Master Specification
Part ST-RE-D2

Design of Retaining Walls

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Contents

ST-RE-D2 Design of Retaining Walls

1 General

a) This Master Specification Part specifies the requirements for the design of retaining wall structures, including:

i) the documentation requirements, as set out in section 2;

ii) the general design requirements, as set out in section 3;

iii) the Design Life requirements, as set out in section 4;

iv) the unsaturated soil mechanics requirements, as set out in section 5;

v) the retaining walls and associated structures requirements, as set out in section 6;

vi) the piling for retaining wall requirements, as set out in section 7;

vii) the secant pile wall requirements, as set out in section 8;

viii) the diaphragm walls requirements, as set out in section 9; and

ix) the Hold Point requirements, as set out in section 10.

b) This Master Specification Part applies to the design of the following that are greater than 1.0 m in retained height:

i) retaining walls and associated structures which support direct loading from earth pressure, hydrostatic pressure (including where the retaining wall forms part of a tanked structure), indirect lateral loading from adjacent temporary and permanent surcharge, equipment loadings, road traffic, light railways, and heavy railways near the top of the retaining wall; and

ii) piled retaining walls (including cast in situ bored or CFA piles, and secant or contiguous piles), and diaphragm walls.

c) In addition to the requirements of this Master Specification Part:

i) for the design of bridge abutments, refer to ST-SD-D1 “Design of Structures” as bridge abutments take significant vertical loadings from bridge structures supported above (unlike typical piled retaining walls) and are subject to special earthquake design provisions as set out in AS 5100 Bridge design;

ii) the structural detailing of retaining walls must take into account the requirements of ST-SD-D1 “Design of Structures”, where relevant;

iii) where retaining walls form part of a Tunnel, refer to TUN-CIV-DC1 “Tunnel Civil Requirements”; and

iv) for the design of reinforced soil structures, refer to ST-RE-D1 “Design of Reinforced Soil Structures”.

d) The design of retaining wall structures must comply with the Reference Documents, including:

i) AGRT Part 2: Planning, Design and Commissioning;

ii) AS/NZS 1170 Structural design actions;

iii) AS 2159 Piling - Design and installation;

iv) AS 4678 Earth-retaining structures;

v) AS 5100 Bridge design;

vi) BS 8102 Code of practice for protection of below ground structures against water ingress;

vii) CIRIA C760 - Guidance on embedded retaining wall design;

viii) BS EN 1538 Execution of special geotechnical works - Diaphragm walls; and

ix) Department Structures Group Drafting Guidelines for Consultants (available from: https://dit.sa.gov.au/standards/standards_and_guidelines).

e) The following documents must be used for guidance, to the extent required by Law and to the extent required to meet the Contractor's obligations in regard to Best Industry Practices and in relation to unsaturated soil mechanics theory, provide guidance in estimating strength, stiffness and volume changes:

i) Briaud J-L. 2013 Geotechnical Engineering: Unsaturated and Saturated Soils, John Wiley and Sons Inc;

ii) BS 8002 Code of Practice for Earth retaining Structures;

iii) BS 8081 Code of Practice for Grouted Anchors;

iv) EN 1992-3:2006 Eurocode 2 - Design of concrete structures - Part 3: Liquid retaining and containment structures;

v) Fredlund, D. G., and Rahardjo, H. 1993 Soil Mechanics for Unsaturated Soils, John Wiley and Sons Inc;

vi) Fredlund, D. G., Rahardjo, H. and Fredlund M. D., 2012 Unsaturated Soil Mechanics in Engineering Practice, John Wiley and Sons Inc;

vii) ICE Specification for Piling and Embedded Retaining Walls (3rd edition);

viii) Khalili N and Khabbaz M. H. 1998, Unique Relationship for the Determination of Shear Strength of Unsaturated Soils, Geotechnique 48(5), pp 681-687;

ix) N. Wharmby, B. Perry and H. Waikato "Development of Secant Pile Retaining Wall Construction Urban New Zealand". New Zealand Concrete Industry Conference, Wellington, New Zealand 2010

x) Woodburn J. A., Underpass Construction using Revetment Walls, DPTI Report GSU 1291, Sept 2009;

xi) Woodburn J. A. RN6203 South Road, South Road Upgrade, Torrens Road to River Torrens, Trial Pile Wall Study DPTI Report GSU 1421, July 2014; and

xii) Woodburn J. A. and Herraman R. A., Revetment Walls for Stiff Unsaturated Clay, Proceedings UNSAT 2014 conf, Sydney 2014.

2 Documentation

2.1 Design Basis

In addition to the requirements of PC-EDM1 "Design Management", for retaining walls with a height of 15 m or greater, the Design Basis must nominate the applicable design standards to be applied.

2.2 Design Report

In addition to the requirements of PC-EDM1 "Design Management", the Design Report must:

a) include all relevant geotechnical design methodologies, assumptions and summary calculations;

b) set out how the design of retaining wall structures and piles accommodates the expansion and contraction properties of retained clay strata, including short-term, long-term, and progressive effects, in accordance with the requirements of section 3e);

c) identify all relevant adjacent assets and provide evidence that wall deflections, including associated and consequential ground movements, are within acceptable limits for each asset, as required by section 6.1a);

d) provide calculations and details of estimated settlements and horizontal deflections including creep likely to occur during construction and the lifetime of the structure;

e) detail the impacts on neighbouring assets; and

f) demonstrate compliance with the applicable Reference Documents set out in section 3.

2.3 Design Documentation

In addition to the requirements of PC-EDM1 “Design Management”, the Design Documentation must:

a) include the assumed construction staging of the works including any assumed requirements for temporary propping, as required by section 3o);

b) include evidence of durability of waterproof joints and any connections between the wall and adjacent lowered roadway, as required by section 3u);

c) include evidence that groundwater will be managed in the long-term;

d) set out the proposed number and location of the inclinometers for piled and diaphragm walls greater than 4 m in height, in accordance with section 6.2c);

e) set out the locations of monitoring points as well as the expected movements at the location of each monitoring point, as required by section 6.2d);

f) assign trigger movement levels to each monitoring point, as required by section 6.2e);

g) include a risk assessment assessing the potential for the loss of more than one prop in the same event, as required by section 6.5b);

h) include a monitoring plan with a proposed methodology for the monitoring of retaining walls and checking of tolerances;

i) include the full specifications for testing of piles and pile materials in accordance with section 7d);

j) include the information required by section 7g) in relation to piling;

k) demonstrate how a watertight structure is to be built within tolerance, including the information required by section 8.1a);

l) include details of the proposed weak concrete mix for primary piles in accordance with the Reference Documents and demonstration of the suitability of the Contractor’s proposed approach, in accordance with section 8.3;

m) include the information required by section 9 in relation to diaphragm walls; and

n) calculations and fully detailed design drawings of the permanent propping system and the temporary propping system.

2.4 Durability Report

The Durability Report must address the durability of the retaining walls in accordance with the requirements of ST-SD-D1 “Design of Structures”.

3 General design requirements

a) The geotechnical design of retaining walls must be carried out in accordance with AS 5100.3 Bridge Design - Part 3: Foundation and soil supporting structures.

b) The geotechnical design of retaining walls must adopt the requirements of AS 4678 Earth-retaining structures, only for the aspects of retaining wall design which are not covered by AS 5100.3 Bridge Design - Part 3: Foundation and soil supporting structures.

c) Where the Contractor considers that AS 4678 Earth-retaining structures may be more appropriate than the requirements of AS 5100 Bridge design, this must be raised as a Design Departure.

d) The design of embedded walls must comply with CIRIA C760 Guidance on embedded retaining wall design, subject to there being no contradiction with the requirements of AS 5100.3 Bridge design - Part 3: Foundation and soil supporting structures, and AS 4678 Earth-retaining structures.

e) In addition to the requirements in AS 5100 Bridge design, soil retaining structures, including walls and piles, must be designed to factor in the expansion or contraction properties of retained clay strata, including short-term, long-term, and progressive effects.

f) Earthquake forces on retaining walls as per AS 5100.2 Bridge design, Part 2: Design loads, and AS/NZS 1170.4 Structural design actions, Part 4: Earthquake actions in Australia, must be considered in the design.

g) Retaining walls will move during service. Any applied façade panels must be designed to be adjustable in service to accommodate 1.5 times the anticipated lateral movement.

h) Calculations of deflections must be in accordance with section 6.

i) Consideration must be given to earth pressures imposed by over-consolidated clays.

j) Load combinations that include unbalanced lateral loadings by applying the most adverse loading combination of minimum and maximum loadings on opposite sides must be considered.

k) Founding criteria for retaining walls to achieve the sufficient bearing capacity under permanent and temporary conditions must be provided.

l) Seepage analysis and groundwater cut-off requirement under permanent and temporary conditions must be considered.

m) Mixed drained and undrained conditions must be considered where relevant.

n) Unloading requirement must be considered where specified in the Contract Documents.

o) The Design Documentation must show the assumed construction staging of the retaining wall works, including any assumed requirements for temporary propping.

p) Permanent and temporary structural elements, including ground anchors, soil nails and batters must not extend outside the Contractor's Activity Zone (CAZ).

q) Analysis of embedded retaining walls must consider the relevant flexural stiffness of the wall at the analysis stage being considered in accordance with the guidance in CIRIA C760 guidance on embedded retaining walls.

r) The design must address earthing and bonding and provision for cathodic protection in accordance with ST-SD-D1 "Design of Structures".

s) Retaining wall cladding must be designed to accommodate the design and construction tolerances of the retaining wall behind.

t) Retaining walls must comply with the requirements of TUN-FIRE-DC3 "Tunnel Fire Engineering", as appropriate.

u) The Contractor must ensure that the design has appropriately accounted for the buoyancy of a tanked structure and includes waterproofed and carefully detailed joints between the base and the walls. The durability of these waterproof joints and any connections between the wall and adjacent lowered roadway must be clearly addressed in the Design Documentation.

v) Any leaks through a retaining wall must be allowed to visibly exit via drainage at the base of the façade and any traffic barriers, as near as possible along the road to the leak location, in

order to simplify leak identification and repair. Spoon drains at road level must direct the water to a sump location.

w) With respect to earthquake detailing requirements:

i) lapping of main flexural reinforcement in potential plastic hinge zones is not permitted;

ii) splices for the vertical and lateral reinforcement must be staggered and not more than 50% of reinforcement in a section may be spliced at a location;

iii) where couplers are to be used to splice reinforcement, consideration must be given to their effect on cover;

iv) where compressive stresses in the wall exceeds 2 MPa due to axial load and in plane bending, cross ties must be used in accordance with AS 5100.5 Bridge design, Part 5: Concrete, clause 11.7.5; and

v) reinforcement lapping zones in adjacent piles in piled retaining walls must not be at the same depth (level) to avoid issues with potential plastic hinges.

x) Unless stated otherwise in the Contract Documents, where retaining walls are located below the groundwater table, they must be designed to achieve Haack Tightness Class 3.

4 Design Life requirements

Retaining walls and associated structures must have a minimum Design Life of 100 years.

5 Unsaturated soil mechanics

a) Where retained soils are above the groundwater table, the Contractor may use unsaturated soil mechanics theory in the retaining wall design where evidence is provided to the satisfaction of the Principal that:

i) the unsaturated soil mechanics theory is appropriate for the proposed design application;

ii) no adverse conditions or potential for future adverse conditions, including presence or evidence of groundwater, perched water, fill, services trenches, or significant granular materials exist with respect to applicability of unsaturated soil theory;

iii) special consideration has been given to the method adopted for evaluating shear strength. Various methods (e.g. Briaud and Fredlund relationships) must be interrogated and a sensitivity analysis undertaken to ensure the appropriate values for apparent cohesion (c_a) are adopted in the design;

iv) given the stiffness and volume of unsaturated clay is related inter alia, to the soil suction, the Contractor has used appropriate soil suction profiles for design, with evidence of the validity of these profiles;

v) given the total suction of the soil in the vicinity of the retaining structure can be greatly reduced by water infiltration from nearby leaking pipes or sand layers, resulting in loss of strength and swelling of the clay soil and deformation of the wall:

A. evidence that the design has accounted for this loss in strength (this is expected to be an unusual occurrence over the Design Life and to only affect a section of the retaining structure corresponding to the extent of water infiltration);

B. evidence that the suction profile in the vicinity of the retaining wall to be used for design in this case has considered Figure 29 of Woodburn J. A. RN6203 South Road, South Road Upgrade, Torrens Road to River Torrens, Trial Pile Wall Study DPTI Report GSU 1421, July 2014;

C. evidence that the design of the retaining structure has allowed for strengthening of the retaining structure (e.g. by soil nails) if water infiltration were to occur;

D. suction changes from the initial as-constructed condition to the equilibrium condition will occur along much of the route and the resulting volume changes will have an effect on pavements and retaining structures. These volume changes must be calculated and considered in design; and

E. deflection of retaining walls must factor in initial deflection on excavation and further deflection due to any surcharge, creep movements, and suction changes during the Design Life.

b) The application of unsaturated soil mechanics theory set out in section 5a) will constitute a **Hold Point**. Unsaturated soil mechanics theory must not be applied to the design until the Hold Point has been released.

6 Retaining walls and associated structures

6.1 Retaining wall performance standards during Design Life

a) For retaining walls and associated structures, the maximum deflections, including associated and consequential ground movements, over the structure's Design Life must be assessed. Limits must be developed based on the tolerances of nearby structures, services, roads, and other assets. The Design Report must identify all relevant adjacent assets and provide evidence that wall deflections and ground movements are within acceptable limits for each adjacent asset.

b) The deflection calculations required by section 6.1a) must be determined at the serviceability limit state.

c) The maximum deflection limits determined in accordance with section 6.1a) must consider:

i) deflections that occur during construction or excavation;

ii) long term deflection of the retaining wall due to changes in soil or structure behaviour; and

iii) deflections due to soil swelling or shrinking as its suction changes from the value prior to construction to equilibrium after construction.

d) The impact of additional deflections on associated structures and safety implications caused by ultimate limit state events must be accounted for.

e) Retaining walls must not be visibly over vertical as a result of horizontal retaining wall movement for serviceability limit state conditions. Additionally, associated structures including guard rail, luminaires, and wall treatments must be designed to ensure that they will not be damaged or be visibly out of alignment as a result of horizontal retaining wall movement. All attached items must allow for alignment to maintain good appearance.

f) When retaining walls are located adjacent to more rigid structures (i.e. adjacent to bridge abutments) the wall design must be assessed and designed to accommodate differential movement.

g) Where a proprietary wall system is being used, the deflection limits determined in accordance with section 6.1a) must not exceed the maximum deflections specified by the manufacturer of the wall system.

6.2 Retaining wall monitoring

a) The design of retaining walls must propose a monitoring and surveillance regime for the relevant embankments, pavements and bridge structures with time intervals as stipulated in RD-EW-D1 "Design of Earthworks for Roads".

b) Monitoring points must be placed mid-height and at the top of all retaining walls adjacent to bridges and then spaced at intervals not exceeding 50 m along the full length of the retaining wall. A minimum of 2 points must be placed on any ramps with spacing between points not to exceed 50 m. At least one point must be placed at the highest point of the wall. The monitoring

points at each section must be placed at the estimated location of maximum deformation. For cantilever walls, measurement points must be located at the top and bottom of the wall.

c) For piled and diaphragm walls greater than 4 m in retained height, inclinometers must be installed within the piles or panels. A risk-based approach must be adopted for the spacing of inclinometers. The proposed number and locations of the inclinometers must be clearly set out in the Design Documentation.

d) The Design Documentation must set out the locations of monitoring points as well as the expected movements during excavation and post excavation at the location of each monitoring point.

e) The Design Documentation must assign stage-by-stage trigger levels to each monitoring point considering assets which may be affected by retaining wall construction and excavation.

6.3 Retaining walls adjacent to bridges

Retaining wall structures must be set back a minimum of 70 mm from the line of more rigid structures, such as bridge abutments, to account for outward movement at the top of the retaining wall structure. A suitable slip joint must be used at these locations to allow free movement of the retaining wall.

6.4 Retaining wall inclination

The visible face or façade of retaining walls must be set at a slope of 1H in 40V or flatter (to allow for serviceability limit state horizontal movement at the top of the wall).

6.5 Propping systems

Where props are used to maintain the stability of retaining walls:

a) the loss of propping must not lead to the progressive failure of the retaining wall;

b) the Contractor must undertake a risk assessment as part of the Design Documentation to determine the potential for the loss of more than one prop in the same event;

c) the design of the retaining wall and propping system must allow for the loss of a minimum of one prop at any location;

d) for temporary steel struts, the design must consider strut and waler stiffness, preload and maximum axial force;

e) in a rail environment, the Contractor must apply the collision loads to the props as set out in AS 5100.2 Bridge design, Part 2: Design loads, clause 11.4.3, as a minimum; and

f) the flicker or strobing effect to road users of any propping must be considered and mitigated where required.

7 Piling for retaining walls

a) All piling must be designed in accordance with:

   i) ST-SD-D1 “Design of Structures”;

   ii) AS 5100 Bridge design;

   iii) AS 2159 Piling - Design and installation, and

   iv) the Durability Report.

b) The piling design must take into account the safety of pile installation methods, vibration and noise, particularly where there are adjacent residential properties.

c) The portions of concrete piles in soil strata which have an exposure classification as per AS 2159 Piling - Design and installation, in the range of moderate to very severe, must be designed with sufficient durability to demonstrate the piles and pile caps achieve the specified Design Life using strategies including:

i) additional concrete cover (minimum 100 mm cover incorporating allowances for construction tolerances);

ii) specialised concrete mix designs; and

iii) appropriate construction material, equipment, and methodologies.

d) The piling design must include the full specifications for testing of piles and pile materials, which must be included in the Design Documentation.

e) For piled retaining structures subject to lateral loading only:

i) dynamic testing of piles is not required to be undertaken; and

ii) integrity testing is required to be undertaken.

f) Where piles are visible, the Contractor must prepare a finished surface specification detailing acceptance provisions for making good soil inclusions and pile bulging and the overall appearance of piles with respect to the urban design framework and durability requirements.

g) The Design Documentation must include:

i) details of fixing provisions for pile retaining wall façades such that the durability of the piles is not compromised;

ii) details of the acceptable tolerance for installed piles (including horizontal tolerance, verticality, cage depth, toe level and cut off level); and

iii) with respect to the design of continuous flight auger (CFA) piles, consideration of the available rig sizes required such that there is no need to withdraw the auger or to pause to add and remove additional auger lengths to achieve the target depth.

8 Secant pile walls

8.1 General

a) The Contractor must demonstrate how a watertight structure is to be built within tolerance to comply with this Master Specification Part. The Design Documentation must include:

i) information on the concrete mixes (to facilitate secant pile wall construction and permeability following construction); and

ii) cladding details and fixing tolerances to accommodate wall movements.

b) Bored piles formed by the CFA or rotary bored method may be used to construct a secant pile wall.

8.2 Design requirements for secant pile walls

Secant pile walls must comply with the following design requirements:

a) pile tolerances must meet or not exceed those required by AS 2159 Piling - Design and installation and additionally as necessary to meet the watertightness requirements set out in section 3x);

b) where cladding is provided, secant pile wall materials and tolerances must provide an appropriate degree of construction tolerance (in plan view) to facilitate cladding;

c) design tolerances must take into account requirements for any attached cladding or waterproofing of the lowered structure; and

d) following consultation with a suitably qualified piling contractor, it must be demonstrated that consideration has been given to the order and timing of the pile installation to ensure the success of the pile wall. The Contractor must carefully consider and balance the strength of the primary piles at the time of the secondary pile installation to ensure that the secondary piles do not damage any primary piles, or run off course due to stronger primary piles.

8.3 Materials and durability

a) The Contractor must develop an appropriate weak concrete mix for primary piles in accordance with the Reference Documents and demonstrate the suitability of its approach in the Design Documentation.

b) The Contractor must consider the following in relation to the design of the primary pile mix:

i) weak mixes and short-term low strengths required for the primary piles have been an issue for batching plants in the past;

ii) primary pile mixes assist with achieving more accurate (subsequent) secondary CFA pile installations. Conversely the permeability of the primary piles affects the long-term performance and permeability of the wall, and these opposing factors need to be carefully considered and balanced; and

iii) issues regarding the importance of achieving appropriate weak concrete mixes consistently as considered in N. Wharmby, B. Perry and H. Waikato “Development of Secant Pile Retaining Wall Construction Urban New Zealand”, New Zealand Concrete Industry Conference, Wellington, New Zealand 2010.

c) Preconstruction testing must be carried out to demonstrate confidence in the primary pile mix.

9 Diaphragm walls

9.1 Design Documentation

The design of diaphragm walls must include the following design outputs as part of the Design Documentation:

a) design calculations and construction details for guide walls;

b) trench stability calculations, considering the head of bentonite slurry that will be maintained for each panel, the maximum allowable groundwater level, the lowest slurry density used in practice, surcharge, guide wall bearing capacity and panel length;

c) calculations of anticipated ground vibration, ground movement and groundwater drawdown, considering the operations of grabs or reverse circulation mills;

d) structural capacity of wall panels to resist load effects from the ground and groundwater;

e) calculations and construction details to achieve the required water resistance and watertightness, including the durability of waterproof joints and waterbars and any connections between the wall and adjacent infrastructure elements (such as base and roof slabs);

f) details of joints and stop ends;

g) details of all cast-in and embedded items including allowances for tolerances and durability; and

h) “soft-eye” design for panels for tunnel boring machine break-in and break-out.

9.2 Design requirements for diaphragm walls

a) The diaphragm wall design must take into account the construction tolerances given in ST-PI-C4 “Diaphragm Walls”.

b) The panel dimensions must take into account the dimensions of available excavating equipment, the method and sequence of excavation, panel stability during excavation and concrete supply.

c) The width of the excavating tool must be at least equal to the design wall thickness.

d) The panels must be designed as vertical elements, with the same horizontal cross-section throughout their depth.

e) A reinforced concrete capping beam must be constructed along the top of reinforced concrete diaphragm walls, where it is necessary to distribute loads or minimize differential displacements between adjacent panels.

f) The diaphragm wall design must consider waterproofing requirements set out in section 9.3.

9.3 Groundwater seepage and waterproofing

a) In relation to groundwater seepage, the Contractor must ensure that:

i) diaphragm walls are not visibly wet from groundwater seepage. Visible weep-holes must not be used;

ii) groundwater does not drip or flow on to or over road pavements, walkways, egress passages, traffic barriers or areas that contain mechanical or electrical equipment;

iii) there are no adverse effects as a result of groundwater chemistry on the overall structural integrity of the diaphragm walls; and

iv) there are no material groundwater chemistry impacts on drainage systems for, including the potential for the precipitation of insoluble salts to reduce the effectiveness of the relevant drainage system.

b) Unless otherwise specified in the Contract Documents, the Contractor must ensure that the following groundwater ingress requirements are met throughout the Design Life of the diaphragm walls:

i) diaphragm walls must meet the watertightness requirements set out in section 3x); and

ii) there must be no groundwater seepage through the pavements and floors (0 l/s).

c) The degree of watertightness must be increased above that specified in the Contract Documents where required to satisfy occupation, health, and safety standards in relation to:

i) contaminated ground or groundwater; or

ii) the usage of the internal space.

d) Access covers must be provided that achieve the specified watertightness requirement of the pavements and floors in which they are installed.

9.4 Structural design requirements

9.4.1 Durability

a) The Durability Report must address the durability of diaphragm walls in accordance with the requirements of ST-SD-D1 “Design of Structures”.

b) Reinforced concrete walls must be maintenance free and must not contain any permanent pre-stressed elements that require pre-stressing and servicing during the Design Life.

9.4.2 Jointing and details

a) The design of the diaphragm wall must take into account the discontinuity of the reinforcement at the joints between the panels and between adjacent reinforcement cages in the same panel.

b) The design of the diaphragm wall must allow space between reinforcement cages of adjacent panels to accommodate the type of joints to be made and to take account of the construction tolerances set out in ST-PI-C4 “Diaphragm Walls”.

c) The design of the diaphragm wall must allow space in the reinforcement cage for the installation of the tremie pipe.

d) The design of the diaphragm wall must allow space in the reinforcement cage for the installation of inserts, reservations, and connectors.

9.4.3 Crack widths

a) The provisions of AS 5100 Bridge design for limiting steel stress in reinforcement must apply where cracks are not expected to extend the full width of the diaphragm wall.

b) Where cracking may extend the full thickness of the diaphragm wall reference must be made to the provisions of EN 1992-3:2006 Eurocode 2 - Design of concrete structures - Part 3: Liquid retaining and containment structures for water tightness class 1.

10 Hold Points

Table ST-RE-D2 10-1 details the review period or notification period, and type (documentation or construction quality) for each Hold Point referred to in this Master Specification Part.

Table ST-RE-D2 10-1 Hold Points

Section reference	Hold Point	Documentation or construction quality	Review period or notification period
5b)	Acceptance of the application of unsaturated soil mechanics theory	Documentation	10 Business Days review