Subcon

SUBSEA STABILISATION, MARINE FOUNDATIONS, REEFS

Perth: +61 8 9200 2218
Singapore: +65 6440 7752
China: +86 137 1529 7879
Email: info@subcon.com
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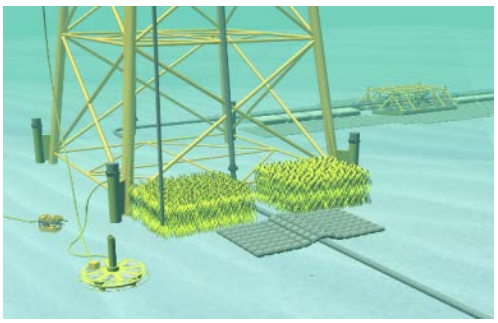
Subsea Stabilisation and Marine Foundations

Subcon are an international company providing subsea foundations and stabilisation. Subcon design, fabricate and install the following: Concrete Mattresses, Pipeline Crossings, Structural Grouts, Span Rectifications, Artificial Reefs, Wharf and Jetty Stabilisation, Heavy Coastal Armour.

Oil and Gas | Nearshore | Renewables | Aquaculture

MANAGEMENT SYSTEM CERTIFICATION
ISO 9001 = OHSAS 18001 = AS/NZS 4801
DNV



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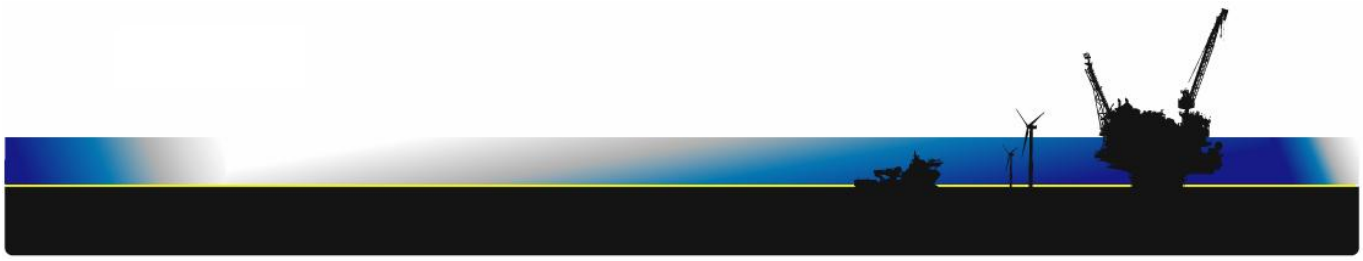

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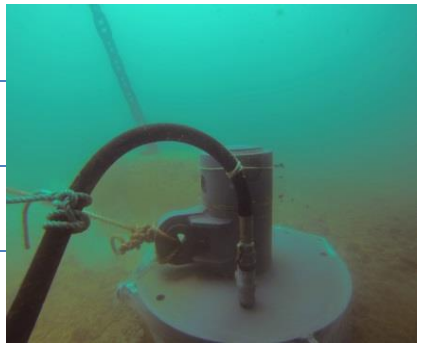
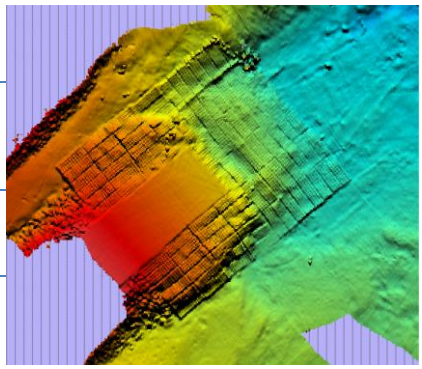
PROJECT EXPERIENCE

Year	Client	Description
2015	Queensland Fisheries	Turner Reef – Low relief fishing reef comprising ~100 modules.
2015	Queensland Fisheries	2 1200m^3 Reefs Simpson and Hardy including 30 x 80m3 Reef modules.
2014	Allied Marine Equipment	PMO Energy 28" Gas Line – Supply of free span correction services.
2014	Technip	Wheastone SSIV Stabilisation – Supply of articulated concrete mattresses.
2014	RecFishWest	Rottnest Island Artificial Reef – Design, Fab. and Install 2 x 400m^3 steel modules.
2014	FTSM	Bayu Undan Freespan Correction – Supply of freespan correction services.
2014	Caldive	Gorgon DomGas Pipeline RockBolting – Supply of Grouting Services
2014	NSW Gov't	Shoalhaven Artificial Reef – Design, Fabricate and Install 20 x 80m^3 modules
2014	Caldive	Gorgon DomGas Pipeline stabilisation – Supply of 40 x 7Te Custom Prefilled Grout Bags
2014	DOF Subsea	Blacktip GEP Spool Scour Remediaton – Supply of Frond Mattresses and Aggregates
2014	DOF Subsea	SPEX Malampaya Freespan Correction – Supply of Grouting Spread, Labour and Fabric formwork
2014	Woodside	Stabilisation and Dropped Object Protection Mattresses at NRA
2014	Dredging International	Wheatstone Micro Tunnel Structural Grouting – 120m^3 continuous pour of Masterflow 871 using Subcon Super Pan Mixer.
2014	BAM Clough	Wheatstone Grouting Services – Provision of labour to batch Masterflow 871
2014	Total AMS	Port of Port Headland Tug Pen Upgrades – Installation of Masterflow 9500 using Subcon Super Pan Mixer





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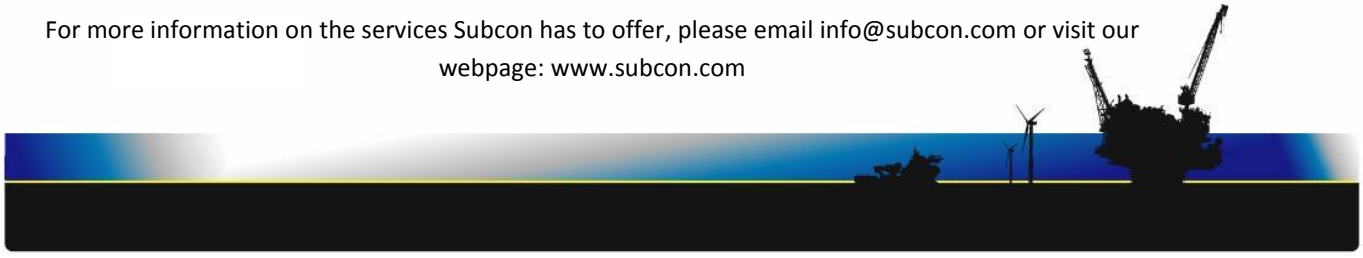

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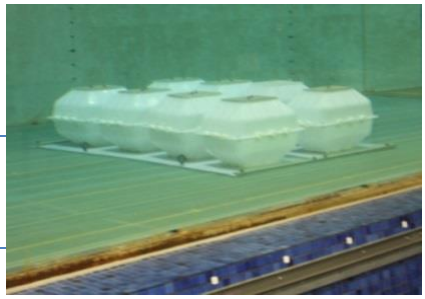
	2014	Caldive	Esso Freespan Correction – Supply of Grouting Spread, Labour and Fabric formwork
	2014	Total AMS	Carnegie CETO Project – Supply of Precast Pipeline Stabilisation Split Clump Weights.
	2014	Ark Maintenance	Cape Lambert Wharf – Pile Structural Repairs – Grouted Clamp
	2014	BAM Clough	Inpex MOF Wharf Stabilisation – CoastMatt™ Geotextile Backed Mattresses and Fabric Formworks
	2013	SS JV WA Water Corp.	Binningup Desal, HDD Transition Box Remediation Grouting. HP injection grouting for seabed stabilisation and internal structural reinforcement grouting.
	2013/14	Subsea 7	Gorgon, Heavy Lift and Tie-ins, Crossings and Support Mattresses, 420 mattresses ex Karratha and Henderson.
	2013	Bechtel	APLNG Project. FLNE RoRo Ramp Remediation and Heavy Armouring, 100 heavy armour matts with AISI 316 Stainless Wire Reinforcing for shallow water.
	2013/14	Fugro FTSM	Greater Western Flank, Expansion Spool Stabilisation, supply of 121 matts including our proprietary X-Matt™.
	2013	Seacore	Carnegie Wave Energy Project, Foundation Pile Grouting.
	2013/14	Allseas	Gorgon, Trunkline Stabilisation, supply of ~1000 prefilled 80kg grout bags.
	2013	Allseas	Wheatstone, HDD Microtunnel Grout Packer Qualification
	2013/14	Subsea7	Gorgon, Heavy Lift and Tie-ins Suction Pile Grouting
	2013	TIMAS	Bukit Tua, Pipeline Crossing and Stabilisation



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2013	Total AMS	Cyclone Mooring and Pile Grouting
2013	Sapura Clough	Otway Phase 3 Development Project, Supply of 650 Flying Lead Stabilisation Grout Bags
2013	Total AMS	Dredging International Cyclone Moorings, Offshore Grouting of 16 Mooring Piles
2013	Subsea 7	Gorgon, Umbilical Crossing Deflector Bollards
2013	Total Angola	Supply of 800 of 80kg ROV friendly bags for trenched umbilical stabilisation
2013	Sapura Clough	Otway Phase 3 Development Project, Supply of Articulated Concrete Mattresses
2013	TekOcean	Santos, Pipeline Remediation, supply of reinforced sand bags
2012	Cypriot Telecom Authority	Supply of Concrete Mattresses for Telecom Cable Stabilisation
2012	Total AMS	Leighton Cyclone Moorings, Offshore Grouting of 16 Mooring Piles
2012	Chevron	Thevenard Island, Grouting of shore supports and well foundation support remediation
2012	John Holland	GLNG Project Custom Designed Fabric Formwork Bags
2012	Rio Tinto	Boyne Island, Gas Pipeline Remediation Installation
2012	Chevron	Wheatstone Pipeline Counteract Structure Stabilisation Engineering
2012	GeoTek	Yass Dam Cofferdam Grout Bag Supply
2012	McDermott International	Macedon Flying Lead Stabilisation Grout Bag Supply
2011	Rio Tinto	Boyne Island Gas Pipeline Remediation Mattress Supply.

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Articulated Concrete Mattresses

Subcon offers a range of Articulated Concrete Mattresses that can be used to provide:

- On Bottom Stability
- Scour Protection with Subcon's unique staggered block
- Dropped Object Protection
- Crossing support

Subcon uses steel or plastic moulds to offer the most economical solution.

Our standard range includes:

Height (mm)	Mould	Width (m)	Length (m)
100	Steel	3	6
150	Steel	2.1	5.3
350	Steel	3	6
150	Plastic	Any width in increments of 0.5m	Any length in increments of 0.5m
300	Plastic		
400	Plastic		
500	Plastic		

Our mattresses can be manufactured with the following features;

- A unique "staggered block" design to reduce current flow through the mattress and reduces scour under mattress.
- Production as close to your loadout site as possible to minimise transportation costs.
- UV stabilised polypropylene rope and high strength concrete to ensure the required design life for the mattresses is exceeded.
- High density concrete for improved weight to volume ratio and mattress performance

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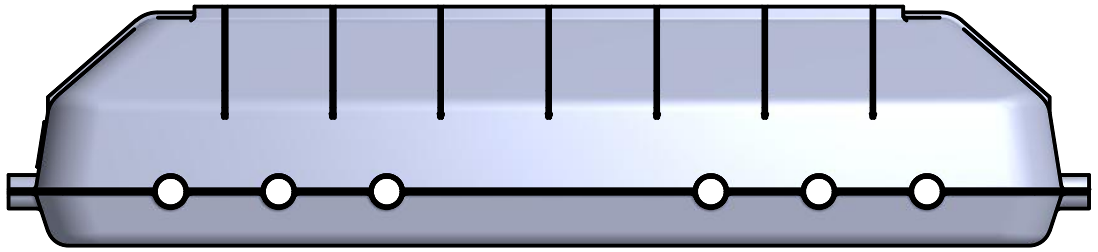
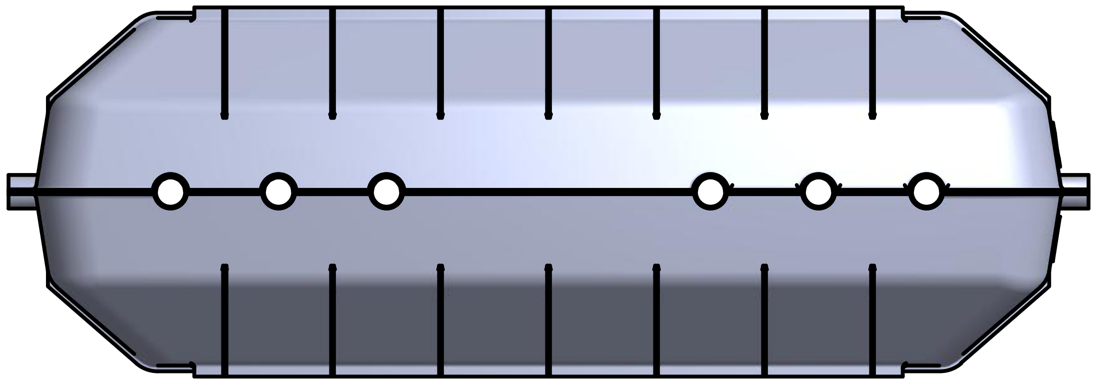
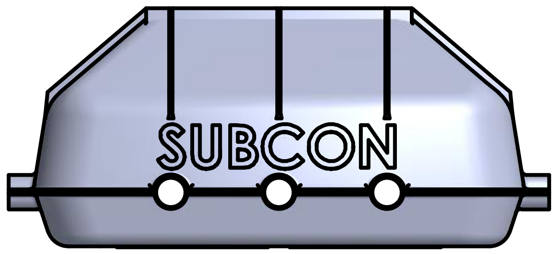


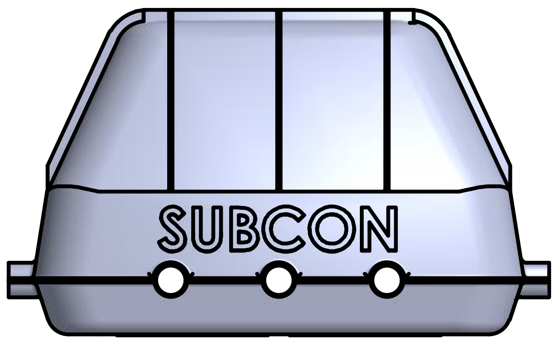
200L Series Mattress



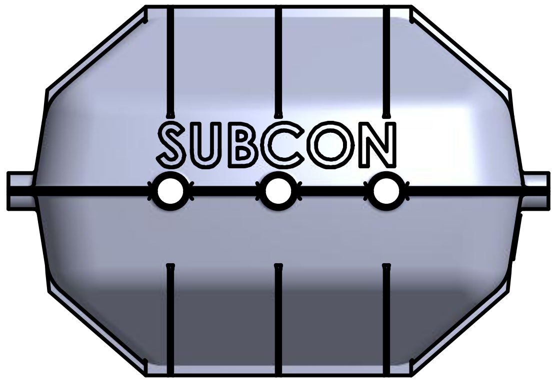
300L Series Mattress



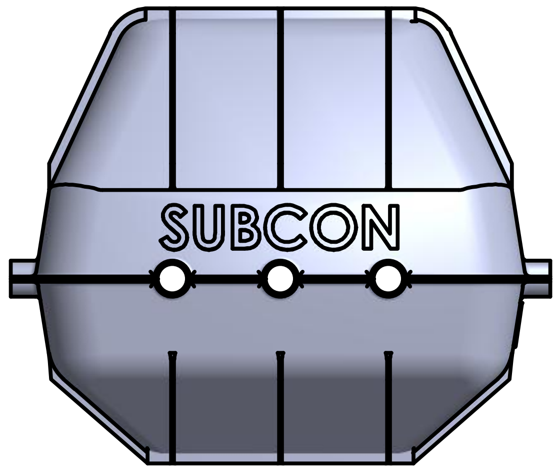
200 Series Mattress



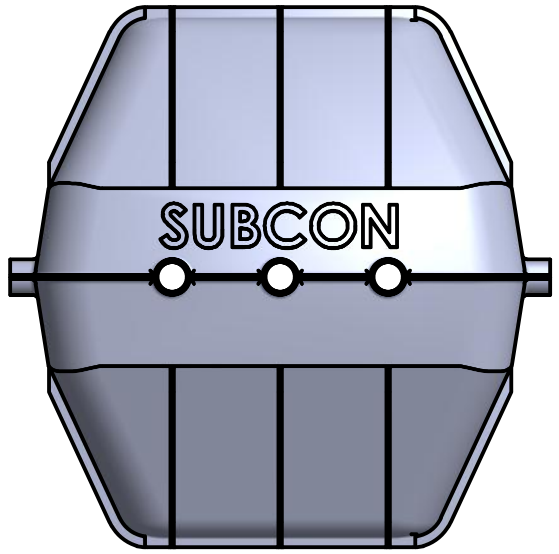
300B Series Mattress



300 Series Mattress



400 Series Mattress



500 Series Mattress

		C		ISSUED FOR REVIEW	JH	MA	JH	
		B		ISSUED FOR REVIEW	JH	MA	JH	
		A		ISSUED FOR REVIEW	JH	MA	JH	
	REFERENCE DRAWING	REV	DATE	REVISION	BY	CHK	ENG	PM

TITLE	SUBCON MATTRESS RANGE			CLIENT SUB
				SCALE NTS
DRAWN	DATE	Subcon	PROJECT SUB	SIZE A1
CHECKED	12/12/12			
ENG.	17/12/12	DRAWING NUMBER 3100-SUB-DWG-000		REV C
CLIENT APP.	17/12/12			

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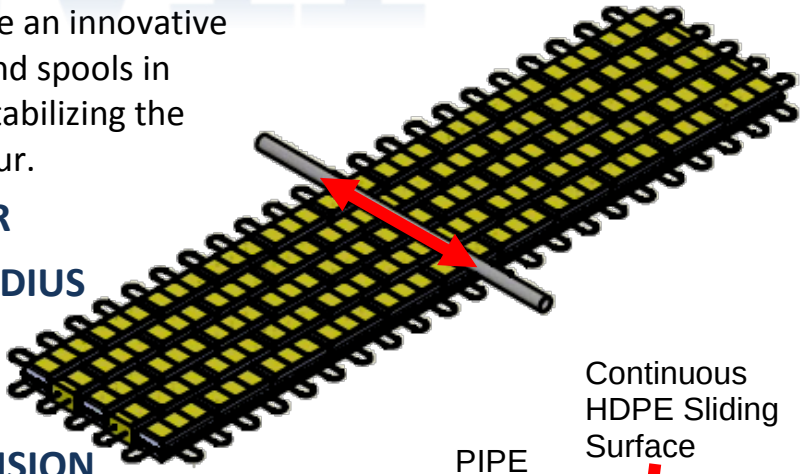
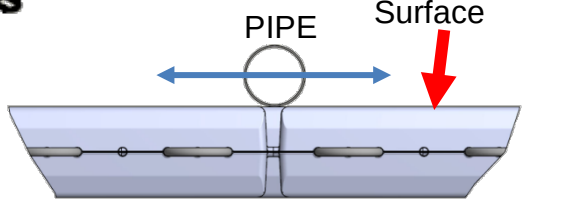
X-MATT®

X-Matt® mattresses provide an innovative way to support pipelines and spools in expansion whilst actively stabilizing the seabed and controlling scour.



X-MATT® IS IDEAL FOR SUPPORTING ZERO RADIUS BENDS, EXPANSION SPOOLS AND PIPELINE AXIAL EXPANSION



A continuous HDPE surface provides a low friction, abrasion free sliding surface for the pipeline or spool to slide on. It allows designers to guarantee expansion and buckling will occur as per the design and that the pipeline will not be overstressed due to burial. It also works in conjunction with counteract structures to ensure zero radius bends and expansion occur without the risk of the pipeline becoming buried or caught under the structure.

STANDARD HEIGHTS:

- 200mm,
- 250mm,
- 300mm,
- 400mm,
- 500mm.

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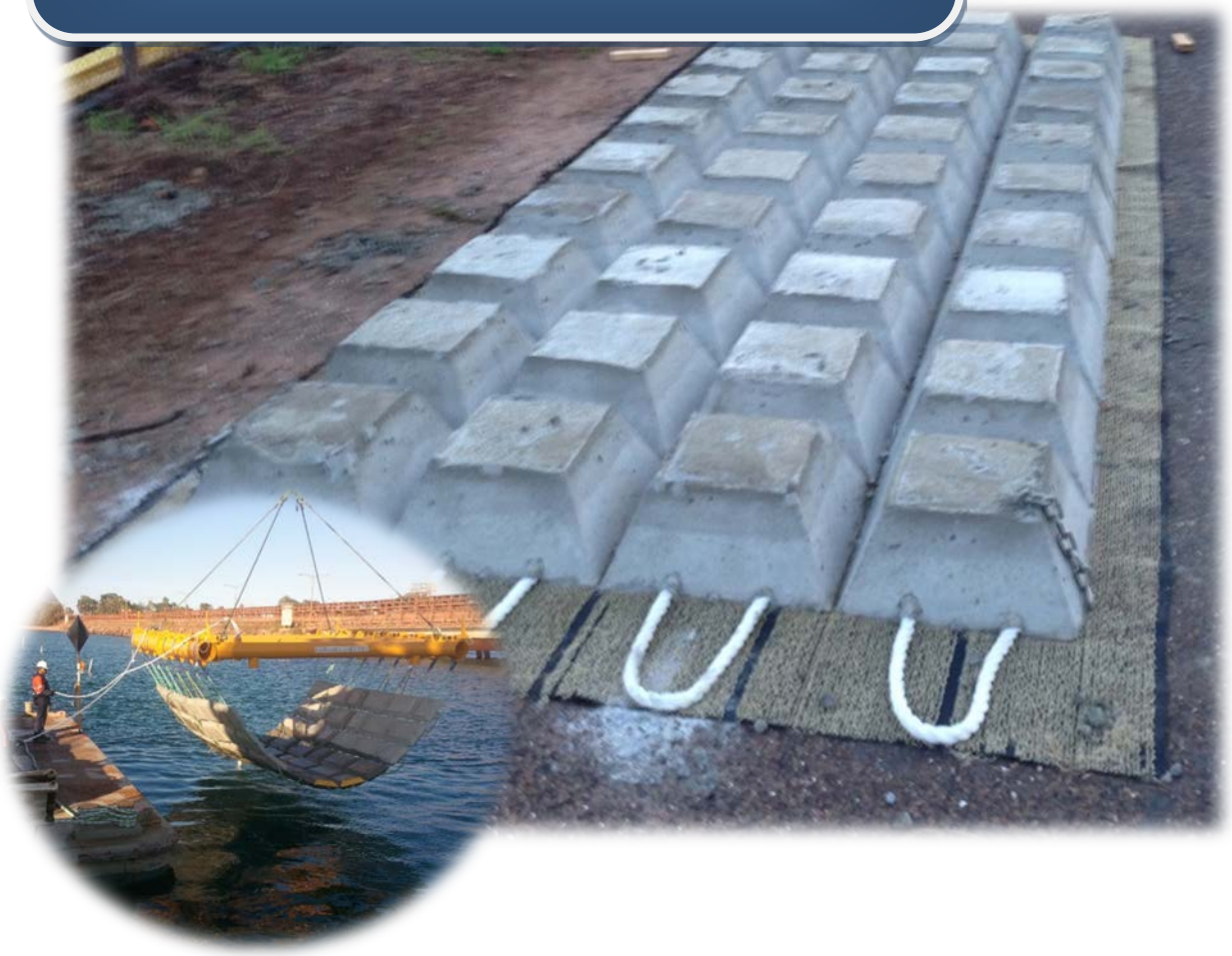
CoastMatt™

CoastMatt™ incorporates concrete blocks cast directly onto polypropylene loopmatting. This guarantees excellent bonding and durability for harsh environments including nearshore stabilization and onshore revetments with high UV exposure. CoastMatt™ is an ideal product for anti-scour prevention, offshore scour control, foreshore stabilization, channel and river revetments and coastal pipeline stabilisation.

Key Features:

- Fast installation rate.
- Up to 50 year durability.
- Resistant against chemical and biological degradation.
- Rope loops for rapid diver installation.
- Scour control skirts provide continuous core containment.



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SGM 1000 Grout Mixer & Agitator

The SGM 1000 is an electric powered grout mixing system comprising of a colloidal mixer, agitated storage tank and a 3 stage mono pump. THE SGM 1000 is fitted with a densitometer to assist in the rapid mixing of grout slurries and a flow meter for accurate assessment of grout volumes mixed and pumped.

The unit can be loaded with bagged product including fines such as sand and bentonite. Material can also be introduced pneumatically to the mixer when combined with a Subcon silo providing a very efficient mixing platform for the production of various types of grout slurries for offshore structures and fabric formwork grout bags.

Specifications

Maximum Flowrate	$4m^3$/Hr
Discharge Diameter	50mm
Pressure rating	12 Bar

Mixer Capacity	300 L
Agitator Capacity	800 L
Lifting Frame Design Standard	DNV 2.7-1 R30

Length	2.9m
Width	2.0m
Height	2.1m
Weight	2700kg
Power Supply	415v – 50Hz, 100kVa via IEC 60309 (6H) 63Amp/415v 4 Pole-5 Wire Outlet (3P+N+E) (Menkes plug)

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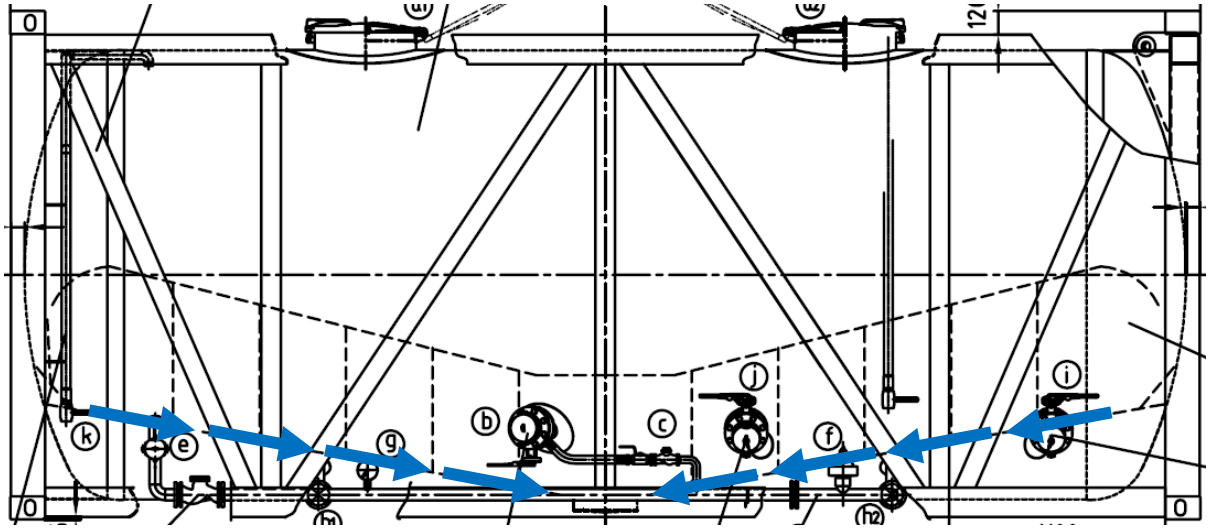
Offshore Cement Silo

Subcon's offshore rated cement silos are designed to DNV 2.7-3 specifically for transferring cement between vessels offshore in sea states up to Hs = 3m.

Features

- CSC Plated for Road, Rail and Sea Transport
- Twin Internal Air Conveyors for constant cement supply & recovery.
- Rated to DNV 2.7-3 R30. Cement can be transfered by crane infield.



TWIN INTERNAL AIR CONVEYORS

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Specifications

Standards and Certification

Lifting Design Code	DNV 2.7-3 R30
Tank Design Code	ASME VII-DIV 1 Edt 2011A
Worksafe Design Registration Number	PV 6-174840/13
Certificate of Conformity for Lifted Equipment (CCLE)	AEC2013-110-L698

Dimensions

Length	6.058m (20’)
Width	2.438m (8’)
Height	2.591m (8’6”)
Cubic Capacity	18.5m^3
Tare	5,800 kg
Nett (Max Payload)	25,200 kg
Typical Payload	22,000 kg
Gross	31,000 kg

Operation

Working Pressure	0.2 MPa/29Psi
Manhole Aperture	500mm
Air Supply Pressure	160-200 kPa/23-29Psi, 700cfm.

Standard Fittings

Air Inlet Pipe Diameter	75mm (3”) male camlock
Cement Inlet (Pressure Filling)	100mm (4”) male camlock
Outlet / Discharge	100mm (4”) male camlock
Cement Discharge Rate	Fully discharged in 19minutes
Cement Remnant Ratio	<0.3% (85kgs)
Gaskets and seals	Teflon

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SPM 10000 PAN Mixer & Pump

Subcon's new high capacity twin Pan Mixer is designed to mix ultra high strength grout (UHS) at a rate of 10m3/hour. The mixing skid consists of 2 x 20ft ISO DNV offshore rated frames stacked on top of each other providing a small vessel footprint.

Subcon's SPM 10000 configuration means that larger volumes of grout can be produced by mixing larger batches, which reduces the number of crane movements by simultaneously loading, mixing, and pumping grout.

The pan mixer is designed to be able to mix both standard strength concrete and also specialised UHS grout such as using BASF's MasterFlow 9500 UHS which is the industry standard for offshore wind turbine transition pieces.

Specifications

Maximum Flowrate	10m^3/Hr
Discharge Diameter	100mm
Pressure rating	70 Bar
Mixer capacity (per mixer)	1m3

Length	6.1m
Width	4.4m
Height	6m
Weight	16,000kg
Power Supply	415v – 50Hz – 60A x 4

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Licensed Contractor Statement

BASF
The Chemical Company

Name of licensee:	**SUBCON**
Faculty:	Offshore grouting contractor
Name of product:	**Masterflow® 9500**
Product validated by:	Det Norske Veritas (DNV) – report #: 12NE7QE-4 1-2TJUT8 EP
Licensed applications:	Grouting in offshore applications such as grouted connections of foundations for wind turbine installations, oil platforms and similar, e.g. monopile foundations, jackets, tripods, etc…
This is to state that:	The licensee has successfully demonstrated their capability to install the "Exa-Grout" Masterflow® 9500 in offshore installations.
Involvement:	BASF Construction Chemicals has verified and validated SUBCON and confirms that the licensee 1. has demonstrated many years of successful experience in this industry, and has a long track record with offshore grouting applications 2. uses only experienced people for these type of applications 3. has the specialized equipment for installing Masterflow® 9500 in offshore installations as mentioned above 4. has committed itself to a specific training on the correct use of Masterflow® 9500 by BASF Construction Chemicals 5. has their personnel regularly re-trained by BASF Construction Chemicals 6. installs Masterflow® 9500 according BASF's method statement and grants BASF the insight into all relevant Quality Assurance documents
Date of license validation:	March 6, 2014
Validity:	This document only applies to the licensee and product mentioned above

On behalf of
BASF Construction Chemicals

Date: March 28, 2014

Place: Augsburg

Luc Westhof
Key Account Manager Wind Power

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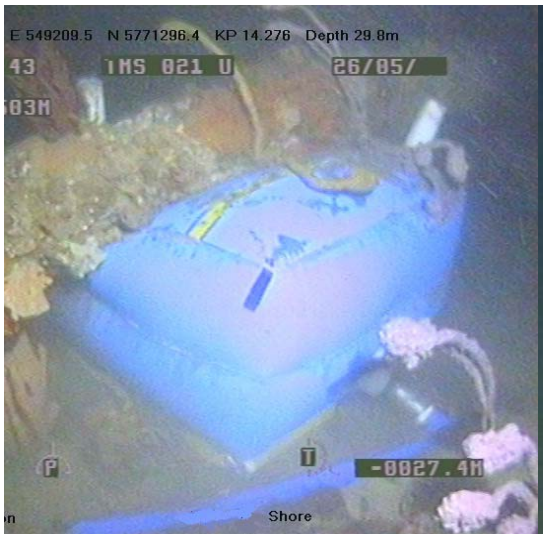
Fabric Formwork Grout Bags

Subcon offers a standard range of fabric formwork grout bags for pipeline support to assist in the rectification of free-spans for subsea pipelines. Subcon fabric formwork supports can also be custom designed to a client's required specification.

Subcon Fabric Formwork grout bags are made from high quality woven UV resistant Polypropylene which is filled in-situ to create a supporting structure. The shape of the final form is defined by the shape of the grout bag.

For free spans less than 500mm in height we offer the S Series bag, whilst our P Series which are pyramid shaped bags, are suited to span heights 500mm and greater.



S1000-500

P700-750

Subcon equipment for installation of fabric formwork grout bags via ROV

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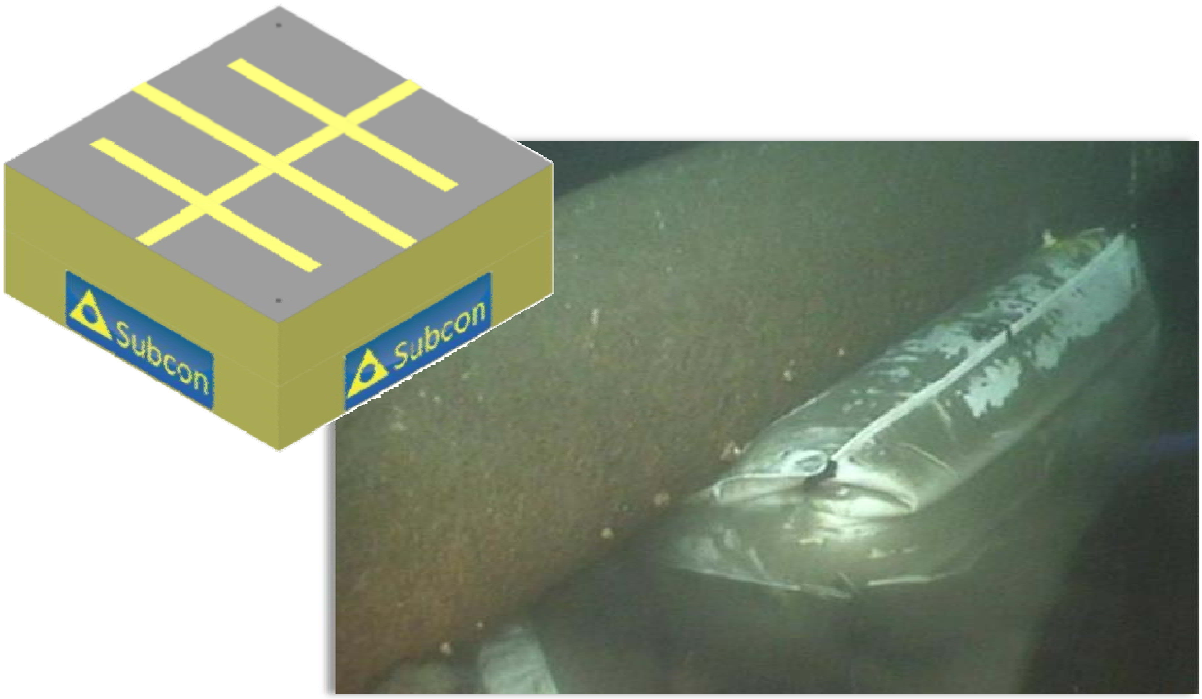
S Series

The Subcon range of S (Slab) Series grout bags are for free spans less than 500mm in height, they come in the following sizes to suit varying pipeline diameters and free span heights:



S1500-300 Grout Bag

Model	Length (mm)	Width (mm)	Suited for a span height of less than; (mm)	Volume (m^3)	Recommended PL Diameter (mm)
S1000-3	1000	1000	300	0.4	50 - 500
S1000-5	1000	1000	500	0.6	50 - 500
S1500-3	1500	1500	300	0.9	500 - 800
S1500-5	1500	1500	500	1.35	500 - 800
S2000-3	2000	2000	300	1.6	800 - 1200
S2000-5	2000	2000	500	2.4	800 - 1200

NOTE: The S Series are manufactured with a contingent height allowance to ensure adequate pipeline saddling is provided.

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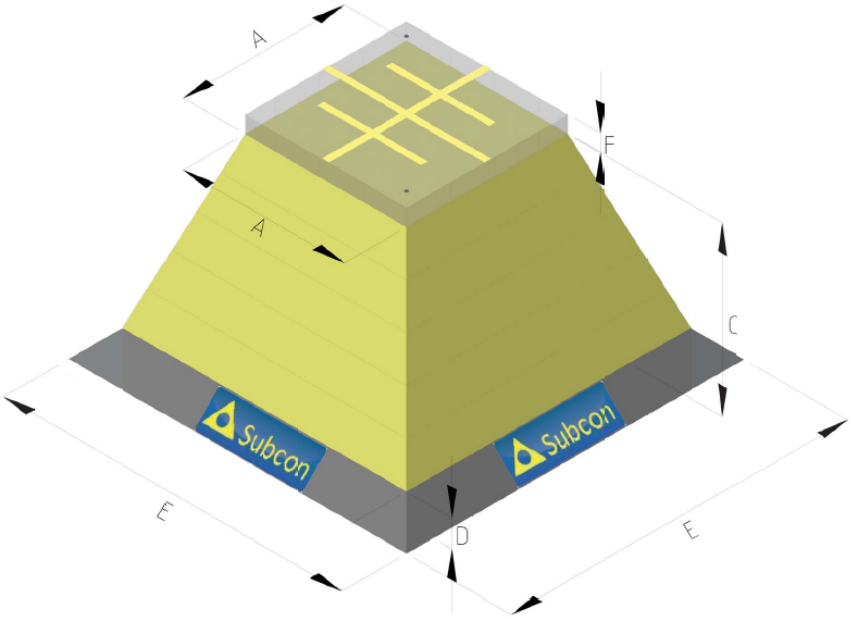
P Series

The Subcon range of P (Pyramid) Series bags are suitable for spans with heights equal to or greater than 500mm.

In the series are a range of types to suit various pipe diameters.

Within each type are models to suit varying free span height ranges.

Please refer to the below tables for details of the standard Subcon P Series range.



Model	Free Span Height		A	C	D	E	F	Volume (m^3)
	Min (mm)	Max (mm)						
P300-750	500	750	600	950	200	1546	0	1.01
P300-1250	750	1250		1575		1910	125	2.18
P300-1750	1250	1750		2205		2274	255	3.95
P300-2250	1750	2250		2835		2638	385	6.46
P300-2750	2250	2750		3450		3002	500	9.84
P500-750	500	750	900	950	200	1846	0	1.66
P500-1250	750	1250		1575		2210	125	3.37
P500-1750	1250	1750		2205		2574	255	5.80
P500-2250	1750	2250		2835		2938	385	9.07
P500-2750	2250	2750		3450		3302	500	13.32
P700-750	500	750	1200	950	200	2146	0	2.41
P700-1250	750	1250		1575		2510	125	4.76
P700-1750	1250	1750		2205		2874	255	7.94
P700-2250	1750	2250		2835		3238	385	16.36
P700-2750	2250	2750		3450		3602	500	23.01
P900-750	500	750	1500	950	200	2446	0	3.48
P900-1250	750	1250		1575		2810	125	6.61
P900-1750	1250	1750		2205		3174	255	10.69
P900-2250	1750	2250		2835		3538	385	15.83
P900-2750	2250	2750		3450		3902	500	22.16
P1200-750	500	750	1900	950	200	2846	0	5.07
P1200-1250	750	1250		1575		3210	125	9.4
P1200-1750	1250	1750		2205		3574	255	14.38
P1200-2250	1750	2250		2835		3938	385	21.47
P1200-2750	2250	2750		3450		4302	500	29.45

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DIVER AND ROV INSTALLED SUPPORTS

Subcon fabric formwork is designed to be diver and ROV friendly. Subcon grout bags have high visibility markings for locating the pipeline, corner tie down/securing loops and over pipe straps.

Subcon ROV bags are deployed complete with ROV friendly connectors to allow the ROV to change out hoses subsea for inflating multiple sealed section grout bags. Subcon ROV bags can be deployed using Subcon's rotating installation table.

GROUTING EQUIPMENT

Subcon has a full range of grouting equipment including; Grout spreads, Cement Silos and installation aids to assist in the deployment and inflation of subsea fabric formwork.

Subcon equipment (including silos) is designed to DNV 2.7-1 with an R30 code to allow offshore lifting laden or otherwise. All equipment is supplied with MPI and Load Test certificates and with certified rigging.

Through Subcon's VOC system competency of Subcon personnel in operation of our equipment is assured.

SGM1000 Mixing & Pumping Spread

Subcon ISO Offshore Rated Cement Silo

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Subsea Grouting Turntable

Used for subsea deployment of fabric formwork for freespan correction, Subcon's turntables incorporate a full bore ROV hotstab for performing multiple grout jobs in one run.

The turntable includes fork tynes for handling onshore, a removable post for transport, an ROV grab handle and rotating table for alignment of the grout bag with the pipeline. Turntable can be drilled to allow bolting of appendages in various configurations.

Particulars

Dry Weight	**900 kg**
Working Load Limit	1.5 Te
Outer Diameter	Ø 2120 mm
Height	1810 mm

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Grout Testing Lab

Subcon has custom fitted an offshore container with a PILOT 4 grout testing machine. Our grout testing lab has all the required equipment to safely test grout and concrete samples on site anywhere in Australia.

The PILOT 4 is an automatic tester used to perform compression tests on concrete specimens by applying a constant load rate on test samples.

Specifications

Product	PILOT 4 Automatic compression tester C4642
Manufacturer	CONTROLS Cernusco s/N (MI) Italy
Capacity	2000 kN
Ram Area	31415.9 mm^2
Ram Stroke	50 mm
Year of Production	2012
Power	750 W
Voltage	220 V

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Subcon Sand and Grout Bags save you time offshore…

Subcon offer standard 20kg polypropylene bags for deploying grout and sand by divers and ROV. Our unique handles ensure that bags can be easily manoeuvred subsea and rapidly placed at the worksite.

Bags can be filled with sand, aggregates or cement to provide different densities and performance subsea. The bags can also be lined with water resistant liners if required to provide longer shelf life and prolonged workability for grout bags once they are deployed subsea. Our bags are load tested and certified by NATA approved 3rd party test facilities here in Australia.

Flying Lead Stabilisation Bags

Subcon are pleased to offer their 75kg custom designed grout bag for applications such as flying lead stabilisation, anti-scour protection and freespan correction in high current applications. Our custom bags are based on our proven construction, handling and general arrangements. They are also load tested and certified in country.

These bags are water tight sealed so that they can be placed on the pipe before being activated by the diver or ROV. The bag is designed to provide 45kgs of on-bottom weight.

Offshore Rated 2Te Bulka-Bags

Subcon offers its own range of bulka-bags specifically designed for offshore applications. Our bags are rated to WLL>2Te for 1m^3 bags. This ensures a nominal 1Te payload of sand or cement will comfortably meet splash zone DAFs for deployment and have spare capacity for entrained water mass in the event that the bags are to be recovered.

Lifting safety is paramount offshore. All Subcon bulka-bags are designed with four lift points. They are also provided with engineering report and batch load test certification from a NATA.

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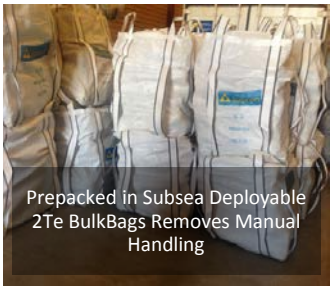
Save Vessel Installation Time with Subcon's 20kg Sand/Cement/Mortar Bag

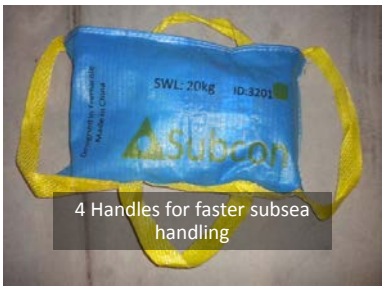
Subcon sand/cement and mortar bags are specifically designed with multiple handles for diver and ROV installation which means the ROV doesn't have to search for one handle. The bag material is heavy duty, with extended wear resistance, to prevent loss of the fill material once in place.

Our bags can be filled with sand, mortar mix or cement to suit the client's needs. Typically, we include a water proof liner for cement and mortar fill mixes.

"Project Engineers who understand that every offshore minute counts recommend Subcon 20kg bags because they require no manual handling and are faster to install".

Features





Uses

- Flying Lead Stabilisation
- Subsea Deployment
- Umbilical Turning Bollards
- Freespan Correction
- Alternative to Manual Handling

The bags can be delivered on pallets, however our 2Te rated offshore bulkabags are the ideal way of handling these bags onto the vessel and for deployment subsea.

Specifications

Principal Particular	Value
Dry Weight in Air	~20kg
Operating Weight (Submerged and Activated)	~13kg
Nominal Fill Density	1300-1400kg/m^3
Dimensions	
Length	500mm
Width	300mm
Thickness	75mm
Proof Load (2 x WLL)	40kg
Minimum Breaking Load	100kg
Denier (weave density)	180g/m^2
Thread	Bonded Nylon (anti-rot)

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Flying Lead Stabilisation Bags

Subcon are pleased to offer their 80kg custom designed grout bag for applications such as flying lead stabilisation, antiscour protection and freespan correction in high current applications.
These bags are water tight sealed so that they can be placed on the pipe before being activated by the diver or ROV. Bags are activated by puncturing them with a knife, spike or the ROV manipulator.

Special Features

- Reduces installation times by ~75%.
- Operating Weight 45kg;
- Highly resistant to "pull out" of the flying lead;
- Twin water proof bag liners are thermally sealed to ensure the cement remains dry until it has been placed on the flying lead, forming its final shape prior to activation;
- Side and end handles for easy ROV/Diver handling.

Specifications

Principal Particular	Value
Dry Weight in Air	80kg
Submerged Weight (Sealed)	20kg
Operating Weight (Submerged and Activated)	45kg
Operating Density	1900kg/m^3
Dimensions	
Length	1.0m
Width	0.4m
Thickness	0.1m
Proof Load (2 x WLL)	160kg
Minimum Breaking Load	900kg
To suit flying lead diameter	25mm – 200mm

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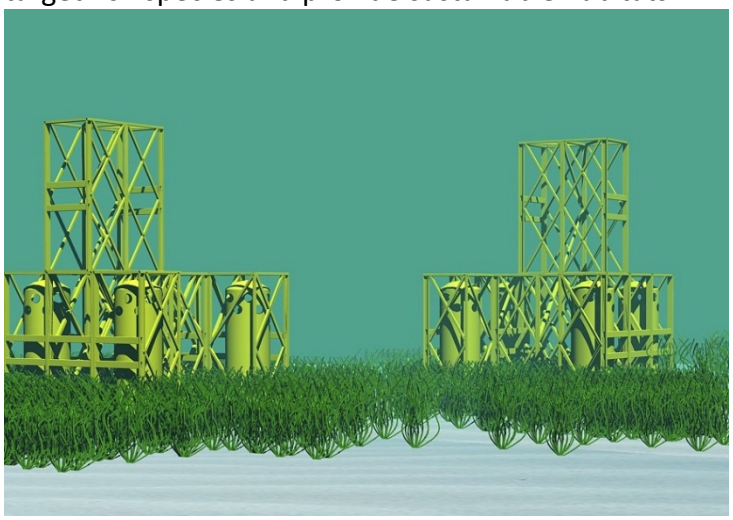
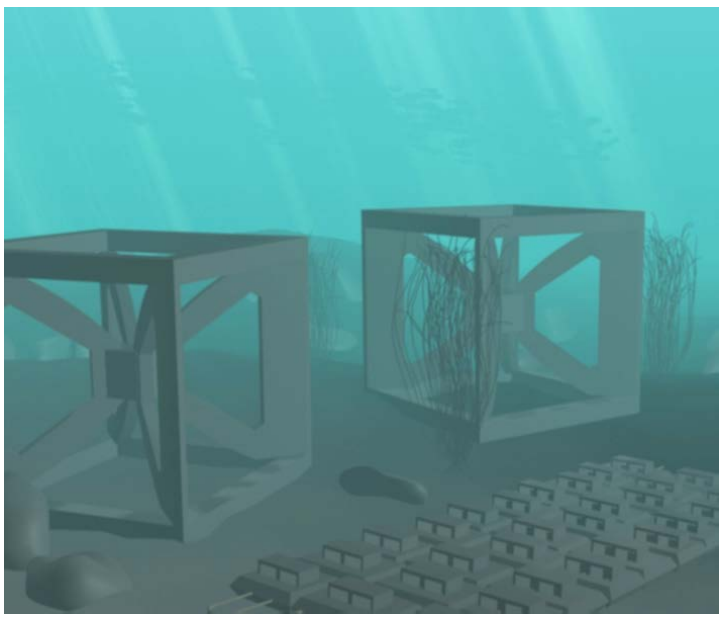
Sustainable Reef Structures

Subcon offers a range of artificial reef structures that can be used to provide:

- Fish and Shellfish Habitats
- Fish Aggregation Devices
- Abalone Habitats

Subcon provides self installing steel reef structures and interlocked articulated concrete mattress technology to offer economical solutions to installing large volume reefs. The reef structures feature vertical reliefs and customized crypts designed specifically to recruit target fish species and provide sustainable habitats.





Mattress designs can be modified to suit various target species including Abalone. They also work well in conjunction with reef blocks to provide living reef solutions as opposed to fish aggregation devices.

e

experience as designers, fabricators and installers of offshore structures makes us a uniquely Western Australian option for artificial reefs.
http://subcon.com.au/subsea-stabilisation/products/artificial-reefs/

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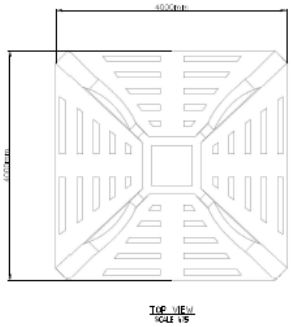
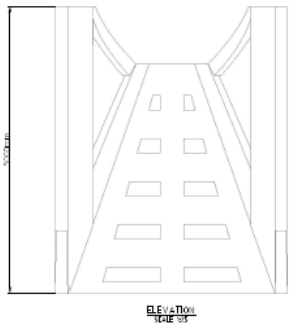
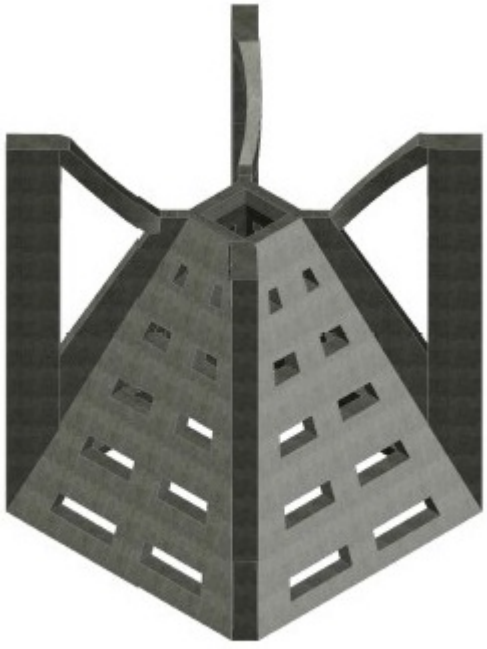
Subcon Reef Temples

Subcon offers a range of purpose built artificial reef structures that are designed to attract a range of different marine species.

The Subcon Reef Temple is made from high strength reinforced marine grade concrete technology to offer economical solutions to installing large surface area reefs that provide a maximum number cryptic spaces and upwelling of nutrients. Subcon use 50 Mpa concrete with a minimum wall thickness of 100mm to protect the structure from corrosion and rusting. The reef structures feature vertical reliefs and customized crypts designed specifically to recruit target fish species and provide sustainable habitats.







Our unique experience as designers, fabricators and installers of offshore structures makes us a uniquely Australian option for artificial reefs.
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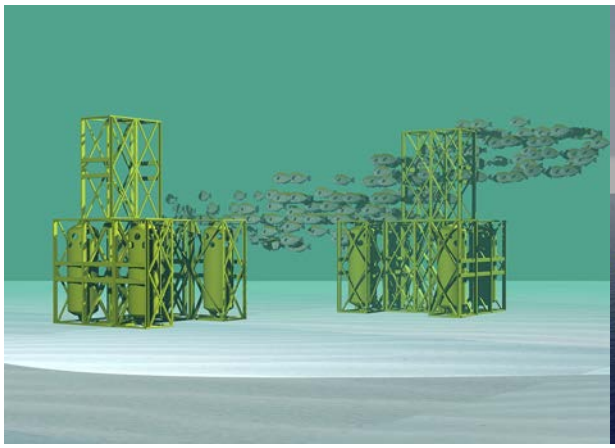
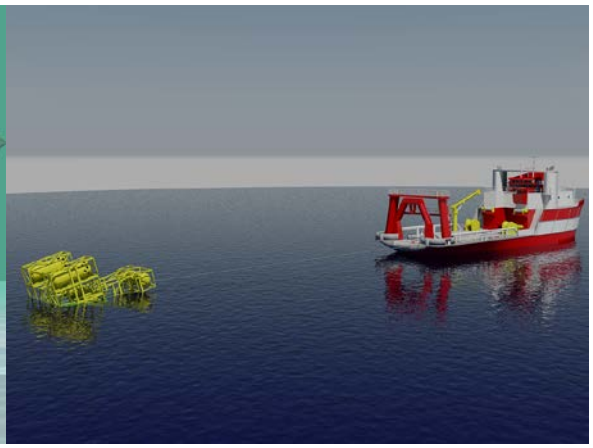
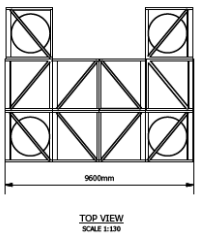
Pelagic Tower

Subcon offers a range of purpose built artificial reef structures that are designed to attract Pelagic fish species.

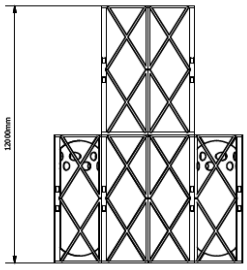
The pelagic tower is made from interlocked frame technology to offer economical solutions to installing large surface area reefs that are self-installing and able to be trucked to the fabrication site. Subcon uses steel frames with a minimum wall thickness of 10mm to protect the structure from corrosion and rusting. The reef structures feature vertical reliefs and customized crypts designed specifically to recruit target fish species and provide sustainable habitats.



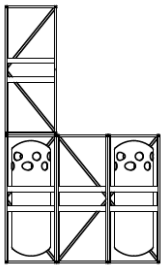


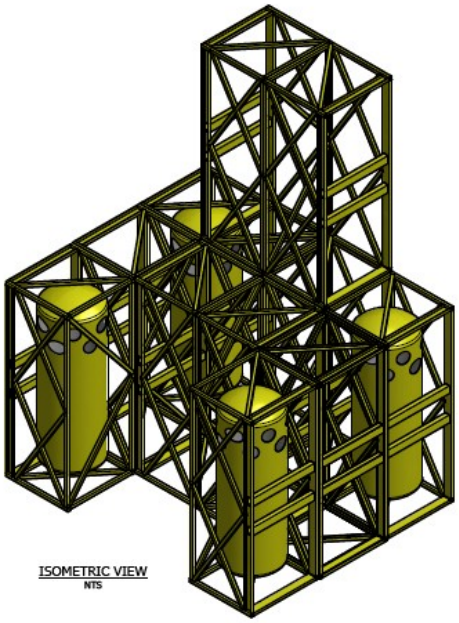


TOP VIEW
SCALE 1:130



ELEVATION VIEW
SCALE 1:130


SIDE VIEW
SCALE 1:130



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Scour Remediation Using Composite Systems of Rock Fill & Mattresses

Nearshore pipelines that cross harbours, rivers and estuaries are exposed to a range of hazards including tidal current induced scour, freespans and impact from vessels and anchors. State authorities typically specify a depth of cover of 1,200 mm to top of pipe, which can be costly and problematic to maintain in high current areas.

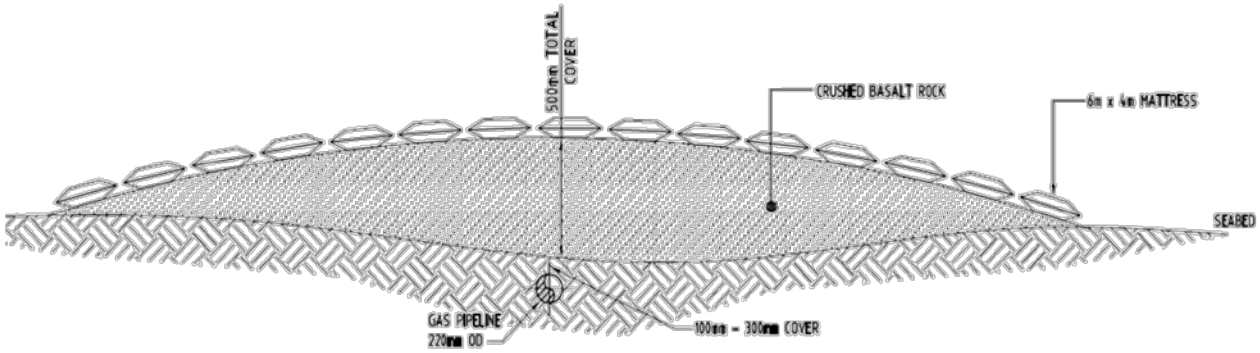
"I found the depth of knowledge that the team provides and the ability to adapt to changing conditions was impressive. I would use Subcon again as my first preference."

- *Boyne Smelters Limited*

Subcon recently worked with its client, their design house and their regulator to implement a cost-effective, hybrid solution that provides an equivalent depth of cover to the pipeline.

Firstly, 10 mm rock fill was used to rectify the scoured section of the pipeline in freespan and increase depth of cover to 600mm along the pipeline. Subsequently, 150 mm thick articulated concrete mattresses were used to provide a stabilising layer of armour over the rock to protect the pipeline from the high current and impact from boating traffic.

Recent 100-year floods provided a good test of the system which, with subsequent inspections, showed was intact and promoting sediment deposition along the pipeline.



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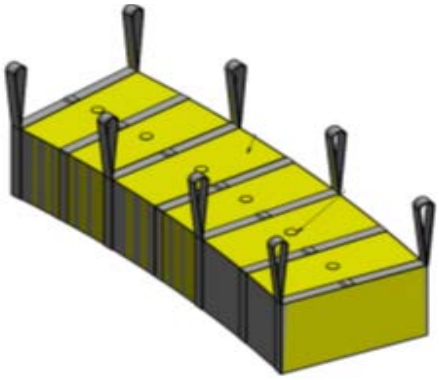
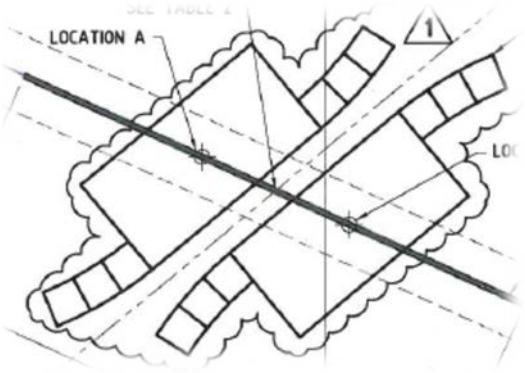
Gorgon Umbilical Crossing Bollards

Subcon supplied eight custom designed grout bag deflectors and a certified lifting frame suitable for subsea installation of the bags by ROV. The bags were manufactured with a built-in radius of 10.5m to match the minimum bend radius (MBR) of the umbilical. The frame was designed to match the MBR and facilitate rapid release by the ROV.

Custom designed grout bags for pipeline and umbilical crossings.

"It becomes a real benefit to us when suppliers like Subcon can take some of our issues off our hands for us and provide a solution, not just a product"; **Subsea7.**





Subcon manufactured a total of ten bags to allow for proof loading and break load testing of two units by a NATA approved test facility. The bags were then delivered, pre-filled with cement, to reduce handling and offshore deployment time. Traceability was maintained by assigning the bags with batch numbers that corresponded to the test samples. The bags were manufactured from UV stabilized, high tenacity, PVC laminated, polyester scrim. One way, flush mounted boat valves were used to seal the bags for transport in order to prevent the egress of cement dust and ingress of moisture until the bags were deployed. The valves were opened prior to deployment to allow flooding and subsequent setting of the cement.

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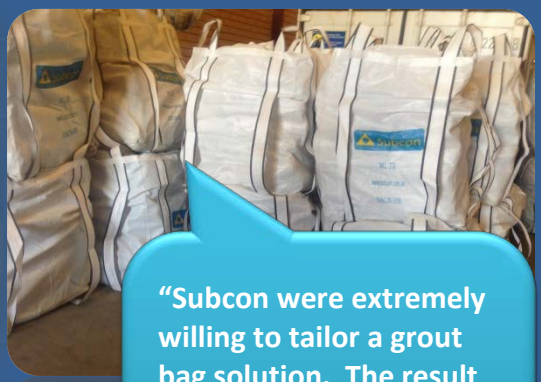
Flying Lead Stabilisation

Subcon has designed and provided over 3000 flying lead grout bags for clients including BHP Billiton's Macedon project, Origin Energy's Otway Phase Three, Chevron's Gorgon Project and Total for umbilical stabilisation in West Africa. These bags were custom designed by Subcon to meet the requirements for subsea placement and activation by ROV.

Features

- **Reduces installation time by up to 75%.**
- **Encases the flying leads providing superior stability long term compared with 20kg bags.**
- **Multiple handles for approach from any angle by ROV = faster handling.**
- **Watertight liner activated on demand subsea means multiple bags can be lifted by ROV.**
- **Delivered in Subcon's custom built 2Te "subsea" bulkabags that can be deployed directly subsea – removing the need for manual handling on deck.**



"Subcon were extremely willing to tailor a grout bag solution. The result was ideal for our purposes", Project Engineer at McDermott, Perth, Australia.

The ROV bags are designed to provide 45kg-50kg submerged weight.

The thermally sealed liner ensures the cement stays dry until the bag is placed on the flying lead.

The density of the activated grout bags in water is 1900kg/m3. ROV friendly handles were also provided in order to make installation easier

The bags are deployed onto the flying leads by ROV in pairs. The sealed liners reduce the submerged weight to facilitate ease of handling onto the flying lead.

Once in position on the flying lead, the bags were activated using the ROV manipulator or a stabbing tool.

Also we have maximised the weight per bag. When compared with installing 20kg bags the installation time is reduced by 75%.

For a product data sheet please contact Matthew Allen at info@subcon.com

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Cyclone Mooring Pile Grouting

Subcon was contracted by TAMS to perform the grouting operations for the installation of thirty-two cyclone mooring pies at Mangrove Passage, Onslow. These works were completed in three phases to accommodate the pile installation schedule and cyclone season.

Features

- The SGM1000 is safer and quieter to operate and faster to mobilise
- Dust extractors prevented exposure of cement dust to people, equipment and the environment
- Specially designed grout mix was provided to supply a high strength product

The project utilised Subcon's compact SGM1000 Jet Mixers. These unique skids include an integrated recirculating jet mixer, agitator tank and a monopump. Our "single skid" philosophy minimises handling, freight, seafastening, hoses on deck and electrical wiring.

The SGM1000 is safer and quieter to operate and faster to mobilise. Dust extractor on the hood of the mixer ensured that the personnel, vessel and environment were not exposed to cement dust.

A purpose grout mix designed was developed and tested in conjunction with a leading additives supplier to provide a high early strength, low shrinkage grout with high sulphate resistivity and a 28 day strength

Subcon's preparation, safety culture, our employees' onsite work ethic and reliable equipment meant that each phase of the project was completed ahead of schedule.

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Berthing Pocket Anti-Scour Heavy Armour

Berthing pockets alongside wharves and RoRo ramps often suffer from scour caused by thruster jet wash velocities in the order of 5m/s+. In these cases rock protection and lighter weight grouted solutions are either ineffective in mitigating the effects of thruster induced scour or else they are prohibitively large.

Available in Heavy Density 3000kg/m^3.

Fully interlocked array for superior stability performance.

Stainless steel wire for extended design life.

Subcon recently worked closely with its client, their design house and the installation contractor to implement a cost-effective, heavy scour solution that provides stability equal to an equivalent depth of cover to a ~D1m rock around the berthing pocket.

Firstly, 75mm rock fill was used to rectify the scoured section of the pocket and to provide a competent filter layer over the existing core. Subsequently, 500 mm thick articulated concrete mattresses were used to provide a continuous heavy armour array over the rock to protect the berth and mooring dolphins from the high thruster jet wash velocities and grounding.

The toe of the leading edge of the mattress array can either be trenched or secured with duck bill anchors to prevent against uplift.

Subcon have ongoing research projects at the Australian Maritime College to support the design calculations associated with this solution.