CONTRACT MANAGEMENT OF LHC CIVIL ENGINEERING AT POINT 5

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Abstract

Civil engineering work commenced in August 1998 at LEP Point 5 for the underground and surface works necessary to accommodate the CMS detector for the LHC project. The principal underground works consist of two parallel caverns, separated by a support pillar, two new shafts, a number of smaller connection and service galleries and tunnel enlargements on the existing LEP tunnel. The surface works consist of the 140 m long SX building for the detector assembly and numerous other steel and concrete structures necessary for the installation and operation of CMS. The civil engineering design and supervision has been awarded to a joint venture of Gibb (UK), SGI (Switzerland) and Geoconsult (Austria), and the contracting to a joint venture of Dragados (Spain) and Seli (Italy) for 112 MCHF. The aim of this paper is to discuss the management of this contract and in particular how the various parties interact in order to work most efficiently.
1 INTRODUCTION

The civil engineering works for the LHC project are divided into four main Packages. Package 02 consists of all the underground and surface works at Point 5 necessary to accommodate the CMS detector.

Owing to the ongoing staff reductions within CERN and the trend towards outsourcing wherever possible, it was decided to award the design, site supervision and the construction to external civil engineering companies. In April 1996, the design and supervision was awarded to Gibb (UK), SGI (Switzerland) and Geoconsult (Austria) for approximately 12 MCHF. To date the joint venture has completed all the tender documents, and 90% of all the drawings and documents necessary for construction are finalized. Nine members of the site supervision team have been mobilized, increasing to fifteen during the peak of construction in the year 2000. After tender negotiations the construction contract was awarded to a joint venture of Dragados (Spain) and Seli (Italy) in May 1998 and work on-site commenced 31 August 1998.

2 DESCRIPTION OF THE WORKS

The principal underground works at Point 5 consist of two new caverns, two new shafts of 20.4 m and 12 m internal diameter, a number of smaller connection and service galleries and tunnel enlargements on the existing LEP. The new experimental cavern UXC55 (26.5 m wide and 24 m high) and the service cavern USC55 (18 m wide and 14 m high) are parallel and in close proximity to each other. The rock cover to the main cavern is only around 20 m with an overburden of about 50 m of water-bearing moraine above. To allow excavation of the shafts to proceed it is therefore necessary to freeze the ground, with excavation and lining in stages and a second lining added later. The main features with regard to special construction techniques are that it is necessary to replace the rock between the two caverns with a 7 m thick concrete support pillar and that the works must proceed in conjunction with LEP operations until final shutdown.

The principal surface works consist of the partial demolition of existing surface buildings to make way for the new 140 m long SX building for the detector assembly. This building has two 80 t cranes internally and a large temporary external crane over the shaft for lowering the detector sections, weighing up to 2500 t each. Owing to the high loadings from the detector, the floor slab needs to have piled foundations. The contractor has successfully tested the three preliminary test piles, which were loaded up to 2700 t. This was achieved by jacking against a very heavy steel frame, which was restrained by a considerable number of 100 t ground anchors. Other new buildings include the SF for cooling & ventilation, SGX for gas supplies, SUX for ventilation, SCX for offices, SH for air handling, SDX over the smaller access shaft and the SY building for security control.

All the spoil generated from the excavation will be permanently stockpiled on the site in accordance with the requirements of an external landscape architect. This will considerably reduce the amount of construction traffic on the public road network.
Figure 1 shows a 3D model of the LHC civil engineering works at Point 5.
3 THE MAIN PARTIES INVOLVED IN THE CONSTRUCTION CONTRACT

3.1 The contractor – Dragados–Seli joint venture

The contractor is responsible for constructing and maintaining the works in accordance with the requirements of the contract documents. The contractor takes full responsibility for the adequacy, stability and safety of all site operations and methods of construction. With the consent of CERN and the engineer the contractor is able to subcontract certain activities.

3.2 The engineer – Gibbs / Geoconsult / SGI (GSG)

The engineer acts in a dual capacity as the agent for the employer and also he exercises the powers reserved to him in the administration of the contract, signed between the employer and the contractor [1]. In administrating the contract the engineer’s decisions must be scrupulously fair and impartial and must be based on the terms and conditions specified.

THE CONDITIONS OF CONTRACT DISTINGUISH BETWEEN THOSE MATTERS WHICH MUST BE SETTLED BY THE ENGINEER AND THOSE WHICH MAY BE SETTLED BY HIS REPRESENTATIVE ON-SITE. THE LATTER IS TERMED THE ENGINEER’S REPRESENTATIVE AND HIS FUNCTION IS TO WATCH AND SUPERVISE ON A DAY-TO-DAY BASIS THE CONSTRUCTION AND MAINTENANCE OF THE PROJECT.

3.3 The employer – CERN

The standard FIDIC (Fédération Internationale Des Ingénieurs Conseils) form of contract provides the engineer with the power not only to instruct any necessary variations to the works, but also to evaluate and certify contractor’s invoices. Since this procedure conflicts with CERN’s rules, it was necessary to reduce the powers of the engineer under the contract, increasing the employer’s role.

4 FIDIC FORM OF CONTRACT

It was decided to adopt a modified version of the FIDIC document as the contract conditions for the civil engineering works. FIDIC has a proven track record, being tried and tested on many construction projects around the world [2]. Organizations such as the World Bank and many governments use the FIDIC model. The standard documents had to be modified to take account of CERN’s special status as an international organization and also to allocate more responsibility to the contractor, therefore reducing the risk to CERN; for example, the contractor bears greater risk in relation to unforeseen ground conditions.

The amended FIDIC document is basically a re-measurement contract, based on a bill of quantities and a series of unit rates. During the works the actual quantity executed under each item is measured and valued at the quoted rates. However, provision is made for the adjustment of rates for varied or additional work and for fixing of new rates by CERN.

5 ADJUDICATION & ARBITRATION

The procedure to be adopted in the settlement of disputes that may arise during the contract is clearly laid down in the contract. The most common kind of dispute occurs when
the contractor **claims** payment for expenditure he has incurred, or loss he considers he has suffered, on account of circumstances which he considers he could not have been expected to allow for in his tender. Initially the engineer must decide whether or not there is provision in the contract under which he can certify this expenditure for payment by CERN.

Should the parties fail to reach a settlement on a claim then a second-stage dispute resolution mechanism has been included in the contract. A panel of adjudicators (independent experts experienced in dispute resolution) will provide a decision. Any appeal from this decision will only be possible after the completion of the works, when arbitration can be used. However, negotiation and settlement is usually preferred and arbitration is considered as a last resort.

### 6 CONCLUSION AND PERSONAL OPINION OF CONTRACTUAL INTERACTION

The Contractor has fully mobilized his site team and is well established on-site with progress to date generally in compliance with the agreed construction programme. A good working relationship between CERN / engineer / Contractor and the local community has been set up and there exists a strong bond of common interest to see good construction materialize and a successful outcome to the project. However, it must be remembered that the independence of the others must be respected and that each party is entitled to his freedom of thought, outlook and privacy.

Although only in its early stages, negotiations between the various parties and the other CERN divisions regarding the planning and coordination of CERN subcontracted works, such as the gantry crane installation, have been constructive and the civil engineering contractor is on programme to achieve temporary releases for such work and sectional completion dates as defined in the Contract. However, the need for good communication and coordination within the CERN divisional project management team cannot be over emphasized, in order to minimize revisions to the tender documents and to achieve planning dates specified in the Contract.

During the tender negotiations some of the contractors raised concerns that they believed the Conditions of Contract to be unbalanced in favour of the Employer and that CERN’s dominant position reduced the role of the Engineer. It is the author’s opinion that this is true and that to some extent the impartiality of the Engineer has been undermined. It is therefore necessary for CERN and the Engineer to work together closely in order to manage the Contract effectively and to ensure success.

### REFERENCES
