

SPECIFICATION OF JACKED ANCHOR FOR RETAINING STRUCTURES

1.0 GENERAL

This specification deals with jacked anchors and shall be read in conjunction with the conditions of contract and the Specification for Excavation. The Contractor shall comply fully with the requirements of this specification in the design, erection and installation of jacked anchors.

Where works are ordered to be performed by the Contractor but are not specified in this specification, the Contractor must carry these works out with full diligence and expedience as are expected for works of this nature.

2.0 SCOPE OF WORKS

The contract comprises the provision of all labour, tools, plants, materials, transportation and all necessary equipment for the following works:

- (a) Design, supply, construct, install and test jacked anchors as part of retaining system to support with safety the sides of open excavations.
- (b) Any other incidental works necessary to ensure the safety and satisfactory performance of the permanent or temporary earth retaining system.

3.0 RESPONSIBILITY OF THE CONTRACTOR

The Contractor shall be experienced in jacked anchor design and construction and shall have equipment and manpower suitable for the work and available for the entire operation of the work. The Contractor shall be wholly responsible at all times for the safety of works.

The Contractor is expected to study and place his own interpretation on the geotechnical data provided as well as obtain further data if he feels necessary. The Contractor shall give due consideration to existing underground utilities and limit of boundary in the design and installation of jacked anchors.

The Contractor shall engage a licensed surveyor to set out benchmarks and reference points from which to layout his work, if such survey works is not provided.

It is the responsibility of the Contractor to acquire necessary permits and documents from the relevant authorities to carry out the work.

4.0 DESIGN BY CONTRACTOR

The Contractor shall include in the submission of the tender, for the Engineer's review, his proposed design of jacked anchors in connection with the permanent or temporary earth retaining system for excavation works. Unit rates of jacked anchors shall be based on the allowable pull out tensile forces required for the safe and adequate performance of the permanent and temporary retaining system. The Contractor's submission of calculations and shopdrawings shall include the following information:

- (a) Jacked anchor layout
- (b) Jacked anchor design details
- (d) Jacked anchor structural and geotechnical design capacity
- (e) Jacked anchor load, length, and size
- (f) Design and details of connection between jacked anchor.
- (g) Design and details of jacked anchor head for the installation of waler
- (h) Waler Beam design and details.
- (i) Endorsement by the Contractor's Professional Engineer
- (j) Any other necessary information required by the Engineer in his review of the Contractor's design.

The Contractor's design calculations and specifications shall comply fully with the requirements of the Engineer's specifications and conditions of contract. In matters not specifically covered by the Engineer's specifications, the Contractor's design shall be in accordance with accepted principles of good engineering practice. It shall be the Contractor's responsibility to clearly itemise those matters.

The review of the Contractor's design by the Engineer does not in any way absorb or reduce the duties and responsibilities of the Contractor to ensure the safety and adequacy of his works.

5.0 METHOD STATEMENTS FOR CONSTRUCTION OPERATIONS

Prior to commencement of works, the Contractor shall submit to the Engineer a detailed method statements for the installation of jacked anchors. For the purpose of this Clause, a method statements shall be a document containing :

- (a) A detailed construction sequence
- (b) Proposed drilling method through the wall or the retained soil behind the wall, if any
- (c) Proposed jacking method (include the setup and reaction system for jacking)
- (d) Material, plant and labour requirements at each construction stage.
- (e) Rate of production output based on resources allocated, such as the average output in lineal metres of jacked anchors per jacking frame per normal working day of 8 working hours per day (inclusive of structural connection to waler beam).
- (f) Shopdrawings showing, among other things, details of all special requirements for the construction activities.
- (g) Methods of testing.
- (h) Calibration and certificate not more than 3 months for each test jack, pressure gauge, load cell and dial gauges used.
- (i) Protection of the jacked anchors from causing future ground deformation if such jacked anchors are to be left permanently embedded in retained ground.
- (j) Backfilling of the holes created in the retained ground after removal of the jacked anchors.

The Engineer shall during the execution of the works require the Contractor to submit detailed method statements of other construction operations. If requested by the Engineer, the Contractor shall submit, within such times and in such detail as the Engineer may reasonably require, such information pertaining to the methods of construction (including the use of construction plant) which the Contractor proposes to use, and such calculations of the stresses and deflections that will arise in the permanent works or any part thereof during construction from the use of such methods, as will enable the Engineer to decide whether the permanent or temporary works can be executed with safety and in accordance with the contract if the methods are adhered to, and without detriment to the permanent or temporary works when completed.

The Engineer shall inform the Contractor in writing within 14 days after receipt of the Contractor's method statement either

- (a) that the Contractor's proposed methods have the consent of the Engineer; or
- (b) in what respect, in the opinion of the Engineer, the proposed methods fail to meet the requirements of the contract.

In the latter event, the Contractor shall take such steps or make such changes in the proposed methods as may be necessary to meet the Engineer's requirements and to obtain his consent. The Contractor shall not change the methods that have received the Engineer's consent without further consent in writing of the Engineer, which shall not be unreasonably withheld. Works shall commence at such times when and not before the Engineer has given his consent to the method of construction.

Consent by the Engineer of the Contractor's proposed methods of construction in accordance with this Clause shall not in any way relieve the Contractor of any of his duties or responsibilities under the contract.

6.0 EQUIPMENT AND LABOUR

The Contractor shall provide all frames, equipment, lifting devices and labour necessary for the installation of jacked anchors.

The Contractor shall satisfy the Engineer regarding the suitability, efficiency and operational capability of the jacked anchor installation equipment. The Contractor shall be required to provide adequate numbers of operational jacking frames to ensure that the works are completed within the time period stipulated in the approved construction programme. The Contractor is deemed to have made provision for the availability of standby plant at all times to allow for the contingency of equipment failure.

The Engineer shall order the removal or replacement of any equipment or staff whenever he is of the opinion that such equipment and staff are not suitable for the works. Equipment found to have a consistent record of breakdowns shall be removed from the site.

7.0 COMPLIANCE INSPECTION

The Engineer shall carry out inspection to ensure that the Contractor follows the approved shop drawings and good engineering practice.

8.0 MATERIALS

8.1 General Requirements

The requirements listed in the following clauses shall apply, wherever relevant, to materials used in all jacked anchors except when otherwise agreed by the Engineer. The handling, storage and use of materials shall comply with manufacturers' instructions.

An jacked anchor shall not contain materials that are mutually incompatible with each other and the surrounding environment.

8.2 Jacked Anchor

The size of the jacked anchor shall be as per drawing. The properties of the jacked anchor shall be submitted for approval of the Engineer. The Engineer can at any time order to carry out appropriate material testing to verify the properties of the supplied jacked anchors.

8.3 Waler

The size of the waler shall as per drawing. The properties of the waler beam shall be submitted for the approval of the Engineer.

8.4 Fasteners and Attachment Devices

Provide high strength nuts conforming to BS 5950 or equivalent. Provide bearing plates conforming to BS4449 and BS 5950.

9.0 CONSTRUCTION

9.1 Reaction System

Prior to the installation of jacked anchor, the reaction system shall be installed at the location as agreed by the Engineer. The installation method of reaction system shall be as per the approved method statement. The proposed reaction system shall not cause any damage to the retaining system.

9.2 Holes for Jacked Anchor Installation

For the installation of jacked anchor, provision of holes through the retaining wall can be formed by either cutting or coring operation. The drilling or boring method used and the location of these holes shall be subjected to the agreement of the Engineer.

The holes shall be of appropriate size in order to prevent structurally damage to the retaining wall and the reinforcement if any. The Contractor shall be responsible for all the costs arised from the damages of the retaining system and the remedial work shall be carried out as per instruction of the Engineer.

9.3 Installation of Jacked Anchor

The jacked anchor shall be installed as per drawing. All jacked anchor shall be, in principle, hydraulically jacked to the specified jacking forces or to the required design length as specified in the drawings.

The jacked anchor shall be well restrained within the jacking frame during the installation to avoid buckling. Sufficient lateral bracing of jacked anchor at certain intervals in both direction will be necessary.

Connection between jacked anchors shall be carried out accordance to the details as shown on the drawing. The connection shall not cause any enlargement of soil/anchor interface, which will reduce the contact resistance between of the jacked anchor and the soil.

While the jacked anchor is successively jacked in, the jacking pressure shall be continuously being registered at every 1m length interval.

After the required design jacking force pressure or length has been achieved, the jacked anchor shall be cut close to the retaining system to enable installation of anchor head and waler beam.

If the required design pressure and length is inadequate, the Engineer shall be informed and the

contractor shall carried out the remedial work as instructed by the Engineer.

9.4 Installation of Waler Beam

The jacked anchor head shall be installed as per drawing after the installation of the jacked anchors. The waler beam, the steel bearing plate and nut shall be installed as per the drawings before the next stage of excavation.

9.5 Welding

All welding shall be in accordance to drawings and comply to BS 5135.

9.6 Excavation

Excavation shall proceed in stages, allowing appropriate working clearance as approved by the Engineer for the installation of next row of jacked anchors. The Contractor shall seek the approval from the Engineer before any stage of excavation.

The Contractor shall response and resolve all non compliance matters as rised by the Engineer before proceed to the next stage of excavation.

10.0 RECORD

The Contractor shall keep record of the installation of each jacked anchor as required by the Engineer and shall submit signed copies of these records to the Engineer not later than next working day after the jacked anchors have been installed. This is to allow the Engineer to select certain jacked anchor for the pull out tests, if necessary.

The signed records shall form part of the records for the works. Any unexpected installation condition (such as insufficient penetration length and jacking pressure) shall be reported in the records.

A detailed record of the jacking pressure over the full length of each jacked anchor shall be kept. The log shall record the jacking pressure for every 1m of jacked anchor penetration.

The Contractor shall inform the Engineer without any delay if any unexpected change in jacking characteristic is encountered.

Alternative systems if any, shall be included and highlighted in the submission of the tender to the Engineer for review and approval.

In principle, acceptance of a design submission does not relieve the Contractor in any way from providing an anchor system of adequate performance and consistent with the specification.

11.0 TESTING

11.1 General

Pull out test shall be carried out to verify the working load of the selected jacked anchor.

11.2 Equipment

Dial gauges capable of measuring to the accuracy of 0.01mm shall be used to measure movement of the jacked anchor and measurement error due to rotation of the measuring point during testing shall be avoided. A calibrated hydraulic jack and pressure gauge unit with the calibrated electronic load cell (preferably vibrating wire type) shall be used as primary load measuring device to measure the test load. The pressure gauge shall be graduated to provide jacking load with accuracy to maximum 1 ton increment. The test loads shall be applied incrementally as per the requirement of BS8081.

11.2 Pullout Testing

The pull out test shall only be carried out on the selected jacked anchor by the Engineer at least 3 days after the installation.

Additional pull out test shall be carried out on the same jacked anchor after longer resting period if required by the Engineer.

12.0 FINAL EXAMINATION AND ACCEPTANCE

The work will be jointly examined by the Contractor and the Engineer as soon as practicable after the completion of the work. The Contractor will be required to carry out survey and prepare final "as-built" drawings of all elements of the work. The drawings shall indicate all dimensions, elevations, as-built locations and cross sections of the jacked anchors.

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