

HYBUILT TECHNICAL DESIGN

Concrete Sleeper Retaining Walls

JANUARY 2023

HYBUILT
RETAINING SYSTEMS

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HYBUILT TECHNICAL DESIGN

CONCRETE SLEEPER RETAINING WALLS



General Notes

1. ALL WORK TO COMPLY WITH THE BUILDING CODE OF AUSTRALIA, THE BUILDING ACT, LOCAL AUTHORITY BY-LAWS AND AS 3600 CONCRETE STRUCTURES.
2. STEEL POSTS TO BE HOT-DIP GALVANISED.
3. FOUNDATIONS TO BE ENGINEER INSPECTED PRIOR TO INSTALLATION OF POSTS TO CONFIRM STABILITY OF FOUNDING MATERIAL.
4. BUILDER TO ENSURE CONSTRUCTION DOES NOT ADVERSELY EFFECT EXISTING STRUCTURES OR SERVICES. SURCHARGE LOADS NOT TO BE IMPOSED ON THE RETAINING WALL BY ANY PERMANENT STRUCTURE NOR SHALL THE RETAINING WALL CAUSE A SURCHARGE LOAD ON ANY OTHER STRUCTURE.
5. IF CONCRETE SLEEPERS ARE CUT, PAINT EXPOSED ENDS WITH AT LEAST 2 COATS OF BITUMASTIC PAINT IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS.
6. GLOBAL STABILITY CHECK OF EARTHWORKS AND RETAINING WALL BY GEOTECHNICAL ENGINEER OR SUBDIVISION ENGINEER.
7. A TYPICAL DOMESTIC FENCE MAY BE CONSTRUCTED ABOVE THIS RETAINING WALL, FENCE HEIGHT NOT TO EXCEED 1.8m.
8. BACKFILL BEHIND RETAINING WALLS WITH FREE DRAINING GRANULAR MATERIAL AND INSTALL 6mm F.C. PACKING AT 600 CENTRES BETWEEN PANELS, 400mm FROM BASE OF WALL TO FORM A CONTINUOUS WEEP HOLE DRAINAGE SLOT.
9. PROVIDE GEOTEXTILE BETWEEN GRANULAR MATERIAL AND EMBANKMENT/TOP COVER MATERIAL AND LAP GEOTEXTILE MATERIAL 200mm MINIMUM. GEOTEXTILE TO BE OF STRENGTH CLASS B AND FILTRATION CLASS 2 FOR GRANULAR SOILS OR CLASS 3 FOR COHESIVE SOILS IN ACCORDANCE WITH DEPARMENT OF TRANSPORT AND MAIN ROADS SPECIFICATION MRTS27.
10. ENSURE A MINIMUM 200mm THICKNESS OF GRANULAR MATERIAL FOR ALL SITES.
11. WHERE RETAINING WALLS ARE GREATER THAN 2m HIGH, INCREASE THE WIDTH OF FREE DRAINING GRANULAR MATERIAL TO AVERAGE AN ADDITIONAL ONE EIGHTH (1/8) OF THE WALL HEIGHT WHERE THE RETAINED MATERIAL IS OF REACTIVITY CLASS 'H1' OR GREATER.
12. FOR SITES WITH WALLS IN EXPANSIVE SOIL, CONSTRUCT THE FACE OF THE WALL TO LEAN INTO THE RETAINED MATERIAL WITH A FACE SLOPE OF 1 HORIZONTAL TO 25 VERTICAL.

Concrete Notes

1. ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH CURRENT RELEVANT CODES, IN PARTICULAR AS 3600 CONCRETE STRUCTURES.
2. UNLESS SHOWN OTHERWISE, CONCRETE USED IN THE WORKS SHALL HAVE THE FOLLOWING PROPERTIES:

ELEMENT	f'c AT 28 DAYS (MPa)	MAX. AGGREGATE SIZE (mm)	MAX. SLUMP (mm)	CONCRETE GRADE
FOOTINGS	AS NOTED	20	80	N40
BLINDING	15	20	100	N40

Design Basis

DESIGN LIFE	60 YEARS
MAX. UPHILL SLOPE	1 in 4 (14°)
FILL SOIL FRICTION ANGLE	30° (REFER TO GEOTECH)
FILL DENSITY	18 kN/m ³
GROUND BEARING CAPACITY	100 kPa
SURCHARGE	5 kPa
HYDROSTATIC PRESSURE HEIGHT	1/2 RETAINING WALL HEIGHT

ALL PARAMETERS TO BE CONFIRMED BY A SUITABLY QUALIFIED GEOTECHNICAL ENGINEER



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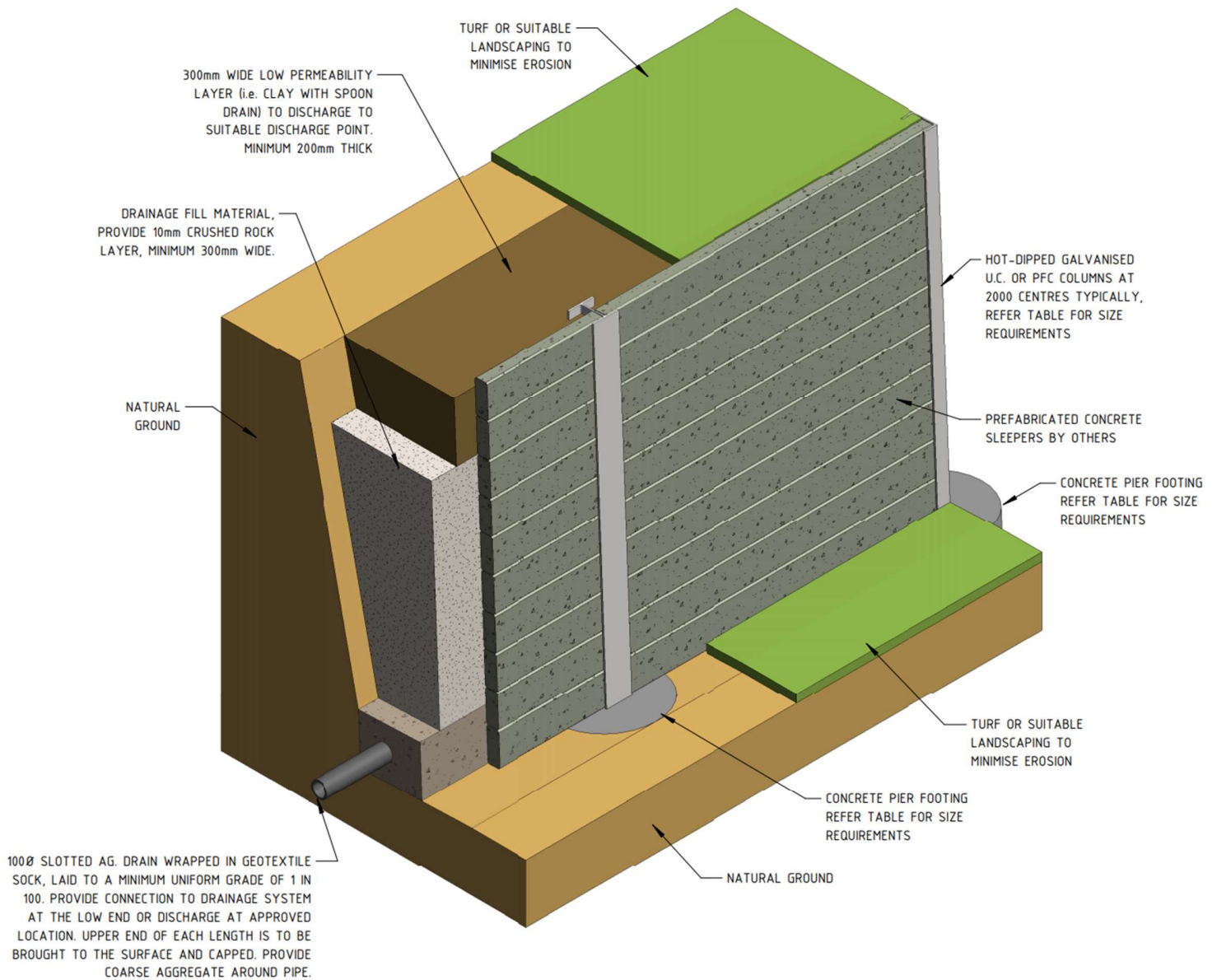
CONCRETE SLEEPER RETAINING WALLS



CONCRETE SLEEPER INSTALLATION CROSS SECTION DIAGRAM

MAXIMUM ACCEPTABLE DEFLECTION OF RETAINING WALL SLEEPERS IS 8mm UNDER NORMAL LOADING CONDITIONS

THIS DRAWING IS A SAMPLE ONLY AND IS NOT FOR CONSTRUCTION PURPOSES. A SITE SPECIFIC DESIGN AND GEOTECHNICAL TESTING IS REQUIRED FOR ALL SITES. THIS RETAINING WALL SYSTEM IS REQUIRED TO BE DESIGNED BY A SUITABLY EXPERIENCED AND REGISTERED ENGINEER (RPEQ).



NO CONSTRUCTION LOADS ALLOWED WITHIN 1.5 x HEIGHT OF WALL OR 2m, WHICHEVER IS GREATER. HAND COMPACTION EQUIPMENT TO BE USED ONLY

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CONCRETE SLEEPER RETAINING WALLS



On the following pages are some pointers that will help you gain confidence and knowledge around the required steps in building your retaining wall.

PLEASE NOTE: This is a guide only. It is always recommended to speak to an engineer regarding your individual site specific conditions as this may change the required design and installation process.

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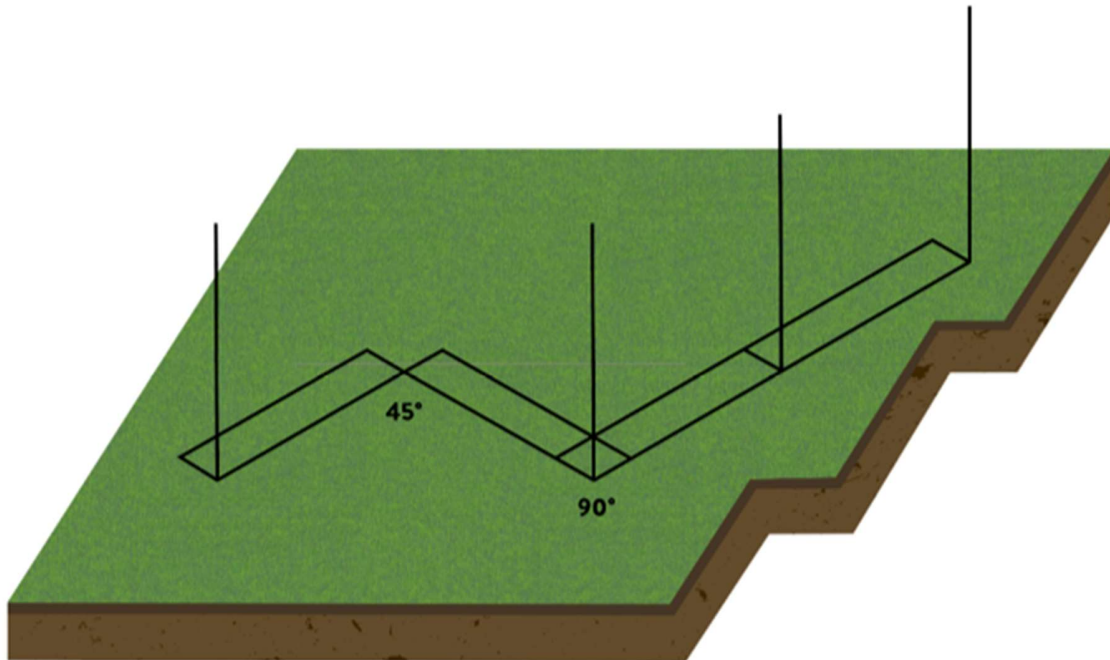
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SITE PREPARATION

Clear the area where the retaining wall is going to be the installed.

Level the ground around the retaining wall with at least 300mm clear/cut behind the proposed retaining wall to allow adequate space for all required drainage materials - agi pipe, geo fabric and drainage aggregate (these will be installed later).



If you are installing a retaining wall close to any solid structure (eg house, water tank, anything concreted into the ground), the retaining wall will usually need to be located at least 1.5 times the distance away from the wall height. It is in these circumstances or if you are unsure to contact an engineer for clarification.



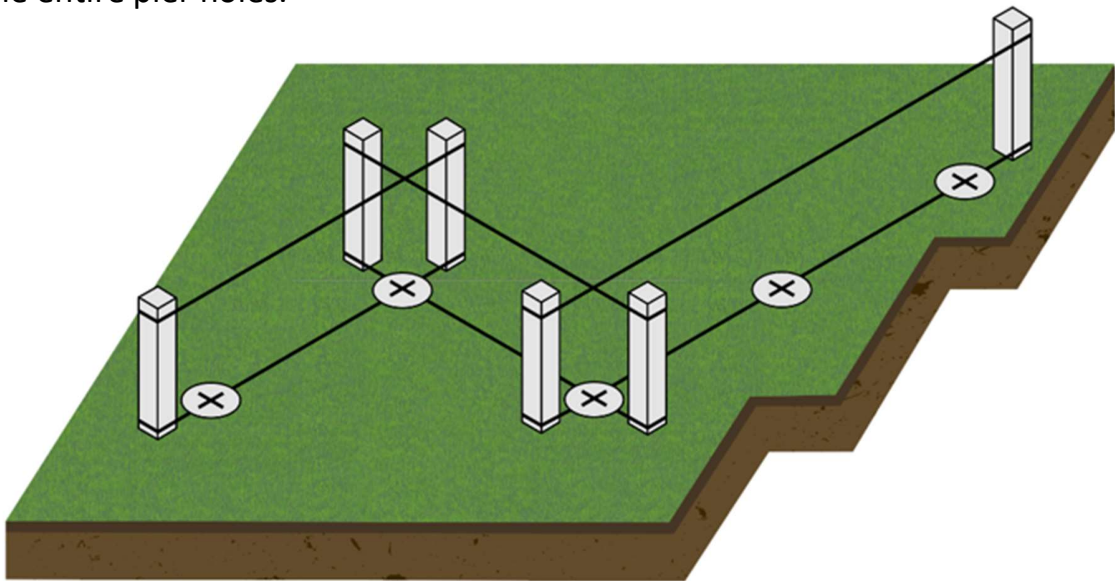
ALIGNMENT AND STEEL POST POSITIONING

Place a star picket at both ends of each retaining wall section to ensure you maintain a straight line when you attach a string line between both star pickets at the top and the bottom. You will need to do this multiple times if your wall is not a straight wall like in diagram 2.

Once you have determined the length of sleepers you are using for the retaining wall (including any cut size sleepers to suit your wall lengths), you will mark the centre posts in the ground at the lengths recommended below:

Sleeper Length (mm)	Distance from Centre Post to Centre Post -No Fence (mm)	Distance from Centre Post to Centre Post - With Fence (mm)
1480mm	1500mm	1510mm
1980mm	2000mm	2010mm
2380mm	2400mm	2410mm
Custom Length	20mm longer than sleeper length	30mm longer than sleeper length

Ensure than all parts of the retaining wall are within your property boundary, including the entire pier holes.





AUGER HOLES & POUR CONCRETE / INSTALLING STEEL POSTS

Now is the time to dig the pier holes for the steel posts.

The standard recommended pier hole width is 450mm and the depth of the hole is the same as the height of the wall e.g. 1m high wall = 1m deep hole = 2m length steel post, however please refer to any engineering requirements that are provided as the hole width and post hole depth might need to be different due to a range of factors.

Retaining walls require a lean back for structural integrity, which is usually recommended to be at least 50mm per 1m of height.

To ensure the steel posts remain in the angle required whilst the concrete sets, we recommend the following:

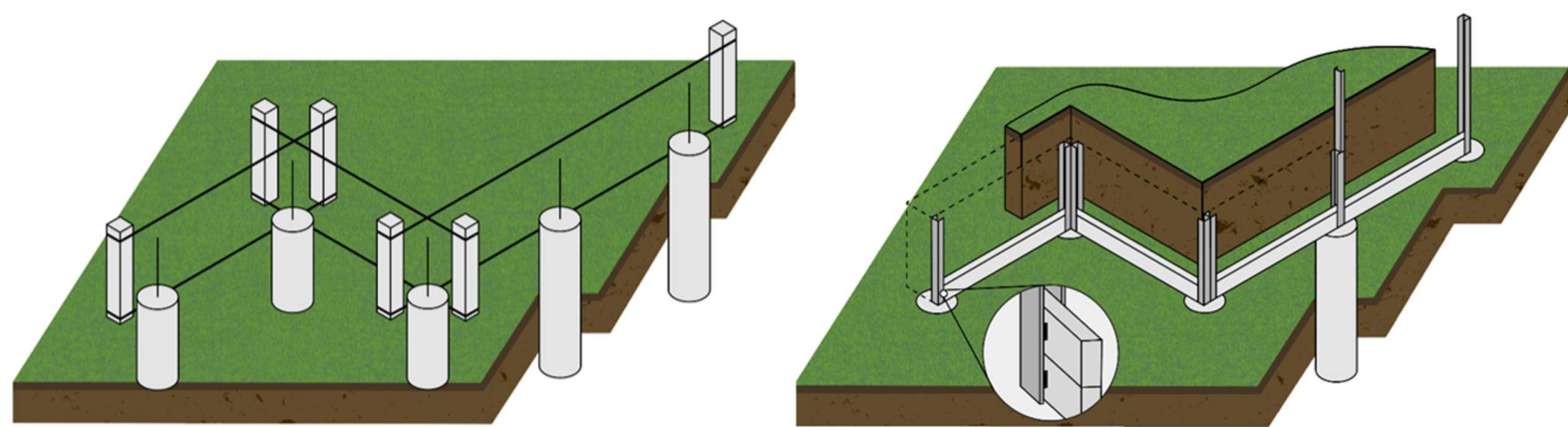
1. Pouring a small quantity of concrete into the base of the pier hole and letting it set so the ground is solid prior to installing the steel posts. This helps avoid the steel posts sinking into the ground whilst the concrete sets.
2. Build a prop to use to hold the steel post in the angle you require them to be in whilst the concrete sets.
3. To get the perfect spacing between the steel posts, use a pre-cut timber sleeper at the exact length the spacing is required for the wall and place it down at the base of the steel post to use as a marker for the other end of the sleeper to place the next steel post along the retaining wall line.

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4. The concrete will usually require a few days to set before curing enough to be ready for the installation of the concrete sleepers (refer to the specific concrete supplier information regarding curing times).



Measure the lengths of the steel posts prior to them setting in the concrete to ensure they are the exact height the wall is required to be.

We recommend that you use at least 25Mpa strength concrete.

When managing a 90 or 45 degree corner you can use pre-welded 90 and/or 45 degree corner posts or utilise two C posts to create these angles. For any other angles required you can utilise the gap between the flange of the steel posts and the sleeper (roughly 10mm) to create angles of up to 20 degrees, or again you can use two C posts to achieve whatever angle you would like.

For a cleaner finish, when dealing with a wall with various heights (seen in the diagram on the right above) you can install two C posts back to back which cater for the wall height it is facing.



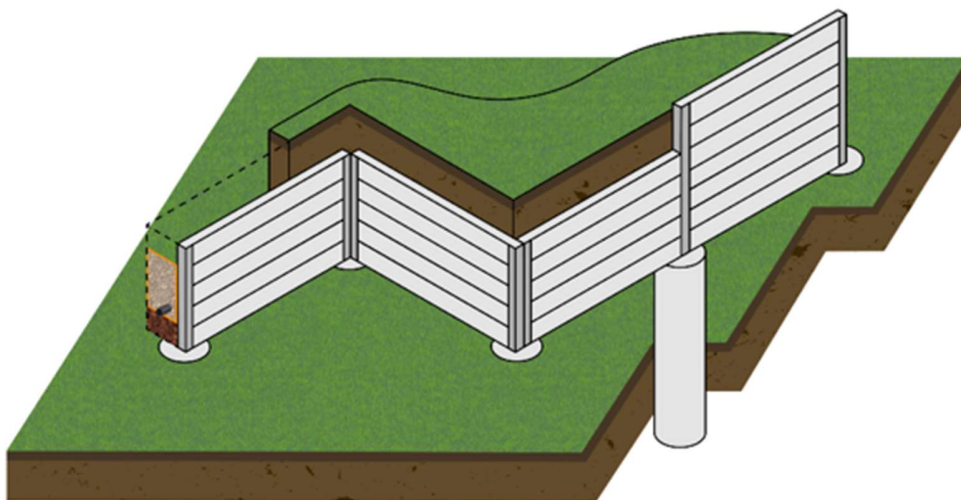
INSTALLING CONCRETE SLEEPERS

To achieve the required height of each sleeper on the bottom row, (if raising the sleeper is necessary) place the first sleeper down between the steel posts and use packers (window packers or similar non-perishable) to stack underneath the sleeper where it sits up against the steel post, which will help you to achieve the exact level required. Confirm with level with spirit level.

We recommend using wedges (we sell plastic ones however you can use pieces of wood cut into wedge shapes also) to be hammered in behind each sleeper (as indicated in the magnified image in the diagram on the previous page). These are wedged in between the sleeper and flange of the steel post, which pushes the sleeper flush up against the steel post front facing flange.

Once the first sleeper is in place – level and chocked forward - you can start to install the remaining sleepers, using the spirit level throughout the process of installing each sleeper to ensure the wall remains level by the time all the sleepers have been placed in.

Any sleepers and steel posts that are cut need to have the exposed ends sprayed with galvanising spray/bitumastic paint or the like to minimise any risk of rust.



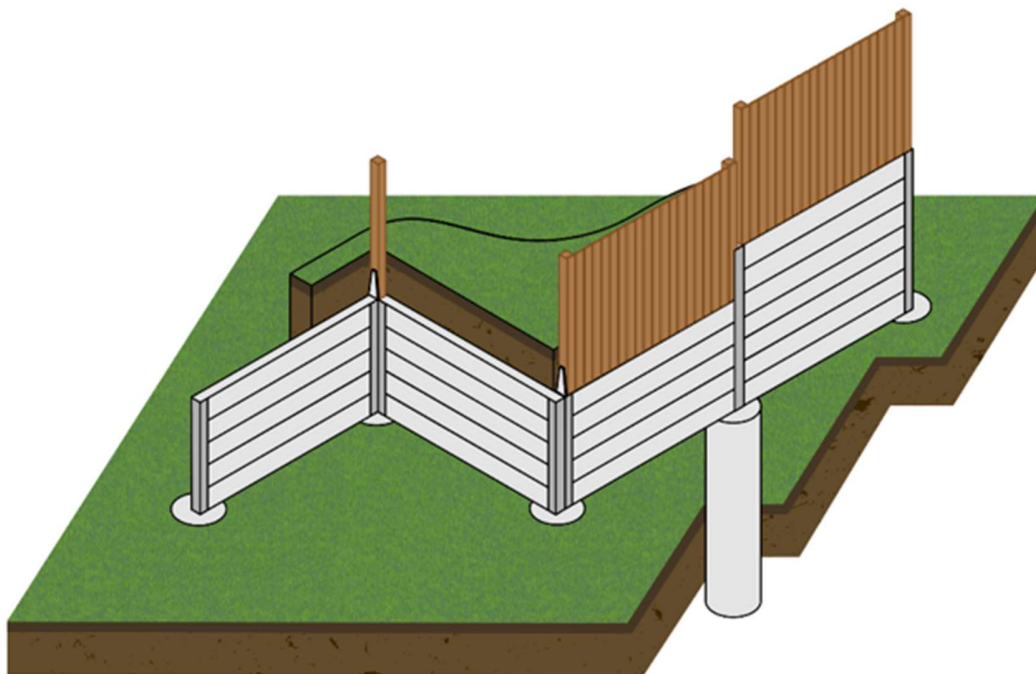
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ATTACHING A FENCE ON TOP OF THE RETAINING WALL

Before installing the top two sleepers, if you are attaching fence post brackets to the top of the steel posts to support the fence being attached on top of the retaining wall, now is the time to attach them with the nuts and bolts provided (or you can weld them on if you prefer that installation option).



DRAINAGE MANAGEMENT

Once the sleepers have been installed, place drainage aggregate (20mm recommended) at the base of the retaining wall as high as the top of the bottom sleeper. Then install the geo fabric material in a U shape, running down the back of the retaining wall and looping up the 300mm cut out behind the retaining wall, leaving a bit of excess cloth free to loop over the top of the 300mm gap. Inside of the geo fabric roll place the agi pipe at the bottom. Then fill with 20mm drainage aggregate up to the

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bottom of the top sleeper. Then cover the top of the drainage aggregate with the geo fabric and cover that top 200mm behind the retaining wall with soil.

Ensure the drainage point of the water is away from behind the wall.

Remember to consider where the water will be draining to after you have funnelled it away from the back of the wall, if it pools somewhere in front of the wall and stays there or runs into another area and causes problems there that will need to be managed separately.

We recommend using 65mm diameter wide agi drainage pipe for walls up to 1m in height and the 100mm diameter wide agi drainage pipe for walls 1m in height and above, unless the area behind the retaining wall has a substantial amount of water drain towards it, then using a 100mm diameter wide agi drainage pipe would be better suited for a wall under 1m in height.

We recommend using the socked agi pipe for all retaining walls, however if you are installing the drainage agi pipe inside of the geo fabric at the base of the drainage aggregate, you can use the unsocked agi pipe.

If you have any additional queries unanswered by this installation guide, feel free to contact the HYBUILT Team.

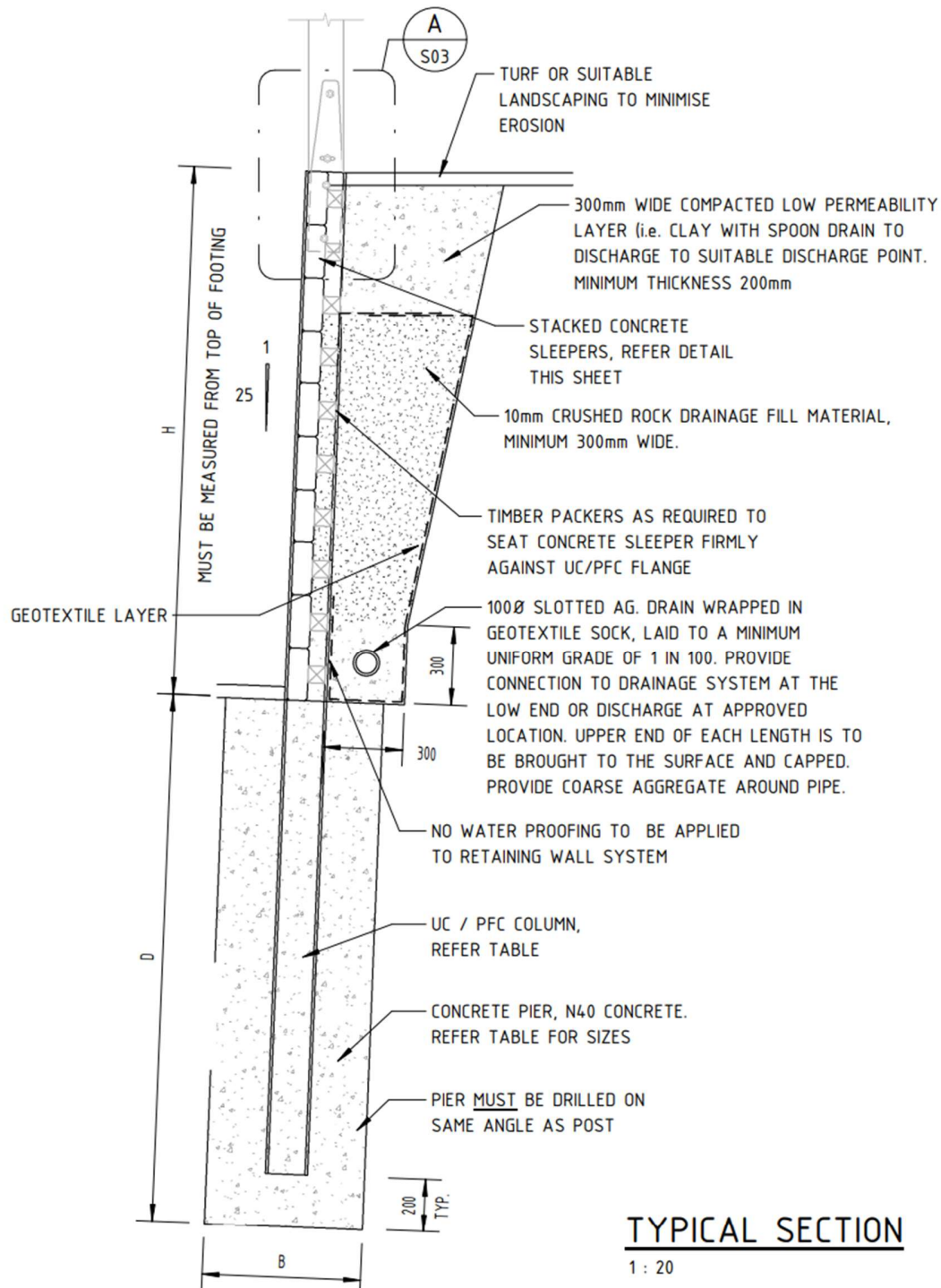
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TYPICAL CONCRETE SLEEPER WALL DESIGN

SINGLE TIER – RETAINING RESIDENTIAL LOT



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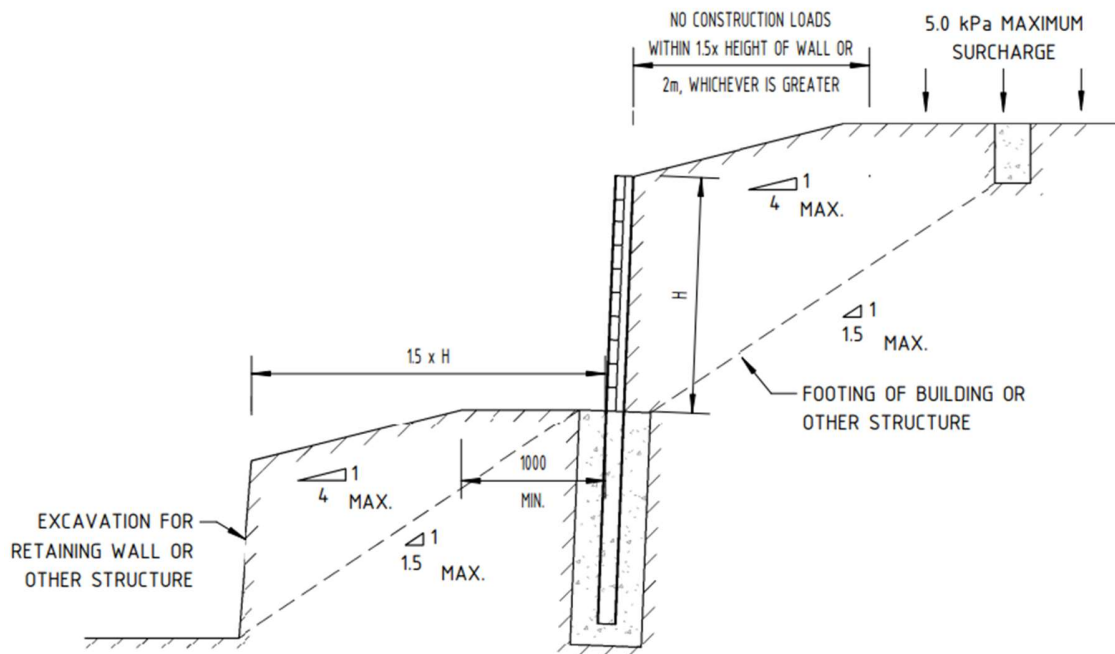


TYPICAL PARAMETERS:

POSTS TYPICALLY AT 2000 CENTRES MAX.

WALL HEIGHT H	PIER DEPTH D	PIER DIAMETER B	INTERMEDIATE POST	END POST	CORNER EQUAL ANGLE	CORNER BASE PLATE	CORNER STUB	HEIGHT OF DOUBLE SLEEPER	HEIGHT OF SINGLE SLEEPER
600	800	450	100UC14.8	100PFC	100x100x6.0 EA	150x150x16 PL	100UC14.8	-	600
800	1000	450	100UC14.8	100PFC	100x100x6.0 EA	150x150x16 PL	100UC14.8	-	800
1000	1200	450	100UC14.8	100PFC	100x100x6.0 EA	150x150x16 PL	100UC14.8	-	1000
1200	1400	450	100UC14.8	100PFC	100x100x6.0 EA	150x150x16 PL	100UC14.8	-	1200
1400	1600	450	100UC14.8	100PFC	100x100x6.0 EA	150x150x16 PL	100UC14.8	-	1400
1600	1600	600	150UC23.4	150PFC	150x150x6.0 EA	225x225x16 PL	150UC23.4	-	1600
1800	1800	600	150UC23.4	150PFC	150x150x6.0 EA	225x225x16 PL	150UC23.4	-	1800
2000	2000	600	150UC23.4	150PFC	150x150x6.0 EA	225x225x16 PL	150UC23.4	-	2000
2200	2300	600	150UC30.0	150PFC	150x150x6.0 EA	225x225x16 PL	150UC30.0	200	2000
2400	2600	600	150UC30.0	150PFC	150x150x6.0 EA	225x225x16 PL	150UC30.0	400	2000
2600	3000	600	150UC37.2	200PFC	200x200x6.0 EA	275x275x16 PL	150UC37.2	600	2000
2800	3300	600	200UC46.2	200PFC	200x200x6.0 EA	275x275x16 PL	200UC46.2	800	2000
3000	3700	600	200UC46.2	200PFC	200x200x6.0 EA	275x275x16 PL	200UC46.2	1000	2000
3200	4200	600	200UC46.2	200PFC	200x200x6.0 EA	275x275x16 PL	200UC46.2	1200	2000

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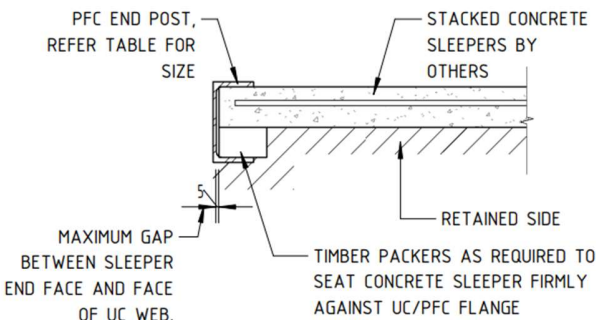
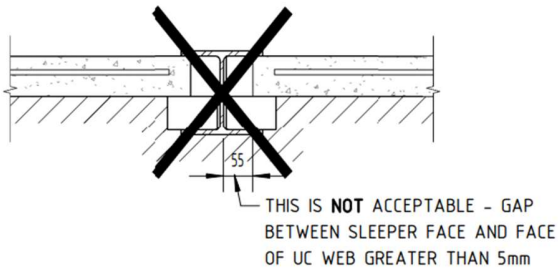
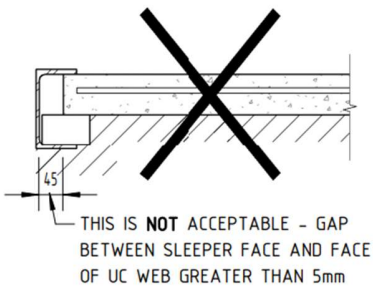


RETAINING WALL - TYPICAL SECTION

1 : 50

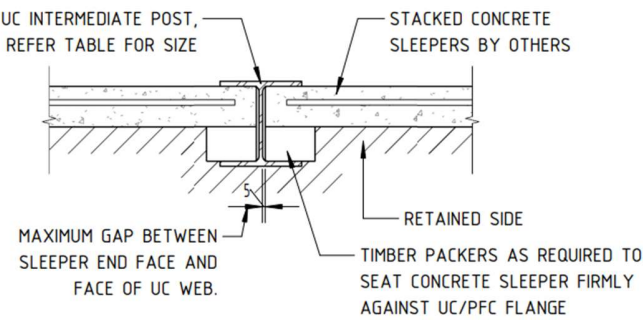
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TYPICAL END DETAIL

1 : 10



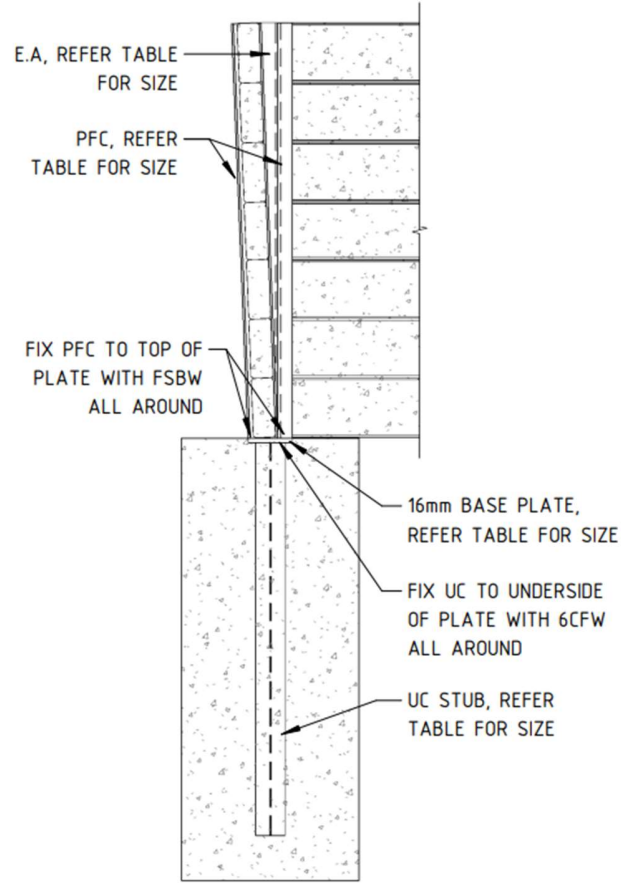
TYPICAL INTERMEDIATE DETAIL

1 : 10



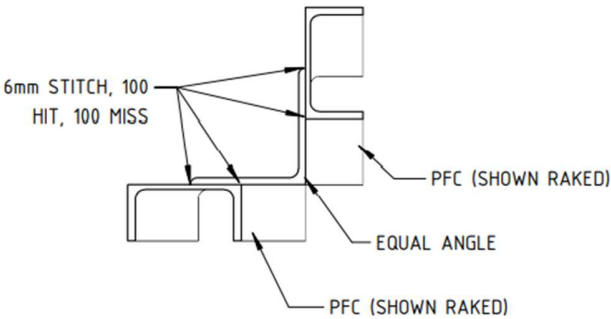
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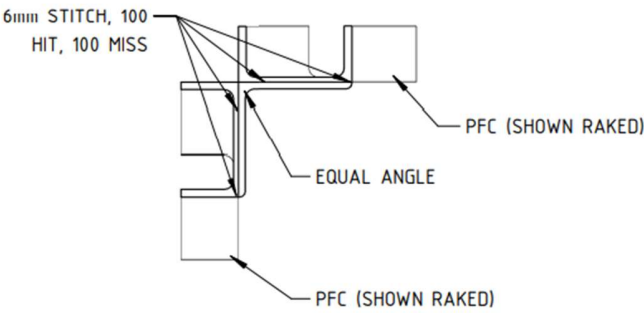
TYPICAL INSIDE CORNER SECTION

1 : 20



TYPICAL INSIDE CORNER - PLAN

1 : 5



TYPICAL OUTSIDE CORNER - PLAN

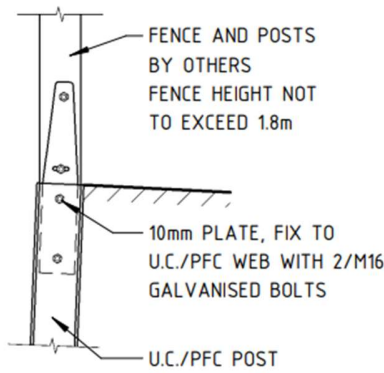
1 : 5

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FENCE POST BRACKET DESIGN



DETAIL
1 : 20

