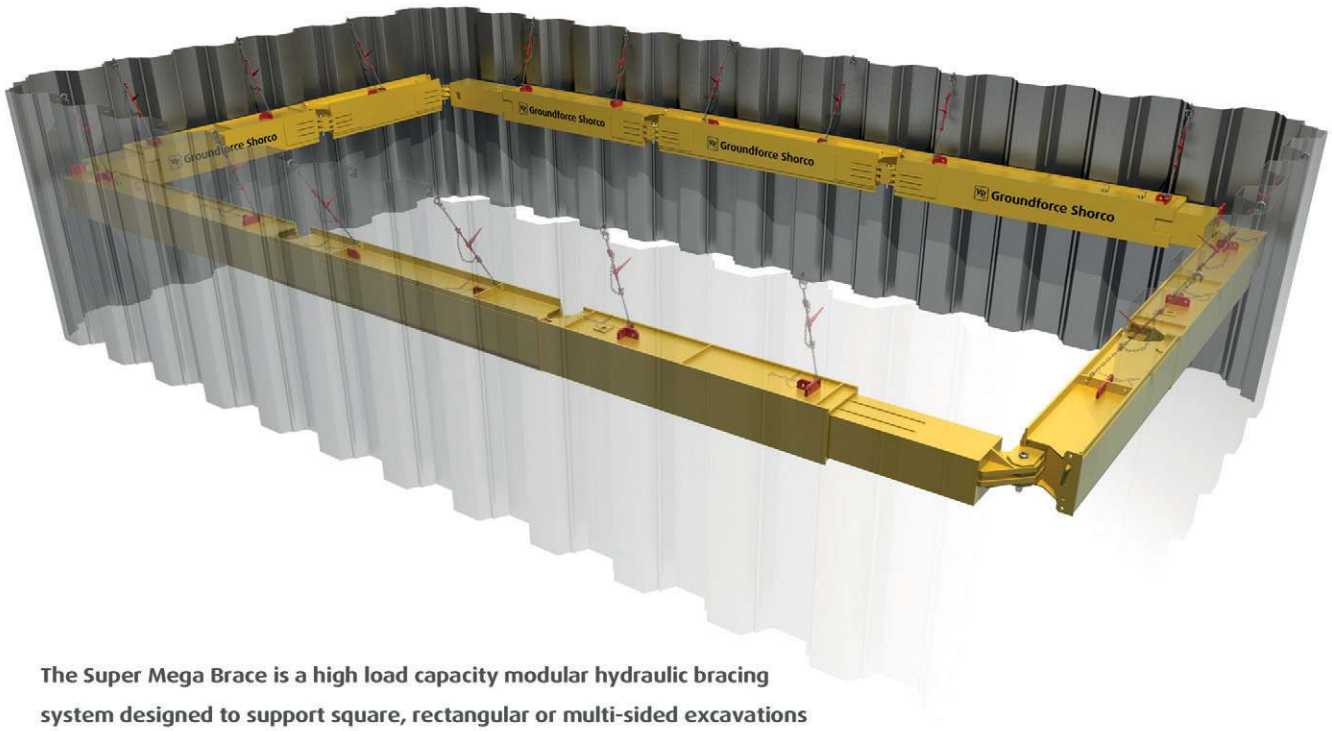
Super Mega Brace



The Super Mega Brace is a high load capacity modular hydraulic bracing system designed to support square, rectangular or multi-sided excavations ranging from 4,7m to 24.2m in plan. Each leg comprises a length adjustable hydraulic unit, a series of modular fixed length extension pieces and a telescopic pinned rough adjuster unit. Connections between modular sections are made on site via a spliced connection with a single pin. The fixed length extensions can be connected together and when combined with cross struts, form a continuous heavy-duty waling beam.

Typical Applications

- Large Tanks requiring clear spans, heavily loaded cofferdams, and excavations for deep basements and similar structures.

Features / Benefits

- Modular format with simple single pinned joint connection facilitates easy installation of large frame configurations
- High load capacity makes it suitable for use in long span and / or deep excavations in poor ground.
- In built corner joint articulation enables the legs to be used for non-rectangular and multi sided excavations.
- Compatible with Groundforce`s range of heavy duty strutting systems to enable high waling loads to be accommodated.
- The hydraulic unit incorporates a double acting ram with integral mechanical lock off valve for security, ease of installation and removal and zero fluid loss.
- Leg configurations can include a rough adjustment unit for greater on site adjustment and versatility



Product Link

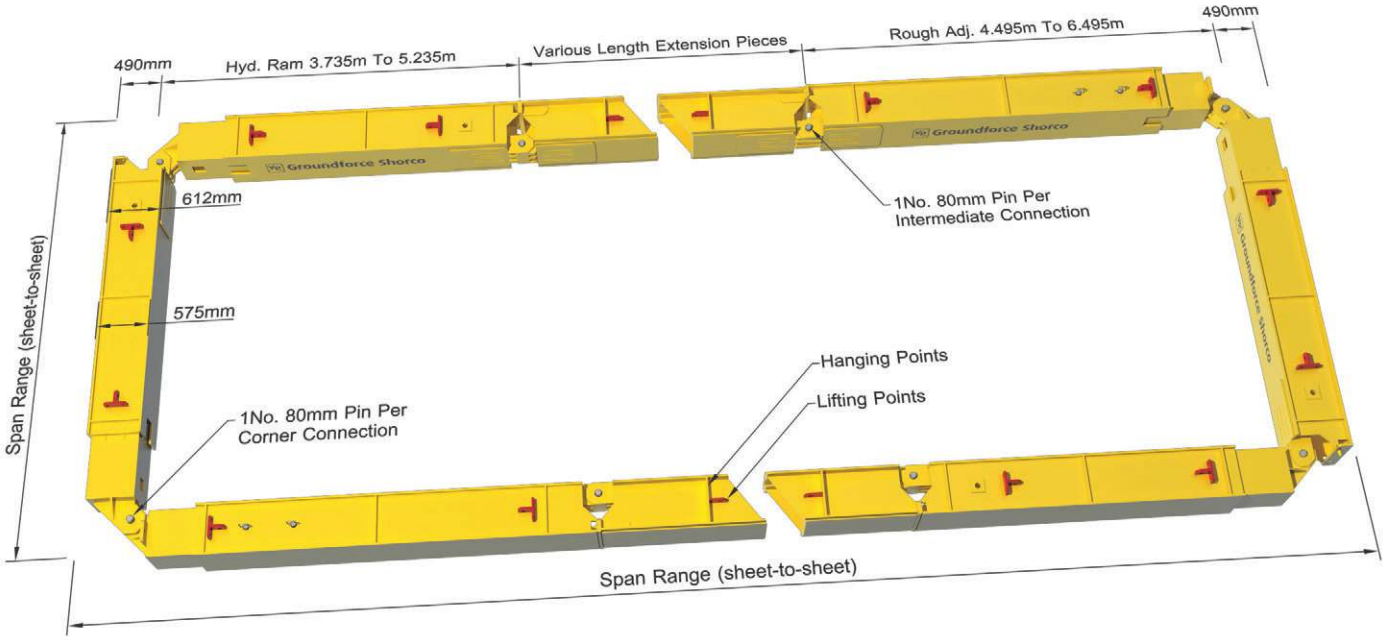
Brace Ancillaries - Section 3.3
Strut Ancillaries - Section 5.4

Compatibility

The Super Mega Brace is compatible with the Groundforce Mega Brace system via end adaptor units.

Super Mega Brace

General Arrangement of a Typical Super Mega Brace Frame



The beam section width is 575mm and the overall section width, inclusive of the joint connection cleats, is 612mm. Therefore:

- Clear opening between beams = sheet-to-sheet dimension less 1150mm.
- Clear opening between connections = sheet-to-sheet dimension less 1224mm.

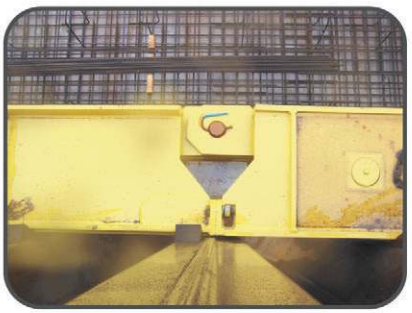
Note: An additional allowance for inward deflection under load should also be taken into account when sizing up overall excavation dimensions, particularly when clear openings are a critical consideration, such as for excavations to install single tanks - see graph on page 3.2.6).

Corner / Intermediate Joint details.

All Super Mega Brace components are pinned together with 80mm Ø (ref 31) pins. The Intermediate joint uses a single pin passing through high strength 6 leaf joint (5 shear planes). Note that the capacity of the joint in bending is 75% of the beam capacity. The corner joint uses a 5 or 4 leaf joint depending on the configuration and the same 80mm Ø pin.



Corner Joint



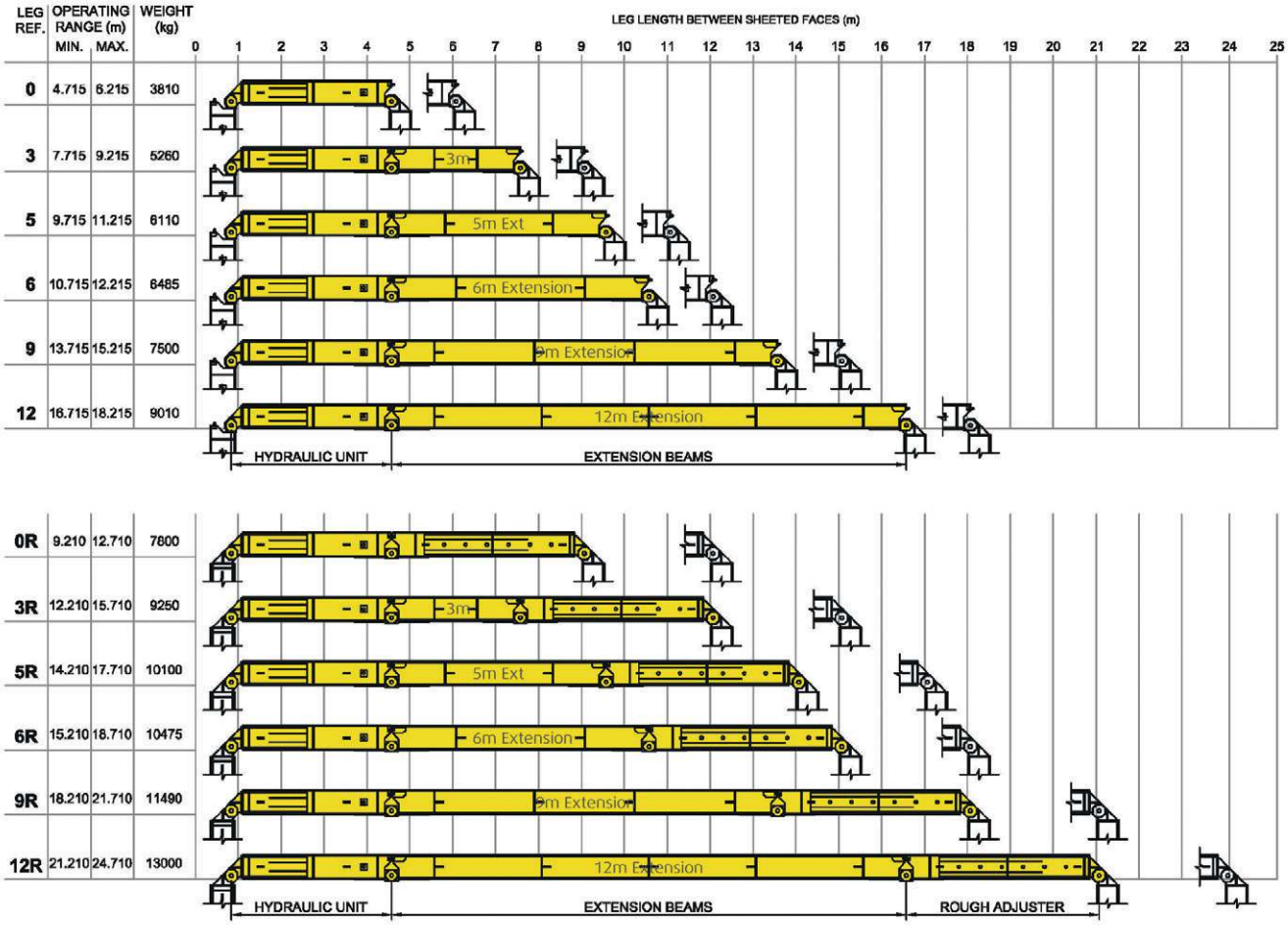
Intermediate Joint

Rough Adjuster Details.

Rough adjustment is facilitated by telescopic inner and outer sleeves with four sets of pin hole drillings at 500mm centres. 2No. 60mm Ø (ref 32) high strength pins acting through multiple shear planes provide resistance to axial load when the desired length has been selected.



Data table for assembled standard leg configurations



Super Mega Brace legs comprise a double acting hydraulic ram unit (with a stroke of 1500mm) , a series of fixed length extension sections and where necessary a 4-stage rough adjustment unit with an available adjustment of 2000mm in 500mm increments, which are all connected together to obtain the desired brace length. The above chart provides information relating to the individual standard configurations of brace legs. The list is not exhaustive as certain legs can be made up with alternative combinations of extension units.

Schedule of Component Weights:	
Description	**Weight per item (kg)**
Hydraulic Ram	3810
Rough Adjuster	3990
3.0m Extension	1450
5.0m Extension	2300
6.0m Extension	2675
9.0m Extension	3960
12.0m Extension	5200

Note:

Careful consideration must be given to the significant weight of the Super Mega Brace components and leg assemblies when planning and preparing site lifting plans.

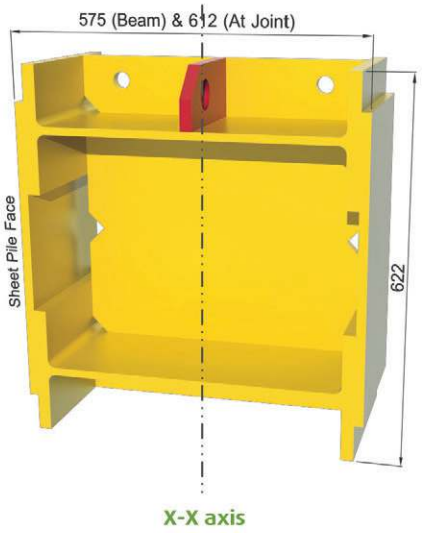


Due to its size and weight, careful consideration must be given to the support of the assembled legs along their length, This can be accommodated by either hanging the units from heavy duty sheeting or piling using certified chain assemblies incorporating length adjustable load bindings (see photo opposite). Alternatively support can be provided by a series of purpose designed gallows brackets welded or bolted to the supporting wall along its length.

Super Mega Brace

Technical Specification. Refer to section 'i' for definition of terms and basis of loading.

A) Fabricated Steel Section:



X-X axis

Comprising of a twin 533x210x122 UC c/w 500mm high,15mm thick doubler plates on the front and back faces to form a torsionally rigid box section . The key properties of the fabricated section acting about the x-x axis are as follows;

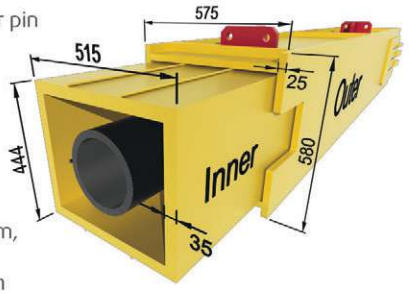
- **Area (gross):** 460cm^2 **Steel Grade:** S460
- **Shear Area:** 145,7cm^2 **Yield Strength:** 440-460N/mm^2
- **Moment of inertia:** 269418cm^4 **Tensile Strength:** 540N/mm^2
- **Section Modulus:** 9379cm^3

The working capacities (including a global safety factor of 1.5) of the fixed length Extension pieces are given below;

- **Axial Compression:** 13496kN **Shear force:** 2468kN **Bearing force*:** 2263kN
- **Bending moment** (hogging and sagging): 2876kNm

***The allowable bearing force** stated (force applied to the front face of beam through a cross strut) is based on the application of a single load acting at its worst case position. Bearing capacity can be significantly increased by positioning the strut directly opposite a stiffener location. Note that if the cross struts are Groundforce MP500 units the stated bearing capacity can be doubled as the load is distributed through much wider bearing plates than has been used to determine the above value.

B) Hydraulic Ram / Rough Adjuster



The hydraulic ram & rough adjuster units comprise telescopic sliding inner & outer fabricated square hollow sections as illustrated opposite offering 1.5m of fine adjustment and 2m of course adjustment respectively. Local axial resistance is provided by either the integral hydraulic ram or the double shear pin in the rough adjuster Shear force and bending moment resistance is provided by the steel sections themselves and their interaction with one another. Structural data for these components is tabulated below.

- **Axial Compression in hydraulic ram:** 1500kN (with a safety factor of 2)
- **Axial Compression in rough adjuster**:** 1500kN **Bending moment in outersleeve:** 2584.1kNm,
- **Shear force in outersleeve:** 3895.2kN **Bending moment at overlap ***:** 1419.3kNm

** relates to the combined shear resistance of the 2No. 60mmØ pins

*** the value stated is based on the maximum leg extension (i.e. minimum overlap)

C) Intermediate Joint



The joint consists of a single 80mmØ pin (EN24T), housed in a 6 leaf joint cassette fabricated from ultra high tensile grade S690 steel. When subject to typical bending conditions into the excavation, the pin within joint at the front of the beam provides tensile resistance through the multiple shear planes whilst the rear bearing area of the joint transfers the associated compressive force in the couple. However the joint is uni-directional and offers little resistance to hogging moment. *Therefore when undertaking a continuous beam type structural analysis, struts must be positioned so that the beam joints do not fall within the hogging zone. Please refer to the technical department for further advice.*

- **Inward (sagging) moment:** 2094.7kNm **Outward (hogging) moment:** 0kNm
- **Shear resistance of pin:** 4739.9kN#

based on 5 shear planes or 6 leaves acting . Refer to page 3.2.5 for guidance on the design of the Super Mega Intermediate Joint.

Verification of the Intermediate Joint capacity under combined load effects

The joint must be verified against of the combined effects of compression, bending moment and shear force in accordance with the following equation:

$$\sqrt{\left[\frac{M}{L} - \frac{N}{2}\right]^2 + V^2} \leq \text{Shear capacity of the Pin}^{\#}$$

Where M = Applied (unfactored) bending moment (kNm),

N = Applied (unfactored) Axial Force (kN)

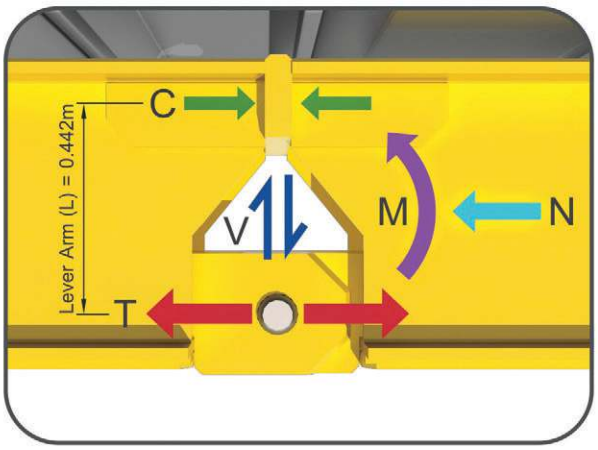
V = Applied (unfactored) Shear Force (kN)

L = lever arm = 0.442m (see diagram opposite)

C = centroid of compression zone

T = tension force (applied to pin)

#Shear resistance of pin: = 4739.9kN (see previous page)



Forces on Joint

Design Notes and Assumptions:

The design verification process of clear spanning Super Mega Brace legs is relatively straightforward providing that consideration is taken of the different moment capacities of the beam and joint. The standard load /span chart on 3.2.6 takes this into account.

Where cross strutting is introduced, the positioning of the struts relative to the joint must be carefully chosen preferably to ensure that zero reverse bending is applied across the joint. If this is unavoidable due to practical constraints, the joint may be positioned in a zone of reverse bending providing it is considered as a pinned zero moment) connection.

The specified bending moment capacities have been calculated using the following assumptions:



- The beam section is a hollow section with high torsional resistance and is therefore not susceptible to lateral torsional buckling.
- Vertical stress due to self weight and accidental loading are ignored as it is assumed that the super mega brace is supported with restraint chains or brackets at regular intervals along its length.
- Coincidental axial loading has a negligible effect on the bending capacity of clear spanning super mega frames. This is however particularly prevalent in kneed braced configurations where welded shear stops or clamps (see photo above) are used to restrain the struts against longitudinal movement. It is recommended that a first principal assessment be made where coincident axial load exceeds 1500kN. Please contact the technical department
- The reverse bending or hogging moment value quoted above has been limited to take into account potential instability in the compression flange due to lack of restraint and location of web stiffeners.
- Flange bearing loads are limited by web bearing, buckling and whether the strut is positioned opposite a web stiffener. The above figure (2263kN) is a conservative value and can be used irrespective of the web stiffeners positions. First principal checks are recommended where strut loads exceed this value.

Super Mega Brace Performance Chart

Super Mega Brace legs act primarily as flexural members designed to resist inward bending due to lateral earth pressures. As the assembled frames support load on 4-sides, coincident axial load generated by perpendicular connecting legs is also taken into account; although this has only a relatively minor effect as axial capacity of individual legs is limited by the hydraulic ram. Refer to the introduction section for more explanation and a summary of load effects included within the design curve presented below.

The chart below indicates the **factored or working load** and deflection performance of clear span i.e. non-strutted Super Mega Brace waling beams across its full span range. The area below the red line represents the envelope in which any given Super Mega Brace leg will perform safely. Ultimate values of resistance have been calculated in accordance with EN 1993 and these have been reduced by a lumped load factor of 1.5 to produce working load values. At shorter spans, the load capacity is restricted by the axial capacity of the integral hydraulic ram unit.

The Red Line indicates the working load limit of Super Mega Brace legs having made allowances for the capacity of the weaker components such as the intermediate joint and the overlapping tubular box sections. The Blue Line indicates the approximate worst case (inward) deflection of a Super Mega beam calculated at mid-span under working load limit conditions. The accounts for any "lack of fit" associated with the modular equipment.

Note: This graph does not apply to cross strutted configurations. The working load capacity of these leg configurations must be determined on a scheme specific basis using data and guidance notes provided earlier within this section. For further information contact the Technical Services Department.

