Code of Practice for Foundations 2017

The Buildings Department has set up a Technical Committee (TC) to, among others, collect and consider the views and feedback from the building industry arising from the use of the Code of Practice for Foundations 2017 (the Code). Taking into account the advice of the TC, the following amendments to the Code have been promulgated:

(a) Appendix A1 – February 2021;

(b) Appendix A2 – July 2022; and

(c) Appendix A3 – August 2023

2. Complying with requirements of the Code will be 'deemed-to-satisfy' the relevant provisions of the Building (Construction) Regulation. Authorized persons (AP), registered structural engineers (RSE) and registered geotechnical engineers (RGE) should observe the requirements stipulated in the Code as well as the latest supplementary guidelines and requirements in relation to foundation works stipulated in other relevant Practice Notes for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers issued by the Building Authority (BA) listed in Appendix B.

3. AP/RSE/RGE should also observe the design, construction, administrative and procedural requirements relating to foundation works as listed in Appendix C.

(YU Po-mei, Clarice)
Building Authority

Ref. : BD GP/BREG/C/11 (IV)

First issue February 1980
Last revision March 2021
This revision August 2023 (AD/NB2) (General revision)

Appendix A1
(PNAP APP-18)

Amendments to the Code of Practice for Foundations 2017

(February 2021)

Legends:

Amended

Deleted

(8/2023)

Amendments to the Code of Practice for Foundations 2017 (February 2021)

Item	Current version	Amendments
1. Clause 1.2 [1]	*Meta-sedimentary rock.* A sedimentary rock that shows evidence of having been subjected to metamorphism that differs from the conditions under which the sedimentary rock originated. *Negative skin friction.* The downdrag skin friction resulted from the consolidation of compressible soil strata.	*Meta-sedimentary rock.* A sedimentary rock that shows evidence of having been subjected to metamorphism that differs from the conditions under which the sedimentary rock originated. *Minor or temporary structures.* External building works designated as minor works items under the Minor Works Control System and other minor structures such as covered walkway, disabled ramp, hoarding, pavilion, pergola and security kiosk, etc. *Negative skin friction.* The downdrag skin friction resulted from the consolidation of compressible soil strata.

[1] Addition of "minor or temporary structures" in the glossary.

Item	Current version	Amendments
2. Clause 2.2.2(5) 1st paragraph [2]	**(5) Footings of Minor Temporary Structures** A presumed allowable vertical bearing pressure of 100 kPa (if dry) or 50 kPa (if submerged) may be used for the design of footings on horizontal ground of minor temporary structures such as fencing and hoarding.	**(5) Footings of Minor or Temporary Structures** A presumed allowable vertical bearing pressure of 100 kPa (if dry) or 50 kPa (if submerged) may be used for the design of footings of minor or temporary structures on flat ground and founded on granular materials.
3. Table 2.1 Notes [3]	Notes: (11) The use of presumptive values does not preclude the requirement for consideration of settlement of the structure.	Notes: (11) The use of presumptive values does not preclude the requirement for consideration of settlement of the structure. (12) Category 2 rock should exclude marble and marble-bearing rocks.

[2] Revision of the design requirements for footings of minor or temporary structures.

[3] Clarification on the definition of category 2 rock.

Item	Current version	Amendments
4. Clause 2.2.4 Notes [4]	Notes: (1) A shallow foundation is taken as one in which the depth to the bottom of foundation is less than or equal to 3m. (2) q should not include any overburden pressure that may be temporarily or permanently removed during the design life of the foundation. In its derivation, the maximum effective overburden depth of subsoil should not be greater than B_f and suitable adjustments should be made to discount any voids that may be allowed for underground utilities. (3) Figure 2.2 shows the generalised loading and geometric parameters for the design of a shallow foundation and the bearing capacity factors are given in Table 2.3. (4) Any weak geological features present in the ground may affect the validity of the bearing capacity equation. Therefore the geological characteristics of the ground should be considered in the evaluation of the bearing capacity.	Notes: (1) q should not include any overburden pressure that may be temporarily or permanently removed during the design life of the foundation. In its derivation, the maximum effective overburden depth of subsoil should not be greater than 3 m or B_f, whichever is the lesser, and suitable adjustments should be made to discount any voids that may be allowed for underground utilities. (2) Figure 2.2 shows the generalised loading and geometric parameters for the design of a shallow foundation and the bearing capacity factors are given in Table 2.3. (3) Any weak geological features present in the ground may affect the validity of the bearing capacity equation. Therefore the geological characteristics of the ground should be considered in the evaluation of the bearing capacity.

[4] Note (1) is deleted. Derivation of the maximum effective overburden depth of subsoil in Note (2) is revised to incorporate the criterion specified in Note (1).

Item	Current version	Amendments
	(5) For shallow foundations on or near the crest of a slope, the ultimate bearing capacity may be obtained by linear interpolation between the value for the foundation resting at the edge of the slope and that at a distance of four times the foundation width from the crest. The latter may be assumed to be equal to that of a foundation placed on flat ground. Figure 2.3 summarizes the procedures for the linear interpolation. The effect of the foundation works on the overall stability of the slope should also be checked.	(14) For shallow foundations on or near the crest of a slope, the ultimate bearing capacity may be obtained by linear interpolation between the value for the foundation resting at the edge of the slope and that at a distance of four times the foundation width from the crest. The latter may be assumed to be equal to that of a foundation placed on flat ground. Figure 2.3 summarizes the procedures for the linear interpolation. The effect of the foundation works on the overall stability of the slope should also be checked.
	(6) The bearing capacity equation is applicable to rectangular shaped shallow foundations. For shallow foundation of an irregular shape, the calculation may be based on the largest inscribed rectangle as shown in Figure 2.4.	(15) The bearing capacity equation is applicable to rectangular shaped shallow foundations. For shallow foundation of an irregular shape, the calculation may be based on the largest inscribed rectangle as shown in Figure 2.4.
	(7) The effective unit weight of the soil γ_s' may be taken as follows: (a) Dry condition (see clause 1.2 for definition): $\gamma_s' = \gamma$ where γ is the bulk unit weight of the soil	(16) The effective unit weight of the soil γ_s' may be taken as follows: (a) Dry condition (see clause 1.2 for definition): $\gamma_s' = \gamma$ where γ is the bulk unit weight of the soil

Item	Current version	Amendments
	(b) Submerged condition (see clause 1.2 for definition): (i) For static groundwater: $\gamma_s' = \gamma'$ where γ' is the submerged unit weight of the soil (ii) For groundwater flows under an upward hydraulic gradient: $\gamma_s' = \gamma - \gamma_w (1 + i)$ where i is the upward hydraulic gradient; and γ_w is the unit weight of water. (c) For intermediate groundwater levels, γ_s' may be interpolated between the above limits.	(b) Submerged condition (see clause 1.2 for definition): (i) For static groundwater: $\gamma_s' = \gamma'$ where γ' is the submerged unit weight of the soil (ii) For groundwater flows under an upward hydraulic gradient: $\gamma_s' = \gamma - \gamma_w (1 + i)$ where i is the upward hydraulic gradient; and γ_w is the unit weight of water. (c) For intermediate groundwater levels, γ_s' may be interpolated between the above limits.

Item	Current version	Amendments
5. Clause 2.3.2(2) 1st and 2nd paragraphs [5 & 6]	**(2) Reference Criteria** For buildings or structures not particularly sensitive to movement, the following movement criteria, evaluated at the base of a shallow foundation or in case of a deep foundation, the base of pile cap, may be used as a reference for developing case specific criteria: (a) The maximum total settlement should not exceed 30 mm; (b) The differential settlement between columns/ vertical elements should be limited to 1:500; and (c) The maximum angular rotation should not exceed 1:500 due to wind or other transient loads.	**(2) Reference Criteria** For buildings or structures not particularly sensitive to movement, the following movement criteria, evaluated at the base of a shallow foundation or in case of a deep foundation, the base of pile cap or the equivalent raft level for driven piles, may be used as a reference for developing case specific criteria: (a) The maximum total settlement should not exceed 30 mm; (b) The differential settlement between columns/ vertical elements should be limited to 1:500; and (c) The maximum angular rotation should not exceed 1:500 due to wind or other transient loads.

[5] Equivalent raft level for driven piles may be used as a reference for developing case specific criteria.

[6] Dead loads may be reduced to 50% for consideration in criteria 2.3.2(2)(a) and (b).

Item	Current version	Amendments
	The above criteria should be assessed based on working loads. For criteria (a) and (b), the full dead loads should be considered, and the imposed loads may be reduced in accordance with the Code of Practice for Dead and Imposed Loads.	The above criteria should be assessed based on working loads. For criteria (a) and (b), the dead loads may be reduced to 50%, and the imposed loads may be reduced in accordance with the Code of Practice for Dead and Imposed Loads.
6. Clause 2.5.4(1)[7]	**(1) General** The foundations shall be so designed and constructed to fulfil the requirements given in this clause.	**(1) General** The foundations should be so designed and constructed to fulfil the requirements given in this clause. Note : For design of foundations to resist accidental loads, reference should be made to the relevant technical guidelines by government departments, e.g. GEO Technical Guidance Note No. 42 for the design of landslide debris impact loads.

[7] Addition of a note on reference guidelines for design of foundations to resist accidental loads.

Item	Current version	Amendments
7. Clause 4.2.2(2) 1st and 2nd paragraphs [8]	**(2) Testing Requirements** … (b) the allowable bearing pressure (q_a) determined by the bearing capacity equations given in clause 2.2.4 or other methods, except the footings of minor temporary structures described in clause 2.2.2(5); or (c) the Young's modulus, E_s (in MPa), of the bearing strata used in the estimation of settlement is greater than 1 times the SPT N-value. The number of tests should be determined with due consideration on the extent of the foundations and the variation of geology of the founding strata, and in no case be less than 2. The tests should be carried out in accordance with clause 8.2.	**(2) Testing Requirements** … (b) the allowable bearing pressure (q_a) determined by the bearing capacity equations given in clause 2.2.4 or other methods, except the footings of minor or temporary structures described in clause 2.2.2(5); or (c) the Young's modulus, E_s (in MPa), of the bearing strata used in the estimation of settlement is greater than 1 times the SPT N-value. The number of tests should be determined with due consideration on the extent of the foundations and the variation of geology of the founding strata, and should not be less than one per soil type for each of the first two 500 m^2 and one for every subsequent 1 000 m^2 of the site coverage area(s) of a building. Any fraction of the test so calculated should be construed as one test. The tests should be carried out in accordance with clause 8.2.

[8] Revision of the testing requirements for shallow foundations on soil.

Item	Current version	Amendments
8. Clause 5.1.1 3rd paragraph [9]	Application for a recognized type of pile should be made prior to seeking approval of foundation plans using such type of pile whenever possible.	Enquiry on any non-recognised pile system should be made to the Building Authority in advance to settle the design principles, prior to the submission of foundation plans using such pile system to the Building Authority for approval whenever possible.
9. Clause 5.2.3(c) 1st paragraph [10]	**5.2.3 ALTERNATIVE APPROACH** … (c) The settlement behaviour of the piles under total loads should be satisfactory.	**5.2.3 ALTERNATIVE APPROACH** … (c) The settlement behaviour of the piles under total loads including NSF should be satisfactory.

[9] Revision of the requirement for using non-recognised type of piling system.

[10] Clarification on the design requirement for the alternative approach to consider negative skin friction.

Item	Current version	Amendments
10. Clause 5.3.3(1) 2nd paragraph [11]	The anchorage resistance of the piles to resist uplifting force can be determined from sub-clauses (2) and (3) below as appropriate. Where other engineering methods are used and the allowable uplift resistance of the pile shaft is based on the ultimate uplift capacity of the pile shaft, the applied factor of safety should not be less than 3 unless the ultimate uplift capacity or the parameters for assessing the ultimate uplift capacity have been verified by tests. In no cases should this factor of safety be less than 2. (a) Anchorage resistance of piles In general, the anchorage resistance of a pile may be taken as: R_a = allowable uplift resistance of pile shaft + effective self weight of pile; and R_u = ultimate uplift resistance of pile shaft + effective self weight of pile	The anchorage resistance of the piles to resist uplifting force can be determined from sub-clauses (2) and (3) below as appropriate. (a) Anchorage resistance of piles In general, the anchorage resistance of a pile may be taken as: R_a = allowable uplift resistance of pile shaft + effective self weight of pile; and R_u = ultimate uplift resistance of pile shaft + effective self weight of pile The ultimate and allowable anchorage resistance of the piles derived from bond resistance can be determined from sub-clause (2)(a) below. The ultimate and allowable anchorage resistance of the piles derived from frictional resistance can be determined from sub-clause (3)(a) or (3)(b) below.

[11] The contents of this paragraph are re-arranged.

Item	Current version	Amendments
	The ultimate and allowable anchorage resistance of the piles derived from bond resistance can be determined from sub-clause (2)(a) below. The ultimate and allowable anchorage resistance of the piles derived from frictional resistance can be determined from sub-clause (3)(a) or (3)(b) below.	Where other engineering methods are used and the allowable uplift resistance of the pile shaft is based on the ultimate uplift capacity of the pile shaft, the applied factor of safety should not be less than 3 unless the ultimate uplift capacity or the parameters for assessing the ultimate uplift capacity have been verified by tests. In no cases should this factor of safety be less than 2.
11. Clause 5.4.11(2)(b) [12]	(b) Piles should be founded on or close to rock not inferior to category 1(d) defined in Table 2.1. Piles may be considered as founded on rock when driven to refusal by using sufficient driving energy. Driven to refusal means the actual penetration of a pile is not more than 10mm per 10 blows and the requirements specified in item (5)(d) are complied with;	(b) Piles should be founded on or close to rock materials not inferior to moderately decomposed, moderately strong to moderately weak rock of material weathering grade III or better, and with not less than 50% TCR of the designated grade. For piles driven to marble and marble-bearing rocks, the design should refer to clause 2.8.2.4(3). The piles may be considered as founded on rock when driven to refusal by using sufficient driving energy. Driven to refusal means the actual penetration of a pile is not more than 10mm per 10 blows and the requirements specified in item (5)(c) are complied with;

[12] Revision of the criteria of founding materials.

Item	Current version	Amendments
12. Clause 5.4.11(5)(c) [13]	(c) Dynamic load tests should be carried out to verify the capacity of at least 10% of the working piles, half of which should be selected from the group of piles with greater depth. The peak driving stress at final set should also be measured which should not be less than 75% of the yield stress of the pile.	(c) Dynamic load tests should be carried out on at least 10% of the working piles, half of which should be selected from the group of piles with greater depth. The peak driving stress at final set should also be measured which should not be less than 75% of the yield stress of the pile. Alternatively, a borehole in addition to clause 7.4.4 should be carried out at a distance not more than 2 m measured from the centre of the concerned pile to verify whether the pile base is terminated on or very close to bedrock.

[13] Provision of an alternative method in lieu of dynamic load tests.

Appendix A2
(PNAP APP-18)

Amendments to the Code of Practice for Foundations 2017

(July 2022)

Legends:

Amended

Deleted

(8/2023)

Amendments to the Code of Practice for Foundations 2017 (July 2022)

Item	Current version	Amendments
1. Clause 4.2.2(2)(a) [1]	**(2) Testing Requirements** When one of the following conditions applies, a sufficient number of plate load tests should be carried out to verify the allowable bearing pressure and settlement estimation for shallow foundations: (a) the allowable bearing pressure (q_a) based on the presumed values in Table 2.1 exceeds 300 kPa (unless the net increase in bearing pressure (i.e. q_a - q_o) is less than 50 kPa); or	**(2) Testing Requirements** When one of the following conditions applies, a sufficient number of plate load tests should be carried out to verify the allowable bearing pressure and settlement estimation for shallow foundations: (a) the allowable bearing pressure (q_a) based on the presumed values in Table 2.1 exceeds 300 kPa (unless the net increase in bearing pressure (i.e. q_a - q_o) is less than 50 kPa), except category 3 intermediate soil; or
2. Clause 5.3.3(1)(a) and (b) [2 & 3]	(a) Anchorage resistance of piles …… Proof test is normally required to justify the tension capacity of piles unless such capacity is taken as less than half of the compressive capacity resulting only from shaft friction and bond between the pile and the surrounding soil. In any case, the adequacy of the related soil mass and rock cone supporting the pile should be checked for uplifting effect.	(a) Anchorage resistance of piles …… Proof test is normally required to justify the tension capacity of piles. When the tension capacity of piles is taken as less than half of the compressive capacity resulting only from shaft friction and bond between the pile and the surrounding soil/rock, and the tension piles have already been considered for selection for compression proof test, then tension proof test is not required. In any case, the adequacy of the related soil column and rock or soil cone supporting the pile should be checked for uplifting effect.

Item	Current version	Amendments
	(b) Anchorage resistance limited by effective weight of soil mass/rock cone The anchorage resistance against uplifting force would be limited by the effective weight of the soil mass and rock cone that can be mobilised by the piles. The ultimate anchorage resistance of a pile or a pile group, R_u, therefore should not exceed the effective weight of the soil mass and rock cone as derived from sub-clauses (2)(b) and (3)(c) below such that:	(b) Anchorage resistance limited by effective weight of soil column and rock or soil cone The anchorage resistance against uplifting force would be limited by the effective weight of the soil column and rock or soil cone that can be mobilised by the piles. The ultimate anchorage resistance of a pile or a pile group, R_u, therefore should not exceed the effective weight of the soil column and rock or soil cone as derived from sub-clauses (2)(b) and (3)(c) below such that:

[1] Exclusion of category 3 intermediate soil from the requirement of plate load test.

[2] Clarification on the proof test requirement for tension piles.

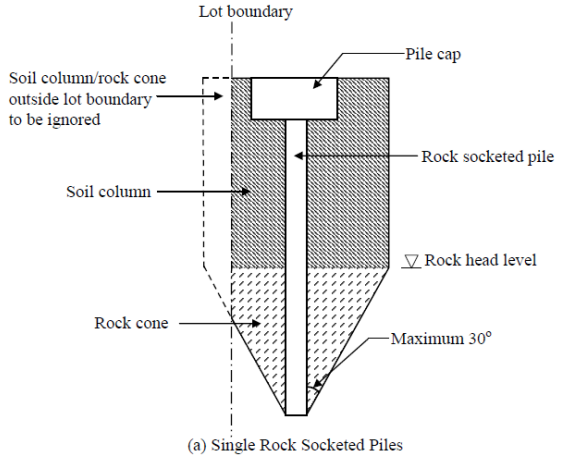
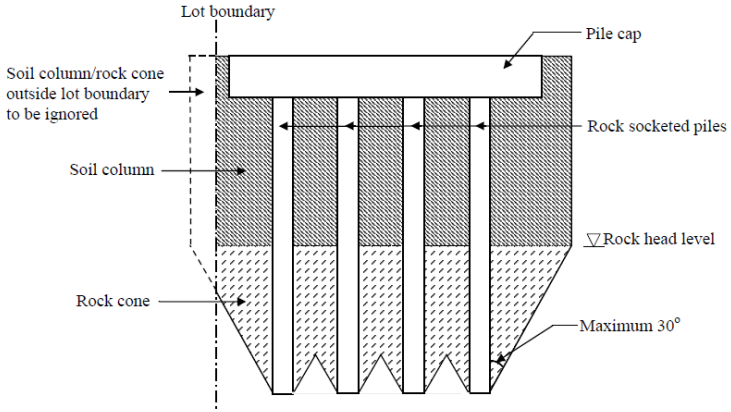
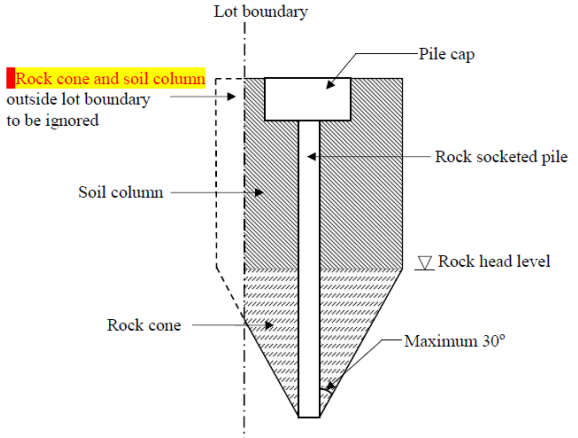
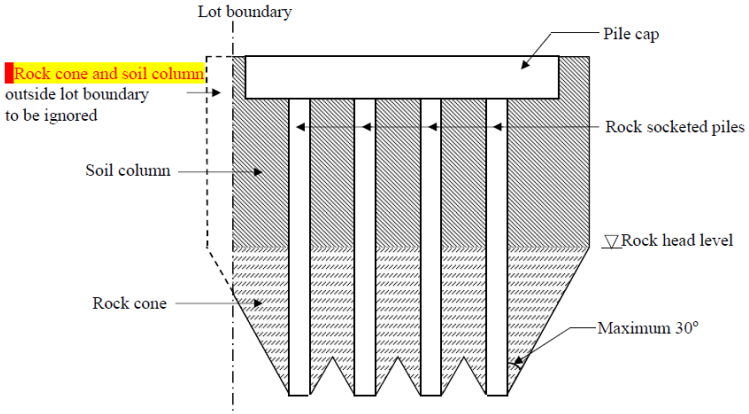
[3] Clarification on the checking of the related soil column and rock or soil cone.

Item	Current version	Amendments
3. Clause 5.3.3(2)(b) [4 & 5]	(b) Assessment of the effective weight of the rock cone and soil column For single or group of closely-spaced piles (i.e. with overlapping rock cone/soil column) that derive the ultimate tension resistance from rock socket, the configuration of the rock cone/soil column as given in Figure 5.1 may be used, and the assessment of the effective weight of the rock cone and soil column should be based on the following assumptions : (i) The half angle of the rock cone at the toe of the pile should not exceed 30 degree measuring from the vertical. (ii) Only the column of overburden soil directly above the rock cone should be considered, and the soil friction at the vertical face of such soil column above the rock cone should be ignored. (iii) Effective weight of the rock cone and the soil column should be adopted. Any part of the rock cone or soil column falling outside the lot boundary should be ignored. (iv) For a group of closely-spaced piles subjected to tension, overlapping effect should be considered when assessing the volume of rock/soil cone to be	(b) Assessment of the effective weight of the rock cone and soil column For single or group of closely-spaced piles (i.e. with overlapping rock cone and soil column) that derive the ultimate tension resistance from rock socket, the configuration of the rock cone and soil column as given in Figure 5.1 may be used, and the assessment of the effective weight of the rock cone and soil column should be based on the following assumptions : (i) The half angle of the rock cone at the toe of the pile should not exceed 30 degree measuring from the vertical. (ii) Only the column of overburden soil directly above the rock cone should be considered, and the soil friction at the vertical face of such soil column above the rock cone should be ignored. (iii) Effective weight of the rock cone and the soil column should be adopted. Any part of the rock cone and soil column falling outside the lot boundary should be ignored. (iv) For a group of closely-spaced piles subjected to tension, overlapping effect should be considered when assessing the volume of rock cone and soil

Item	Current version	Amendments
	used for resisting the combined uplift force.	column to be used for resisting the combined uplift force.
	(v) For a group of piles with same individual tension capacity, checking of rock/soil cone failure of individual pile is not necessary when the group effect has been considered as stated in (iv) above.	(v) For a group of piles of the same size with the same individual allowable anchorage resistance, checking of overlapping effect on rock cone failure of individual pile is not necessary when the group effect has been considered as stated in (iv) above.
	(vi) Where the tension capacities of piles within a pile group are not the same, checking of rock/soil cone failure of individual pile is required. The effective weight of the overlapping part of rock cones between piles may be distributed to each pile on a pro-rata basis according to the tension capacities of the piles.	(vi) Where the allowable anchorage resistances of piles within a pile group are not the same, checking of overlapping effect on rock cone failure of individual pile is required. The effective weight of the overlapping part of rock cones and soil columns between piles may be distributed to each pile on a pro-rata basis according to the allowable anchorage resistances of the piles.

[4] Clarification on the checking of overlapping effect on rock cone failure for piles with rock socket.

[5] Clarification on the assessment concerning the rock cone and soil column.

Item	Current version	Amendments
4. Figure 5.1 [6]	 (a) Single Rock Socketed Piles  (b) Group of Closely-Spaced Rock Socketed Piles **Figure 5.1 Configuration of Rock Cone/Soil Column for Rock Socketed Piles**	 (a) Single Rock Socketed Piles  (b) Group of Closely-Spaced Rock Socketed Piles **Figure 5.1 Configuration of Rock Cone and Soil Column for Rock Socketed Piles**

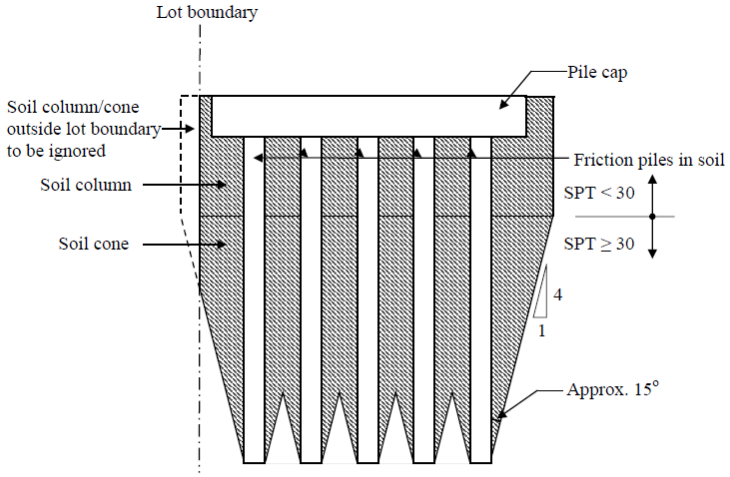
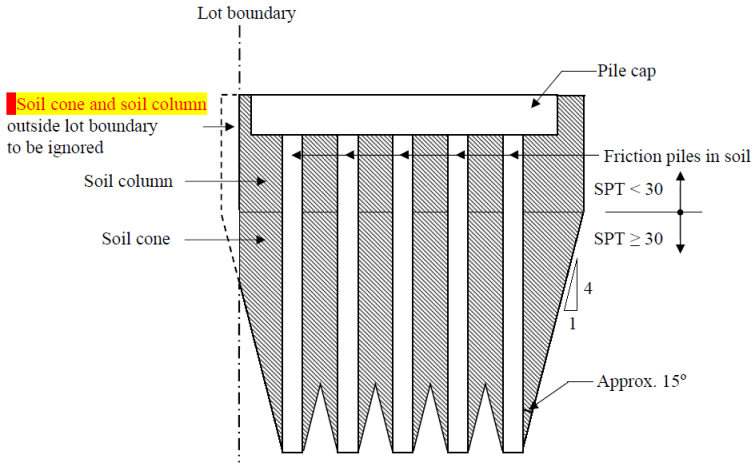
[6] Clarification on the assessment concerning the rock cone and soil column.

Item	Current version	Amendments
5. Clause 5.3.3(3)(c) [7 & 8]	(c) Assessment of the effective weight of the soil cone/soil column For a group of closely-spaced piles (i.e. with overlapping soil cone/soil column) that derive the ultimate tension resistance from friction in granular soil, the configuration of the soil cone/soil column as given in Figure 5.2 may be used, and the assessment of the effective weight of the soil cone/soil column should be based on the following assumptions: (i) For single pile subjected to tension, checking on soil cone failure is not required. (ii) For soil with an SPT N-value of not less than 30, the angle of dilation of the soil cone should not exceed 1 in 4 (i.e. approximate 15 degree). For soil with an SPT N-value of less than 30, the angle of dilation of the soil cone should be taken as zero. (iii) Skin friction on the face of the soil cone/soil column should be ignored. (iv) Effective weight of the soil cone/soil column should be adopted. Any part of the soil cone/soil column falling outside the lot boundary should be ignored. (v) For a group of closely-spaced piles with same	(c) Assessment of the effective weight of the soil cone and soil column For a group of closely-spaced piles (i.e. with overlapping soil cone and soil column) that derive the ultimate tension resistance from friction in granular soil, the configuration of the soil cone and soil column as given in Figure 5.2 may be used, and the assessment of the effective weight of the soil cone and soil column should be based on the following assumptions: (i) For single pile subjected to tension, checking on soil cone failure is not required. (ii) For soil with an SPT N-value of not less than 30, the angle of dilation of the soil cone should not exceed 1 in 4 (i.e. approximate 15 degree). For soil with an SPT N-value of less than 30, the angle of dilation of the soil cone should be taken as zero. (iii) Skin friction on the face of the soil cone and soil column should be ignored. (iv) Effective weight of the soil cone and soil column should be adopted. Any part of the soil cone and soil column falling outside the lot boundary should be ignored. (v) For a group of closely-spaced piles of the same size

Item	Current version	Amendments
	individual tension capacity, overlapping effect of the soil cones should be considered when assessing the volume of soil cone/soil column to be used for resisting the combined uplift force.	with the same individual tension capacity, overlapping effect of the soil cones should be considered when assessing the volume of soil cones and soil columns to be used for resisting the combined uplift force.
	(vi) Where the tension capacities of piles within a pile group are not the same, checking of soil cone failure of individual pile is required. The effective weight of the overlapping part of soil cones and columns between piles may be distributed to each pile on a pro rata basis according to the tension capacities of the piles.	(vi) Where the tension capacities of piles within a pile group are not the same, checking of overlapping effect on soil cone failure of individual pile is required. The effective weight of the overlapping part of soil cones and soil columns between piles may be distributed to each pile on a pro-rata basis according to the tension capacities of the piles.

[7] Clarification on the checking of overlapping effect on soil cone failure for piles in granular soil.

[8] Clarification on the assessment concerning the soil cone and soil column.

Item	Current version	Amendments
6. Figure 5.2 [9]	 **Figure 5.2 Configuration of Soil Cone/Soil Column for Group of Closely-spaced Friction Piles in Soil**	 **Figure 5.2 Configuration of Soil Cone and Soil Column for Group of Closely-spaced Friction Piles in Soil**
7. List of Figures[10]	……	……
	Figure 5.1 Configuration of Rock Cone/Soil Column for Rock Socketed Piles	Figure 5.1 Configuration of Rock Cone and Soil Column for Rock Socketed Piles
	Figure 5.2 Configuration of Soil Cone/Soil Column for Group of Closely-spaced Friction Piles in Soil	Figure 5.2 Configuration of Soil Cone and Soil Column for Group of Closely-spaced Friction Piles in Soil

[9] Clarification on the assessment concerning the soil cone and soil column.

[10] Corresponding amendment to the titles of the figures.

Appendix A3
(PNAP APP-18)

Amendments to the Code of Practice for Foundations 2017

(August 2023)

Legends:

Amended

Deleted

(8/2023)

Amendments to the Code of Practice for Foundations 2017 (June 2023)

Item	Current version	Amendments
1. Contents [1]	**5. Pile Foundations** 5.1 General 5.1.1 Recognized Types of Pile Foundations … **8. Testing of Foundations and Ground** 8.5 Core-Drilling Test	**5. Pile Foundations** 5.1 General 5.1.1 Common Pile Foundation Types … **8. Testing of Foundations and Ground** 8.5 Proof Core-Drilling Test
2. List of Tables [2]	Table 2.9 Reference Value for Redundancy Factor	Table 2.9 Reference Value for Redundancy Factor Table 2.10 Presumed Allowable Vertical Bearing Pressure under Foundations on Marble Bedrock and Presumed Allowable Bond or Friction Between Marble and Concrete or Grout for Piles
3. Table 2.1 Notes: (6) [3]	Notes: (6) The bearing surface of rock on which the foundation will be rested should be of the designated category and in an intact condition for a depth not less than 600 mm.	Notes: (6) The bearing surface of rock on which the foundation will be rested should be of the designated category and no rock core within 600 mm depth from the pile base is logged as "non-intact" in accordance with GEOGUIDE 3.

[1] Revision of recognized types of pile foundations to common pile foundation types and core-drilling test to proof core-drilling test.

[2] Inclusion of Table 2.10.

[3] Clarification on rock condition within 600 mm depth from the pile base.

Item	Current version	Amendments
4. Table 2.1 Notes [4]	Notes: (12) Category 2 rock should exclude marble and marble-bearing rocks.	Notes: (12) Category 2 rock should exclude marble and marble-bearing rocks. (13) Reference should be made to clause 2.8 and GEO Technical Guidance Note No. 26 (TGN 26) for foundation design in areas underlain by marble and marble-bearing rocks.
5. Table 2.2 Notes [4]	Notes: (2) The presumed value of transient tension is for design for transient load such as wind load.	Notes: (2) The presumed value of transient tension is for design for transient load such as wind load. (3) Reference should be made to clause 2.8 and GEO TGN 26 for foundation design in areas underlain by marble and marble-bearing rocks.

[4] Addition of a note on reference for foundation design in areas underlain by marble and marble-bearing rocks.

<table>
<tr><th>Item</th><th>Current version</th><th>Amendments</th></tr>
<tr><td>6. Clause 2.8.2.4 [5]</td><td>2.8.2.4 FOUNDATIONS BEARING ON MARBLE BEDROCK

(3) Piles Driven to Marble Bedrock
…</td><td>2.8.2.4 FOUNDATIONS BEARING ON MARBLE BEDROCK

(3) Piles Driven to Marble Bedrock
…
(4) Presumed Allowable Bearing Pressure and Bond or Friction

The presumed allowable bearing pressure under foundations on marble bedrock and the presumed allowable bond or friction between marble and concrete or grout for piles as stipulated in Table 2.10 could be applicable in lieu of rational design method.

Table 2.10 Presumed Allowable Vertical Bearing Pressure under Foundations on Marble Bedrock and Presumed Allowable Bond or Friction Between Marble and Concrete or Grout for Piles

<table><tr><th>Description of marble bedrock</th><th>Presumed allowable bearing pressure (kPa)</th><th>Presumed allowable bond or friction between rock and concrete or grout for piles (kPa)</th></tr></table></td></tr>
</table>

[5] Inclusion of presumed allowable bearing pressure and bond or friction for foundations bearing on marble bedrock and Table 2.10.

Item	Current version	Amendments
		Marble Class I or II and with not less than 95% TCR of the designated grade, which has a minimum UCS of rock material not less than 50 MPa (or an equivalent point load index strength PLI_{50} not less than 2 MPa) | 7 500 | 700 (under compression or transient tension) Marble Class I or II and with not less than 85% TCR of the designated grade, which has a minimum UCS of rock material not less than 25 MPa (or an equivalent point load index strength PLI_{50} not less than 1 MPa) | 5 000 | 350 (under permanent tension) Notes: (1) Notes on using presumed allowable bearing pressure and bond or friction as given in Table 2.1 and 2.2 respectively should also be applicable, where appropriate. The TCR of the designated grade shall also be proved within the zone of influence of the foundation load, whereas the minimum zone of influence should not be less than three times the diameter of the pile base.

Item	Current version	Amendments
7. Clause 5.1 1st paragraph [6]	All pile foundations should be durable, of adequate load carrying capacity and of a recognized type suitable for the ground conditions. The piles should be able to withstand the expected wear and deterioration throughout the intended design working life of the superstructure that they support.	All pile foundations should be durable, of adequate load carrying capacity and suitable for the ground conditions on which the foundations rest. The piles should be able to withstand the expected wear and deterioration throughout the intended design working life of the superstructure that they support.
8. Clause 5.1.1 [6]	**5.1.1 RECOGNIZED TYPES OF PILE FOUNDATIONS** A recognized type of pile foundation is a piling system which has been proved satisfactory to the Building Authority and incorporated into a list which is available from the homepage of the Buildings Department. The RSE usually in conjunction with the RSC experienced in a piling system which is not a recognized type may seek recognition of the system by submitting all technical details of the system to the Building Authority, including material specification, manufacturing process, method of installation, method of assessing pile capacity, applicability relating to ground conditions and selected examples of uses of the system elsewhere, if applicable. A demonstration of	**5.1.1 COMMON PILE FOUNDATION TYPES** The pile foundation types that are commonly used in Hong Kong and their particular requirements are given in clause 5.4.1 to 5.4.12.

[6] Revision of recognized types of pile foundations to common pile foundation types.

Item	Current version	Amendments
	the performance of the system is usually required. Enquiry on any non-recognised pile system should be made to the Building Authority in advance to settle the design principles, prior to the submission of foundation plans using such pile system to the Building Authority for approval whenever possible.	
9. Table 5.2 Notes [7]	Notes: (2) Subgrade reaction is to be reduced in the direction of loading.	Notes: (2) Subgrade reaction is to be reduced in the direction of loading. (3) For the ratio of pile spacing to pile diameter less than 3, alternative methods (e.g. elastic continuum method etc.) for checking the effect of lateral load on pile group should be used.
10. Clause 6.5.2(c)[8]	Load tests, core-drilling tests or any other suitable tests to confirm the load-carrying capacity, integrity and material properties of the existing foundations; and	Load tests, proof core-drilling tests or any other suitable tests to confirm the load-carrying capacity, integrity and material properties of the existing foundations; and

[7] Clarification on the reduction factor for horizontal subgrade reaction when ratio of pile spacing to pile diameter is less than 3.

[8] Revision of core-drilling tests to proof core-drilling tests.

Item	Current version	Amendments
11. Clause 6.5.3(b)[9]	Core-drilling test on each reuse pile to verify the concrete strength, founding level and founding condition. The core-drilling test should be carried out in accordance with clause 8.5.	Proof core-drilling test on each reuse pile to verify the concrete strength, founding level and founding condition. The proof core-drilling test should be carried out in accordance with clause 8.5.
12. Clause 6.5.6(b)[10]	Core-drilling tests on each reuse footing to verify the concrete strength, founding level and founding stratum condition.	Proof core-drilling tests on each reuse footing to verify the concrete strength, founding level and founding stratum condition.
13. Clause 7.4.4[11]	**7.4.4 POST CONSTRUCTION PROOF DRILLING** *Large Diameter Bored Piles, Barrettes and the Like* To ascertain the soundness of the interface, core-drilling should be carried out at the concrete/rock interface for each of the large diameter bored piles, barrettes and the like. The core-drilling should cover at least 1 m above and below the interface.	**7.4.4 POST CONSTRUCTION PROOF DRILLING** *Large Diameter Bored Piles, Barrettes and the Like* To ascertain the soundness of the interface, interface proof drilling should be carried out at the concrete/rock interface for each of the large diameter bored piles, barrettes and the like. The core-drilling should cover at least 1 m above and below the interface.

[9] Revision of core-drilling test to proof core-drilling test.

[10] Revision of core-drilling tests to proof core-drilling tests.

[11] Revision of core-drilling to interface core-drilling.

Item	Current version	Amendments
14. Clause 7.4.5 2nd paragraph[12]	Alternative procedures and acceptance criteria other than test loading or core-drilling with sound justification based on recognized foundation engineering principles and relevant to a particular site and building may also be adopted, provided that the following are submitted to the Building Authority to demonstrate the suitability of the proposed method of testing:	Alternative procedures and acceptance criteria other than test loading or proof core-drilling with sound justification based on recognized foundation engineering principles and relevant to a particular site and building may also be adopted, provided that the following are submitted to the Building Authority to demonstrate the suitability of the proposed method of testing:
15. Clause 8.1 3rd paragraph[13]	Except standard penetration tests (see clause 8.3) and proof test by core-drilling (see clause 8.5), all tests specified in this Chapter should be carried out by a HOKLAS accredited laboratory.	Except standard penetration tests (see clause 8.3) and proof core-drilling test (see clause 8.5), all tests specified in this Chapter should be carried out by a HOKLAS accredited laboratory.
16. Clause 8.5[14]	**8.5 CORE-DRILLING TEST** Proof core-drilling test is commonly used in large diameter bored piles, barrettes and the like which can reveal the soundness of the founding rock, concrete and the interface between the pile and the rock. When carrying out core-drilling tests:	**8.5 PROOF CORE-DRILLING TEST** Proof core-drilling test is commonly used in large diameter bored piles, barrettes and the like which can reveal the soundness of the founding rock, concrete and the interface between the pile and the rock. When carrying out proof core-drilling tests:

[12] Revision of core-drilling to proof core-drilling.

[13] Revision of proof test by core-drilling to proof core-drilling test.

[14] Revision of core-drilling test/tests to proof core-drilling test/tests.

Appendix B
(PNAP APP-18)

List of Practice Notes for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers in relation to Foundation Works

(a) Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers (PNAP) APP-22 on Dewatering in Foundation and Basement Excavation Works;

(b) PNAP APP-24 on Railway Protection under Railways Ordinance, Mass Transit Railway (Land Resumption and Related Provisions) Ordinance and Area Number 3 of the Scheduled Areas in Schedule 5 to the Buildings Ordinance;

(c) PNAP APP-30 on Geotechnical Control on Developments in Mid-levels Scheduled Area;

(d) PNAP APP-49 on Site Investigation and Ground Investigation;

(e) PNAP APP-61 on Geotechnical Control on Developments in Area Numbers 2 and 4 of the Scheduled Areas;

(f) PNAP APP-62 on Protection of Sewage and Drainage Tunnels;

(g) PNAP APP-97 on Consent Procedures for Building Works and Street Works;

(h) PNAP APP-134 on Development in the Designated Area of Northshore Lantau; and

(i) PNAP APP-137 on Ground-borne Vibrations and Ground Settlements Arising from Pile Driving and Similar Operations.

(8/2023)

Appendix C
(PNAP APP-18)

Design, Construction, Administrative and Procedural Requirements relating to Foundation Works

Design and Construction of Foundations

Pile Foundations

When a registered structural engineer (RSE) intends to apply a piling system which is not commonly adopted in local practice for foundation construction or not complied with the requirements/conditions set out in the Code of Practice for Foundations 2017 (the Code), the design principles involved should be settled with the Building Authority (BA) prior to the submission of foundation plans using such pile system for approval, whenever possible. This would facilitate the RSE to proceed with confidence and avoid abortive work.

2. A pre-submission enquiry and conference as recommended in Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers (PNAP) ADM-19 should be made to the BA in advance.

3. All technical details of the system should be submitted to the BA, including material specification, manufacturing process, method of installation, method of assessing pile capacity, applicability relating to ground conditions and selected examples of uses of the system elsewhere, if applicable. A demonstration of the performance of the system is usually required.

4. Pile sections used in socketed steel H-pile or driven steel bearing H-pile may require demonstration of the compliance with section 3 of the Building (Construction) Regulation (B(C)R). The following information should be submitted to the BA for consideration prior to seeking approval of foundation plans using such type of pile section whenever possible:

(a) A brief description of the manufacturing process of the piles;

(b) Samples of pile identification and mill label;

(c) Samples of mill certificates;

(d) Sectional properties of the piles including tolerances checking;

(e) Chemical and mechanical properties of the piles including general specification, maximum carbon equivalent values (CEV) and satisfactory test results from a laboratory accredited under the Hong Kong Laboratory Accreditation Scheme (HOKLAS) or other laboratory accreditation bodies which have reached mutual recognition agreements/arrangements with HOKLAS;

(f) Welding specification including welding procedure test specifications, sample welding procedure test results and electrode specification;

(g) Pile capacity;

(h) Pile design;

(i) Quality assurance and quality control schemes including a brief description of the manufacturing process and product inspection and quality management system certificate; and

(j) Test reports by a laboratory accredited under the HOKLAS or other laboratory accreditation bodies which have reached mutual recognition agreements/arrangements with HOKLAS.

5. A list of steel H-pile sections with the required information as listed in paragraph 4 above which had been submitted to the BA and found satisfactory is available on the Buildings Department's (BD) website (www.bd.gov.hk) under the "Deemed-to-Satisfy" page of the "Resources" section. These pile sections are considered to have "deemed-to-satisfy" section 3 of the B(C)R concerning the design and construction of foundations. If the proposed steel H-pile section is not on the list, the BA may require all information listed in paragraph 4 to be included in the foundation plans submission for consideration.

Technical Guidance Note No. 53 issued by Geotechnical Engineering Office

6. The Geotechnical Engineering Office of the Civil Engineering and Development Department issued the Technical Guidance Note No. 53 (TGN 53) on 19 January 2023. Subject to the conditions given in the notes to Table 1 of TGN 53, if the presumed allowable values of the founding stratum as given in TGN 53 are adopted in the design of the foundation system, the BA will impose the following conditions under item 6 of section 17(1) of the Buildings Ordinance when granting the approval of the foundation plans:

(a) Settlement analysis of the foundation should be performed to take due account of the as-constructed pile lengths/founding levels and the soil-structure interaction;

(b) Assessment of the structures supported by the foundation should be carried out to confirm that the structures can tolerate the settlements determined at (a) above;

(c) Upon completion of the foundation works, a report containing the analysis and assessment conducted in (a) and (b) above should be submitted to the BA;

(d) A settlement monitoring scheme should be implemented to monitor the performance of the foundations throughout the construction period of the superstructure. The monitoring scheme should be submitted to the BA for agreement before the commencement of pile cap/superstructure works; and

(e) A final performance review report on the settlement behaviour of the structure with consideration of settlement records in (d) above should be submitted prior to the application of occupation permit or the submission of Form BA14 for alteration and addition works as appropriate. Occupation permit will not be issued or Form BA14 will not be acknowledged until the final performance review is found satisfactory by the BA.

Shallow Foundations

7. Mass concrete fill is often applied for benching uneven or sloping rock surface for construction of shallow foundation. However, mass concrete fill of significant size (i.e. with a maximum depth greater than 1 m) placed beneath the footing or raft foundations should be regarded as a structural element and designed in accordance with the Code of Practice for Structural Use of Concrete 2013.

Registered Specialist Contractor for Pre-drilling, Post Construction Proof Drilling and Proof Core-drilling Test

8. All pre-drilling, post construction proof drilling and proof core-drilling test must be carried out by a registered specialist contractor in the Ground Investigation Field Works category. The contractor who is appointed to carry out proof core-drilling test required under section 20 of the B(C)R should make declaration on its relationship with the foundation contractor, including whether or not it is a holding, subsidiary, or an associated company of the foundation contractor, or has financial relationship with it e.g. cross-directorship, or has financial interest in such foundation works.

Interface Proof Drilling for Large Diameter Bored Pile

9. For large diameter bored piles, barrettes and the like, the concrete should be in good contact with the bedrock at the interface and the rock should be consistently of the required grade beneath the pile base. To facilitate successful proof drilling at the interface, a pipe of not less than 150 mm diameter may be left in and stopped at about 1 m above the interface. Minor imperfection observed during the interface proof drilling, such as a thin layer of sediment, segregated concrete at the interface or weathered seam in the rock beneath the pile base, may be considered acceptable provided that the RSE/registered geotechnical engineer (RGE) can demonstrate the acceptance with justifications and additional proof drilling, if required. As an alternative, the RSE may include in the foundation plans the proposed remedial works for rectifying any such imperfections. The proposals should provide details of the method statement and the supervision required by the RSE.

Plan Submission and Consent Application

10. When geotechnical reports and supporting documents are required for submission of foundation plans or records, such reports and documents should be prepared and signed by the RGE. Reference should be made to PNAP APP-141.

11. Installation of pile walls and grout curtain along the site boundary would provide additional precautionary measures for safeguarding settlement sensitive structures, roads or underground services against possible adverse effects imposed upon them during the installation of the socketed steel H-piles at close proximity. In this respect, the consent for the commencement of works for those piles located within 10 m from the site boundary may not be granted unless the record plans and assessment report for the installation of related pile wall and grouting works have been submitted. To facilitate the processing of such consent application, the RSE may submit the Form BA8 for the piles together with the record plans and assessment report for the related pile walls and grouting works concurrently. In the case of large sites where consent application for those piles may be submitted in stages, the RSE/RGE should submit an additional assessment report to justify the adequacy of the precautionary measures at the time of consent application.

12. Except in cases where there are imposed conditions to be met first, for example, pre-construction condition survey to sensitive buildings, shoring to adjoining buildings, etc, the BD may grant approval of plans for foundation works and consent for the commencement of such works at the same time. If the AP/RSE wishes to take advantage of the streamlined procedures for concurrent applications for approval and consent, the application for consent for the commencement of works should not be submitted before the 32nd day after the date of submission of the corresponding foundation plans for approval, so as not to cause unnecessary administrative complications.

13. To minimise the idling time on construction sites, earth-retaining elements such as sheet/pipe pile walls may be installed and, if applicable, initial stage excavation and lateral support works[1] may be carried out concurrently with the foundation works. Once the earth-retaining elements have been satisfactorily installed, a consent application may then be made and the corresponding supervision plan be submitted for the commencement of the remaining excavation works for substructures prior to the final completion of foundation works. This would allow excavation works for substructures be carried out while foundation record plans are being scrutinised and proof tests are being arranged.

14. Consent to the commencement and carrying out of the pile cap and superstructure works will not be given until:

(a) the foundation records have been submitted and found satisfactory;

(b) the Form BA14 certifying the completion of foundation works has been submitted;

(c) the required proof tests have been satisfactorily carried out; and

(d) all relevant imposed conditions including material testing requirements have been complied with.

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[1] The initial stage excavation and lateral support works refers to the excavation down to bottom of the first layer of struts but not exceeding 1.5 m below the existing ground level and the erection of the first layer of waling and struts as shown in the approved plans.

Form BA14, Foundation Record Plans and Reports

15. Upon completion of the foundation works, a Form BA14 certifying the completion of the foundation works should be submitted according to regulation 25 of the Building (Administration) Regulations. For exceptionally large sites, foundation works may be suitably phased and separately considered for proof testing. BD should be consulted as early as possible on such phasing arrangement. To expedite the selection of piles for proof tests, foundation record plans and reports may be separately submitted prior to the submission of the Form BA14.

16. If sufficient information is available in the submitted record plans and reports, BD would within 14 days of the receipt of the Form BA14 for foundation works inform the AP/RSE of the representative piles identified for proof tests. To avoid unnecessary delay, the AP/RSE should ensure that full information on the completed piles is included in the foundation record plans and reports.

17. Review of piling design with back-analyses and submission of foundation plans to amend the pile loading schedule would be required in the following circumstances:

(a) the difference between the as-built pile lengths and the approved tentative pile lengths by more than ± 5%; or

(b) the difference in as-built pile lengths among piles within close proximity results in significant redistribution of pile loads or implies the existence of a steep bedrock profile.

If the variation is significant, additional ground investigation (GI) may be required to justify the deviation. Such requirement of additional GI will be determined by BD on a case-by-case basis. For foundation works in Area Numbers 2 and 4 of the Scheduled Areas, attention should be drawn to the requirements stipulated in clause 7.8 of the Code and PNAP APP-61.

18. The review of piling design with back-analyses and the updated pile loading schedule plans can be submitted together with Form BA14 certifying completion of the piling works and the corresponding piling record plans. BD will proceed to select piles for load test and process the pile loading schedule plans concurrently, so as to speed up the processing of Form BA14.

19. For large diameter bored pile foundations, AP may submit Form BA14 to BD after completion of interface proof drilling at the concrete and rock interface for at least 85% of the completed piles. In addition, the submission of all test result for concrete cubes at 28 days is not necessary if sufficient justification is available at this stage. Provided that other information as required in the approval of the foundation plans has been submitted and found satisfactory, BD would select representative piles for proof core-drilling tests while the remaining interface proof drilling and concrete cube testing are still in progress. In case there are irregularities found thereafter, BD may require additional proof core-drilling tests. Form BA14 would only be acknowledged when the results of all the interface proof drilling, proof core-drilling tests and required documents are submitted and found satisfactory.

(8/2023)