



Springkerse Ind Est
Springkerse Road
Stirling
FK7 7SN

Tel: ++44(0)1786 479568
Fax: ++44(0)1786 450534

BAE SYSTEMS

METHOD STATEMENT for DRILLING and BLASTING

PURPOSE

This Method Statement details the works involved in the controlled underwater drilling and blasting of rock at BAE Systems, Scotstoun, to enable further excavation for the formation of the Deep Water Berth.

This Method Statement will be supplemented by brief additional method statements if particular local conditions require such an approach.

Site staff will be briefed on the content of this Method Statement and will then sign the Briefing Record at the back of this document.

CONTRACTOR – Farrans Construction Ltd

Site Address: BAE Systems, Scotstoun, Glasgow.

Site Contact: Luis Alves Tel – [REDACTED]

SUB-CONTRACTOR - Albion Drilling Group Ltd (contact details as per this letterhead)

Site Contacts: George Sneddon: [REDACTED]

Deliveries Contact: Gus Rennie: [REDACTED]

REFERENCES

Contract Agreement

Contract specification

Site Health & Safety Plan

HSC Approved Code of Practice Health and Safety in Quarries (Quarries Regulations 1999).

BS 5607:1998 Code of Practice for Safe Use of Explosives in Construction Industry.

BS7385 Part 2 1993: Evaluation and measurement for vibration in buildings

PREREQUISITES

The prerequisites prior to working are:

1. An approved method statement
2. A site specific Risk Assessment
3. All necessary plant and labour
4. All necessary approvals from other bodies.

WORK TO BE DONE

The works are required as part the excavation process in the formation of three deep water berth pits at BAE Systems Scotstoun, referenced as pits A, B and C. It is envisaged that drilling and blasting may be required on Pits A and C, but not likely on Pit B.

Following the removal of the existing concrete structures within each pit, drilling and blasting will be carried out on Pits A and C to reduce the rock level and permit the construction of the new pit slabs. Excavations depths range from 0.5m to 1.0m and so blast depths will range from 2.0m to 3.5m to allow suitable and sufficient charges to be used accordingly and achieve the required cut profile. Blast holes for bulk blasting will drilled on a 1.5m x 1.5m grid as used previously on works carried out in 2007 and similarly, the use of pre-split holes will be deployed along the quayside sections to help mitigate against overbreak and reduce vibration on the existing quay.

Blast holes will be charged using packaged explosives such as Senetel Powerfrag with typical blast hole charges ranging between 5.0 and 12.5kg. Blasts will be initiated using a Non-Electric system with each hole being fired on an individual delay to minimise the MIC (Maximum Instantaneous Charge) and control vibration.

Drilling and Blasting works will be completed from a mobile barge/platform with operations being taking place 24hrs day. With blasting operations scheduled only for daytime working hours.

PREVIOUS EXPERIENCE

Details of similar works completed by Albion in the marine environment can be seen in the attached experience document.

WORK PROGRAMME

Prior to the main works commencing, a test blast will be carried out in the work area to demonstrate contract vibration limits are not being exceeded. Following successful test blasting the Barge/Pontoons will reposition in the most suitable location of the work area to begin production drilling. Where possible the test blast will be the first production blast only utilising conservative charges.

A typical cycle of positioning, drilling and blasting will be carried out over a 24 hour period, this will include one blast fired at the end of the cycle in daylight hours:

Cycle durations may shorten if it is necessary to carry out deck charging whereby several individual explosive charges are placed within a drill hole (e.g. to limit ground vibrations on nearby structures). The decision whether to deck charge holes will depend upon site conditions and vibration results acquired onsite during the project.

Occasionally it will be necessary to reposition the barge to maintain an efficient work programme and optimise blasted rock faces. This will be carried out in a logical manner.

It is estimated that around 14 blasts will be required at each pit location with an approximate duration of 10 days at each location.

SITE ARRANGEMENTS

The following arrangements are agreed:

Resource	Supplied By ADG	Supplied by Farrans
Suitable, stable platform/barge	-	Yes
Welfare facilities	-	Yes
Setting Out	-	Yes
Fuel	-	Yes
Stemming	-	Yes
Skip	-	Yes

ACCESS TO THE WORKS

Access to the works will be by barge/pontoon supplied and operated by Farrans.

The barge will be positioned over the area to be blasted by the main contractor.

The driller will set up the rig at the borehole location and ensure the drilling mast is vertical using an inclinometer.

DRILLING RIGS

Atlas Copco 9H5 Crawler Rig or Atlas Copco 404 Crawler Rig.

GUARDING

All drilling rigs will be fitted with a interlocking guard to reduce the risk of driller entanglement. When the guard is open to allow the changing drill rods, the guard will be tied/secured back until the drill rod is either added or taken off.

DRILLING RIG MAINTENANCE

All plant will be serviced prior to arriving on site.

Routine maintenance and repair works will be completed on site as necessary.

METHOD: DRILLING

Farrans will provide setting out/positioning information of the hole positions required at 1.5m centres and will provide the target excavation depths of the rock to be removed at each location.

Drilling will be carried out using an Atlas Copco 9H5 or Atlas Copco 404 tracked drill rigs using a rotary percussive DTH hammer with a Symmetrix/Robit N131 casing system.

Drillers will be fully trained and experienced operators.

Hole size will generally be 110mm dia. and drilling patterns will be 1.5m x 1.5m however these parameters will be reviewed following the trial blast to ensure that the required depth is being achieved.

The driller will drill through the overburden using the simultaneous drilling and casing system. When the casing is firmly sealed into rock head, the pilot bit will be disconnected from the casing and the drill string will be removed leaving the casing securely in the rock.

The down-the-hole hammer and string will then be lowered into the casing, allowing the driller to open the rock socket to the required depth.

Once the borehole is complete, the hole will be flushed out thoroughly, checked that it is free from obstructions and that it is at the required depth and ready for charging.

CHARGING

1. Explosives will be delivered to site by an authorised/licensed carrier on a daily basis, and will be stored securely in an approved explosives store that is fixed to the barge.
2. When on the barge, all explosives will be kept in the approved explosives store until required.
3. Only Albion's authorised shotfirer's shall handle explosives and accessories to carry out blasting operations.
4. Prior to charging the hole, the casing and rock socket will be checked for depth and freedom from obstructions.
5. Charging the hole – Once the hole has been checked for depth the required length of cartridge explosive will be made up and taped together to reduce the risk of becoming decoupled in the hole. Two Non-electric Exel detonators D500ms with KP primers will be used to prime the cartridges (85mm Senatel Pulsar cartridge explosive).
6. The complete/primed charge will be lowered carefully to the base of the hole and checked to confirm that it has gone to the full depth. Care shall be taken during loading of the cartridges and if stuck it can be recovered by pigtail screw.
7. Once the charge is in place, the ends of both detonators shall be securely held while stemming (14mm chips) is placed carefully into the hole. This will be done before the casing is removed. The stemming will be supplied by the Main Contractor.
8. Once stemmed, a retrieving ring will be dropped over the casing and onto the seabed which will be used to capture the detonator lines after the casing has been removed.

9. The Non-electric lead tubes will then be placed inside the casing and the casing will be withdrawn.
10. The retrieving ring pulled back on to the barge with the two detonator leads attached.
11. The leads will be taped together and secured to the side of the barge until ready for connecting/firing.
12. This method will be applied to each hole.
13. On completion of charging, any surplus explosives and accessories to be returned to the explosives store on the barge.

Connecting and Firing the Blast

1. With drilling and charging complete, the Non-Electric detonators will be connected together using 17ms delayed connectors as required to ensure that vibration levels are controlled. Holes will be connected in series and with the initiation line attached to the first hole. All connectors will be placed into the water for firing.
2. The barge will be moved back to a safe distance from the blast.
3. The positions of sentries will be agreed on site with Farrans Personnel.
4. On completion of the agreed audible warning sequence (see below) the shot will be initiated using an approved firing device.
5. The blast will take place when the shotfirer is satisfied that it safe to do so.

Marine Protection Measures

1. 30 minutes prior to the blast and right up until blasting takes place, a designated Marine Mammal Observer (MMO) will observe the river Clyde for any dolphins, seals, or other marine mammals in the surrounding area.
2. An Acoustic Deterrent Device, ADD, (seal scarer) will be positioned into the water at the commencement of this 30minute period and will remain in place until after the blast is fired. This will deter any marine wildlife from approaching the blast area before firing. The noise and disturbance of the drilling operations themselves will deter any marine wildlife from approaching the works whilst in progress.

Our experience over the last 35 years is that the above measures have been adequate for the protection of all marine wildlife.

The main contractor will implement a system of notification with harbour authorities and BAE Systems personnel.

AUDIBLE WARNING SEQUENCE

In liaison with the site personnel responsible for site management, the shotfirer will ensure that all plant and personnel have been cleared from the danger zone.

The shotfirer will ensure that sentries are briefed on their duties and that all sentries are in place before commencing with the blast. The audible warning procedure is as follows:

3 minutes prior to firing - SIREN SOUNDED FOR 30 SECONDS.

Immediately prior to firing - 3 SHORT BLASTS ON THE SIREN WITH THE SHOT BEING FIRED AFTER THE THIRD.

AFTER INSPECTION OF THE BLAST BY THE SHOTFIRER -

ALL CLEAR - 2 SHORT BLASTS ON THE SIREN

Firing will be done only by the appointed shotfirer after he has personally ensured that the danger zone is clear.

On completion of blasting, the shotfirer will examine the blasted area for misfires before giving the ALL CLEAR.

No plant, personnel or traffic are to enter the danger zone until the ALL CLEAR has been sounded.

BLAST DESIGN

There will be a written Blast Proposal – see attached proforma – for each blast which will show patterns and drill depths of the holes to be drilled. The Blast Proposal will be made available for inspection by any interested party.

The shotfirer will design each blast to give optimum results taking into account the specific character of each section of work. (All as per Explosives Regulations). The hole firing sequence will be designed so that each hole is fired individually to minimise the MIC (Maximum Instantaneous Charge) and hence reduce vibration. The minimum delay between each hole firing will be 8ms.

MISFIRE PROCEDURE

References to misfires can be found in the quarries regulations 1999. As part of 'Blasting Operations' it is required that a check for misfires is carried out after each blast.

A misfire is an occurrence in relation to the firing of shots. There are two types of misfires Type A and Type B. Type A misfires are not applicable to non-electric initiation systems, and it is therefore only Type B misfires that will apply on the BAE Systems project.

1. Immediately after each blast the shotfirer will check for a misfire by pulling the detonator leads back onto the barge and examining each lead.
2. If the lead is not visibly discoloured and if the detonating connector has not been activated then the connector will be replaced.
3. The lead and the new connector will be lowered into the water, and the remainder of the holes initiated using the Nonel firing device.(The exclusion zone must be reassessed prior to firing).
4. If any misfires are outwith the checks listed in items (1,2) the shotfirer shall consult with the blasting manager before carrying out any additional remedial action.

VIBRATION

ADG Ltd will place Vibrographs at predetermined onshore locations as agreed with Farrans and BAE Systems.

Blasts will be monitored by us using permanent recording three-directional vibration measuring instruments at suitable agreed nearby locations. Vibration levels will be kept within the norms laid out in the internationally recognised British Standards 7385:1993, "Evaluation and Measurement for Vibration in Buildings, Part 2: Guide to damage levels from ground borne vibrations".

Vibration predictions can be generated by using regression data from the previous works completed in 2007.

NOISE MONITORING

Pre-Start modelling of noise will be carried by Ocean Science Consulting Ltd. If required, ongoing monitoring will continue as works progress.

SHIPPING

To minimise the risk of damage to vessels & structures by waterborne shockwaves, suitable distances from blasts can be predicted by using another formula:

$$D = 24\sqrt{W}$$

Where
 D = Distance to the blast (m)
 W = Maximum Instantaneous Charge (kg)

Please note that this formula relates to an explosive charge freely suspended in water and *not* to a charge embedded within a drill hole. The magnitude of a waterborne shockwave from a blast initiated in rock is typically 5 - 10% of that from a freely suspended charge as the explosive energy is dissipated through the surrounding rock before reaching the water column.

Adequate warning will be given to all parties through our blast warning procedures to enable all vessels to retire to the safe recommended distance.

LIGHTNING

Lightning occurring in close proximity to drilling & blasting operations can be hazardous. Production will therefore cease if deemed necessary by the barge Supervisor. All explosives & detonators will be returned to their magazines and all detonator shock tubes will be gathered together before being lowered to the seabed for their protection.

SAFETY, HEALTH AND THE ENVIRONMENT

It is Albion Drilling Groups policy to attach the greatest importance to the safety of all persons and the protection of the environment whilst engaged in work on their contracts and the Company considers this a Management responsibility equal to any other function.

Further, that all its operations are executed at all times in such a way as to ensure, so far as is reasonably practicable, the health, safety and welfare of all its employees and all persons likely to be affected by its operations. The same dedication will be shown to the protection and conservation of the environment.

MITIGATING MEASURES – WATER

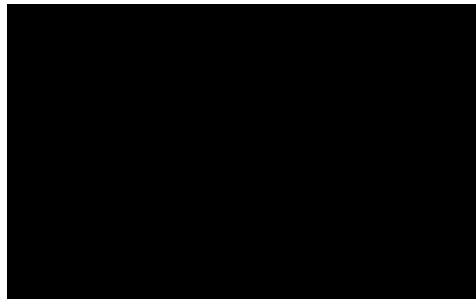
All diesel required to operate our drilling rigs and compressors will be stored in double skinned plastic tanks which comply with British Standards. The spill compartment will be capable of containing 110% of the inner tank contents thereby ensuring no accidental spillage. The transfer of fuel will be conducted from the service vessel/tug and will be carried out in compliance with all the relevant port regulations.

In the unlikely event of a diesel spill occurring while refuelling is being carried out, spill kits and absorbent granules will be utilised on deck to contain the fuel.

All lubricants and the like will be stored in drums located on bunded drip trays which will be capable of containing a spill from a ruptured drum. Oil which is captured by such a drip tray will be disposed of as waste oil when sufficient has been collected. Transfer of waste oil to land will be conducted in a manner which complies with port regulations and will be collected by a specialist local company for correct disposal or recycling. During land transfer, spill kits and the like will be on standby in the unlikely event of spillage on shore. Any contaminated spill pads, rags or granules will be disposed of in a correct manner and will be treated as hazardous waste as with waste oil.

RESPONSIBILITIES

Production Director: Jim King -
Blasting Manager: Alisdair Pye -
General Foreman: George Sneddon
Plant Manager: Frank Short -



BRIEFING RECORD

Briefing given by: _____ Position: _____

I have been briefed on the content of this Method Statement. I understand all that has been said to me and I have had the opportunity to raise any queries on the work that is to be carried out.

NAME	POSITION	SIGNATURE	DATE