

Preparing work on construction sites



www.ByggAi.se

Foreword

The fact that preparation and planning is required to carry out construction work efficiently and safely has been known for a long time. In order for the preparation to have an impact in the organization, active participation from both those who are going to do the work and adjacent work is required. This is achieved with work preparations on site where a goal also is to develop the organisation's competence and the skills of individuals – to *create a learning organisation*.

For a number of years a knowledge bank with practical information, advice and tips from completed construction work has been built. The knowledge bank is freely available to everyone on the internet at www.ByggAi.se. Anyone can download from the more than 180 work instructions and use in their own work. Redistribution is not allowed!

A methodology and training material is also available.

Please send comments and suggestions for improvement to the address below.

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Cover photo: Mats Persson

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1 Work preparation- in an organisation that wants to learn

Today's construction places increasing demand on good knowledge and efficient production. One way to achieve this is to involve the production staff in the planning of work on the construction site. When the entire staff is involved in the planning of the work, a *learning organisation* is made possible, where the staff continuously can *develop* their *knowledge* and *competence*.

The preparation of the actual work lays the foundation for implementation. In order to achieve the desired result, the choice of the workmanship method, labour, materials, machines and equipment is made during work preparation. Everything must be based on the requirements of clients and standards, and regulations regarding quality, environment, safety etc.

The conditions for work preparation differ and it is important to adapt the implementation to the individual project. ***Available general descriptions should always be adapted to the individual project's prerequisites!***

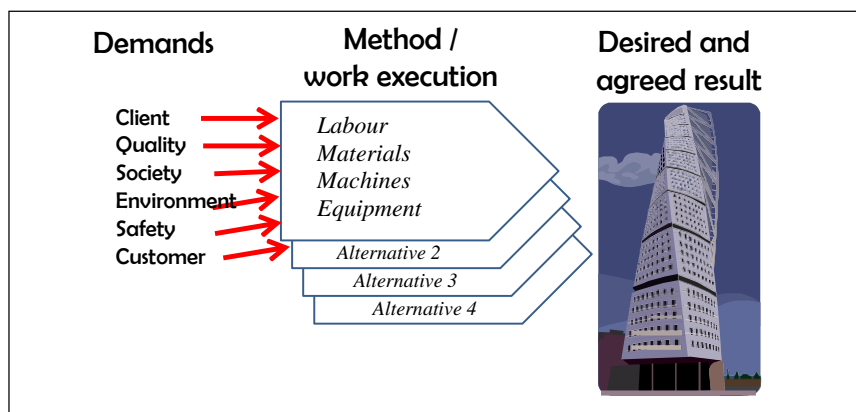


Figure 1. The requirements for the implementation of a construction project are governed by the customer's and society's requirements for the final product and the implementation process.

The advantages achieved with work preparation are above all that the work runs smoother and is carried out in a safer way with good result. When everything is prepared in advance, there is no need to interrupt the work and fewer problems arise.

An effective way to prepare a task is to use work instructions as a basis. Work preparation is most important for work that involves long series, many hours, new solutions and complex organisation. Many hours of work can be saved, see figure 2 below. There is always a learning curve when work is repeated. With work preparation the production is lower directly from the start of work.

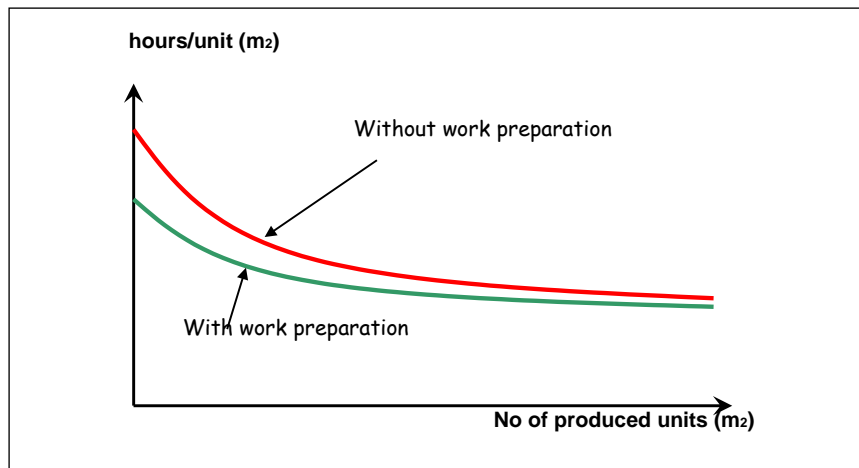


Figure 2. Work preparation makes work more efficient. (The learning curve for work processes in the construction industry)

Work preparation should be done for all operations on a construction site. Most importantly, for tasks that:

- contains a large amount of work (hours) and lasts a long time,
- involves cooperation of people,
- applies to new tasks and technically complex tasks,
- are difficult to correct afterwards,
- are important and critical to the project,
- have identified technical or occupational safety and health risks,
- have strict tolerance and/or quality requirements.

2 Basis for work preparations- Work instructions

On the website www.ByggAi.se there are more than 180 different *Work instructions* documented. Each work instruction describes a good way how a work should be planned and carried out, and explains the process of work preparation in four main headings – **Pre-conditions**, **Preparation**, **Self-inspection** and work **Execution**.

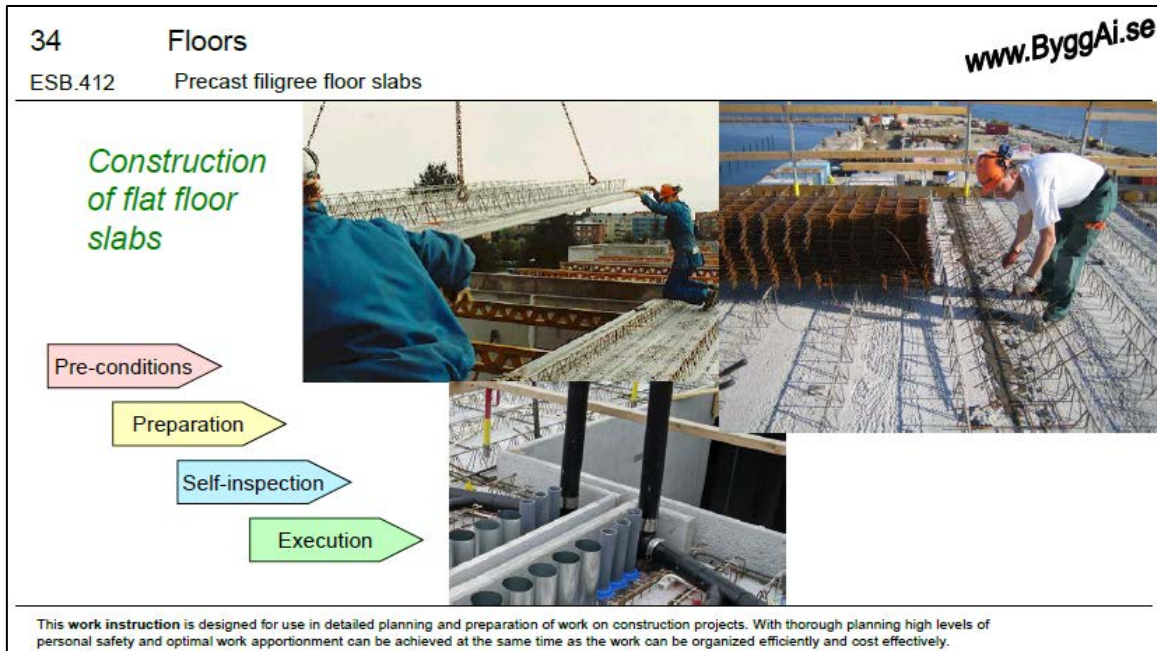


Figure 3 – First page of a work instruction.

2.1 Pre-conditions

2.1.1 Explanations

For some work instructions there is an explanatory page, e.g. for *Precast filigree floor slabs*. This may apply to new materials or to conditions that require an explanation, which is why it is important to do work in a certain way.

Pre-conditions 1(4) Explanations		Building component: 34 – Floors – Precast filigree floor slabs - 2 (23)	
Precast filigree floor slabs Precast filigree floor slabs is a formwork system with high dimensional accuracy. It consists of an approximately 45 mm thick concrete slab with embedded reinforcement. The top surface is rough for good adhesion with topping. The underside is smooth and nonporous, making it ready for painting. The precast filigree floor slab is manufactured with field reinforcement and the reinforcing carrier. Under- and diagonal wire in the carrier is embedded in the plate floor structure. The reinforcement carriers are bracing elements during transport and installation, and then acts as reinforcement between the plate floor structure and topping.		Installations Precast filigree floor slabs can be equipped with various installations. For example, electrical boxes and entrances for electric installations to internal walls, ventilation fixings, handrail brackets and boundary formwork. In addition, it is possible to prepare holes for plumbing and setting out of bathroom units on the top of the filigree floor slab as desired. On an assembly plans the supporting construction is shown. The installation Manual facilitates the planning of the installation sequence to the assembly itself.	
		Technical description Thickness: 40 - 50 mm. (thicker variants exists) Width: 2400 mm is standard. Length: Technical length of about 12 meters, construction length from 6 to 8.5 m.	

Figure 4 – Explanation of the technique used in Pre-conditions.

2.1.2 Personal safety - risk inventory

In order to facilitate the establishment of risk analyses and to highlight experience of risks that exist for each work instruction, a table of the elements that, according to the available statistics, have caused accidents and injuries is used.

Pre-conditions 2(4)
Safety — Risk assessment

Building component: 34 – Floors – Precast filigree floor slabs - 3 (23)

Work activity: Installation of filigree floor slabs

Work activity & Problem	P	C	Risk= P*C	Action
Falling during work – assembly and transportation	2	200	400	Use fall protection harness
Cluttered workplace= twist/fall-injuries	5	70	350	Regular tidying
Strong winds can overturn formwork (shoring and stray beams)	3	100	300	Secure stability continuously
Crane Working with material – falling & crushing	3	70	210	Educate in crane directing/strapping
Falling material/crushing injuries	10	15	150	Helmet compulsory

Probability = P	P = 0,1	Very unlikely	(<1 times/10 years)	C=0,5	Trifle	
Consequence = C	P = 1	Unlikely	(1 times/10 years)	C=1	Tiny	(1 - 2 days sick leave)
Risk = P * C	P = 3	Low probability	(1 times/3 years)	C=5	Small	(3 - 7 days sick leave)
	P = 10	Relative probability	(1 times/year)	C=15	Tactile	(8 - 29 - "-")
	P = 30	Probable	(1 times/month)	C=70	Severe	(30-299 - "-")
				C=500	Very severe	(>300 - "-")

Figure 5 – General risk assessment for an activity.

In addition to the risk analysis, images and text that are relevant for the work operation from, among others, the Swedish Work Environment Authority's brochures.

2.2 Preparation

2.2.1 Equipment and materials, checklists

The pages for equipment, materials and checklists contain information about equipment/tools as well as materials needed for the work. It is recommended to prepare auxiliary materials and mounting elements – nails, screws, fasteners etc. – well in advance in order to ensure the right quality of the preparation.

Preparation 1(3) Equipment and Materials	Building component: 34 – Floors – Precast filigree floor slabs - 6 (23)
Tools and Equipment:	
Equipment for erection of flat floor slabs	
<input type="checkbox"/> Skewer iron	
<input type="checkbox"/> 2 crowbars	
<input type="checkbox"/> Bending tool for rebar	
<input type="checkbox"/> Hand grinder and cutting disc for concrete	
Hand Tools	
<input type="checkbox"/> Hammer	
<input type="checkbox"/> 2 ladders about 3.5 m	
<input type="checkbox"/> Protective handrails	
<input type="checkbox"/> Railing stanchions and bars	
<input type="checkbox"/> 2 fittings type FRIMEDA for crane lifting provided by the supplier	
Protective equipment:	
<input type="checkbox"/> Fall protection harness	

Figure 6 – Equipment and Materials that are normally used for the work.

2.2.2 Delivery, reception and material handling

Contains comments on how to receive, unload, transport and store the materials. Here are alternative suggestions for suitable tools and equipment for materials handling.

2.2.3 Residue management

On the construction site large quantities of residues is generated and recycling possibilities depend on how the waste is handled on site. For kitchen joinery, for example, the packaging is often possible to recycle if it is dry and clean. Masonry generates heavy mixtures of mortar and brick parts that need removal/transportation from site. *There are still construction projects with inadequate sorting at waste materials.* In addition to direct economic gains on recycling or landfill costs, better management in the workplace provides many positive side effects.

2.3 Self-inspection

Support for self-inspection is provided in a form with proposals for items to include.

Self-inspection 1(2) Template & instructions		Building component: 34 – Floors – Precast filigree floor slabs - 9 (23)				
No	Check	Method or equipment	Frequency	Result	Date Signature	Deviation/Remedy Approval/Non-A
1	Assembly					
2	Sealing					
3	Additional reinforcement					
4						
5						
6						
7						
8						
9						
10						
11						

Figure 6 – Items for Self-inspection.

The form has the following columns:

- **Item to check** – specifies the work result to check.
- **Method or equipment** – how to check and with what equipment.
- **Frequency** – when to check/at what intervals.
- **Result** – approved or not?
- **Date** – the date of the check.
- **Non-conformance/action** – action required from deviation.

2.4 Work execution

The implementation, assembly of materials or execution of the work is documented with pictures and text from previous projects. It is intended that this will make it easier for the staff who do the same type of work next time will get an idea in detail of how all the parts have been implemented. Facilitating this as a basis for making the work even *a little better!*

Execution 4(13)

Installing filigree floor slab

Building component: 34 – Floors – Precast filigree floor slabs - 14 (23)



Receive and install.





Disconnect.


Use fall protection harness!

Execution 8(13)

Sealing of the filigree floor slab

Building component: 34 – Floors – Precast filigree floor slabs - 18 (23)

Jointing before casting produces less “burrs” between the floor and wall elements and round the steel columns.



Wheel barrow with grout.






Figure 7 – Pictures ant text explaining the work process.

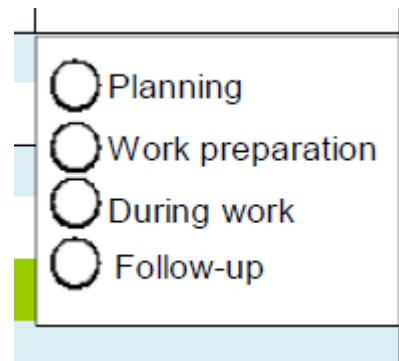
3 Work preparation form- at different stages

A standard procedure is used when doing Work preparation and a template facilitates this procedure. The main work preparation is done when before the actual work starts on the construction site. However there is also three typical possibilities to do preplanning and follow-up.

A first work preparation is done during calculation and early **planning**. In order not to lose sight of thoughts and ideas from this work, notes are made on the template. When it is time to carry out the work, a "main" **work preparation** is made. After the work has been going on for a while, a **reconciliation (during work)** can monitor if the work is going according to plan? If/what needs to be adjusted and what can be done better. If new staff are to start working on the task, it may also be advisable to re-prepare the work. Finally, a **follow-up** shall be carried out and experience recorded and reported further so that experience can remain within the organisation.

The empty form for preparation of work with instructions is available at www.ByggAi.se

Project number/projects/site		Date	Prepared by
Construction part	Task		<input type="radio"/> Planning <input type="radio"/> Work preparation <input type="radio"/> During work <input type="radio"/> Follow-up
Starting date	Finish date	Hours/size of team	
Work preparation based on the following preconditions and documentation			
Drawings/specifications etc.			
Requirements - Instructions from manufacturer/supplier			
www.ByggAi.se - other information - cost estimate			
Starting conditions - checks before start - safety and working environment			<input type="checkbox"/> Risk of falling <input type="checkbox"/> Dangerous subst <input type="checkbox"/> Heavy materials <input type="checkbox"/> Sundry: <input type="checkbox"/> Fire risk:
Risk analysis & handling - Technology, environment etc.			Remedy
Description of working method - logistics and materials handling			
Staffing - who will do the work?			
Materials and auxiliary materials - fasteners and oil—			
Assistive devices - machines, tools, equipment, temporary devices ...			



4 Three steps of the work preparation

Work preparation has three main steps:

1. **Prepare - work preparation** – task for site management
2. **Implement - work preparation** – with workforce
3. **Follow up - work preparation** – collect knowledge and experiences.

4.1 Prepare

In order to prepare the work preparation, the management collects all available documentation for the work to be prepared and overall project information, e.g.:

- Documents describing what is to be produced: drawings and descriptions, requirements in the administrative regulations trade standards and quality requirements.
- Information from manufacturers and suppliers – installation instructions, folder and instructional films – as well as industry regulations. Perhaps a representative of the material supplier can participate and provide information or training?
- Production planning: time, delivery, machine and project plans, calculation, workplace disposition plan, quality, environmental and work environment plan, and risk analysis for technical and occupational safety and health risks.
- Working instructions from www.ByggAi.se.
- Make a visit the place for the works and document with a camera/smartphone.

The preparations also include ensuring that there is a meeting room with suitable equipment, e.g. computer projector, whiteboard, etc. Those who will carry out the work should be included in the work preparation.

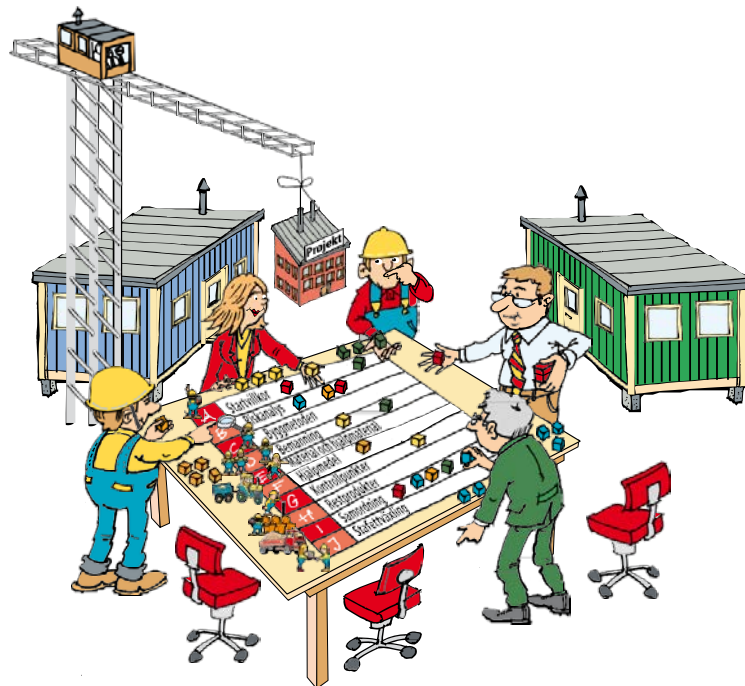


Figure 4.1 - Preparation of work with the staff at the construction site

4.2 Implement

Overview, conditions and requirements

Gather the group that will carry out the work: skilled worker, supervisor, construction engineer and other professionals who affect or are affected by the choice of execution for the relevant work. Start by reviewing the prerequisites for the project, the overall planning (production cycles and logistics planning), joint plans and site drawing for the work to be carried out. Make sure everyone understands the pre-conditions.

Review the collected documentation for the work: envisions, pre-work, self-inspection and implementation. Use presentation equipment and whiteboard for the planning.

34

Floors

ESB.412

Precast filigree floor slabs

www.ByggAi.se


Construction of flat floor slabs

Pre-conditions

Preparation

Self-inspection

Execution



This work instruction is designed for use in detailed planning and preparation of work on construction projects. With thorough planning high levels of personal safety and optimal work apportionment can be achieved at the same time as the work can be organized efficiently and cost effectively.

Discuss how the requirements are to be achieved and how the work should be carried out. Use the www.ByggAi.se cars as inspiration. Is anyone who has done the likeness- the work before and can tell you about how the work can work smoothly thanks to e.g. accessibility and smart materials handling. Has it ever gone wrong? What caused a problem? Can it be avoided at this site?

Use the work preparation template to note as below. It can be used to develop the knowledge within your company.

Start by filling in project names, operations, calculated/budgeted working hours, codes, etc. on the form. Do not forget to note who participates and who is holding the pen when the work preparation is carried out.

A – Start criteria

Define the start mode. Requirements for previous activity? What usually works badly?

Which UE and side contractors are involved in the operation?

Takeover conditions, controls?

What is required before the operation starts?



B – Risk analysis

What are the risks involved?

What are the options?

What preparedness is needed to deal with problems?

How should the risks be addressed?

Choose the method of working!



C – Construction method and material handling

Describe all the inputs in the activity

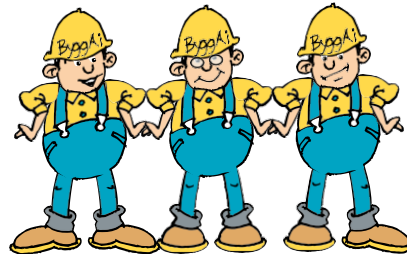
- how the work is to be carried out.



D – Staffing

Who's going to do the job?

Is authorisation or special training required?



E – Materials and help materials

What materials are required for the working method? Calculate and make a list of materials with quantities.

How will materials be handled at the workplace: delivery, transport, reception control, unloading, pile-up, protection against damage, transportation on the construction?

What auxiliary materials such as fixing elements, oil, seals etc. is needed for the work?

Minimize internal transport on the construction site. Is it possible to arrange deliveries to the entry point, "just-in-time"? Container deliveries?



F – Equipment and tools

What machines, tools, temporary devices and equipment is needed for work (electricity, water, heating, lighting, compressed air)?



G – Checkpoints

What are the requirements for the finished product?

What does rules/standards and the supplier say?

What control measures are needed for the working environment, the environment and other risks?

Establish self-inspection planning.



H – Residues and waste

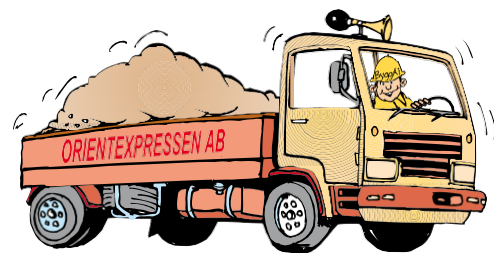
Handling and sorting at source of waste and residues is analysed.



I – Coordination

Coordinate the part with other activities at the workplace/ UE/side contractors!

Inform and communicate with all concerned!



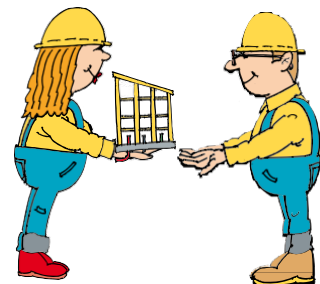
J – "Relay exchange"

How is the work handed over to the next activity/profession?

Does the finished work need to be protected?

Is protection/cover of building parts or other contractors' work required?

How will it be cleaned up before the next profession picks up?



4.4 Make reconciliations and follow up

When work has been going on for a while, follow-up and monitoring must be carried out. Analyze what has worked well and less well so far. Give suggestions for improvements in implementation.

- Compare hours spent in relation to planned.
- Note what can be improved.
- Note what worked poorly.
- Give advice to the next team that will prepare similar work.

4.5 Form/Template for Work preparation

Download a form/template for work preparation from www.ByggAi.se/workpreparation