

PRODUCTION REPORT

Business Academy Aarhus

Architectural Technology and Construction Management

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13bk2ena, group no 2

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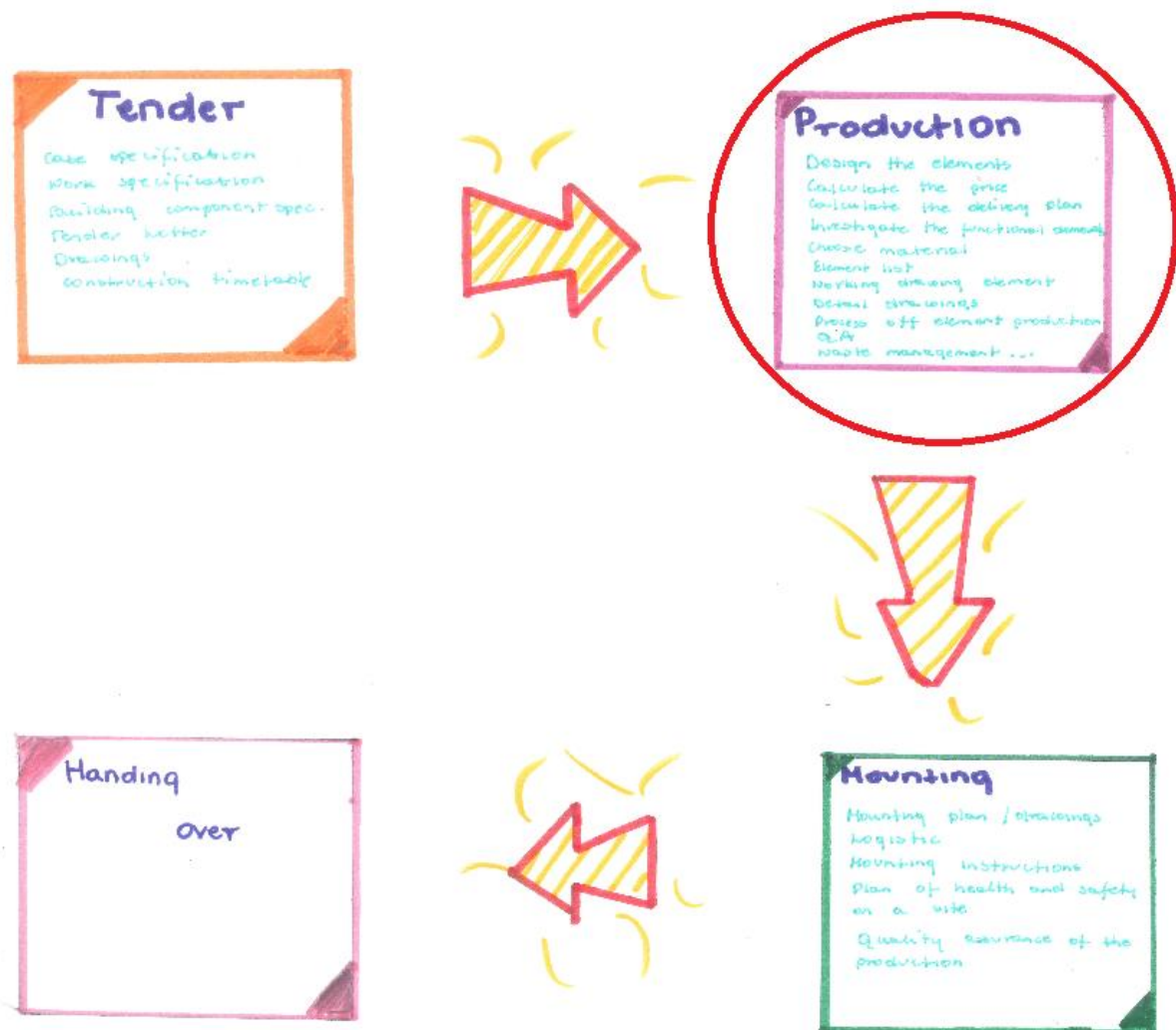
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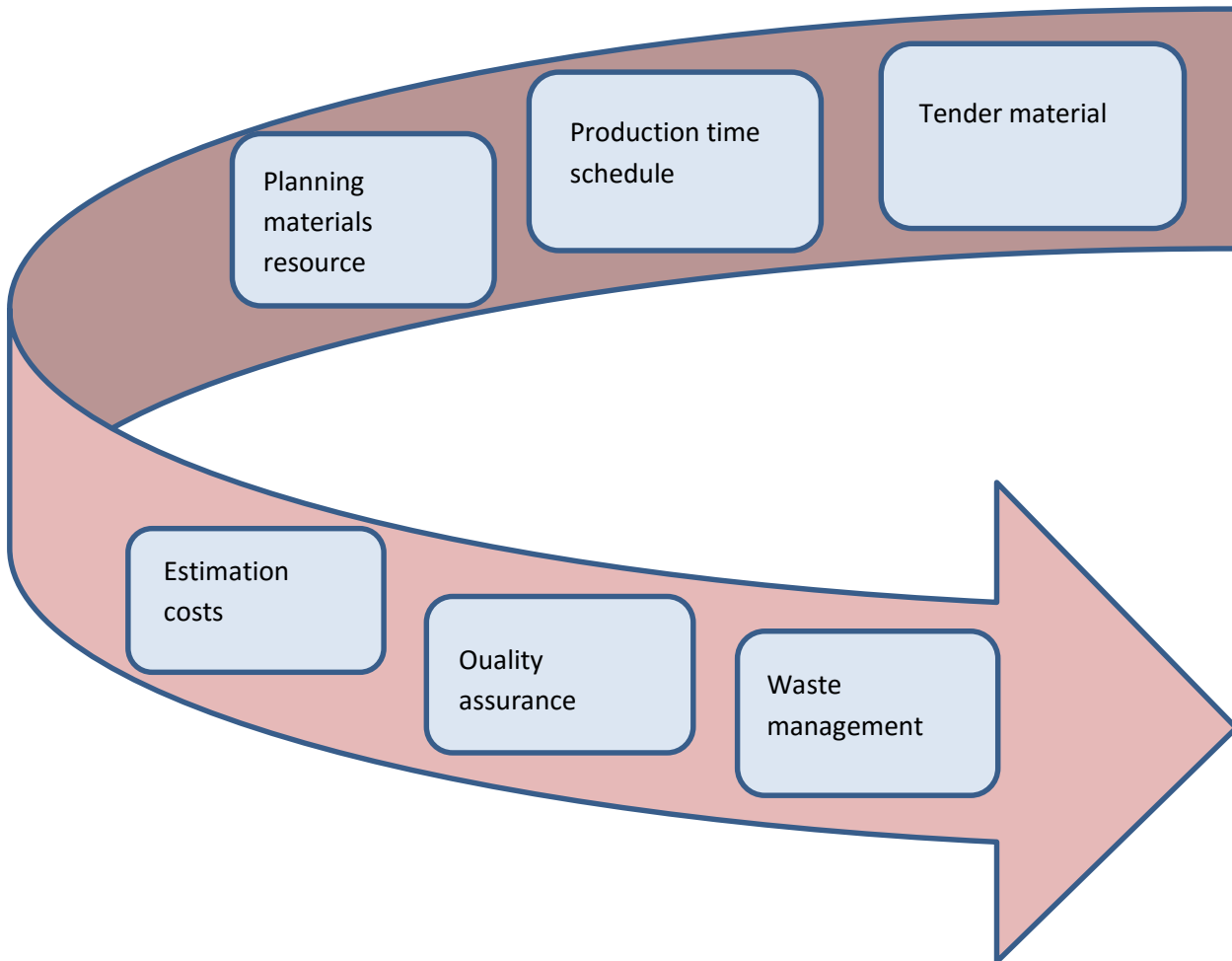
Problem statement

How does the prefabrication subcontractor make use of the tender material and how is this information transformed into the planning of linked processes that the manufacturing work consist of?



The diagram show the faces of crating prefabricated elements for the building. After definition all elements and work we moved on to the production face, which we are going to explain in that report. Next step is a mounting face and handing over part.

Plan of production



The production manager gets the tender material consists all necessary drawings as well as case specification and work specification. After that is needed to scrutinize the materials and approved. Before production should be prepared production time schedule about the time for the next steps of production as well as the person which is responsible for that step of element production. The important thing is to choose correct materials and planning resource of them, as well as required is to estimate costs.

When the production starts, during this process we need to make quality assurance from time to time, which is usually established. Also is necessary to know what to do with waste materials. The decision of re-use a material must be taken. And if it is able to re-use, it will be made waste management. (Ola)

The production manager

The production manager is involved with the pre-production (planning), as well as the production (coordination and control of manufacturing processes). He ensures that services and wares are produced successfully and that the correct amount is produced at the suitable cost and level of quality, also he secures part of transport, that the panels are delivered to the building site.

Most production managers are responsible for both human - particularly those who work in your team and the client as well as material resources.

Typical tasks for which the production manager is involved:

- To oversee the production process, drawing up a production schedule
- To meet the requirements of the client by preparing necessary documentation, drawings and calculations
- To ensure that the production is cost efficient
- To make sure that production of element is going on time and are of good quality
- To work out the human and material resources needed
- To estimate costs and setting the quality standards
- To observe the production processes and adjusting schedules as needed
- To be responsible for the selection and maintenance of equipment
- To observe standards of product and implementing quality-control programmes
- To work with managers to implement the company's rules and targets
- To ensure that health and safety guidelines are followed
- To inspect worker performance
- To identify training needs. (Ola)

Concretus Panels

The company called Concretus Panels has been existed for 15 years and has been successful, although in later years, the company has been under pressure and so the forecast expansion has not materialized. In fact, the company has struggled to maintain the attained market shares; however there appears to be a slight improvement on the way. There are plans to expand the sale beyond Denmark to Germany but still we are working on that plan. Every five years Concretus Panels is updating their factory by building new production line or buying new machines. Right now in a factory are working 200 employees but from year to year the number increased.

The company's vision is to be able to compete with slightly lower prices than the competitors, but without compromising the level of quality. The second vision is to accelerate process of production elements: make it faster but with the best quality. The third vision is that no contract is too laborious;

it is merely a question of correct planning. Consequently, the management is particularly attentive to quality assurance, right from receiving an order to the delivery. This means that all orders are drawn and calculated in the company's own drawing department, regardless of which drawing level the tender material is presented with. Equally, it is expected that all employees conduct financially responsible quality assurance. The quality assurance handbook defines how a special quality plan for each individual order must be prepared, and how the required documentation must be completed according to the order's complexity.

Typical customers have been subcontractors or general contractors, who handle the mounting themselves. The company's order usually concludes with delivery on the building site. The company has 3 trucks with cranes and five element-transportation tracks to reduce waiting time. The biggest element which the company can transport is 3,86m x 11 m. (Asia)

Production drawings

All of drawings are finished and checked before giving to the employees on a production line. Each drawing is check by our engineer and constructing architect. All mistakes are corrected and then given to the where they are printed and laminated (to avoid any distraction which can happen on a production line). Each drawing has 3 copies: one for employees, one for engineers and one which is put in documentation. Every prefabricated element has own documentation with all drawings, corrections and changes. Every element drawing has serial number, so it is easily to find a special drawing and in some cases use exactly the same one. Drawings need to be executed from 3D modeling, so the model can be used for data extraction, and thereby fulfill the BIM information level 5.

On every drawing element company is putting functional demands: fire resistance, protection against moisture, heat transfer coefficient and loads.

Quantity take of

Quantity take off is a narrowed measurement of materials and work needed to complete a construction project. Each component has its individual quantity take off. Quantity take off consist all measurements of width, height, length, as well as weight, load and materials. (Ola)

BIM model

BIM model is creating for every drawing but the company are not using it right now. They do not have special computers for that and overall opportunity. As it was mention before the company is updating every 5 years. The future perspective is to using 3D drawings on a production line. It will give a better understanding of define element and it will also reduce waste of material which they are using. It will also give a better overview about materials. Every employee has a 3D model which they can move, turn and check layers. It will also save some time and money which we are spending for printing and laminated drawings. (Asia)

Functional demands

Every element has own functional demands which are fire resistance, protection against moisture, heat transfer coefficient and loads. All of that information you can find in a building component specification, which is in work specification, or next to the drawing element. During making the element the company is really careful with using materials which can fulfill all of demands. After that is made quality assurance to check if product is correct one. The company has some special programs for that for example Moisture program.

If the element it is not stable or has any kind of drawback then it is going to be used again, as a different part of element or we are giving it to the road company (which is using that material for making road) or if it is completely bad we are throwing as a trash. (Asia)

U-value

All elements which the company produced are calculated and made according to the building regulations for the energy. A good influence for the heat loss coefficient has the best choice and careful selection of materials and also work which is precisely made. (Ola)

Production flow

Production flow is the production of large amounts of standardized products, involves making many copies of that products very quickly. The method of fast and precise production is based on using assembly line technique. The element is partially sent between workers and their so called "tables". Workers do their work on an individual steps for example one of them is making holes and recess another one takes care of placement materials, this is not based on the method that each worker makes the whole product from start to finish. This method allows to be precise in the special field as well as of the saving the time and creating large numbers of similar products efficiently.

That line allows achieve high volume, the detailed organization of materials flow, careful control of quality standards and division of duties. Also what is important that the production method is financially the most efficient and effective because there is less of a need for skilled workers.

The flow production is capital and energy intensive, it uses a high proportion of machinery and energy in relation to workers and also that kind of production is automated. But despite this and by this that method of production could achieve perfect elements. However, should be marked that the impact of element perfection is also manual work. By investing money in the machine, energy and team work we can reach greater profits.

Another major fact is the appropriate planning of production and organization of the halls as well as workstations allow avoid wasting time on transportation of concrete at large distances.

System of company's work and its production is based on the avoidance of impeded chain of goods supply, which reduces the efficiency of the flow. They try to avoid co called bottle neck effect. (Ola)

Materials/stock and waste management

What is waste?

The definition of waste is depending on the type of material and in where it comes from. In general is waste an unwanted part of a production, such as leftovers, garbage or simply just trash. The waste comes from manufacturing of prefabricated concrete elements.

How come if the company did not have any? Or can it be, that the company simply just does not have any wasted elements?

Where did all the waste go?

When a factory produces a concrete element, it is produced as a unique element. It might be mass-produced later, but in the beginning, all elements are unique. To have as little waste as possible, all the drawings and forms that are made to produce an element, need to be done with minimum waste. This sounds logical, but is in fact a very essential detail when it comes to the amount of waste a factory makes. The way to do this is to order their rebar in coils of 100 meters instead of ordering them in rods of 1-6 meter. Then they simply cut the length themselves, which means they spare a lot of waste and many leftover centimeters in the end. Therefore, they almost waste none of their rebar. But of course there will always be a little leftover.

The small amount of the inevitable waste that are unused after producing concrete elements, are crushed into gravel and reused in production of new concrete elements. When it comes to producing concrete elements, it is easy for the factory to get rid of the waste and spare parts, simply because they reuse them in the next production of element.

For example:

In the table below you can see a summary of the concrete factory Bison's waste and see how they are able to reuse their waste 100%.

<i>Activities</i>	<i>Waste generated</i>		<i>Waste disposal (%)</i>			<i>Saved Material (%)</i>
	<i>Type</i>	<i>%</i>	<i>Re-use</i>	<i>Recycle</i>	<i>Landfill</i>	
Manufacturing						
Automated Hollow core floor sections	Concrete	2%	100%	0%	0%	-/-
Production of Concrete	Water	Negligible	100%	0%	0%	-/-

The table is a summary of Bison's waste in production¹

Personnel logistic

¹ <http://www.wrap.org.uk/sites/files/wrap/Pre-cast%20concrete%20-%20Full%20case%20study1.pdf>

The personnel logistic is based on the planning for each person on the building site. Personnel logistic also distinguish persons, who are responsible on each step of production. That kind of planning is made to avoid wasting time and to be well informed what is currently going on the building site, when the process of each element starts and finish, if we need to find it we know where and when the production of specific element is placed. Also the personnel logistic can be helped of payment for done work because we know how many hours each person works. (Ola)

Quality assurance

The forms involved in the manufacturing and production of prefabricated concrete elements

Why the forms in precast concrete production are important, what they are made from and how they are used.

Precast concrete manufactured off-site negates the need for temporary works and reduces material wastage resulting in a more efficient use of material.

The nature of concrete and of the production methods allows manufacturers to produce standardized elements using pre-set forms and shutters that may be reused hundreds to thousands of times before they have to be replaced, which allow cost of formwork per unit to be lower than for site-cast production.

Non-standard elements

The form or mold, is typically made from laminated planks of timber. The molds are placed and arranged by the workers on a production table or pallet - newer technologies means that the workers are helped by lasers which translates into less mistakes and minimum time spent measuring.

The molds act as a temporary shape for the fluid concrete, and the layout possibilities are almost endless. However, the more complex the shape, the more waste is produced as the forms need to be cut instead of just being rearranged into another shape.

After the shape of the future element is finished, reinforcement is placed inside the molds, and fluid concrete is poured inside of it. The filled mold goes into a huge oven which speeds up the drying process of the concrete. After the concrete has dried up, the element is taken out of the oven, the forms are removed from the element and are stacked up. If they are still useable for the next

element (and most likely they are), they are put back into shape, ready to give shape to the next element.

For more intricate designs, various other materials can be used along with the formwork to create for example embossing writing or shapes in the element.

Standard elements

For standard elements the process is rather similar to the nonstandard one. The difference is that usually the formwork is done by using steel molds, which do not allow for deviations from the standard design. (Marius)

The company's finances

The company finished 2012 with a coverage (C) of 14,8 % which resulted in a net profit of 580.000 Danish Kroner before tax. By no means was this an impressive result but with the current situation in the building industry, top management considers it acceptable. However, it has been emphasized to those responsible that everybody needs to be very careful with tender calculations. This means that all variable expenses must be double-checked by the production manager before extra charges for fixed costs, interest rates and book depreciations are added.

As the result for 2012 is at the same level as 2011, it is expected that a C of 14,8 % will also be acceptable for 2014 in order to maintain market shares, but an increase in turnover would be welcome. It has been emphasized that an increased profit is desirable. Consequently, anything that can be rationalized must be done to make the company more competitive in the market.

The turnover last year was about 42.000.000 Danish Kroner. Previous balance sheets demonstrate that it has been capable of producing up to 20 % more square meters of panels a year with the current production equipment. Therefore, the target for 2014 is to increase production by 20 %, as this will not require huge investments.

Variable costs

Salaries

Approximately 2 years ago the company began to have only salaried employees with a monthly salary both in production and administration. The monthly salary in the production follows the average for employees in the building industry, with bonuses for extra effort, e.g. "no flaws and defects".

All managers in the production are calculated in the accounts as fixed expenses, whereas everybody

in the production is calculated as variable expenses, regardless of their employment as salaried employees. Every team leader is considered a production employee.

Working hours are usually from 4 am till 10 pm to make the production flow work. So far it has been unproblematic to find employees willing to have staggered working hours. In principle, the working hours are flexible and should the need for changes in the working hours arise, the individual employee arranges his hours with his team, provided the individual observes the time norm. The employees are happy with the flexible arrangement, however, some have not been able to adjust to it, and in a few cases it has been necessary with redundancies.

Materials

Materials are purchased at best price. The company has, however, primarily purchased on contract, meaning a contract is signed about delivery guarantees, discounts and credit terms. Costs for materials are therefore known for the current period (usually a year at a time). Materials are to be handled so that any leftover products and waste are sorted correctly in accordance with current environment rules.

Equipment

The cost of the equipment used in the actual production is calculated as book depreciations and part of the coverage. As some deliveries cannot always be handled by the company's own vehicles and the transport lengths vary considerably from order to order, transport costs are always included as a variable expenditure and calculated for each order as an additional charge.

Working environment

Working environmental matters are generally given high priority in the company. CONCRETUS PANELS have in later years attempted to implement modern management and organization principles. The human resource is central to the work process and the top management expects a good personnel policy. In real terms this means that in the planning of the production, the greatest possible considerations of the employees' well-being must be shown, not merely for their sake, but also because it appears that productivity actually increases when the work conditions are good and the work content is meaningful. In the planning of the production, the challenge is therefore to find the optimum interaction between applied technology, the material and the organization of the work, as well as, giving the human well-being high priority.

Quality assurance

The company's philosophy is that the best quality assurance is obtained through a good working environment. In other words, there has to be an incentive to make things right the first time. Therefore, the company is considering introducing a system which can continuously provide information about how the individual team/employee is doing in terms of making the least possible mistakes. Not so as to stigmatize the individual, but rather to encourage those who do well and reward them with a visible incentive.

Collectively, the employees are also rewarded with an additional bonus to their salary, when an order is completed without any changes made. When faults are found on a panel at delivery on a building site, this is also considered as a breach and the order cannot procure the extra pay benefit.

Your role as production managers is to make a quality plan for the actual order which matches the above-mentioned points.

Conclusion

The process of the production of prefabricate elements must be really precise but simply. The whole steps of work must be divided according to the planning of production and to employers work.

The important thing is the fact that the company needs a person who scrutinizes the tender material and takes care of quality control during the process, to not have a big waste in production.

Everything needs to be documented in case of changes, mistakes and accidents on the production lines (health and safety plan).

The whole production face is really important, if the company have mistakes during the process, there is a risk of wasting money and also time.

List of resources

- [http://en.wikipedia.org/wiki/Production_\(economics\)](http://en.wikipedia.org/wiki/Production_(economics))
- http://en.wikipedia.org/wiki/Mass_production
- A2014_Production management CONCRETUS panels (we use as a template)
- Production_Planning_A2014.pdf
- <http://www.wrap.org.uk/sites/files/wrap/Pre-cast%20concrete%20-%20Full%20case%20study1.pdf>
- <http://www.boligbeton.dk/Vision.9.aspx>
- <http://www.boligbeton.dk/Historie.6.aspx>