Summary of Decisions of the Structural Engineering Committee
SEC Meeting 1/2017 held on 23.3.2017

Case 4/2017

Issue: Shaft Grouted Frictional Mini-Pile

Recommendation: (1) To accept the design principle of mini-piles (4 Nos. of Y50 Grade 500 rebars grouted in pre-bored holes of 323.9mm diameter) with post-pressurized grout in Completely Decomposed Granite (CDG) to enhance shaft friction for resisting vertical load subject to the satisfactory verification by static loading tests on the two trial piles (TP1 and TP2) for vertical load complying with the acceptance criteria, stipulated in paragraph 5 and the following criteria/ conditions:

1.1. The ultimate shaft grouted friction in CDG shall not exceed 4.8 x N with a maximum limit of SPT "N" value of 40 (i.e. 192kPa); and the frictional resistance should only be considered where the minimum SPT "N" is greater than 10;

1.2. A factor of safety (FOS) of 3 will be adopted for calculating the allowable shaft friction;

1.3. A detailed quality assurance proposal on grouting works shall be submitted. It shall specify the quality assurance measures adopted in controlling grout pressure, volume and time;

1.4. For each grout mix one sample of grout shall be provided from each 10 batches of grout, or every $10m^3$ from the amount of grout produce in a day, whichever is the smaller, to determine the crushing strength of the grout. Sample shall be provided not more than 1 hour after the grout has been mixed;

1.5. One trial pile TP2 will be load-tested to 3 times of the working pile vertical capacity to verify the shaft friction capacity; and the other trial pile TP1 will be load-tested to 2 times of the working pile vertical capacity.

1.6. Loading test for trial pile TP1 with 4 nos. of reaction piles will be carried out first to verify the construction methodology. To verify the design ultimate shaft friction capacity, loading test for trial pile TP2 with 8 nos. of reaction piles will be carried out after the test result of trial pile TP1 is found satisfactory. Due to site congestion and construction programme, the trial piles, TP1 & TP2, will not be reused as working piles. Among the 4 nos. reaction piles for TP1, 2 nos. of them will also be used as the reaction piles for TP2, i.e. there are a total of 10 reaction piles in the two tests.

Furthermore, among the reaction piles, 2 nos. of them are proposed to be reused as working piles.

1.7. A performance review report of trial pile tests shall be submitted to the satisfaction of the Building Authority upon completion of the static loading tests.

1.8. The minimum cover to reinforcement of the shaft grouted mini-pile should be not less than 50mm (Y50) and the minimum pile spacing between the shaft grouted mini-piles should not be less than the circumference of the pile. (3.14 x 323.9 = 1017 mm i.e. 1020 mm is adopted)

1.9. Site supervision level should be enhanced by increasing the RSE's T5 and RSC's T4 supervision to full-time supervision during the post-pressurized grouting works.

(2) To accept the use of 63.5mm diameter DYWIDAG threadbars as rebar in trial pile TP2 only. TP2 will not be used as a working pile.

Decision: Having noted the background information and arguments together with RSE's supervision arrangement, members endorsed the recommendations on the condition that quality supervision and the quality control of non-shrink grout should be provided by both the RSE's and RSC's team of supervisors to ensure that the post-pressurized grouting works would be carried out satisfactorily.