

Appendix D6

Preliminary Study on the Silent Piler

Working Paper – Assessment of Use of ‘Silent’ Piling Techniques for Subway Construction

INTRODUCTION

Due to the environmental impact of piling works in the density urbanized area through which the subway route passes, it has been suggested that a ‘silent’ piling technique should be considered. This paper considers the merits of such a system and its availability and suitability for the works envisaged.

DESCRIPTION OF THE WORKS

The subway construction involves excavation works down to a depth below ground level of approximately 6.5m. This runs along Mody Road and Blenheim Avenue and possibly across Chatham Road, as well. The whole route is surrounded on both side by buildings (shops and accommodation). The geology along the route varies, however, the ground conditions at the foundation depth, along the subway length, can be approximately summarized as follows :

- | | | | |
|-----------------------------|------|------------------|----------|
| • Rock (grade 3 or better) | 111m | Typical N values | > 200 |
| • CDG | 150m | Typical N values | 50 – 200 |
| • Alluvium / marine deposit | 38m | Typical N values | < 100 |

Envisage construction sequence will require temporary piling to form the open excavation. The piling will have to extend sufficiently below the formation level to achieve water cut off. In areas of high rockhead, the temporary piling will not have to extend into the rock.

DESCRIPTION OF THE ‘SILENT’ PILING TECHNIQUE.

Although other manufacturers may exist, the type of equipment investigated here is produced by ‘Giken’. This is of Japanese manufacture and has been in use for a number of years in both Japan and Europe (especially UK and Holland). According to the supplier, this system has been used in Singapore but not (as yet) in Hong Kong.

The mechanism is best described as a hydraulic press that pushes piles into the ground, (the jaw of the machine can accommodate various section shapes and sizes but steel sheet piles are usually associated with this system). This totally avoids the noise and ground vibration that results from percussion driving.

The pushing forces (maximum 120 tonnes) takes a reaction from the machine which champs itself onto 3 piles that have already been driven. Hence, the maximum allowable driving force is totally dependant upon the friction/cohesion forces acting on the previously driven piles (see attachment 1).

The machine can advance itself along the pile line although a small crane is needed to pitch the piles into the jaws.

DISCUSSION

Previous experience concurs with the manufacturers claims that the system is very quiet and virtually vibration free. Certainly from an environmental point of view, this system totally alleviates the problems normally associated with this kind of work. However, there are limitations of this system. These are seen as :

1. Maximum driving pressure of 120 tonnes corresponds to an N value of approximately 90-100.
2. Constant 'pressing' power not as effective as chiselling in unexpected hard ground or through obstructions.
3. Constant use of high pressing force causes racking and piles to go out of verticality - in both planes.

From the geological information, it can be seen that only 12% of the length of the subway is in ground with expected N values less than 90-100. Although pre-drilling can be carried out with this equipment, to place piles into ground harder than this, there seems little advantage in employing this system over a conventional method.

Although there is known to be at least one other silent piling type process, Giken is the only one known to be available in Hong Kong. Giken operate as a sub-contractor and it is known to be an expensive method per driven square meter of piling. To specify its use would also amount to a nominated subcontract arrangement and would not be a competitive tendering situation.

Even a specification that limits noise and vibration to that only achievable with this system would not overcome the lack of competitive pricing, although it may avoid the risks associated with a nominated subcontract arrangement.

CONCLUSION

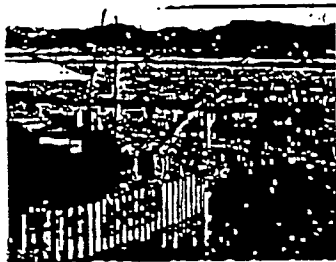
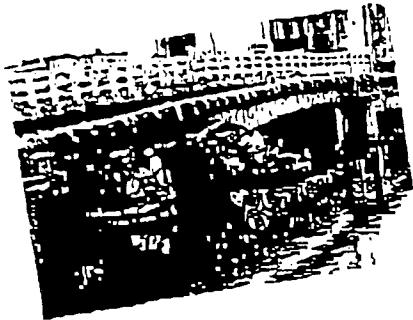
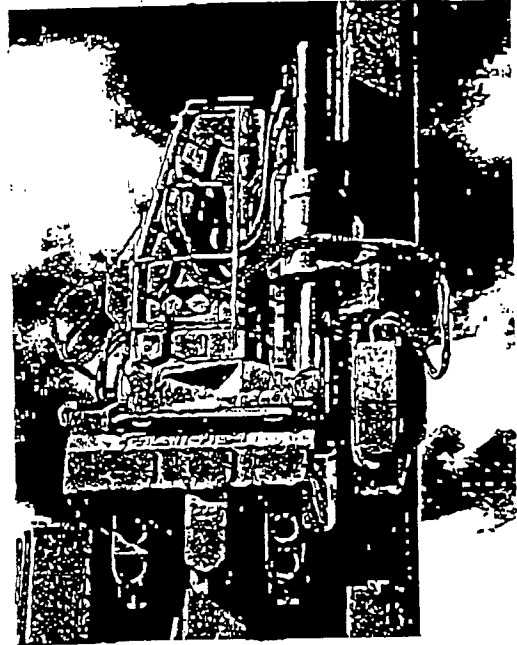
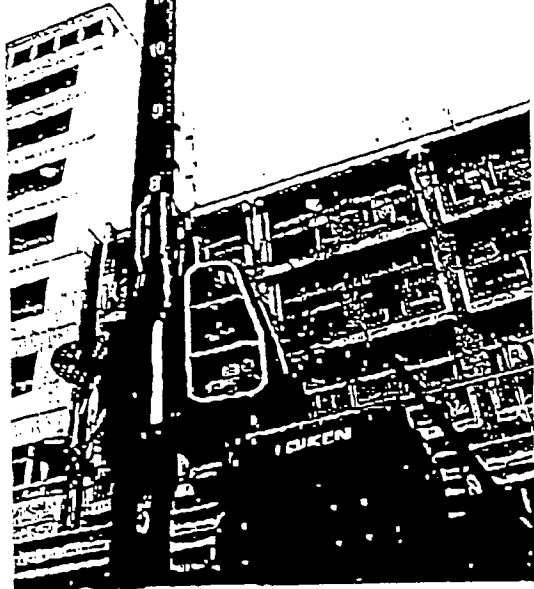
Although this system overcomes many of the environmental problems associated with sheet piling, its limitations in hard ground and ground containing obstructions (such as boulders) make it un-suitable for much of the length of the subway. Given the need, therefore, for contemporary methods of piling in these areas, the use of the Giken 'silent' piler is not worthwhile for the relatively small areas where it is suitable.

Contractually and from a competitive tendering point of view it may be undesirable to specify the use of this system for Temporary Works.

As strict as possible noise and vibration limits should be set which, although would not preclude the use of this system if a contractor chose it, would allow for other contemporary methods of pile installation. Other mitigation measures should be investigated to mitigate the resultant impacts from noise and vibration.

SILENT PILER

Hydraulic Pile-Jacking System, approved by Japanese Ministry of Construction.



The **GIKEN SILENT PILER** was designed to allow piling work in areas where the noise and vibration associated with conventional percussive or vibratory equipment would generally preclude their use.

The principle of the **SILENT PILER** is based upon utilising the skin friction or adhesion developed on previously driven piles to provide a reaction force against which the **SILENT PILER** can hydraulically jack in the next pile. The absence of percussive or vibratory impulse on a pile allows **SILENT AND VIBRATION FREE PILING**.

