate	76	49
Sodium Hydroxide, 10%	60	NR
Sodium Hypochlorite, to 5 ¼%	43	20
Sodium Monophosphate	76	49
Sodium Nitrate	76	49
Sodium Nitrite	76	49
Sodiumm Sulfate	76	49

Chemical Environment	Maximum Recomended Service Temperatures °C	
	Vinylester	Polyester
Sodium Tetraborate	60	49
Sodium Thiosulfate	60	49
Soy Oil	76	37
Stearic Acid	76	49
Styrene	NR	NR
Sulfamic Acid	76	49
Sulfated Detergents	NR	49
Sulfite Liquor	71	37
Sulfur Dioxide, gas-dry	76	49
Sulfur Dioxide, gas-wet	76	20
Sulfur Trioxide, gas-wet or dry	76	NR
Sulfuric Acid, to 25%	76	26
Tartaric Acid	76	49
Tetrachloroethylene	NR	NR
Toluene	NR	NR
Trichloroethylene vapor	NR	NR
Trisodium Phosphate	76	NR
Urea, 35%	43	NR
Vinegar	76	65
Water, Distilled	81	65
Water, Tap	81	65
Zinc Chloride	76	49
Zinc Nitrate	76	49
Zinc Sulfate	76	49

Australian Head Office
abn 61160899703
a 6/7-9 Streiff Road, Wingfield SA 5013
t +1300 26 10 74 f +1300 08 10 75
service@sisau.com.au
sisau.com.au

sydney
17 Jumal Place
Smithfield
NSW 2164
Australia

melbourne
135 Boundary Road
Laverton North
Victoria 3026
Australia

brisbane
1094 Lytton Road
Murarrie
Queensland 4172
Australia

hong kong
Room 102, 1st Floor
The Centre Mark
287 - 299 Queen´s Rd
Central Hong Kong

shanghai
RM 1001A
Hua Sheng Building
No.398 Han Kou Road
200001 Shanghai
People´s Republic of China

shenzhen
27-3, 27th Floor
Shun Hing Square
Di Wang Commercial Centre
Lu Wu District, Shenzhen
People´s Republic of China

los angeles
Suite 135
5230 Pacific Concourse Dr.
Los Angeles
CA 90045
United States

Annexure 3

sustainable infrastructure systems

Terms & Conditions of Trade

v2.4

Terms & Conditions of Trade

Sustainable Infrastructure Systems (Aust) Pty Ltd ('SIS')

ABN: 61 160 899 703

These are the entire terms and conditions of trade for goods supplied by SIS on or after 1st July, 2013 to customers within Australia or export customers outside Australia (the 'Customer').

1. Definitions

Under these terms, unless the context otherwise requires:

a. 'SIS' means Sustainable Infrastructure Systems (Aust) Pty Ltd;

b. 'Customer' means the Customer as specified in the Account Application and any Quotations provided to prospective Customers;

c. 'Quotation' means SIS's quotation for the supply of the Goods to an existing or prospective customer;

d. 'Goods' means the goods sold and purchased or agreed to be sold and purchased, pursuant to the Quotation;

e. 'Order' means the Customer's instructions to SIS to supply the Goods, pursuant to Quotation;

f. 'Default Event' means any of the following:

i. The customer does not make a payment due to SIS;

ii. The customer is unable to pay its debts as and when they fall due (insolvent);

iii. The customer ceases or suspends to conduct its business, or threatens to do the same;

iv. A resolution passed or proposed or an order made or a summon is presented to wind up the customer;

v. A receiver and / or manager or other form of insolvency administrator is appointed over all or part of the customer's assets;

vi. The customer makes or proposes to make any arrangement with its creditors;

vii. The customer commits an act of bankruptcy;

viii. Execution is levied on any of the customers' assets.

2. Applications

a. All orders placed with SIS shall only be accepted subject to these Terms and Conditions of Trade. SIS may at any time, and from time to time, alter these Terms and Conditions and such altered Terms and Conditions of Trade shall apply after notification by SIS to the Customer.

3. Payment, Credit and Prices

a. The Customer shall pay for the Goods in Australian currency, unless quoted otherwise, at the price specified in the Quotation;

b. The Customer must pay for all the Goods before the due date stated on the invoices issued by SIS;

c. The Customer shall pay on delivery the full amount of the purchase for three consecutive orders prior to a credit application being considered / approved;

d. Amount of the Goods in excess of the Approved Credit Limit must be payable prior to delivery;

e. Interest is charged on amounts outstanding after 21 days from due date;

f. SIS may withdraw any credit or limit the amount of credit extended to the Customer at any time;

g. The Customer must pay the GST and any other applicable taxes on the Goods;

h. All prices shall be those referred to in SIS's price lists and/or arrangements current at the date of invoice and prices shall be subject to change without notice;

i. If the total weight or length of any item supplied includes a fraction of a kilogram or metre, the Customer will be invoiced and must pay for the fraction as a whole kilogram or metre;

j. If a default event occurs:

i. SIS may withhold further deliveries of Goods and/or withdraw any credit facilities; and;

ii. All amounts outstanding to SIS by the Customer, even if not otherwise due for payment, become immediately payable.

4. Deliveries

a. SIS will deliver the Goods to the delivery address as specified by the Customer in the order;

b. The Customer shall pay the cost of delivery unless stated otherwise in the Quotation;

c. If the Goods are sold ex – SIS store, the Customer must, at its own cost and risk, collect the Goods within reasonable time;

d. Delivery is complete when the Goods are unloaded from the delivery vehicle. Unloading of the Goods will be at the Customer's cost and risk;

e. Customer representative must be present at the delivery address at the time the Goods are delivered. The representative must sign the delivery advice the driver of the delivery vehicle presents as proof of the delivery;

f. SIS may deliver the Goods even if the Customer's representative is not present;

g. If SIS fails to deliver a portion of the Goods by the estimated date or to deliver at all, the Customer is not entitled to terminate and refuse delivery of the balance of the Goods;

h. SIS shall not incur or be held responsibility of any expenses caused by the delay in supply of goods, which are manufactured overseas and shipment to Australia by the third party. All care and responsibility are taken to ensure that goods are delivered on time.

5. Progress Payments for Construction Work

a. All Construction Work undertaken by SIS on behalf of the Customer shall be governed by the 'Building and Construction Industry Security of Payment Act (1999) NSW';

b. Under Section 8 of the Building and Construction Industry Security of Payment Act (1999) SIS shall be entitled to receive and recover progress payments in relation to the Goods supplied and/or work carried out on the premises of the Customer, or their agent;

c. The amount recoverable will be the proportion of Goods supplied and/or work undertaken in accordance with the contract price of the entire project;

d. Any Goods supplied and / or installed on a construction project which have been fabricated to custom specifications will require payment in full even if the order is cancelled within the 7 day period stated in Clause 8 below.

6. Retention of Title

a. Title to Goods remains with SIS until the customer pays to SIS all amounts the Customer owes to SIS;

b. While the Customer retains title to Goods;

i. On reasonable notice, SIS may enter

premises where the Goods are stored to inspect;

ii. The Customer may sell the Goods in the ordinary course at full market value, until a default event occurs;

c. Until the Customer pays all amounts it owes SIS, the Customer:

i. Must store the Goods in a safe and secure manner that identifies them as SIS's goods, distinguishable from other goods in the Customer's possession;

ii. Acknowledges that it holds the Goods as SIS's Bailee and that a fiduciary relationship exists with SIS; and the Customer must hold the proceeds from any sales of the Goods on trust for SIS and clearly identify these amounts in accounts;

d. If a Default Event occurs:

i. The Customer's right to sell the Goods immediately terminates; and

ii. Without notice to the Customer and without prejudice to any of its other rights, SIS may recover and/or resell the Goods unpaid for and may enter the Customer's premises by its servants or agents for that purpose. The Customer shall indemnify SIS for all its claims, actions, suits, demands, and other costs or damages to or arising out of such entry.

7. Tolerances

a. Each SIS invoice shall be prima facie evidence of classification, numbers and measurements of the Goods delivered;

b. The Goods will be supplied with the tolerances as to quality, dimensions, weight, gauge, chemical composition, physical properties, finish, shearing and degree of flatness specified within SIS data sheets and manuals.

8. Warranties and Liability

a. SIS warrants:

i. For a period of three (3) years from the date of delivery, that the Goods will be free from defects in material and workmanship, except defects normally regarded as being commercially acceptable; and

ii. Subject to paragraph 5, that the Goods will conform to the description as stated in the Quotation;

iii. Except as set out in paragraph 6a and 6c SIS:

1. Excludes all conditions and warranties in relation to the Goods whether imposed or implied by statute or otherwise; and

2. Will not be liable for any loss, damage or injury including loss of profits and consequential loss, arising from the condition, supply or use of the Goods, or out of SIS's breach of performance, whether or not caused by SIS's negligence.

b. These terms includes terms implied by any statute which cannot be lawfully excluded including those implied by Division 2 of the Trade Practices Act and, if applicable, the Fair Trading Act (NSW) and the Sale of Goods Act (NSW). These terms specifically exclude the Sale of Goods (Vienna Convention) Act (NSW),

in relation to the supply of goods and services that are not ordinarily acquired for personal, domestic or household use or consumption. SIS's liability for breach of those terms (other than Section 69 of the Trade Practices Act, NSW) will be limited, at its option, to any or more of:

i. In the case of goods, the replacement, repair or payment of the cost of replacement or repair of the goods; and

ii. In the case of services, supplying the services again or payment of the cost of having the services supplied again.

c. The Customer acknowledges that it has exercised independent skill and judgement in acquiring the Goods and has not relied on any advice or representation by SIS or any description, illustrations or specifications contained in any document produced by SIS which have not been stated expressly in these terms.

d. The Customer will be taken to have adequately inspected the Goods upon delivery and waived any claim which it may have against SIS unless:

i. The Customer gives SIS written notice of the claim within 7 days after delivery of the Goods; and

ii. SIS is given a reasonable opportunity to investigate the claim.

9. Stocking

a. If the Customer does not collect or accept delivery of the Goods within 30 days of the Goods becoming available for delivery, SIS may:

i. Deliver the Goods to the Customer, in which case the delivery will be taken as a delivery pursuant to these terms; or

ii. Treat the Customer as having cancelled the Order.

b. The Customer is aware of moisture trapped between the articles when stored may lead to staining or soiling which is not easily removed. SIS will not be liable for any loss or damage the customer sustains arising out of anything referred to in this paragraph 7 and will not be required to remove any stains or soiling.

c. If the Customer requests a deferment of delivery of Goods and SIS agrees to defer delivery, the Customer must pay the storage fee SIS specifies.

Australian Head Office
abn 61160899703
a 6/7-9 Streiff Road, Wingfield SA 5013
t +1300 26 10 74 f +1300 08 10 75
service@sisau.com.au
sisau.com.au

sydney
17 Jumal Place
Smithfield
NSW 2164
Australia

melbourne
135 Boundary Road
Laverton North
Victoria 3026
Australia

brisbane
1094 Lytton Road
Murarrie
Queensland 4172
Australia

hong kong
Room 102, 1st Floor
The Centre Mark
287 - 299 Queen´s Rd
Central Hong Kong

shanghai
RM 1001A
Hua Sheng Building
No.398 Han Kou Road
200001 Shanghai
People´s Republic of China

shenzhen
27-3, 27th Floor
Shun Hing Square
Di Wang Commercial Centre
Lu Wu District, Shenzhen
People´s Republic of China

los angeles
Suite 135
5230 Pacific Concourse Dr.
Los Angeles
CA 90045
United States