



# **Quantity surveying role in Construction Projects**

## **-a comparison of roles in Sweden and the UK**

Examensarbete

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## **Sammanfattning**

Varje projekt är unik och beroende av flera aktörer och leverantörer som normalt varierar från projekt till projekt. För att en byggtreprenör skall vara framgångsrik och konkurrenskraftig så är det viktigt att leverera projektet i tid, inom budget och med hög kvalitet.

Våra slutsatser och intervjuer i denna studie visar att korrekta ritningar, ömsesidigt förtroende och väl fungerande kommunikationer är viktiga faktorer för ett lyckat projekt. Byggindustrin är på väg mot ett utökat samarbete. Personliga möten är fortfarande viktiga även om ny teknik förenklar kunskapsutbytet. Därför bör regelbundna möten mellan konsulter och underleverantörer hållas under hela designprocessen.

Under flera decennier har diskussioner om hur man gör byggbranschen mer effektivt drivit på utvecklingen av standarder och system. Det finns nu allt större tryck på att införa nya produktionsfilosofier i konstruktionen för att uppmuntra hållbara värden och minska den negativa effekten av arbetstiden i ett projekt.

Det övergripande syftet med den här studien är att öka förståelsen och fördjupa kunskaper om relationen mellan aktörerna i byggprocessen och hur projektet är upphandlat för att bidra till bättre slutresultat för både beställare och entreprenör.

Vi har försökt markera betydelsen av ”quantity surveying” och dessutom att jämföra roll skillnaden allmänt mellan Sverige och Storbritannien.

## **Abstract**

Quantity surveying is concerned with controlling and managing the construction projects. Working with quantity surveying will give us an understanding of the technical aspects of construction over the whole life of a building or facility, accommodate the requirements of a building to suit the particular circumstances of a project, achieve the best quality and value within the client's specifications and understand contracts, budgets, quantities and measurements.

The aim of this study is to provide an introduction to the role of Quantity Surveying in the Construction Industry to explain the measurement process in variation order, waste management and preparing of the bills of quantities. Providing instruction in developing skills and logical approach in measuring simple building works and provide a platform for further studies in the measurement and pricing of building works.

Choosing the right strategy is a crucial step when pursuing a desired goal, this necessity applies to companies, organizations, and individuals and as well research. A Comparison between Sweden and United Kingdom (UK) in project practices with focus on quantity surveying is studied to enable and increase the understanding of organizational roles and responsibilities for any construction project.

This degree thesis contains four main parts and it is based on interviews with project team members chosen for the examination in different project based companies in Malmö and other cities in Sweden, and relevant theories and information from the literature and various reports.

### *Keywords:*

Quantity surveying, project management, variation, procurement, construction industry, interview.

## Förord

Detta examensarbete är den sista kursen på vår utbildning till byggingenjörer. Examensarbetet är gjort under våren 2011 på Institutionen för Urbana Studier på Malmö högskola.

Många personer har bidragit med värdefulla kunskaper och tankar och på så sätt möjliggjort projektet, speciellt de personer vi har intervjuat under arbetets gång:

Thomas Alm, ansvarig för internationella projekt (SKANSKA)

Benny Johansson, Byggnadsingenjören (SWECO STRUCTURES)

Bonny Svensson, logistik chef (PEAB)

Anders Nyh, ansvarig för internationella projekt (NCC)

Mattias Åberg, projektledare (NCC)

Samtliga har varit till stor hjälp och förtjänar ett stort tack för att de ställt upp och svarat på frågor som genererat värdefull information för studien.

Ett särskilt stort tack vill vi rikta till vår handledare Anders Peterson för hans engagemang och den tid han ägnat åt att driva arbetet framåt.

Slutligen vill vi tacka familj och vänner som har stöttat oss under arbetets gång.

Malmö, 2011

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# Introduction

## **Background**

An understanding of the implications of a construction project design decisions at an early stage ensure that good value is obtained for the money to be expended.

Traditionally Quantity Surveying is concerned with contracts and costs on construction projects and quantity surveyors control construction costs by accurate measurement of the work required. These methods, however, cover a range of activities which may include value management, tendering, valuation, change control, claims management and cost estimation. The quantity surveyor facilitates the design process by systematic application of cost criteria so as to maintain a sensible and economic relationship between cost, quality, utility and appearance which thus helps in achieving the client's requirements within the agreed budget.

A construction project is a complex net of contracts and other legal obligations, each of which must be carefully considered. In its simplest form a contract may be an oral agreement, and for most projects, printed standard forms are used as the basis of the contract in order that all parties may have a clear picture of their rights and obligations.

It is recognized that surveyors are now playing a more important role in the area of contract administration and all aspects of the surveyor's professional work relate directly or indirectly to construction work of all kinds.

The Quantity surveyor has traditional independent role in the team comprising client, architect, engineer and contractor combined with expertise in drafting and interpretation of contract documents will avoid disputes and ensure the effective progress of a project.

## **Aim**

Typical subject areas for the Quantity Surveying include Construction Project Management, Construction Engineering, and Construction Contracting Operations.

The main objective of this study is to provide information on a general overview of the quantity surveying to achieve the best quality and value within the client's specifications. The

aim of this thesis is to point out some important moments of quantity surveying like variation orders, bills of quantities and construction waste management.

This will enable an increased understanding and provide new opportunities to create secure platforms which render the project to be more advanced.

## **Limitations**

The information referenced in this thesis, has been taken from different books, thesis, published papers and conferences. The chosen theories and are selected as the most important ones for the subject.

The research area was within the construction industry and construction management, and the focus will be on the role, work processes and experience.

At the initial phase of the study involved two main elements: literature review and interviews. These elements are described in detail throughout the study, to further enable good understanding of the importance of Quantity Surveying's role in construction projects and the differences of the role between the UK and Sweden.

There were some limitations with this study. The empirical research that is done for this thesis is limited on the country of Sweden need to be mentioned because of time and money.

Furthermore, the study is dependent on the participants in the interviews. Even though the interviewees participated were well experienced in their own areas.

# Method

## **Inquiry**

The development of Swedish construction industry and project management has influenced when the state shaped the construction sector as a major client and market regulator.

The main attempt of this study is to understand the circumstances related to the roles and responsibilities of the quantity surveying and construction projects relationships in general between the United Kingdom and Sweden.

## **Theoretical framework**

In this study we try to highlight the importance of quantity surveying roles in construction projects. The theoretical framework within this thesis had identified that the good knowledge base of quantity surveying roles and its relationship to the skills used by the engineers in different construction sites will provide a service both to the client (owner) and the subcontractor.

Moreover, our study discusses the most important forms of quantity surveying that the engineers are in need of during the different stages of the construction process and its unexpected variations, such as: Changing in the original work (variation order), preparing bills of quantities, new site instruction, construction materials waste, safety, etc.

In addition to, a comparison has been made between Sweden and the United Kingdom, regarding the typical subject areas.

## **Expected result**

Quantity surveying has important roles in the construction process. The development of some major parts of quantity surveying roles in the construction projects was addressed by this thesis, because it is a logical first step towards integrated construction.

This study will show the benefits to integrate and exchange of information between designers, contractors and the methods behind the historical issue and the exchange of quantity

surveying paper, in addition to, the importance of waste management during all phases of building construction.

Moreover, it is well known that experienced engineers have good knowledge about quantity surveying and are aware of its importance in their daily construction work, while the newly graduated engineers might lack the essential information that they are in need of. By using the guidelines of this project, we hope to enrich the knowledge of the newly graduated engineers in major quantity surveying aspects.

Finally, a comparison between Sweden and United Kingdom (UK) in project practices with focus on quantity surveying is studied to enable an increased understanding of organizational roles and responsibilities for any construction project.

# VARIATION ORDER

## **Introduction**

Construction projects are complex because they involve many human and non-human factors and variables. They usually have a long duration, various uncertainties and complex relationships among the participants. The need to make changes in a construction project is a matter of practical reality. Even the most thoughtfully planned project may necessitate changes due to various factors. (O'Brien, 1998)

Construction contracts usually have a time or date by which the contractor must complete the work, but many construction projects suffer from delays, financial complications, and unsatisfactory outcomes because of the insufficient attention paid for the evaluation of the variation orders. Variations are common in all types of construction projects and play an important role in determining the closing cost and time of the projects.

Variation order means the alteration, change or modification of design, quality or quantity of work omission, addition or substitution of the work. It is also including the alteration of the kind or standard of any of the materials or goods to be used in the work, and the removal from site of any work, materials or goods which are not in accordance in the contract.

Any additions, deletions, or other revision to project goals and scopes are considered to be variations, whether they increase or decrease the project cost or schedule. Most commonly, lack of timely and effective communication, lack of integration, uncertainty, a changing environment, and increasing project complexity are the drivers of project variation.

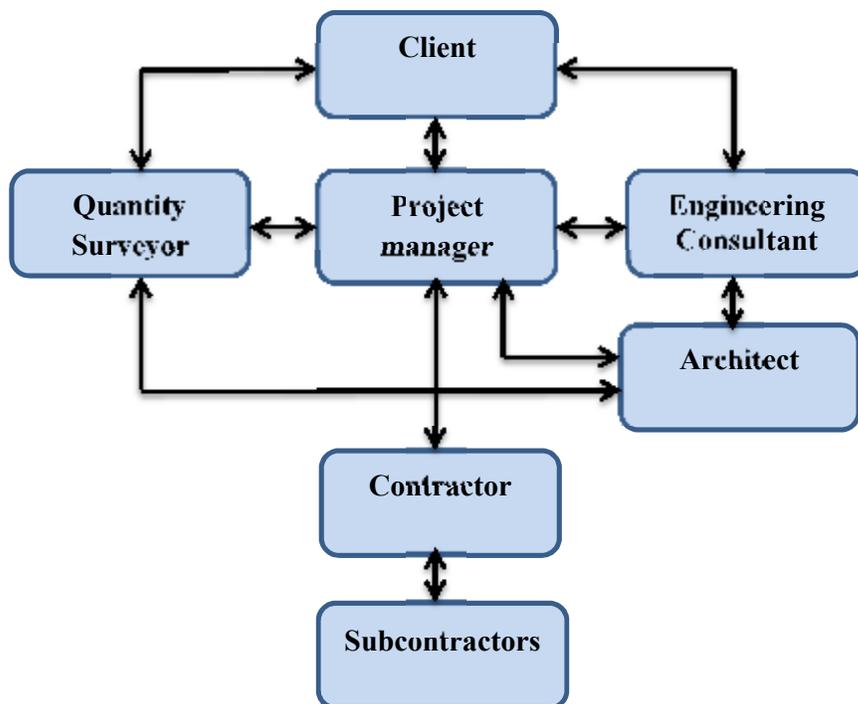
(Yunus, 2007)

There are provisions on variation orders in a building contract, the variations works sometimes did not satisfy both of parties who felt disappointed to carry on the works. It will give impact on the cost of the project, extend the completion period and it will bring inconveniences to all the parties involved in construction industry, which are client, consultants and also contractor.

Learning from these variations is imperative because the professionals can improve and apply

their experience in the future and would also be valuable for all building professionals in general. This would eventually lead the decision maker and assist them in developing an effective variation management system and selecting the most appropriate controls. The fundamental idea of any variation management system in a building project is to anticipate, recognize, evaluate, resolve, control, document, and learn from past variations in ways that support the overall viability of the project. Therefore, all parties involved should cooperate to assure that the efficiency of construction and thus will minimize the variation orders in construction industry.

The site instruction is often not defined and mentioned in the conditions of the contract, but it is issued as additional or modified drawings which may be necessary for the execution of the work and remedying any defects and written within a few hours or a day of the events, all in accordance with the contract. It can be also verbal instruction to the contractor from the engineer or from an assistant to whom the appropriate authority has been delegated under this clause, but immediately backed up by a written confirmation. (Fig.1)



**Figure 1:** Relationships and communication links (UK), according to our own understanding from interviews

## **Types of variation**

An effective analysis of variations and variation orders requires a comprehensive understanding of the root causes of variations. There are many reasons why variations occur. They may be due to extra work caused by subsurface conditions, additional quantities of works or materials, reduction of work, errors in contract documents. The types of variation can be classified according to their criteria, which are:

- The nature of the variation.
- The identity of the initiator.
- The effect of the variation. (Singh, 2002)

### **The nature of the variation**

The nature of a variation order can be determined by referring to both the reasons for their occurrence and subsequent effects, distinguished two types of variation orders namely beneficial and detrimental variation orders.

A beneficial variation order is one issued to improve the quality standard, reduce cost, schedule, or degree of difficulty in a project. It eliminates unnecessary costs from a project and as a result it optimizes the client's benefits against the resource input by eliminating unnecessary costs. A detrimental variation order is one that negatively impacts the client's value or project performance (Arain & Pheng 2005). A client who is experiencing financial problems may require the substitution of quality standard expensive materials to sub-standard cheap materials.

### **Identity of the initiator**

Classification per identity of initiator is a change made by any one or more principal parties: consultant, contractor, nominated sub- contractors, nominated suppliers, and also contract administrator.

The consultant directly initiates variations or the variations are required because the consultant fails to fulfill certain requirements for carrying out the project. Some variations can happen because of:

- Change in design.
- Errors and omissions in design.
- Conflicts between contract documents.
- Technology change.
- Inadequate scope of work for contractor.
- Lack of coordination.
- Design complexity.
- Inadequate working drawing details.
- Consultant's lack of judgment and experience.
- Lack of consultant's knowledge of available materials and equipment.

The contractor may suggest variations to the project, or the variations may be required because the contractor fails to fulfill certain requirements for carrying out the project. Some of the variations can be:

- Contractor's financial difficulties.
- Contractor's desired profitability.
- Lack of contractor's involvement in design.
- Unavailability of equipment.
- Shortage of skilled manpower.
- Differing site conditions.
- Unfamiliarity with local conditions.
- Contractor's lack of judgment and experience

There are other variations because of: Safety considerations, change in government regulations, weather conditions, unforeseen problems. (Sh.Ruzanna, 2006)

### **Effect of variation**

The most frequent effect of variation orders is the increase in cost. Variation orders may affect the project's total direct and indirect costs. Therefore, any major addition or alteration in the design may eventually increase the project cost.

Additional payment for contractor, increase in overhead expenses, rework and demolition were considered as the most frequent effect of variation orders.

The management of variation orders of a project is considered successful if the variation orders are resolved in a timely manner to the benefit of all the parties and the successful management of variations demands awareness, preparation and input from the project owner as well as the project contractors. (Yunus, 2007)

### **Factors influencing the variation**

There are a number of reasons for the introduction of changes on building works and many factors that influenced the variations like inadequate briefing from the client, inconsistent and late instructions from the client, incomplete design, and lack of meticulous planning at the design stage. The most important factors that influence the variation are:

- Client's requirement.
- Change of end user's management.
- Discrepancies between the works and statutory requirement.
- Poor management.
- Request by the contractor

### **Strategy action on minimizing variation order**

Generally minimizing variation is not easy. Some situations are avoidable and some may be unavoidable, but there are strategy actions that can be taken in order to minimize the variation in different stages as:

- a) More thorough detailing in design to reduce variation in future.
- b) Contract document and adequate time for the Quantity Surveying to prepare the document is important in order to avoid problem in future.
- c) Clear and thorough project brief would assist in eliminating variations arising because of the unclear scope of work for the contractor it will also help to reduce the miscommunications between the parties.
- d) Direct communication and continuous coordination will provide professionals an opportunity to review the contract documents thoroughly that would help in

eliminating the variations arising because of conflicts in contract documents and also eliminate design discrepancies and errors as well as omissions in design.

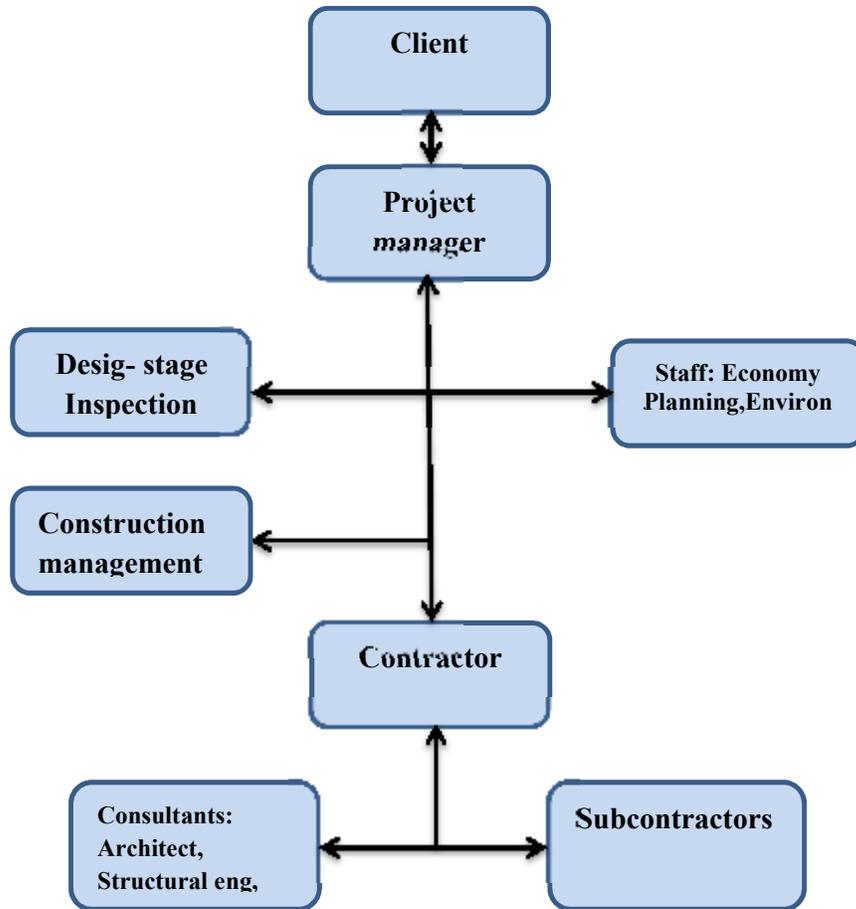
## **Interview**

In this changing world, companies have had to learn how to formulate and implement their strategies through projects in order to successfully face opportunities.

To gain some understanding of the variation order in Swedish construction industry, we met Benny Johansson from SWECO Structures AB in Malmö.

The interview topics were chosen based on the research question of this study. We investigated the impact of variation orders on project performance in order to take proactive measures to reduce them and the interviewee had extensive experience from the Swedish construction industry from both contractors and consultants, therefore, interesting findings could be found during the interview.

He mentioned that if any changes are made with the project planning, relevant participants will be noticed immediately and therefore they could adjust their own work accordingly, so that negative impacts caused by changes are minimized according to valid documents and according to Standard Swedish regulations (Ändring och tilläggsarbeten, s.k. ÄTA (eng. Variations, adjustments, alterations, additions or omissions, correctional and additional work CAW)). (Fig.2)



**Figure 1:** Relationships and communication links (Sweden), according to the interviewee.

There are two main types of change order, contractual changes and cost changes.

Contractual change is handled and decided upon by the project manager, if within the initial boundaries and mandate given by the client. If the changes are ordered by the client, it will be decided upon by the client. It is however always the project manager, while informing the client, who handles the changes and negotiates with contractors. It is common for the client to give financial mandate to the project manager for changes up to 100 000 SEK (10 000 EUR), although it varies substantially depending of project size.

The majority of Swedish contracts today are based on the standardized conditions of contract. These documents are developed and issued by the Building Contracts Committee (BKK). BKK is a non-profit association consisting of authorities and organizations in the Swedish

construction sector. The main objective of BKK is to constitute a negotiation body for the principals regarding general conditions for different kinds of contracts.

Many countries have a legislation that regulates contract relationship. The relationships between the client and the contractor in Sweden are regulated by general conditions of contract. The performance contracts are based on (General Conditions of Contract for Building), (AB) (BKK).

## **Summary**

Variations present problems to all parties involved in the construction process.

The nature of variation was identified as omission, addition and combination of both.

To meet this challenge successfully, project participants can minimize variations with extra careful, design stage and also during the course of construction. Continual improvements in building design and construction must be made. Building designers and constructors should be alert to these advances and learn how to apply them skillfully.

Management strategies would assist in clarifying the project objectives and in identifying the noncompliance with their requirements at the early stage and can be aimed to control variations in procurement of construction projects to achieve specific goals.

Direct communication and continuous coordination will not only eliminate errors and design discrepancies as well as omissions in design but also provide an opportunity to review the contract documents and help that a project finished within the shortest time with eliminating of the variations arising because of those conflicts.

# Bills of Quantities

## **Definition**

Bills of quantities (BOQ) have been one of the key control documents, in both the building and civil engineering sectors, for over a century. Indeed the bill of quantities was the *raison d'être* for the development of quantity surveying as a separate profession. The use of a BQ increases the efficiency in obtaining competitive tenders, as well as being the key document when calculating monthly payments and valuing variations. (Seeley, 2001)

A BOQ's is a document that lists and itemizes an estimate of how much material is needed, as well as manpower, equipment, profit and any other work that needs to be done in order to complete the project. It is usually given out as a quote estimate in the bidding process.

With respect to the client, the main disadvantage of the BQ system is that they, the clients, carry the risk of any errors in the stated quantities; clarification and correction necessitating the issue of a variation order.

But with respect to the contractors, the use of bills of quantities may prevent them from developing effective cost control systems. (Potts, 1995)

The BQ could take one of three options: a full SMM BQ, a builder's BQ, or an elemental cost plan. (Janssens D, 1991)

(Elemental cost planning is a system of Cost planning and Cost control, typically for buildings, which enables the cost of a scheme to be monitored during design development).

## **Creation**

Bills of quantities are prepared by quantity surveyors. They are prepared by a "taking off" process in which the cost of a building or other structure is estimated from measurements in the architect's drawings. These are used to create a cost estimate such as in regard to the square area in meters of walls and roofs, the numbers of doors and windows, and systems as heating, plumbing and electrics. Similar types of work are then brought together under one item, a process known as "abstracting". Since the architectural drawings are dimensioned in millimeter (mm), so that it is necessary to convert the plan dimensions to meters (m) to two decimal places when transposing dimensions to quantity surveying paper. (See AppendixI)

The easiest way of measuring quantities is to write the “taking off” figures manually on a standard quantity surveying paper. (See AppendixII)

The relevant costs of the materials and labor costs of the operations or trades used in construction are provided by estimating books. As the rates for materials and labor change due to inflation, these books are frequently republished.

There are different styles of bills of quantities, mainly the Elemental BOQ and Trade Bills.

### **Contingency sum**

A Contingency sum is an item found within a Bill of quantities (BOQ).The item refers to unforeseeable cost likely to be incurred during the contract.

There are two types of contingency sum. The first refers to a specific item i.e. 'additional alterations to services when installing said shower unit'; where an item for alterations to existing services is not contained within the BOQ but some work is envisaged.

The second type of sum is where money can be allocated to any item, within the BOQ, in the same way as the above example or used as 'additional work to be undertaken by the contractor, at the request of the contract administrator'.

The first is usually approximated by the client’s PQS and the second by the contractors QS (or commercial manager).

### **Criticisms**

Bills of quantities compound labor and material costs by combining them into a single rate that is then adjusted in regards to material quantities. They also do not consider all the main costs incurred by contractors such as construction plant, temporary works, and payments made on an interim bases in regard to work completed. Thus they do not actually model real costs. An alternative form of cost document that took account these costs was developed at Building Research Establishment called operational bills. (wikipedia.org)

Bills of quantities may prevent contractors from developing effective cost control systems.

They impair transparency in regard to changes and costs “It has been suggested that the reason why bills of quantity still find favor with contractors “is the opportunity it provides for

creating a smoke screen around the contractor's original intentions. Thus, front end loading may go undetected, and new rates may be negotiated almost from scratch”. (wikipedia.org)

## **Interviews**

To gain some understanding of the Swedish construction industry, we had an interview with Thomas Alm from SKANSKA, who is responsible for the international projects. The interviewee has extensive experience from the Swedish and UK construction industry from both contractors and consultants.

Answering our question about whether there were Bills of quantities in Sweden as in the UK, Thomas explained that the bills of quantities in Sweden called “amount materials list” which is a description to the material required for the work on site. The customer usually orders it, for a breakdown of costs for materials, time, workers, etc. and the cost estimator who prepares it, is usually available in the construction company. Thomas said that in Sweden, we determine an approximate cost for each whole project while in UK, the Quantity Surveyor has the task to calculate more detailed expenditure.

In the second interview with Anders Nyh from NCC who is also responsible for international projects in his company, we were informed that the bills of quantities used in Sweden are mostly unlimited, because it depends on how much items we are dealing with, if we want for example to break up a mountain, the costs depends not only on the amount and how many cubic meters you have to move, but the costs also depend on other complications, like the costs of transportation, how dangerous the materials are, etc. According to Anders Nyh, the list of the amount of the material is usually determined by the project manager or, in larger projects, it tends to be a project engineer.

# Construction waste management

## **Introduction**

Material waste is considered as one of the most important problems in the construction site. Every type of construction project is accompanied by enormous heaps of construction waste causing huge impact to the environment.

Therefore, the reuse and recycling of waste production are crucial to reduce material waste and thus, reduce pollution.

It is only few years ago when companies are more alert for waste management. In Sweden most construction companies request detailed analysis of waste management at all stages of construction process.

According to quantity surveying studies, the benefit from identifying the construction materials will definitely lead to the saving of money as long as a useful waste management procedure is carried out.

Recently, it is noticed that effective and detailed analysis of site waste management is a necessity for most construction companies.

## **Construction material waste**

A major change in waste management was noticed in Sweden in the past ten years. The responsibility of how to deal with different group of wastes is being made by the producers. As a general definition, waste is any material of no use or value to the owner or in other words, it is that material of no longer part of chain of utility.

Nowadays, construction materials waste management has drawn more and more attention. In fact, service providers following acceptable construction waste management practices are likely to have greater credibility in industry.

In this work, we will focus on how we can rearrange and reuse the construction site material waste in an indisputable and safe way.

Engineers should consider the usage of good waste management practice on construction sites in order to ensure compliance of staff and subcontractors with the environmental legislation so in the same time they get benefit from it to reduce the costs and save money by lowering the quantities of wasted materials and creating better image of the construction site.

The processes that can be done to have good site construction waste management may include the following:

- Better project planning (the purchasing of exact quantities of required materials, stacking and storing of site materials).
- Organizing material waste disposal. This should be started at the initial stages of project planning and continued through all phases of the project. The engineer has the authority to cancel and return delivered materials on site if they are not as per specifications or they are damaged.
- Planning to increase level of recycling of construction waste. Segregation of different types of material wastes as they are generated is of great benefit. (Telford, 1995)

### **Site waste management progress report**

Waste management plan includes the collection, quantifying of resources, transportation, processing, recycling or disposal of waste materials.

We may use the example of report shown below to identify and classify the waste of any substance or object that a company discards, intend to discard, and or required to discard. However, the term 'discard' has a special meaning. Even if material is sent for recycling or undergoes treatment in-house, it can still be a waste.

Waste materials can be sorted into uniform categories of classes, usually by size, weight, color and material. (Picture 1)



**Picture 1:** Stacking of site materials

Wastes from construction, demolition and excavation operations will normally be a controlled waste, classified as commercial or industrial waste, and hence subject to waste-related legislation. (See site progress report AppendixIII)

### **Site waste management plan**

Site waste management plan includes all types of construction materials expected to be created from the construction site and should be kept at the site as a reference. A construction company should prepare a site waste management plan at the start of a project and should be also updated according to project progress.

The preparation of good site waste management plan is important tool for construction companies to:

- Rearrange and reuse of construction materials (suitable soil, demolition materials, pruning's and surplus construction materials). The further use of waste materials in their original form after repairing or modification and thus avoid material waste, save raw material purchase and reduce waste transportation cost.
- Identify and measure construction waste materials to minimize construction waste. This can be achieved by limiting of packaging by weight or volume or by making materials recyclable.
- Reduce rising costs of waste disposal.
- Improve environmental performance. (Wiley-Blackwell, 2010)

(See site waste management plan AppendixIV)

## Checking

- ☞ It is important to be aware of hazardous wastes on the construction site, such as, asbestos, chemicals, oils or contaminated soils, all of which lead the companies to have extra legal responsibilities and may be required to complete detailed waste transfer consignment notes.
- ☞ Check the registration certificate of the waste carrier before handing over the waste.
- ☞ Check with your waste carrier where the waste being taken and make sure the destination is authorized to receive it.
- ☞ Be alert to any evidence or suspicion that demolition, earthworks or construction waste is being dealt with illegally. (constructingexcellence.org.uk)

## Safety

The importance of safety has been understood in the construction industry in general. The awareness of good practice should be promoted as a part of health and safety induction and training for coworkers on site.

The inadequate safety measures and not keeping the site clean both might lead to increased risk of accidents and injuries to the workers. Therefore, the consequence of that will be an increase in insurance cost and wages are paid to workers on sick leaves due to injuries. Thus, safety not only prevents accidents but also cost saving. In the same way, effective project management with good quantities can produce cost saving. (constructiondata.wordpress.com)

Better Safety = Less Accidents and Less Waste (Loss of Manpower) = Lower Cost  
Better Project Management = Better Productivity = More Efficiency = Less Waste = Lower Cost.

Less waste = Safety = lower cost

## Interviews

Through an interview with Bonny Svensson at PEAB Company in Malmö (Road improvement project), we tried to get an idea of how common it is with the use of the rest site construction materials waste. (Picture 2)



**Picture 2:** Recycled asphalt stockpiles

The purpose of the interview was to investigate and clarify the value of the rest product and the site construction material waste during the construction process.

From the interview we understood that there were many benefits from removing, recycling and reusing for the existing asphalt roads, such as:

- Remove: Means reduce existing asphalt stockpiles
- Recycle: Reuse replenishable materials and recycle for a greener tomorrow
- Repairing and replacing the secondary roads: Better communications
- Cost saving

Taking into consideration that the two main words NO WASTE has a great value in quantity surveying operation and waste management planning, first by ordering the exact amount of materials needed for each step and according to the drawings. Second no need to purchase and haul more than the site needs and to ensure that you have enough materials to do the job.

Finally, the stock asphalt piles will be used in construction of small secondary roads.

After contacting the Swedish company NCC for inquiry about this subject and the process of waste management, we contacted a Project Manager at NCC AB Mattias Åberg, and we found out that they do not report their waste production. NCC sorts the produced waste in each project into different groups according to the waste type and then transports them to SydSam in Malmö/Lund.

SydSam is a networking organization for municipalities, counties and regions in southern Sweden. In SydSam includes six counties: Blekinge, Halland, Jönköping, Kalmar, Kronoberg and Skåne. The office is located in Kalmar.

Then, SydSam basically prepares the reports including the statistical analysis of waste and send them to the construction company at the end of the project.

The Swedish NCC does not have specialized personal for reporting and continuous checking of waste production. The project Manager is only one who ensures that the waste produced during any project is wholly transported to SydSam, which in turns sends back the waste production statistics.

For NCC, the transporting of waste only to SydSam is of lower cost than if the later is responsible for both transportation and reporting waste production.

The NCC advisor Mattias Åberg stated that one disadvantage to be considered in Sweden is that no enough spaces for sorting construction Wastes. Therefore, sending these wastes for SydSam to sort and analyze will result in increased cost on the construction Company. The NCC advisor added that there will be no exact estimation of how materials are used during the project progress and estimation of materials that are left over. Therefore, it is also a cost issue!

In addition to, NCC usually gets rid of all left over materials for every project because for this Company different project required different material unless it is well known the other project under process might use these materials. This will result in increased hazardous waste and their impact on the environment, but by reusing of these waste materials, we will lessen their hazardous effect.

# DISCUSSION ABOUT QS IN SWEDEN AND THE UK

## THEORY

Quantity surveying prepares schedules of quantities of the various project elements. In many places in the world, a schedule of quantities is prepared for most types of construction contracts, including lump sum and unit price. In other places the quantity surveyor prepares schedules of quantities for unit-price contracts, while the quantity take-off work for lump-sum contracts is left to individual tenders. The practice differs, however, with the responsibility for generating these quantities through material take-offs often falling on individual contractors and their estimating staff.

Quantity surveys are conducted at various points during the planning and design phase, not just during construction document development. The contract documents of material quantities vary in different parts of the world. For all unit-price (measure-and-value) contracts, these quantities must be provided, because the tenders are based on a common set of quantities.

The Swedish industries contractor appoints a projector procurement engineer due to the fact that in Sweden they use “amount materials list”(Swedish, mängdförteckning), instead of the bill of quantities. A similar profession, known as estimator, exists in the UK.

There are only marginal differences between the estimator and the quantity surveyor concerning required ability and responsibility. The main difference is that, whereas the quantity surveyor has a solid base in the academic world, being provided extensive and tailored education, the estimator is left with only a marginal specific education and no possibility of being afforded a specific estimating degree. (Hackett & Hicks, 2007)

The client in the Swedish construction industry engages a cost estimator and a building project manager in order to handle variation issues and contracts.

Because the contract sets the rules of the project, it creates the foundation for the construction process and most of the incentives needed to move the project in the right direction.

One of the enduring characteristics of the construction industry is its variability of demand. This variability of demand in many ways shapes the nature of the industry and the firms which operate in it.

Apart from modernizing the construction practices in Europe, it has also brought momentous change of perception towards the importance of proper costing and cost documentation of construction projects.

All construction projects, of any size, type or complexity, follow a procedure, beginning with the preliminary planning and feasibility study and leading on through schematic design, design development and construction contract document preparation.

## **Interviews**

During the interview with Thomas Alm from the company of Skanska, who is responsible for the international projects, we had a question about why the Swedish construction industry does not have the role of quantity surveyor but is usually well known in the UK?

Mr. Alm thought that it was a very interesting question.

He said that in the UK the construction industry is working in a different way compared to Sweden. The construction organizations in UK have a different system. They work in a high level for testing and inspection on various activities of a project. Mr. Thomas added that here in Sweden, it is usually the builder himself who decides about the amounts of materials necessary for the project. It is known that Quantity surveyors have a broad agenda in managing all costs relating to building projects and they are specialized in analysis of data for any material used and reconcile it all, while in Sweden, the builder or the client is usually responsible for that. So what Thomas Alm said, "In Sweden, it is not important if there is more or less material because you can always order", because the type of contract is lump sum.

There is also cost estimator instead of quantity surveyor, but the cost estimator does not have the same education as the quantity surveyor. The quantity surveyor is more qualified, as producing cost estimations, controlling the budget, advising in design matters regarding costs,

producing tender documents for consultants and contractors, and handling change orders. Asking if we can possibly call them Mängdregleringsmän (eng. Quantity surveyor)? Thomas Alm said that we can possibly call them (Mängdregleringsmän), but they are almost not found in Sweden because their role is not considered to be crucial in the construction site. It's very difficult to find them in Sweden.

The builder themselves in Sweden play a major role regarding quantity surveying and have more value in the site than those in the UK, because they already have the system where the Quantity Surveyor for calculation and ordering of materials. So if there would be a (Mängdregleringsman) in Sweden, he would just be simply working in the site with builders and would have the same name / status.

According to the NCC Anders Nyh who is responsible for international projects, quantity surveyor is not common in Sweden but it is a mix between an engineer and lawyer, in other words, (Mängdregleringsman) in Sweden have no judicial education. In Sweden it is a regulated standard contract law, while in the UK's they usually use a long contract for individual projects.

According to the interviewee, the project managers in Sweden most often study an additional course to get more knowledge about quantity surveying, because it falls on the project managers to handle and often also perform cost estimations.

## **PROCUREMENT**

Any construction process can be divided into four main phases: program, design, procurement and production. In the procurement phase the client chooses the contractor and the parties sign the contract.

The Swedish construction sector has for some time struggled with problems with increased costs, delays and faults. However, there is a noticeable growing interest within the Swedish construction sector to apply new theories, ideas, and achieve a more effective construction process. (Toolanen, Olofsson and Johansson, 2004)

The construction industry has, generally, three types of specifications for projects, design and build- prescriptive and performance contracts. These specifications regulate the responsibilities in the projects.

Swedish construction contracts are mostly based upon standard rules worked out jointly by client federations and the Swedish Contractors Federation. The AB 04 regulation for example, is applicable to contracts in which the client has the main responsibility for the design of the project, whereas the ABT 06 regulation is applicable for contracts where the responsibility for the design is distributed to the contractors.

Sweden uses three generic contract forms:

- Prime contracting models (DBB: design–bid–build)
- Design and build models (DB: design–build)
- Construction management models (CM)

Design-bid-build is a general contract implies that a client signs only one contract with a general contractor, who in turn appoints subcontractors to carry out the work. The general contractor is solely responsible for the coordination of subcontractors. This type of organization is more often used in Sweden than divided contracts.

The DBB procurement is also the most widely used strategy in the UK and in many countries. In design-build contracts the contractor is responsible for both design and construction. The client signs only one contract, thus this form is the most straightforward from the perspective of responsibility. In the procurement documentation, the clients set their demands in terms of functionality.

The main difference between each model is primarily how the design responsibility is distributed between client and contractors.

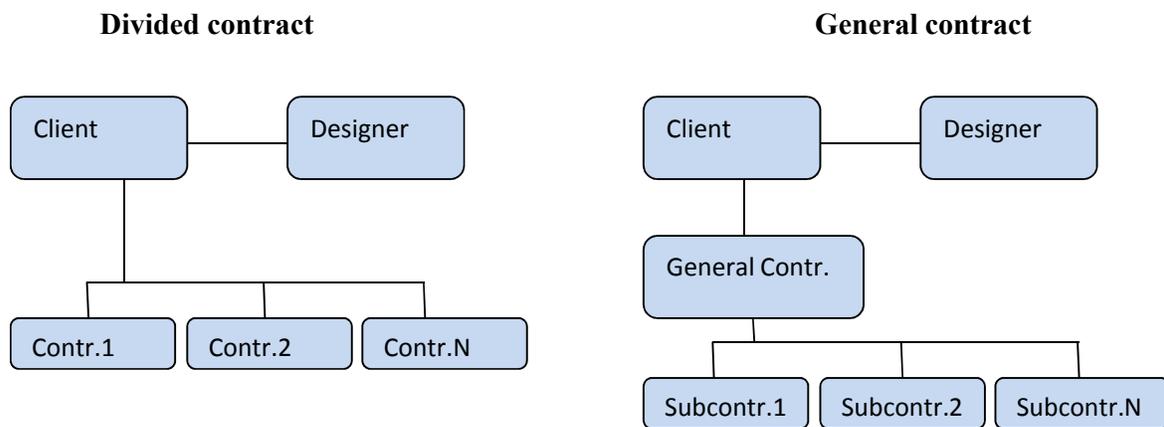
Effective collaboration is claimed to lead to fewer disputes, lower construction costs and a better quality product. Positive experiences in the UK have led to the concept being adopted in Sweden.

The general agreements regulate the responsibilities and undertakings in the contracts based on a balance between rights and responsibilities between the actors (contractor and client).

Who is responsible for design and who is responsible for construction are clearly defined.  
(Simu, 2006)

Only the contractor is responsible in the general contract for the construction and any uncertainty in the design is the client's responsibility. It means that the contractor has the right to get any adjustment or occasionally compensation according to the contract when any dispute occurs between the actors.

Small projects are more vulnerable to changes and additions in contractual agreements, hence, the need to plan ahead for uncertainties should be high.



### Organization structure in performance-based contracts

A general contract implies that a client signs only one contract with a general contractor, which in turn appoints the subcontractors to carry out the work. The general contractor is solely responsible for coordination of subcontractors. This type of organization is more often used in Sweden than divided contracts.

The table below shows the strengths and weaknesses among the different forms of contracts, according to the interviews and our study.

<b>Form</b>	<b>Strengths</b>	<b>Weaknesses</b>
Performance-based contract	Flexibility for the client in terms of design Possibility to choose the best tender for both design and construction	Higher construction costs Higher coordination costs Lack of information and knowledge transfer between actors
Design-build contract	Shorter building time Single responsibility	Cost uncertainty Quality uncertainty Necessity of high professional skills from the contractor
Partnering	Increased returns Shorter building time Openness for alternative solutions Knowledge transfer between actors	Increased number of meetings Necessity of high professionalism from all actors Difficulty to get a fix price of the contract

The standard agreement for contracts in the construction industry in Sweden is Allmänna Bestämmelser (AB), with different agreements depending on the form of the contract undertaken.

AB04 is for general contracts and ABT94 is for building and design contracts. The Construction Contracts Committee (Byggandets Kontraktskommitté, BKK) representing various actors in the Swedish construction industry prepares these general agreements. (Simu, 2006)

## **Project management**

Project management is the bringing together of individuals and groups to form a single, cohesive team working toward a common goal.

Project management is growing in importance worldwide, and has a major impact on project productivity and quality. Its principles and techniques help complete projects on schedule, within budget, and in full accordance with project specifications. At the same time, the project management helps to achieve the other goals of the organization, such as quality, productivity, and cost effectiveness.

The project manager often has the responsibility for planning, organizing, integrating, controlling, leading, decision-making, communicating, and building a supportive climate for the project and ensures that the architect's designs are within the developer's cost allowances

and building requirements and that the contractor's work will be timely and properly executed according to contract specifications and at a fair price.

For project management to be effective there should be formal, written policies and procedures that explain the role and authority of project managers. The procedures often constrain the availability of resources or the terms under which resources are available to the project. This includes carefully monitoring and reporting on progress, resolving problems as they arise, controlling any changes in the project plan and managing risk.

Traditionally, the British system relies on the architect/engineer for problem-solving during the briefing process because of a relatively open market, and low levels of state regulation. This lies in contrast with some other European countries, where the design is sometimes developed using contests. The latter lessens the architect's power over the project, apart from conception.

The central government control is based on and expressed in statutory law in Sweden, whereas common-law countries display stronger professional identities, in construction as well as in other sectors. The legal system in Sweden is closely connected to the principles of civil law. (Lindh & Meyerson, 1998)

The government assigns the authority agencies the responsibility to promulgate regulations. The state also shaped the construction sector as a major client and market regulator. (Swedish construction, 2002)

Engineers and architects in Sweden are mere consultants with a weaker professional identity, because, the construction sector has developed in relative isolation from the outside world, whereas in the UK the architect is the (clients) representative where duties may include supervision and coordination of the design aspects throughout the construction process.

The project manager in UK is recognized as situated on a strategic level and has the responsibility in the early stages of the project to handle the process on behalf of the client, controlling the project execution plans, time plans and is not directly involved in the work executed on site, while the project manager in Sweden, usually starts with creating a project plan and some schedules, moving the project forward by discussing with consultants and architects. Initial cost estimation is made by the project manager, followed by the

hiring of consultants for the establishment of the tendering documents, as well as appointing a design team manager to gain them as a support function in planning, estimating and quality controlling.

Most clients in the UK, do not have their own competence in construction project management, and they therefore appoint a professional team. The project management team typically comprise of an architect, a structural engineer, a mechanical/electrical engineer, a quantity surveyor, a planning supervisor for health and safety, a construction design management (CDM) coordinator, and a civil engineer should the project require it. The quantity surveyor is required from the beginning, to produce the feasibility study.

Cost estimates are handled by the quantity surveyor, a role unique to the Anglophone world, in conjunction with the rest of the project team. But the final responsibility for the budget lies on the client.

In Sweden, the client is responsible for that the work regulations in PBL (Plan- och bygglagen) are followed and that the social requirements are met. The construction client is the part that carries out or assigns others to carry out construction, demolition or land work. Thus, the client is by law responsible for functionality, design and technical solutions. The client is also responsible for a satisfactory working environment. (Vennström, 2008)

The client does usually not approach project management consultants until the project has expanded beyond the client's own capacity.

The client does, in a vast majority of construction projects, contact a project manager in an early phase, to help with the planning and organizing of the project in collaboration with the client. It is however the client's responsibility to approve or reject proposals presented by the project manager, who is in closer contact with consultants and contractors during the project. This decision-making role of the client is mostly prevalent for design matters such as quality and environment, but does also stretch to the realization, such as procurement and finance. (Nordstrand, 2000)

Understanding the important role of Quantity Surveying and Project Management which is the art of directing and coordinating human and material resources in construction process, will improve the construction quality in general, minimize the costs, forecast the probable consequences, give suitable solutions and better circumstances to develop the construction industry.

## Conclusion

From our study, we think it will be useful if quantity surveying and waste management should have their own representative in every construction company who plan the flow of materials throughout the project in order to cut waste and increase the value of work activities in site production. Big savings are achieved by improving the flow of material without spending extra money.

The quantity surveyor is responsible to calculate any variation and extra work on site as per requirement of the project.

The comparison of quantity surveying in both Sweden and UK showed that the project manager is in charge of cost estimation and budget of any construction project. However, there are some differences. In Sweden, the project managers themselves are responsible for the cost estimation whereas, in UK; a quantity surveyor is the key role in those areas but still in collaboration with the project manager. The three major responsibilities for a Quantity surveyor are: To produce cost estimates, enabling budgetary and finance control; to provide advice concerning contract strategy and taxation; to prepare contract documents for procurement of consultants and contractors. In other words, the negotiation of contracts, prices, change orders and interim payments are being the responsibility of Quantity Surveyor.

It is also found that the Swedish construction industries on the whole do not have the role of Quantity Surveyor in their supply chain because of the fact that Swedish contractors instead of the bill of quantities assign a project/procurement engineer to solve any contract variation issues. If the variation orders were not realistically priced, this will result in increased construction cost.

Moreover, the errors in documents and late procurement are usually handled by the Project manager. One important finding, in Sweden is that, the client does, in a vast majority of construction projects, contact a Project manager to help with planning and organizing of a project. It is the client's responsibility to approve or reject proposals by Project Manager. Although the clients' role is prevalent for design matter however, it may also stretch to

include procurement and finance.

Therefore, in Sweden, most studies show the importance of both the Project manager and the client as the decision-makers in most construction projects.

Managers at all levels in Sweden (from site level upwards) working for both contractors and clients usually have taken courses in construction law, often provided by their companies.

The success of any project requires the right product, methods and manpower and each must complete the other.

Construction projects in both U.K. and Sweden provide a classification of workmanship that if not monitored properly will not in reality meet up to the required standards outlined in the contract documents.

The Project Manager is the leader and the Quantity Surveyor, if present, should coordinate with the Project Manager and the Purchase Department to control and minimize any cost variations which might have major impacts on the project performance and achievements.

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# Appendixes

## Appendix I

Drawing dimension (mm)	Taking off (m)
1118	1.12
1100	1.10

## Appendix II

Item	Description	Unit	Quantity	Rate	Total price	Note

Drawing nr \_\_\_\_\_

Location \_\_\_\_\_

## Appendix III

Item	Type of material	Approx. weight of materials in kg or ton	Rearranging of materials on site	Saving of materials	Reusing of material
<b>Total weight</b>					

Appendix IV

**Site waste management plan**

- **Company name:**
- **Project name:**
- **Project no.:**
- **Supervisor name:**
- **Target:**

Read carefully and follow the description below:

You must indicate the approximate percentage % by weight of the general waste and debris on site.

- Preparing plan, minutes of meeting and tool box talk.
- Preparing plan (rearranging containers and skips for the waste construction materials).
- Meeting with the staff and the subcontractor's in order to discuss the site activities.
- Tool box talk with the workers in order to follow up all the safety procedure and comply with the waste management plan.
- Make sure that the lists of accepted and rejected materials will be transported from the site.

The table below shows how can you identify and reuse the expected site waste construction materials, its quantity, disposal method and handling procedure.

<b>Type of material</b>	<b>Quantity</b>	<b>Disposal method</b>	<b>Handling procedure</b>