CASE STUDIES

USE OF GOOD SAFETY MANAGEMENT PRACTICES (FINLAND)

1. Organisations involved

The main contractor was a consortium of Skanska and NCC Construction Finland. Skanska is a large construction group with expertise in construction, development of commercial and residential projects and public-private partnerships. It carries out all aspects of the construction, development and infrastructure process ï from financing projects, through design and construction right through to facilities management, operation and maintenance (Skanska, 2011).

NCCõs Construction units construct residential and office properties, industrial facilities, roads, civil-engineering structures and other types of infrastructure. The core business is conducted in the Nordic region, the Baltic countries and Germany. Furthermore, housing projects in Nordic markets are also a vital business activity (NCC, 2009).

2. Description of the case

2.1. Introduction

The construction industry is one of the most injury-prone industries worldwide in terms of serious injuries, loss of work time, hospitalization, disability, and mortality, therefore the consortium of two Finnish construction companies, Skanska and NCC Finland, decided to find ways to improve the safety of constructions sites by running a safety project at Sello (Espoo, Finland) construction site.

Due to the large scale of the Sello construction site (size of the area and the buildings to be built, number of contractors and workers, etc.), the safety challenges in this project were estimated to be more complicated than those of traditional, smaller, construction sites. The building site, where this project was conducted, was the second phase of a six-floor shopping centre called Sello (located in Espoo, Finland), with a gross volume of 107 000 m^2/537 000 m^3 (size of the building), consisting of 140 shops and other business premises (such as restaurants, cafeterias, hairdressers and day-spas, cinema, and other service type business as well as office space for several companies). The main contract type was a target price contract with a value of 170 million ú, including design and construction. On average, 307 employees, including 49 officers worked on the site, and 1.5 million working hours were registered in total at the end of the project. The project had two main contractors (ie. Skanska and NCC Finland) and about 160 sub-contracts. There were about 120 designers (ie. architects, structural engineers, interior designers, electrical wiring and ventilation designers, etc.) in this project and they made about 225 000 hours of design. (Mämmi, 2006)

The construction site was constricted to a small geographical area and surrounded by a logistic centre and main roads (ring road 1, E18, etc.), particularly the ring road 1 which is one of the busiest highways in the Helsinki region. All this meant heavy traffic load ï people and vehicles ï and complicated work environment (picture 1). In addition, the timetable for the construction was tight, from May 2003 to August 2005. All special alteration works (such as personalized interior designs, etc.), which were requested by the end-users (ie. businesses operating in the premises), were also required to be carried out within this strict time line. All these issues identified were estimated to increase the safety risks (ie. fallings, collisions) of workers as well as of other people (passer-bys, visitors) near the construction site.

Picture 1: The Sello construction site was surrounded by a logistic centre and main roads. Source Henri Mämmi NCC, copyright NCC.

2.2. Aims

The safety aims of the project were to have high level of safety performance, which could be measured by indicators, such as lack of serious accidents. The main actions were to identify and use the most appropriate (site specific) good safety management practices, as well as to further develop the safety management process of a large scale construction site. Work site safety practices were continuously and actively improved, based on practical experience, during the project.

2.3. What was done, and how?

The whole construction project was conducted using good safety management practices. Safety was included from the beginning ï in the design, as well as in all the construction phases. The client stated the safety index aim to be 85 per cent using the TR safety observation method (Mämmi, 2006).

The TR safety observation method means a constant observation policy that contains, among others, a pre-set criteria for acceptance of items and work performances, weekly site observations by the safety organisation of the site, and the posting of these observation results on a public feedback board, which was available for everyone on site. TR is a method that has been proved to be efficient for measuring, and improving, the level of safety at construction sites (FIOH, 2010; Laitinen, 1999).

The Sello site main contractors decided to aim for 87 per cent TR safety index, which is higher than the client had requested. The weekly results of the TR safety observations showed that the safety index of the construction site reached every week better level than the original request was. The TR measuring results were from 86 to 98.6 per cent each week. During the project the use of the TR measurement instruments were adjusted (calibrated) to correct deviation from the original standards' requirements seven times by external safety consultants.

Technical design

Workers' safety was strongly emphasized in the design process; the safety aspect was taken into account in every decision during planning, and in the end the work site excelled in promoting

permanent and long-lasting safety solutions. The basic aim for design was that the construction work is always able to be done safely, without taking any risks.

Designers were expected to make only safety-promoting design solutions. For example, permanent stairs and guardrails were built as early as possible and the pre-fabricated building units used were small enough to promote safety in the lifting and assembling of these units. In addition, the work schedules were designed so that different work tasks were carried out at different times and in different places, and the overall working order promoted safety. The technical designs, plans and instructions needed to be made in time and detailed enough to support the implementing of the construction project. A good example of detailed design was the system of safety railings installed during the prefabricated units' installation phase. The steel sleeves for these safety rails were installed to the pre-fabricated building units already at the steel factory (Mämmi, 2006). This meant that it was easy and quick to install the safety guardrail to these fixings. The placements of these fixings allowed the installation of wall elements without taking away the safety railings.

Picture 2: The safety rails were installed before the installation of wall elements. Source Henri Mämmi NCC, copyright NCC.

To improve the communication and co-ordination of the designers and the site personnel, a design co-ordinator was working at the site. The design co-ordinator solved problems (such as finding missing plans and informing all concerned on changes of materials and designs), specified technical designs and ensured that information channels operated smoothly and efficiently. Both the designer and the design co-ordinator were taking part in making the site-specific plans, like how to install glass roofs and protect the construction work from weather changes (rain, snow, ice, low and high temperatures, etc.).

Safety demands for contractors

The client demanded a high safety level on the construction site, and therefore the project contracts clearly stated the level of site safety that all the contractors were to follow. The client wanted resources (such as know-how, status, and the time resources of the safety manager and safety representative) for safety to be ensured through contractual means.

The main and sub-contract sizes were planned as large enough to interest companies with a good safety reputation, and requests for tenders were sent to pre-selected subcontractors. Positive safety attitude and good safety reputation was one of the main conditions for choosing a subcontractor. Safety demands, own site supervisors, pre-accepting of sub-contractors (by the main contractors), and work and task planning were included in the contracts. Choosing skilful sub-contractors influences both work safety and the safety of the end users of the constructed building and its surroundings.

Site and safety planning

Even with effective pre-planning before construction work starts, a good safety policy is that one must always be prepared for problems (to err is human) and have time during the implementation to find better solutions for safety. The Sello main contractors made a number of different work plans for the site, including different solutions for controlling the traffic and lifting heavy pre-fabricated building units. The contractors then assessed the safety risks of these plans and chose the safest site plan.

The basic principle for pre-planning the Sello site was to select safety solutions which had the best records and were estimated to be the safest solutions available at the moment. The main constructors sought the most cost-effective, yet of high safety standards, methods for improving the safety at the site, and as a result, for example, choose only crane lifts to be use on site. Good co-operation between designers, main contractors and subcontractors when analysing different possible solutions, as well as good time planning, was considered essential for good workplace safety by the Sello constructors. As an example on the actions to improve the keeping to the schedules, the contractors set up temporary weather protection for roofs to avoid delays due to bad weather conditions (such as heavy wind, rain and snowing). (Mämmi, 2006)

Sub-contractors were included in the planning of the Sello site work and safety before construction work began, because of their valuable special competence and knowledge, but also to have them committed to the safety solutions at the required level. Joint planning ensured smooth co-ordination of the building work and smooth information flow. The planning process was part of work consolidation and communication. Site supervisors were required to follow-up safety plans, and intervene if deviations become apparent. The aim was that the work schedule is as fixed as possible from the start, because all changes to the schedule in the busy, large-scale construction site were considered potential safety risk as the change might not be heard in time by all the workers concerned.

Work methods, tools and materials were chosen on the basis of safety and economy for the whole construction site. For example, the whole construction site was covered with coarse gravel to assure firm ground for heavy machines and traffic vehicles, and sector building models were used to separate different work phases and areas.

Work site safety

The safety goals defined for the work site were followed-up by weekly work site safety check using the TR-method. All accidents and hazards at the site were investigated and reported to all parties. In addition, the tidiness and order of the work site was monitored regularly. The main contractor approved every subcontractor, followed the conduct of safe practices, and gave feedback to the subcontractors. (Mämmi, 2006)

The primary site supervisors had to possess safety know-how and have a strong pro-safety attitude. Experience, knowledge, safety competence, high motivation, and commitment to good safety were all merits for the supervisors.

Safety communication and co-operation with all site partners is essential at any given construction site, as they are a shared workplace for numerous different parties. At the Sello site, safety was integrated into all project meetings: the guiding principle was that when safety is mainstreamed into all meeting agendas, there is no need for separate safety meetings.

In this project, the main objective was the absence of risk taking. Dangerous acts or acts that broke rules were never accepted. The constructors considered quickly addressing the unsafe as an important, powerful message ï in general, things deemed important are accepted as rules and carried out. The detailed attention to the safety issues by the main constructors set the tone for all parties in the work site. Everyone ï both workers and visitors ï had to undergo instruction on safe conduct for the particular construction site before being allowed entry. A brief site specific safety guide was part of the introduction material.

Lessons of this project

The principle lesson of the Sello-project was that planning, and particularly pre-planning, is an important part of a construction project, particularly of a project of this size. Sufficient resources must be allocated for planning. With effective pre-planning it is possible to prepare for problems and find better solutions for safety in advance. Subcontractors should participate in safety planning because they have valuable special competence and knowledge as well to have them committed to the safety strategy from the beginning. Joint planning ensures smooth co-ordination and information flow between all parties.

Safety issues should be mainstreamed into project meetings. When safety is integrated into meetings, separate safety meetings are not needed, and safety is always taken into account in decisions.

Dangerous acts, acts that break rules, and risk taking should never be accepted. Addressing unsafe acts quickly is essential ï important issues are usually followed up.

2.4. What was achieved?

The safety results of the construction site were very good ï ten times less accidents than average. Accident frequency of the site was 7.2 accidents per million work hours, and only 11 minor occupational accidents occurred. As a baseline for these numbers, the average accident frequency of the construction sector is 73.1 accidents per million work hours. The benefits of the improved safety were calculated to be 1.01 million ú.

This construction site was chosen as Finland's site of the year 2004, by a jury of experts, with special reference to good safety actions. The construction site also received a special mention in the Finnish competition called "Occupational safety toward the point of the world" in 2005.

2.5. Success factors

The decisions and background work carried out before the site was set up were crucial for reaching good safety levels on the Sello site. The fact that resources had been reserved for production planning was evident in the successful pre-planning, which pre-empted potential problems and identified good safety-promoting solutions in advance.

The safety management of the site was a part of the daily management, supervising, guidance and meeting process, not a separate operation. This meant that safety was included in all decision-making. The interference in risk taking was fundamental value and risk taking was never permitted. The site used systematically commonly known good practices and the operational systems of the main companies and further developed these good practices. All partners strictly adhered to their safety requirements, in good co-operation with other partners. Sub-contractors were also involved from the beginning of the project.

2.6. Further information

Juha Suvanto
Safety Manager
NCC companies
P.O.Box 13
FIN- 00281 Helsinki
Finland
Street address: Mannerheimintie 103a
Tel. +358 010 507 5380
Mobile +358 50 531 0535
Fax. +358 10 507 5656
E-mail: juha.suvanto@ncc.fi
www.ncc.fi

Antti Leino
Safety Manager
BU Skanska Finland
P.O.Box 114
FIN - 00101 Helsinki
Finland
Street address: Paciuksenkatu 25
Tel. +358 20 719 2082
Mobile +358 40 866 8551
E-mail: antti.leino@skanska.fi
www.skanska.fi

2.7. Transferability

All these good safety management practices can be transferred to other construction sites as such, but sufficient resources must be reserved for pre-planning, co-operation and communication.

3. References, resources:

- Skanska (2011), About Skanska. Retrieved 16 September 2011, from: http://www.skanska.co.uk/About-Skanska/

- NCC (2009), About NCC. Retrieved on 16 September 2011, from: http://www.ncc.se/en/About-NCC/NCC-Group/Organization/

- Mämmi, H., "NCC Rakennus Oy: Kauppakeskus Sello 2-vaiheen työmaa. 1,5 miljoonaa työtuntia, tapaturmataajuus 7.2.", Presentation in the seminar of Ratuke project, 19.5.2006 [In Finnish].

- FIOH ï Finnish Institute of Occupational Health (2010), TR-tuoteperhe ï Rakennustyönturvallisuus [TR safety observation method, in Finnish]. Retrieved on 16 September 2011, from: http://www.ttl.fi/fi/tyoturvallisuus_ja_riskien_hallinta/tapaturmien_ehkaisy/tyoturvallisuuden_edistamiskeinoja/tr_tuoteperhe/sivut/default.aspx

- Laitinen, H., Marjamäki, M., Päivärinta, K., (2009), The validity of the TR safety observation method on building construction. Accident Analysis & Prevention, Volume 31, Issue 5, September 1999, pp. 463-72. Available at http://www.sciencedirect.com/science/article/pii/S0001457598000840