Technical Specification for
Supply of pre-fabricated concrete blocks

Abstract
This technical specification concerns the concrete shielding blocks to be used in the Secondary Beam Areas (SBA) of the North Area.
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1. INTRODUCTION

1.1 Introduction to CERN

CERN, the European Organization for Nuclear Research, is an intergovernmental organization with 21 Member States. Its seat is in Geneva but its premises are located on both sides of the French-Swiss border (http://cern.ch/fplinks/map.html).

CERN’s mission is to enable international collaboration in the field of high-energy particle physics research and to this end it designs, builds and operates particle accelerators and the associated experimental areas. At present more than 11,000 scientific users from research institutes all over the world are using CERN’s installations for their experiments.

The accelerator complex at CERN is a succession of machines with increasingly higher energies. Each machine injects the beam into the next one, which takes over to bring the beam to an even higher energy, and so on (see Figure below).

Further information is available on the CERN website http://cern.ch.

1.2 Introduction to Engineering Department - Machines & Experimental Facilities Group

The EN (Engineering) Department is committed to provide the Engineering Competences and Technical Coordination required for all CERN activities, whilst fully taking into account the requirements of all stakeholders, in order to meet the goals of the Organization. This commitment covers the conception, design, installation, operation, maintenance and dismantling phases of the CERN facilities, including the Proton Synchrotron (PS), the Super Proton Synchrotron (SPS) and their experimental areas.

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1 The CERN Member States are currently Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Israel, Italy, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom. In addition: Serbia is Associate Member State in the pre-stage to Membership and Romania is Candidate for Accession.
The MEF (Machines & Experimental Facilities) group is, amongst others, responsible for the design, installation and maintenance of the beam lines to the PS and SPS experimental areas.

1.3 Introduction to the Pre-fabricated Concrete blocks

The use of the supply is required for ensuring radioprotection safety aspect. Separating beam areas from the neighbourhood requires concrete and cast iron shielding to stop the radiation coming from these experimental areas. The shieldings are assembled from pre-fabricated blocks, stacked up to 8 meters height.

2. SPECIFICATION OF THE SUPPLY

The successful bidder (hereinafter referred to as the “contractor”) shall deliver the pre-fabricated concrete blocks (hereinafter referred to, in whole or in part, as the “supply”) as defined in this technical specification and the documents and drawings attached to it. The supply shall originate from CERN Member States.

These specifications shall be obeyed by the contractor and all its subcontractors for this supply.

2.1 Deliverables Included in the Supply

The supply shall include:
- Pre-fabricated blocks with specified anchorages
- Packing
- Shipping

2.2 Services Supplied by CERN

CERN will supply the following services:
- Unloading the supply on the CERN site. The charge for the subcontractor in handling the concrete blocks ends with this unloading.

3. TECHNICAL REQUIREMENTS

3.1 General description

The contractor is responsible for the supply of prefabricated concrete blocks of good quality, in conformity with the more specific prescriptions described below.

In particular the contractor assumes liability for all damage occurring during the production, intermediate storage and transport until reception at CERN.

The prefabrication of the blocks shall be realized in a prefabrication factory or on a properly equipped work site, including: the formwork, the supply and installation of the frame of reinforcement bars or wire-mesh, the supply and pouring of the concrete, the insertion of fittings for handling, the clean trowelling of the non-formed surface, the final treatment and the storage of the blocks up to the transport according to the management of the works and the loading on the transport vehicles, the tools for handling, the finishing of the surfaces according to plans or particular prescriptions.
3.2 Blocks description

CERN typically uses standardized block sizes (mainly in multiples of 80 cm). The technical drawings attached to the contract order indicate the specific dimensions.

3.3 Manufacturing of the blocks

3.3.1 General informations

The CERN responsible for the project will provide the contractor with the general drawings that will allow the contractor to produce execution drawings of the blocks, including the formwork. The supply of these construction drawings is at the charge of the contractor and the costs should be included in the unit price of the elements to be supplied. The formwork drawings will be submitted for approval to the CERN project responsible prior to launching the production. Accordingly the contractor will be responsible for respecting the precise dimensions and tolerances.

In order to determine the construction principles and the materials to be used for the formwork, the contractor must take into account:

- The required surface quality,
- The vibrating modes.

The contractor is responsible for the quality, precision, and straightness of the blocks, which shall under no circumstances exceed the tolerances specified in the drawings.

3.3.2 Concrete

It is foreseen to use the following quality of concrete:

C40/50: Cement Fluvio 4 or equivalent: minimum 350 kg/m³
E/C < 0.47
Vibrated
Additives: Type and dosing as proposed by the contractor such as to guarantee their specified characteristics

The indicated dosages are the maximum ones. In case the concrete does not comply with the prescriptions, the dosages can be increased upon agreement with CERN. The cost of the increased dosage is at the charge of the tenderer.

The additives and, if applicable, fly ash or any other addition are included in the unit price of the prefabricated blocks and the quantities will be fixed in agreement with the CERN responsible after preliminary tests.

Special cements may only be used after authorisation by the CERN responsible.

Remarks:

Based on the composition of normal concrete (density ~2.4 g/cm³), the contents in terms of the following chemical elements must be kept low: Natrium, Iron, Manganese, Magnesium.

The following trace elements that may be present in concrete will induce high radiological risks and must therefore be reduced to the absolute minimum: Cobalt, Europium, Caesium, Hafnium, Iridium, Silver, Scandium. The anticipated concentrations of these elements shall be announced by the contractor and is subject to approval by the CERN responsible prior to launching the production.
3.3.3 The aggregates
The granules are classified according to their size. The following classes are mainly used:

0-4 mm (sand); 4-8 mm; 8-16 mm; 16-32 mm

The maximum accepted diameter is 32 mm.

3.3.4 Fabrication
For the fabrication of the concrete, the contractor will use a mixing plant that guarantees a regular and homogeneous mixing of the components remaining within the specifications throughout the whole production. The addition of water after the fabrication is forbidden.

3.3.5 Implementation
The vibrating of the concrete will be performed systematically. There will be enough spare vibrators to avoid any interruption of the operation. The vibrating will be done in successive layers of 30-50 cm.

3.3.6 Temperature of the freshly poured concrete
During the pouring the temperature shall be In air ≥5°C and of the concrete (ingredients) ingredients in the range of 5°C and 30°C,

3.3.7 Use of antifreeze
During winter and before each concreting stage, the tenderer must obtain permission from CERN for the use of antifreeze and define with CERN the mitigation measures to be taken.

3.3.8 Concreting
No joints are allowed for the concreting of a single block element.

3.3.9 Reservations
The use of wood or porous materials is forbidden as spacers for any openings.

3.3.10 Curing treatments
Except under specific conditions, the contractor must include in his unit prices, in agreement with the Swiss norm SIA 118/262 or the equivalent French norm, the protection and treatment of the concrete surfaces, in particular against too fast desiccation of the concrete.

3.3.11 Reinforcing Steel
All the reinforcement steel will be of High Adherence (HA) type. The steel nuance is B500 for bars and B500B for trellis.

The tenderer will ensure the adequate fixation of the steel, thus avoiding any movement of the steel during the concreting phase. All spacer blocks shall be made of concrete.

The contractor shall dimension the reinforcing steel providing the mechanical strength of the concrete blocks in view of typical handling, of exposure to outside environmental conditions typical
for the Geneva region and of the additional loads as indicated in the technical drawings attached to the contract order.

3.3.12 **Formwork**

The surfaces of the formwork must be smooth (metallic formwork – type IV) and the other surfaces must be cleanly trowelled.

3.3.13 **Products for form removal**

The products used for rectifying the surface or easing the form removal may not stain or colour the surfaces or alter the concrete quality. On top of that they must be compatible with surface coatings e.g. for water tightness.

3.3.14 **Lifting and handling tools**

Unless stipulated otherwise, the cost of supply and installation of lifting tools are included in the unit price of the blocks. The lifting anchorage is Halfen® DEHA (anti-corrosion treated) to put on three faces of each block (unless stipulated otherwise in the technical drawings).

The contractor is solely responsible for the robustness and safety of the lifting and handling elements implemented in the blocks, respecting the safety rules of the competent professional safety organisations. The contractor must check the compatibility of the chosen type of lifting elements for the handling, transport and installation operations up to the delivery at CERN.

The loads implied during handling of the blocks must be compatible with those taken into account in the specification of the blocks. The contractor will ascertain that this is indeed the case and will reinforce if necessary, in agreement with CERN. This intervention must be included in the unit prices.

The positioning of the integrated lifting elements must be compliant with the construction drawings.

3.3.15 **De-shuttering, heating and bake-out**

The procedure of removal from the mould must be compatible with the resistance properties of the concrete, with the steel in place.

The contractor shall take all precautions necessary to avoid cracking or deformations incompatible with the conditions of future use of the blocks. If required, formworks with tilting tables will be used. This option is included in the unit price.

Heating of the blocks can only be performed if the prescribed qualities of the concrete are not affected. In particular any fast drying of the concrete and thermal shocks shall be avoided. An authorisation for this by the CERN project responsible is subject to a prior presentation of test results showing satisfactory results.

3.3.16 **Continuous assessment and geometrical checks**

The quality control checks of the concrete are at the cost of the contractor.

For every day of concrete production the tenderer shall provide 3 cubes or cylinders that are compressed during 7, 14 and 28 days. He systematically takes samples during the pouring of the
main concrete blocks. The samples and tests are included in the unit price. He will inform the CERN responsible of the resistance of the concrete used.

The contractor shall perform systematic dimensional checks of the prefabricated blocks and will submit to CERN the reports of these geometrical checks.

3.3.17 Storage and transport

The storage of the blocks will be organised to avoid any permanent deformation that would add to the fabrication and installation tolerances.

The delivery of the blocks on the work site shall be planned with CERN and follow a distribution planning per point which will be communicated to the tenderer before delivery.

The prefabricated blocks will be checked and loaded according to good common practice. At arrival at CERN they shall not show any signs of damage visible with the naked eye.

The transport price includes handling costs as well as the storage at the factory and the intermediate storage on the concrete work site, as well as customs fees for delivery on French territory.

3.3.18 Quantity surveying principles

The prefabricated blocks are measured in accordance with the Bill of Quantities.

3.3.19 Tolerances and checks

All manufacturing tolerances are indicated on the consultation drawing or in the B of Q.

The contractor shall make sure, by systematic checks, that the blocks are compliant with the execution drawings (formwork, concrete, integrated elements, steelwork, etc).

The tenderer must inform the CERN responsible in the following cases:

- In case of incomprehension of the drawings,
- In case of a modification,
- In case a piece or drawing is not in agreement with good practice.

The contractor may only start the pouring of the first block of each series with the explicit agreement of the CERN responsible. The CERN responsible must be informed at least 48 hours in advance.

3.3.20 Identification of blocks

Each block has to be identified by marking the number of the order, the type, the weight and the number of the block (running index).

In addition three aluminium plates (width 100 mm x height 50 mm x thickness 2-3 mm) have to be placed on three different faces on each block. The plates shall be embedded into the blocks, such that the face (width 100 mm x height 50 mm) is clearly visible and the plate surface is set back from the block surface by 1-3 mm. These aluminium plates allow putting self-adhesive stickers indicating additional information for tracking purposes (inventory, RP information …). The plates shall be fixed (screws or other anchoring without altering the flatness of the visible plate surface), such that they are not removed by typical handling operations.
4. PERFORMANCE OF THE CONTRACT

4.1 Delivery Schedule

Once the contractor is notified of the award of the contract, he shall deliver the supply according to the dates indicated in the contract order.

CERN reserves the right to amend this delivery schedule before the start of the installation works. In such case, CERN will inform the contractor in writing about the definitive date to start the on-site installation two weeks before such date.

At the beginning of the contract and before the start of material procurement, the contractor shall submit for CERN's approval a detailed schedule defining the processes and methods, which he intends to implement. At CERN's request, he shall provide for information, in writing, a detailed account of the arrangements, which he intends to make, and the equipment and installations to be provided.

CERN and its representatives shall have free access during normal working hours to the manufacturing or assembly sites, including any subcontractor’s premises, during the contract period. The place of manufacture may only be changed after written approval by CERN.

The schedule shall make provision for CERN’s official holidays and take into account weather and other conditions related to the execution of the contract.

The contractor shall supply, within one month from the start of the contract, a written programme detailing the manufacturing and testing schedules, etc. The programme shall include preliminary dates for inspections and tests.

4.2 Documentation Handling, Quality Control and Quality Assurance

The contractor shall plan, establish, implement and adhere to a documented quality assurance program that fulfils all the requirements described in this technical specification.

In addition to the requirements of section 3, the contractor may propose any internationally recognised design standard, subject to prior written approval by CERN. The contractor shall state his intended method of design including applicable codes as part of his bid. CERN reserves the right to veto the use of certain codes or norms if it is considered that their application will not fulfil this technical specification.

The contractor shall submit all documents produced in electronic format:
- Drawings in CATIA®, AUTOCAD® and/or HP-GL format;
- Text documents in Microsoft Word® and/or PDF format;
- Cost breakdowns and equipment lists in Microsoft Excel® format;
- Schedule in Microsoft Project® format.

4.3 Packing and Shipping

The contractor is responsible for the packing and, where included, the transport to CERN. He shall ensure that the equipment is delivered to CERN without damage and any possible deterioration in performance due to transport conditions.

5. CERN CONTACT PERSONS

Persons to be contacted for technical matters:
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