QPRO Concrete Sleepers

TECHNICAL DESIGN GUIDE

EARTH RETAINING WALLS



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DESIGN SPECIFICATION

D1. DESIGN IS IN ACCORDANCE WITH THE FOLLOWING STANDARDS:
AS3600:2018 - CONCRETE STRUCTURES
AS4678:2002 - EARTH RETAINING STRUCTURES
AS4100:1998 - STEEL STRUCTURES
AS1170.0:2002 - SDA - GENERAL PRINCIPLES
AS1170.1:2002 - SDA - IMPOSED LOADS
AS1170.2:2011 - SDA - WIND LOADS
AS1170.4:2007 - SDA - EARTHQUAKE LOADS

D2. DESIGN ALLOWS FOR A MAXIMUM IMPOSED LOAD OF 5kPa

D3. DESIGN ALLOWS FOR A 1.8m TALL SOLID TIMBER FENCE. WIND LOADS FOR REGION B, TERRAIN CATEGORY 3

D4. A MAXIMUM RETAINED SLOPE OF 1V:10H (6°) HAS BEEN ALLOWED FOR IN THE DESIGN

D5. WALL HAS BEEN DESIGN WITH A 1:20 BACK LEAN. VERTICAL PLACEMENT OF POST WILL INCREASE POST SIZE & FOOTING DEPTH

D6. ALL HEAVY VEHICLES & PLANT EQUIPMENT MUST BE KEPT A CLEAR DISTANCE OF 1.5xWALL HEIGHT AWAY FROM THE RETAINING WALL

D7. NO ALLOWANCE HAS BEEN MADE FOR IMPOSED LOAD FROM ADJACENT STRUCTURES; HOUSES, DRIVEWAYS, SHEDS ETC. STRUCTURES IN THE LINE OF INFLUENCE TO BE DESIGN BY SUITABLY QUALIFIED ENGINEER

D8. LARGE TREES & SHRUBS ARE NOT TO BE PLANTED WITHIN 1x WALL HEIGHT OF RETAINING WALL

D9. NO ALLOWANCE HAS BEEN MADE FOR WATER PRESSURE BEHIND THE WALL. RETAINING WALLS ARE TO BE INSTALLED WITH APPROPRIATE DRAINAGE BEHIND THE WALL & ACROSS THE SITE

D10. NO ALLOWANCE HAS BEEN MADE FOR ROCK EXCAVATIONS OR WEAK SOIL PROFILES. SITES WITH COMPLEX SOIL PROFILES SHOULD SEEK ADVICE FROM A GEOTECHNICAL ENGINEER

D11. MAXIMUM ALLOWABLE DEFLECT FOR CONCRETE SLEEPER IS THE LESSOR OF L/125 AND 16mm

D12. MAXIMUM EXPOSURE CLASSIFICATION OF SLEEPERS = B1

D13. ALL SLEEPERS ARE MANUFACTURED IN ACCORDANCE WITH QPRO-STD-01 TO 04. TESTING AND QUALITY CONTROL PROCEDURES IN ACCORDANCE WITH ISO 9001:2015.

D14. FULL SCALE TESTING OF QPRO SLEEPERS HAS BEEN UNDERTAKEN AT ALFATEST Pty Ltd. ADOPTED DESIGN IS MOST CONSERVATIVE RESULT FROM TESTING & DESIGN IN ACCORDANCE WITH AS3600:2018

SOIL PROPERTIES

S1. SOIL PROPERTIES ASSUMED IN DESIGN ARE:

MATERIAL	UNIT WEIGHT (kN/m^3)	INTERNAL FRICTION ANGLE (°)	DRAINED COHESION (kPA)
STIFF CLAY	18	26	2
VERY STIFF SANDY CLAY	19	30	0

S2. SOIL PROPERTIES ARE FOR COSTING/ SMALL GARDEN WALL USE ONLY. LARGE WALLS REQUIRE SITE SPECIFIC GEOTECHNICAL INVESTIGATION

MATERIAL PROPERTIES

M1. ALL CONCRETE PIERS IN DESIGN ARE ASSUMED TO HAVE:
GRADE - N25
SLUMP - 80 +/- 15
MAX. AGGREGATE - 20mm

M2. ALL PIER REINFORCEMENT TO BE N CLASS REINFORCEMENT TO AS/NZS 4671. NORMAL CLASS, GRADE 500

M3. ALL POST ARE QPro 'H' & 'C' BEAM CONCRETE SLEEPER WALL POST. GRADE 300 IN ACCORDANCE WITH AS 3679.1:2010 & HOT DIP GALVANISED TO AS/NZS 4680

M4. ALL SLEEPERS ARE QPro STANDARD 75mm SLEEPERS, AS PER QPRO-STD-01 TO QPRO-STD-04

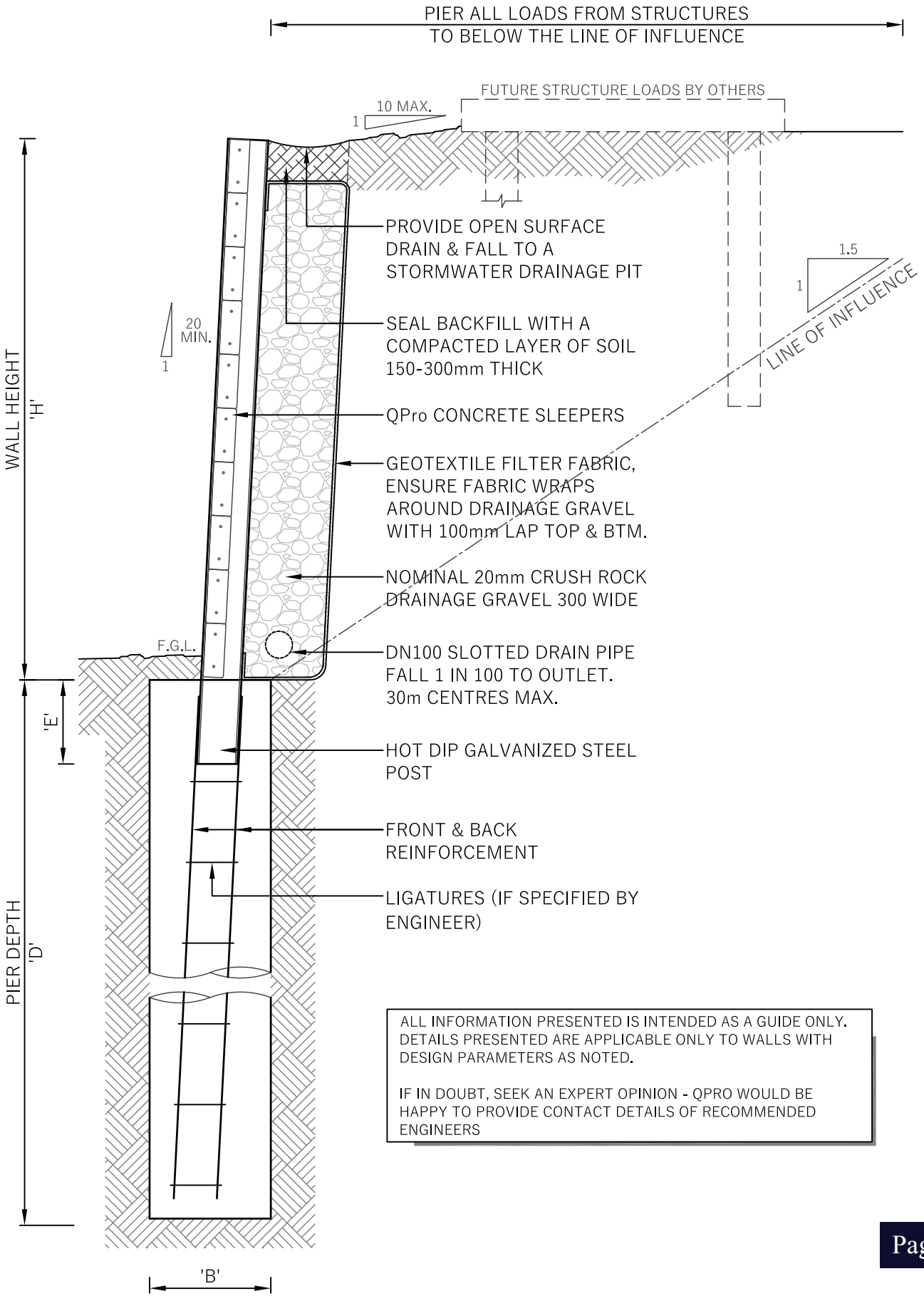
M5. THIS PRODUCT CONTAINS SILICA

ALL INFORMATION PRESENTED IS INTENDED AS A GUIDE ONLY. DETAILS PRESENTED ARE APPLICABLE ONLY TO WALLS WITH DESIGN PARAMETERS AS NOTED.

IF IN DOUBT, SEEK AN EXPERT OPINION - QPRO WOULD BE HAPPY TO PROVIDE CONTACT DETAILS OF RECOMMENDED ENGINEERS

TYPICAL CONCRETE SLEEPER WALL

SINGLE TIER - RETAINING RESIDENTIAL LOT



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CONCRETE SLEEPER SPAN TABLES

STIFF NATURAL CLAY

DESIGN LOADS: Dead load, g: nil
Live load, q = 5kPa
Wind load = Region B, TC3 to 1.8m high solid timber fence

SOIL PARAMETERS: Internal friction angle, ϕ = 26°
Drained cohesion, c' = 2kPa
Unit weight of soil, γ = 18 kN/m^3

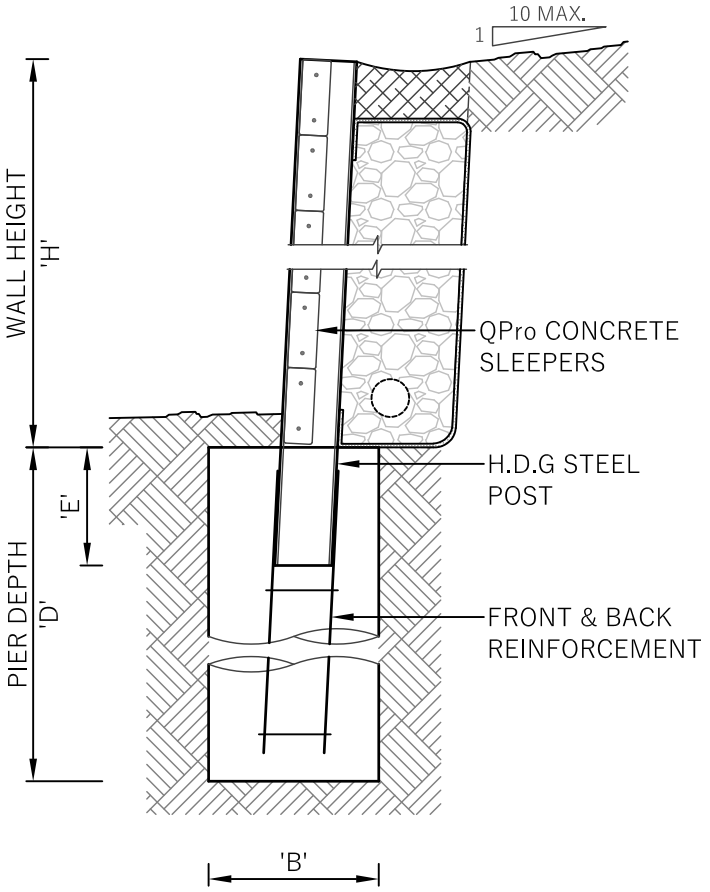


TABLE 1.1 - SLEEPER HEIGHTS

WALL HEIGHT	SLEEPER LENGTH		
	1600	2000	2400
400	SINGLE	SINGLE	SINGLE
600	SINGLE	SINGLE	SINGLE
800	SINGLE	SINGLE	DOUBLE
1000	SINGLE	SINGLE	DOUBLE
1200	SINGLE	SINGLE	N/S
1400	SINGLE	SINGLE	
1600	SINGLE	DOUBLE	
1800	SINGLE	DOUBLE	
2000	SINGLE	DOUBLE	

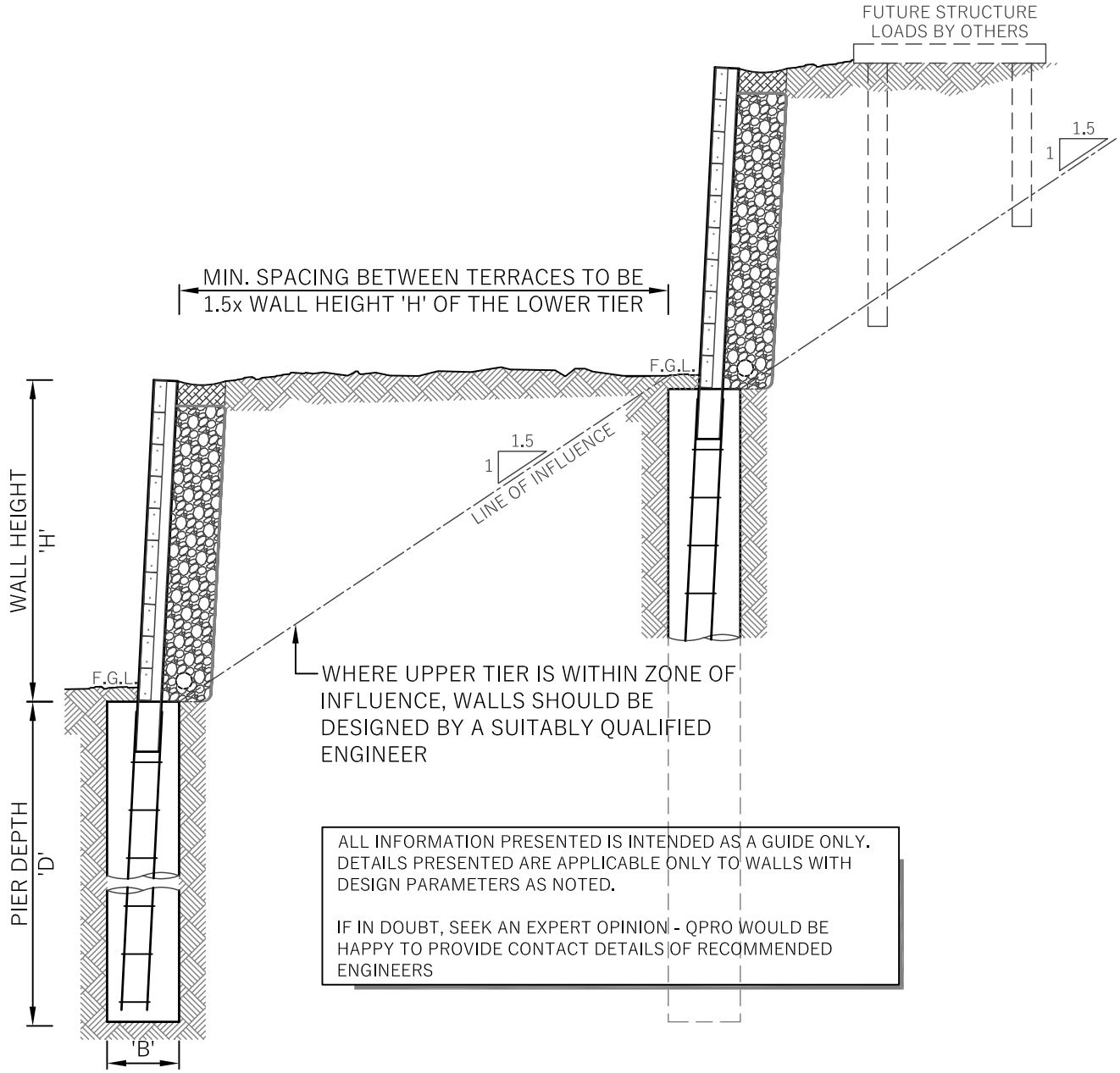
NOTES
1. SINGLE - Single Sleeper, DOUBLE - Double Sleeper, N/S - Not suitable
2. Sleeper max heights are based on servicability limit state. Max deflection is lessor of is L/125 or 16mm.

TABLE 1.2 - BORED PIER & POSTS

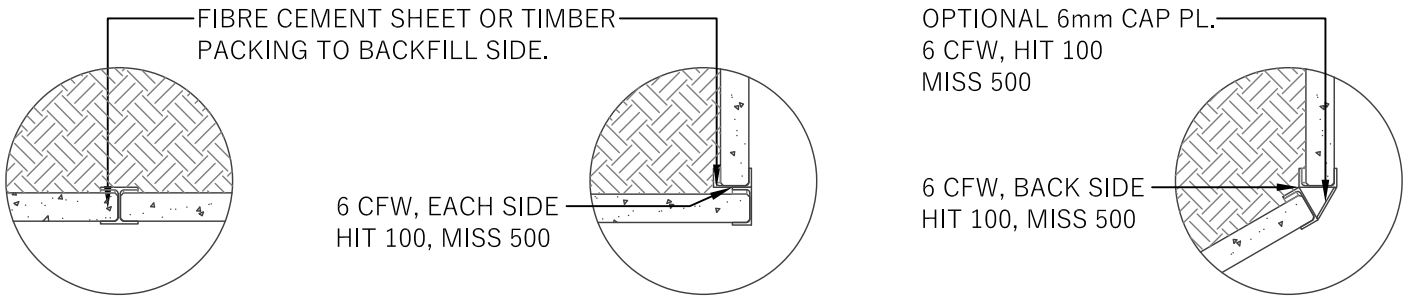
WALL HEIGHT 'H'	FOOTING DEPTH 'D'	SLEEPER LENGTH	INTERMEDIATE POST	FRONT FACE REINF.	BACK FACE REINF.	POST EMBED 'E'	END POST	
400	1000	2000	100UC14.8	2-N12	2-N12	350	100 PFC	
600	1100	2000	100UC14.8	2-N12	2-N12	350	100 PFC	
800	1250	2000	100UC14.8	2-N12	2-N12	350	100 PFC	
1000	1450	2000	100UC14.8	2-N12	2-N12	350	100 PFC	
1200	1650	2000	100UC14.8	2-N12	2-N12	350	100 PFC	WALLS OVER 1.0m REQUIRE ENGINEERING CERTIFICATION
1400	1900	2000	100UC14.8	2-N12	2-N12	350	100 PFC	
1600	1950	1600	100UC14.8	2-N12	2-N12	350	100 PFC	
1800	2250	1600	100UC14.8	2-N12	2-N12	350	100 PFC	
2000	2450	1600	150UC23.4	2-N16	2-N16	400	150 PFC	

NOTES:
1. Table is intended as a guide only. All walls over 1.0m, in close proximity to other structures or with large soil batters should be designed by a suitably qualified engineer
2. Wall design will vary with soil properties, a soil test from a suitably qualified person & engineering may result in improved design parameters

TYPICAL TERRACED WALL DETAIL



TYPICAL CORNER DETAILS

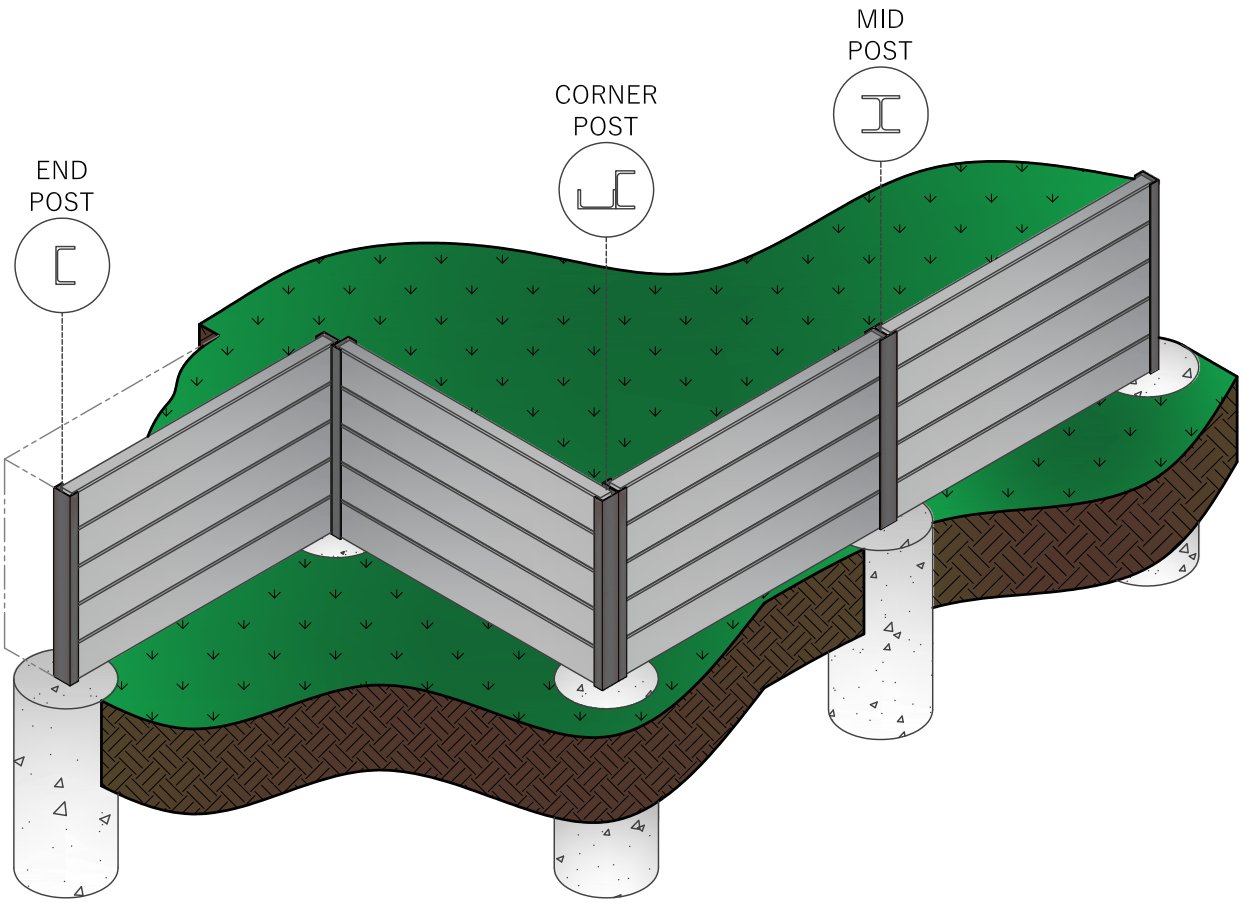


MID POST

90° DEG. CORNER

ANGLED CORNER

TYPICAL INSTALLATION



CONSTRUCTION NOTES

C1. CHECK WITH YOUR LOCAL COUNCIL WHETHER BUILDING APPROVAL IS REQUIRED

C2. ALL PIER HOLES, POST & FENCES MUST BE WHOLLY CONTAINED WITHIN THE RETAINING WALL OWNERS LOT

C3. IF CUTTING BACK EXISTING BANK, CARE IS TO BE TAKEN TO ENSURE NO FOOTINGS/ STRUCTURES ARE DESTABILISED

C4. IT IS THE CONTRACTORS RESPONSIBILITY TO ENSURE ALL EXCAVATIONS, TRENCHES & PIERS ARE FENCED OFF WITH SAFETY BARRIERS AS REQUIRED

C5. ENSURE 50mm COVER TO ALL POST REINFORCEMENT.

C6. ALL PIER HOLES SHALL BE FIRM, DRY AND FREE FROM LOOSE MATERIAL PRIOR TO PLACEMENT OF CONCRETE

C7. ENSURE SITE HAS ADEQUATE DRAINAGE WITH SUB-SOIL DRAIN OUTLETS INSTALLED TO THE RETAINING WALL AT 30m CENTRES.

C8. SUB-SOIL DRAINS SHOULD BE REGULARLY FLUSHED/ INSPECTED BY A QUALIFIED PERSON TO ENSURE PROPER FUNCTION OF THE DRAINAGE SYSTEM

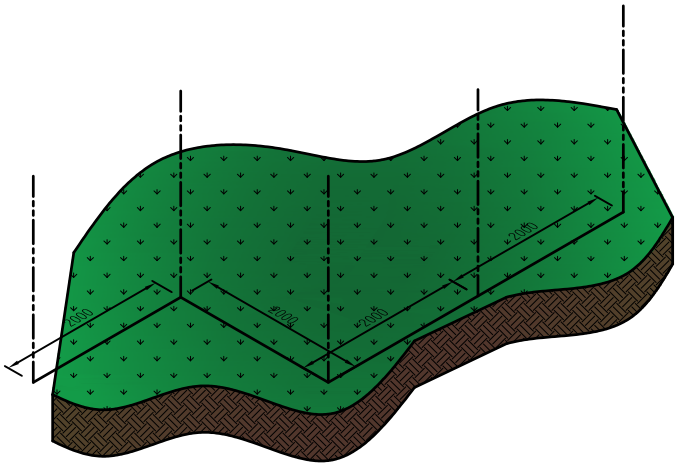
C9. SLEEPERS ARE HEAVY. SLEEPERS SHOULD ONLY BE LIFTED BY 2 PERSONS OR WITH THE ASSISTANCE OF PLANT EQUIPMENT

C10. ALL SLEEPERS CUT ON SITE TO BE TREATED WITH HIGH BUILD EPOXY OR INORGANIC ZINC SILICATE TO AS2312.1:2014. TREATED SURFACE IS TO BE DRY, CLEAN & FREE FROM DEBRIS OR CUTTING SLURRY

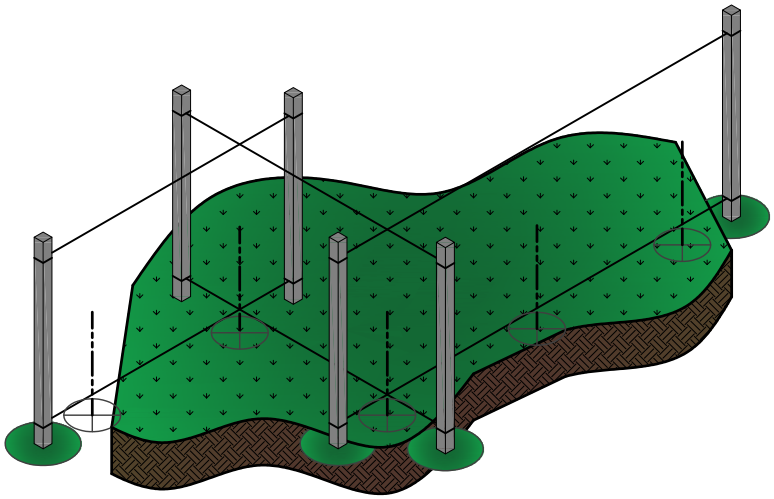
C11. EFFLORESCENCE IS A WHITE POWDERY DEPOSIT THAT CAN NATURALLY FORM ON CONCRETE SUBJECT TO REPEATED WET/DRYING CYCLES. TO MITIGATE EFFLORESCENCE ENSURE ENVIRONMENT IS DRY & FREE DRAINING.

SLEEPERS ARE MANUFACTURED FROM RAW NATURAL MATERIALS. VARIATIONS IN COLOUR CAN OCCUR BETWEEN BATCHES, PHYSICAL INSPECTS OF SLEEPERS IS RECOMMENDED PRIOR TO MAKING AN ORDER

IT SHOULD ALSO BE NOTED CONCRETE NATURALLY SHRINKS AS IT DRIES OVER TIME, AS A RESULT CONCRETE WILL ALMOST ALWAYS FORM HAIRLINE CRACKS. CRACKING IS NOT A STRUCTURAL DEFECT UNLESS CRACK WIDTHS ARE OVER 0.3mm, THIS IS BASED ON GUIDANCE FOR RESIDENTIAL CONCRETE WALLS FROM AS2870:2011

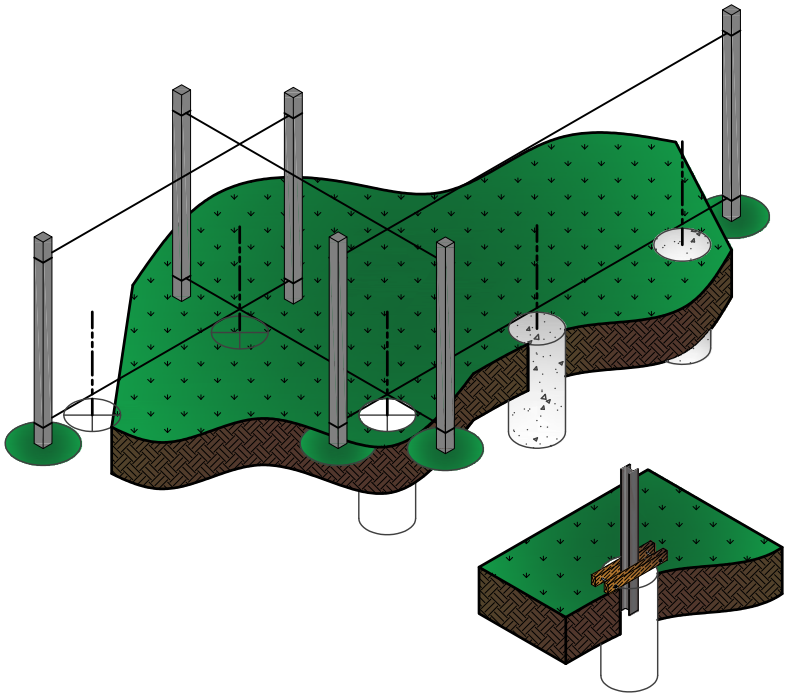


1. PREPARE THE SITE
   - Clear all topsoil & vegetation from the proposed area where you plan to build the wall
   - Level the site and ensure you leave 300mm of area behind the wall for drainage pipe & aggregate



2. ALIGNMENT & HOLE POSITION
   - Place a star piquet or peg at both ends of proposed walls.
   - Attach string line to each piquet, both top & bottom, to keep wall aligned
   - Starting from one end of the wall, mark the ground at intervals = selected sleeper length

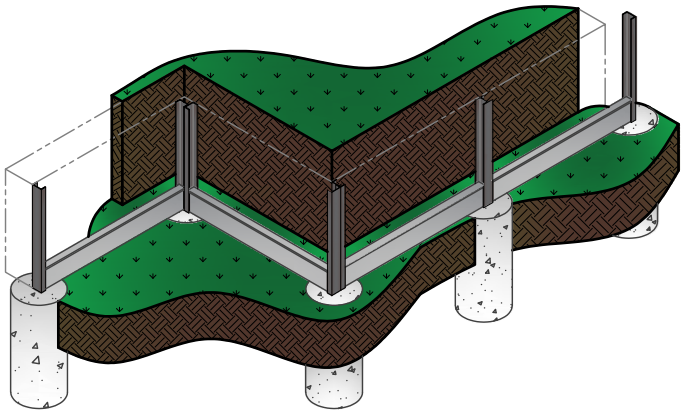
   Note: Bored piers should be wholly contained with your own boundaries



3. AUGER HOLES & POUR CONCRETE
   - Auger holes as per the design guide (landscaping walls only) or your engineers specifications.
   - Ensure post are installed with a minimum lean back of 1:20 (50mm per 1.0m of height).

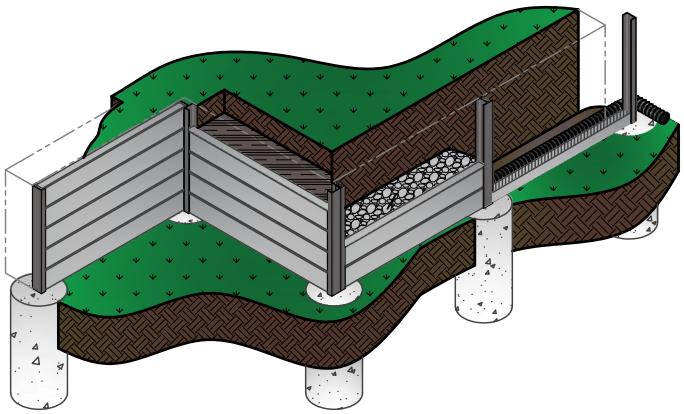
   Option 1
   - Pour concrete into holes one at a time.
   - Set post by lowering into ground until level with the top string lines.

   Option 2
   - Set post in position with string lines & brace with temporary propping. E.g. clamping post between two timber planks & spanning planks over pier.
   - Pour all holes at the same time.



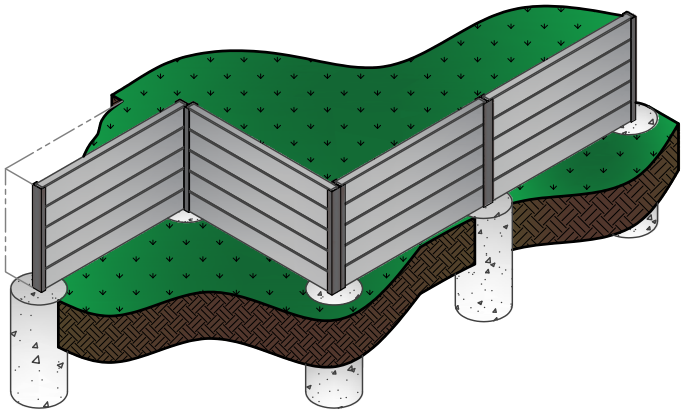
4. CHECKING POST

- Ensure all post are aligned with the string lines, use of a spirit level is recommended.
- Confirm height from the top of the concrete pier to the top of steel post & confirm sleepers will finish flush with the top of the post. (i.e. distance should be equal to an increment of 200).
- If required install a concrete sleeper on each side of post to ensure correct positioning.
- If you are installing a fence above your wall, QPro fence brackets should be installed at this stage.



5. AGG. PIPE, GRAVEL BACKFILL & SOIL CAP

- Allow concrete piers to cure for 3 days or as specified by your engineer.
- As per detail on page 3 of this guide; install Agg. pipe at the base of the wall, ensure geofabric is wrapped completely around drainage gravel with 100mm lap top & bottom
- Backfill with 300mm wide drainage gravel and wrap geofabric behind & over gravel.
- Installed a 150-300mm compacted soil cap over the geofabric & drainage gravel.
- Ensure surface finish directs stormwater flow away from wall to a drainage pit.



6. FINISHED WALL

- Enjoy your new QPro sleeper wall!
- Clean site & landscape as desired.
- Machine equipment & heavy vehicles should not be used on the high side of the wall, a minimum distance of 1 x Wall Height should be maintained.
- To ensure the longevity of your wall, no excavations should take place in front of the wall after completion.
- If you plan to build near the wall in future, contact an engineer for advice.