

Saimaa University of Applied Sciences  
Technology, Lappeenranta  
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**PROJECT CLOSURE PREPARING AND A  
SUBCONTRACTOR'S WORK PERFORMANCE  
CONTROL AND ACCEPTANCE IN  
CONSTRUCTION MANAGEMENT IN RUSSIA**

Bachelor's Thesis 2010

## ABSTRACT

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Project Closure Preparing and a Subcontractor's Work Performance Control and Acceptance in Construction Management in Russia, 49 pages

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The goal of the bachelor's thesis was to find out ways to decrease the amount of work during project closure by improving quality of subcontractor's work, timely detection and termination of defects and flaws and controlling the time schedule of works. The joint activities of general contractor and subcontractor must be aimed at ensuring the timely commissioning of production capacities and facilities, strict implementation of plans and schedules.

One of the strategies used to improve coordination efforts is a weekly subcontractor meeting. The primary focus of these meetings is to review work progress, update changes in the schedule, discuss potential interface conflicts, share information regarding equipment and personnel requirements, address any discrepancies in the plans and specs, and clarify any procedural questions.

In construction companies to improve construction quality a composite quality control system is developed and embedded. It is based on company quality standards. The quality of civil and erection works depends not only on the work of executors, but on the active participation of the whole construction company personnel.

Building a work acceptance schedule and controlling its implementation is very important in order to complete the project on time. The time schedule that was made during work on the building site helped to organize the acceptance of works and thus this will not be a problem at the end of the projects.

Keywords: project closure, acceptance inspection, quality control

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# 1 INTRODUCTION

This bachelor's thesis work has been written for "Lemminkäinen Stroy Ltd" in Russia during the period from February till May 2010. I worked on the building site of the residential house building "Aleksandria". It is situated in the south-eastern part of Saint-Petersburg near the metro station "Proletarskaya". Aleksandria is a seventeen storey building with underground parking places. The whole building consists of 11 sections, the first stage of construction considers full completion of sections 6-11 of the building. Sections 1-5 were started to be built by other contractor – "Stone Ltd", but when the world financial recession started, "Stone Ltd" stopped the erection. Likewise "Lemminkäinen Stroy Ltd" has suffered from world financial recession, but luckily it caused only a minor extension of construction time. The end of construction and project closure is planned to happen in October 2010.

The main goal of this work was to find out ways of quality improvement and methods of work performance control of subcontractors, so as to simplify the process of the final inspection of the building by the accepting committee during project closure arrangements. The most widespread problem with subcontractors is delays in time schedule and poor work quality. The thesis has been carried out by analyzing normative documents and regulations like SNIPs, GOSTs and contracts. Also actual working on the building site as a quality supervisor in a tight cooperation with subcontractors helped to find specific methods of work organization.

## **2 CONSTRUCTION MANAGEMENT**

Construction management is the overall planning, co-ordination and control of a project from inception to completion aimed at meeting a client's requirements in order to produce a functionally and financially viable project that will be completed on time within authorized cost and to the required quality standards. Project management is the process by which a project is brought to a successful conclusion (Wikipedia).

The term "construction management" generally relates to services provided by an advisor acting as a representative of the project owner. These services typically involve responsibility for administering the design and construction contracts as well as managing or overseeing the planning, design and construction. Construction management services can be performed by an independent party on a standalone basis, or by an architect or engineer who also provides design services on the project. Work scopes for the construction manager (CM) can be tailored to meet a variety of owner needs, project types and project delivery methods (Camilleri&Clarke Associates).

### **3 PROJECT DELIVERY**

Project delivery is the process by which all of the procedures and components of designing and building a facility are organized and put together in an agreement that results in a completed project. The process begins with the compilation of needs and requirements of the owner spelled out in the architectural program. These needs and requirements are first expressed in preliminary plans from which initial material, equipment, and systems selections are made. With these selection decisions, the design becomes further refined until all design decisions are made and a final set of contract plans and specifications are completed. The owner then determines which procurement methodology (purchasing steps) to use to buy the construction services and the criteria that will be used to select the contractor. Finally, the owner selects which type of contract to employ. Once selected, the contractor goes about planning an overall strategy for delivering the project in accordance with the plans and specs that have been developed. All the parts and pieces of the agreement are put in place and the game plan is established. This game plan also determines how the players will interact and communicate with one another over the course of the project. (Jackson & Barbara 2004)

#### **3.1 Project delivery types**

There are basically three project delivery methods: design-bid-build, construction management, and design-build. The functions associated with construction management are required in all three methods even though only one of them is actually named construction management. These three project delivery methods differ in five fundamental ways:

- The number of contracts the owner executes
- The relationship and roles of each party to the contract
- The point at which the contractor gets involved in the project
- The ability to overlap design and construction
- Who warrants the sufficiency of the plans and specifications

Regardless of the project delivery method chosen, the three primary players — the owner, the designer (architect and/or engineer), and the contractor — are always involved. (ibid.)

### **3.1.1 Design-Bid-Building**

A project delivery method in which the owner holds two separate contracts for design and construction. A Schematic view of this method can be seen on Figure 3.1. Design-bid-build is commonly referred to as the traditional method of project delivery, and the traditional accountabilities apply. In this scenario, the owner first hires the architect or engineer to design the building or structure. The design professional prepares a design, moving through the three standard design phases: schematic design, design development, and finally contract documents. Under this arrangement, the design professional is usually selected on a qualifications basis and is typically paid a fee or a percentage of the building cost for his or her services. After the plans and specifications are complete, the owner selects the general contractor who will provide the construction and construction management services. The most common means for selecting the general contractor under this method is by low price or low bid: several competing contractors estimate the project based upon the contract documents and the builder with the lowest price gets the contract. The general contractor typically subcontracts various sections of the work to specialty contractors. Under this method, the owner holds two separate contracts, one with the designer and one with the contractor. In this arrangement, all dealings between the designer and the contractor go through the owner. There is no legal agreement between the designer and the contractor. This method is very linear in nature and the contractor does not have any input regarding the design of the project. The contractor is only responsible for carrying out the work as spelled out in the plans and specs and will utilize the various construction management functions to accomplish this task. (ibid.)

### Design-Bid-Build Linear Approach



Figure 3.1 Design-Bid-Build Linear approach

Under the design-bid-build method, the owner warrants the sufficiency of the plans and specs to the contractor. If there are gaps between the plans and specs and the owner's requirements, or any errors and omissions in the design, the owner is responsible for paying for those corrections. The contractor is often the one who discovers the errors and submits the change orders necessary to correct the work. (ibid.)

#### 3.1.2 Construction Management

Construction management may be viewed from several different perspectives, and one of them is as a specific project delivery method. Under this method, construction management services are provided to the owner independent of the construction work itself. It provides a contractual avenue by which the owner can bring the CM function into play early in the project planning and make direct dialogue with the design team possible. In these circumstances, the construction manager, acting on behalf of the owner, can contribute by providing value engineering, life cycle cost analysis, conceptual estimating and scheduling, and what is called constructability reviews during the design process and head off possible incompatibilities between design and construction, which typically result in cost overruns, time delays, conflicts, and legal claims down the road. (ibid.)



### 3.1.3 Design-Build

The design-build methodology has grown significantly in popularity over the past ten years. It is often referred to as single-source project delivery and is the closest method we have to the master builder approach of old. In this arrangement, there is only one contract. The owner contracts with a design-build entity, which will be responsible for both the design and the construction of the project. Whereas design-bid-build has linear sequencing of the work, design-build often integrates and overlaps design and construction, as can be seen on Figure 3.2, and allows for something called fast tracking. Under the design-build method, the design builder warrants the sufficiency of the plans and specs to the owner. The design-builder is liable for any gaps between the plans and specs and the owner's requirements for the performance of the building. If there are any shortfalls, the design-builder picks up the tab. One of the greatest advantages to design-build is the possibility for early contractor involvement. Under this method, all of the team players — the designers, the contractors, the material suppliers and manufacturers — have an opportunity to be in continuous communication throughout the project. (ibid.)

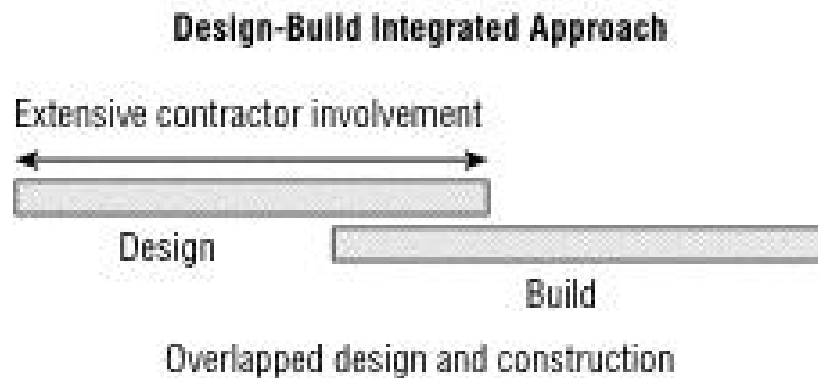


Figure 3.2 Design-Build Integrated Approach

## **4 SCHEDULING**

One of the great things about being on the team that develops the project schedule is that you really get to think through the project before it is ever built. Similar to the estimating process, scheduling forces you to consider details and elements of the job long before you ever encounter them on the job site. You will get to think about all of the materials, labor, subcontractors, and equipment that it will take to complete the project. You will also get to consider all of the factors that influence the efficient use of those resources. You will have a chance to ponder and discuss the circumstances that could slow down the process and cause the project to be delayed. You will have an opportunity to develop the strategy that will carry the project to a successful completion. It is a lot of work to mentally process all of this information, but this is what it takes to put together a construction schedule. It also takes experience and a good knowledge of the construction process so that you can identify and sequence all of the activities needed to complete the job. In addition, you will have to perform a few scheduling calculations. (ibid.)

### **4.1 Calendar plan**

Calendar plan - a project document that defines the sequence and timing of individual works, establishes their technological relationship with the nature and volume of construction and installation works

Initial data for the development schedule are the working drawings, details of construction research, information about material-technical resources and regulatory terms of construction. In drawing up the schedules provided for the use of advanced manufacturing technology works, execution of construction line method with a maximum coincidence of works, uniform loading of performers and uniform resource consumption, compliance with the requirements of technical conditions and safety regulations.

In the calendar plan as a planned unit takes an object with the volume of construction and installation works in monetary terms and the timing of construction for years, quarters and months. In the schedules of works on individual objects the planned units are the types of construction and installation works, expressed in natural meter.

Preparation of schedule carried out in sequence: a detailed study of design materials with the appointment of the construction methods and choice of major construction machinery; calculated the amount of work with the definition of regulatory complexity to perform under the established range, the number of car-shifts and the composition of work teams; nomenclature of stages, complexes of construction works are established and included in the schedule. Shifts of work of construction machinery are established; composition of the integrated brigades, duration of the individual works and the total duration of all work at the facility is calculated.

Design materials are studied to identify the most advanced technological and organizational solutions. The component parts and construction products are original data for establishing the number of work fronts, the number of specialized and integrated teams. The complexity of building and construction works is defined with the help of ENIRs (Time norms and costs of building works) in accordance with the amount of works calculated from working drawings. In carrying out work in specific conditions that are not covered in ENIRs, counting labor is performed by local standards. Since the value of labor is strongly influenced by the modes of production of construction and installation work, they are defined and assigned before counting labor input. After calculating the complexity of certain types of building and construction works building of schedule is commenced with the timing and sequence of their technological implementation.

Times of performance of certain types of works are determined on the basis of their complexity and depend on front of works, production methods, number of workers and machinery, number of shifts.

The procurement schedule is drawn up in accordance with the calendar plan, demand for which is determined by the working drawings, building regulations and other regulatory sources.

## **5 SUBCONTRACTORS**

The general mode of construction is using subcontractors to execute the construction work while key supervision, overall planning, safety and quality control is performed by the contractor. Thus, a contractor's ability to select subcontractors and to work effectively with them is very important. While much management attention is given during the bidding phase, the selection and management of subcontractors during the construction phase is left to the construction team, who is usually technically oriented. The goals and objectives of a subcontractor must be understood as other than completing the work within the budget and schedule, which include: winning sufficient numbers of contracts to continue; enhancing technology and skill base; securing financial returns.

### **5.1 Subcontract**

In accordance with the requirements of the construction subcontract the subcontractor shall within the prescribed period of the contract to build according to general contractor wishes a particular object or perform other construction work, and the general contractor undertakes to create the necessary conditions for the subcontractor to perform work, accept the result and to pay the stipulated price. (Construction field relationships)

In the subcontract the general contractor acts as a customer, and subcontractor as a general contractor. The actual contract is made on the same layout as the contract with the customer and general contractor. General contractor and subcontractor relationship are regulated by mandatory rules of law, as well as guidelines and regulations agreed by parties. (ibid.)

Joint activities of general contractor and subcontractor must be aimed at ensuring the timely commissioning of production capacities and facilities, strict implementation of plans and schedules. In order to ensure efficient interaction between all parties involved in the construction the relationships are established in such a way that all subcontractors employed on this construction site, obey to

the general contractor promptly. The latter thus has no right to interfere in purely economic activities of subcontractors. (ibid.)

## **5.2 Responsibilities of general contractor**

General contractor in accordance with the agreed upon contract assume some responsibilities. He must provide the readiness of the object for implementation of subcontract works, give to the subcontractor copies of technical documentation and inform him about all changes in documentation. Also the general contractor must allow the subcontractor to use main electrical board of the building site, but all assembling works of electrical network needed are made on subcontractor's money, costs of electrical energy used by subcontractor in his office premises are not paid. Places for office and other premises of the subcontractor should be provided. The water-supply unit of the building site can also be used.

The general contractor should appoint the person, whose responsibilities are the control and acceptance of works done by subcontractor. Accepted works should be paid according to the contract agreement. If the work is not accepted, there should be a motivation for this in written form.

## **5.3 Responsibilities of the subcontractor**

The main obligation of the subcontractor is the implementation of all works meant in the contract within the time schedule. Timing and order of execution of works are necessary to be done as meant in the contract. Delays caused by the general contractor (e.g. work place transmission delay) are reasons for extension of date of works start. Weather conditions could also be reasons for schedule shifting, if the impossibility of work implementation at such conditions is proved by conclusion of appropriate organization. If it is needed the subcontractor should work in 3 shifts or day and night in order to stay within the schedule.

Before starting work the subcontractor must develop and conform works implementation plan. A technical engineer must be placed in charge of brigades that are working on the object.

Works should be implemented in accordance with project, working drawings, SNIPs (Russian building norms and rules). Quality should be on the demanded level, defects and flaws detected during acceptance or within the guarantee period must be terminated for his own expense.

Materials provided by the subcontractor himself should be certificated. Examples of these materials should be given to the general contractor on demand for tests. If the materials are provided by the general contractor they should be accepted by the subcontractor in appropriate way. If use of these materials will cause impossibility of work implementation or major defects of finished work, subcontractor cannot reply to the fact of bad quality of materials if they were accepted not in a appropriate way. These works will not be paid. The subcontractor must use these materials sparingly. All materials remaining after finishing the works should be returned to general contractor.

The subcontractor must implement the instructions given by the general contractor, if they are not contrary to the contract. The subcontractor is allowed to engage his own subcontractors, but only by agreement with the general contractor. Personnel, equipment and works must be ensured.

#### **5.4 Possible problems with subcontractors**

The causes of failure are attributed to both the contractor and subcontractor. The failure of a contractor is more attributed to the lack of skills needed to manage the subcontractor. The failure of a subcontractor, generally, is attributed to the lack of management skills, experienced manpower and, to some extent, financial strength. When a subcontractor begins to fail, this either leads to termination or requires significant effort and support by the contractor.

In either case, the net result is increased cost and schedule slippage. Major contributors to failure are poor work execution, technical capability and contract administration. The categories contributing least to failures are neglect, fraud and disaster. Also subcontractors generally suffer from a lack of qualified supervision. This results in reworks and slower performance.

Inherent risks, associated with the project, are not properly identified or assessed; hence, they are not adequately quantified in the project bid. Examples include: labor and material availability; escalation in labor and material costs; weather conditions, quality and skill of available labor; and construction methods and procedures specified, among others. Delays in mechanical erection adversely affect the contractors for electrical, instruments, insulation and painting.

The failures of subcontracts, attributed to poor execution, are caused by: improper workload; shifts in schedules; late delivery of drawings and materials; interference and poor coordination between other contractors on site; and communications.

Another area of procedural differences is safety and quality-processing of non-conformities. Also, while the contractor maintains the overall safety and quality at the work site, for low bidders, contractors have to enter to perform safety, schedule/planning and quality control. A late start and/or slow job progress has a spiraling effect on a subcontractor. Due to labor and financial limits, if the work gets out of sequence, the subcontractor cannot handle the situation. This circumstance is caused by a number of factors, like early mobilization to a site, late delivery of drawings and materials, changes in work schedule due to other work progress and changes in quantities, etc. Most of the time, a contractor is under pressure to open the site as called for in the master schedule, and it is crucial to take a realistic and optimum approach.



## **5.5 Notifying subcontractors about changes in time schedule**

It is critically important that these changes get communicated in as timely a fashion as possible, especially to subcontractors. When a subcontractor signs on to perform a portion of the work, he will create work plans and schedules based on the start date and finish date originally negotiated with the superintendent. Remember that subcontractors are performing work for a number of general contractors on a number of different jobs. They cannot drop everything they were working on just because you modified your schedule. The sooner the project manager or superintendent notifies them, the better. In this case, you do not want to wait until the overall schedule revisions are completed. You want to communicate specific time-line changes to your subcontractors using the more detailed short-interval schedules. These more detailed schedules are often done by hand and discussed with the individual subcontractor at an on-site meeting. (Jackson & Barbara 2004)

One of the common complaints lodged by subcontractors is that superintendents wait until the last minute to spring schedule changes on them. They then must hustle and scurry trying to adjust all of the schedules for their other jobs. They are forced to juggle their crews, causing significant inefficiencies and possibly disrupting the work flow on other projects. Getting such short notice is very frustrating and certainly not appreciated. Superintendents (and their companies) get a reputation for how they handle these schedule adjustments, and the subcontractors' pricing will often reflect their frustration with this handling. Companies that convey schedule changes promptly and do a good job keeping the subcontractor in the communication loop may actually receive lower subcontractor bids than those who have a reputation for last-minute adjustments. (ibid.)

As potent a management tool as the schedule is, a superintendent who fails to make proper use of it will never benefit from its value. Constant monitoring of the actual project performance relative to the planned performance helps the superintendent keep on top of the schedule changes. Once the actual performance data is inputted into the schedule, the updates can be made very

quickly and revisions can be communicated to the subcontractors immediately. This allows the subcontractors to likewise adjust their schedules as the project moves along. (ibid.)

## **6 WAYS TO ENFORCE SUBCONTRACTORS**

The main instrument used to enforce subcontractors is money. They are not interested in losing it, and because of that you can try to use this fact to control them. Due to that you should mention all the procedures concerning work payment process and financial penalties for delays in the contract.

### **6.1 Payment procedures**

The procedure of work payment that was defined in the contract considers prepayment to the subcontractor. The prepayment is made to cover the subcontractor's mobilization expenses, equipment delivery expenses and material expenses. The following payments cover the works implemented by the subcontractor and accepted by the contractor. Only in the case of acceptance of works the payments are done. The periodicity of these payments is once in two weeks. Also the guarantee amount is paid to the subcontractor after completion and acceptance of all works that the contract considers. The guarantee amount is 5% from the total work costs.

### **6.2 Financial penalties**

As already been said the penalties are made to force the subcontractors mobilize and get to work if they are behind the schedule, but of course the amount of these penalties should be reasonable, because subcontractors can lose their financial strength and stop working at all. The contract considers the following penalties:

- Work start delay - 0,2% total work cost per day
- Intermediate timing delay - 0,2% of total work cost per day
- Work completion delay - 0,2% of total work cost per day
- If work completion delay is more than 15 days - 5% of total work cost per day

- Untimely clearing of building site from subcontractor's equipment - 15 000 RUR (400€) per day
- Defect correction delay - 15 000 RUR (400€) per day

Apart from these penalties, the subcontractor has to pay all losses caused by these delays as well as loss of profit. All these penalties are applied as retentions from the last work payment to the subcontractor.

### **6.3 Contract discharge**

In some cases it is better to change the subcontractor that continuously causes problems and is moving behind the schedule. It is better to take another one then apply penalties to the first one, because the task is to finish the project on time rather than save money. The budget considers these expenses so it is wise to quickly find another subcontractor for these works, because they have to be done.

The contract should have paragraphs where the procedure of its discharge is described as well as reasons for it. The contract can be discharged unilaterally by the general contractor in following cases:

- Work start delay is more than ten days and it is caused by reasons not related to the general contractor
- Regular work completion delays that cause extension of building time by more than 7 days
- Regular violation of work safety regulations
- Constant poor work quality

When discharging the contract the subcontractor have to return all materials and equipment provided to him by the general contractor or compensate the cost. Also he should compensate all inflicted losses.

## **7 WEEK PLANNING**

One of the important things of a site management process is week planning. Every week an internal meeting of the contractor and a meeting with subcontractors are held. Week meetings help to introduce all project participants into situation and to deal with all possible problems. This is the main principle of control on building site.

### **7.1 Weekly internal meeting**

On the internal meetings all information concerning site works is discussed and orders to the members of the construction team are given. Also minutes of the meeting is made. Questions discussed on the meetings are:

- Schedules, permission from the authorities, other permits
  - new schedules given by subcontractors, schedules concerning new works that are needed to be implemented
  - permissions received and needed to receive
- Procurement
  - quantity of purchased materials
  - contracts awarded
- Resources (labor), subcontractors
  - number of workers on building site
  - subcontractor's responsible persons and their phone numbers
- Situation on the building site
  - done work tasks
  - work tasks needed to be done
  - problems with subcontractors, amount of work done, works behind schedule
- Cost control
  - budget economy
- Quality
  - major defects and methods of their repairing

- Work safety
  - TR-meter
  - responsible persons and their duties
  - accidents
- Other questions

## **7.2 Meetings with subcontractors**

One of the strategies used to improve coordination efforts is the weekly subcontractor meeting. The primary focus of these meetings is to review work progress, update changes in the schedule, discuss potential interface conflicts, share information regarding equipment and personnel requirements, address any discrepancies in the plans and specs, and clarify any procedural questions. It is important that all appropriate subcontractors be encouraged to attend each of these meetings so that everyone hears the same information. The superintendent should direct the meetings and facilitate the group's interaction to best serve both the project and each individual subcontractor.

Meetings with subcontractors are held almost every week. The project manager and site engineers discuss and solve problems caused by subcontractor. Often it is poor work quality, working behind the schedule and ignoring work safety regulations. Information provided by the subcontractor:

- The number of employees at the site on the day of the meeting
- The amount of work done on the day of the meeting
- Works that are currently performed
- Schedule and possible delays, as well as the reasons for these delays
- The volume of the delivered material and equipment, which at the time of the meeting are on site

## 8 QUALITY CONTROL

Construction quality means conformity of finished building or works quality to design decisions and standards. Quality should be formed at all stages of the construction process: planning, building, exploitation. That is why it is a complex problem which depends on all parties of the construction process: state organs, owners, developers, construction and erection organizations, manufacturers, transport organizations. (Sokolov 2008)

Quality of construction works is estimated by the following features:

- Functional features – degree of conformity to the primary function
- Technological features– combination of technology effectiveness and level of productivity with production price and quality
- Design features – strength, durability and reliability
- Esthetical features – architectural expressiveness of building or interior appearance, exactness and carefulness of implemented works

Typical reasons of construction flaws are bad design decisions or technical conditions aberrations, use of poor quality materials. Design flaws are usually made because of the incompleteness of an engineering survey or calculation mistakes. Use of poor quality materials also causes major flaws or even failures of the structure. (ibid.)

Works implementation quality depends on many factors, main of which are failure to execute requirements of work process technology, failure to comply necessary technical order when implementing interrelated works, lack of technical supervision of work process. (ibid.)

Also construction quality is affected by presence of exact work production plan, workers skill level, on-time and completeness of materials delivery, coordination between general contractor and subcontractors, correct organization of quality control and supervision, level of construction management planning, stimulating scheme of payment. (ibid.)

## 8.1 Methods of quality improvement

In construction companies to improve construction quality a composite quality control system is developed and embedded. It is based on company quality standards. This system contains the following features:

- Quality design of civil and erection works
- Preparing of the building production
- Material and technical supply
- Metrological and geodesic provision
- Selection, placement and education of personnel
- Labor discipline organization
- Stimulation of work quality improvement
- Legal regulation of civil and erection works quality

The quality of civil and erection works depends not only on work of executors, but on active participation of the whole construction company personnel. (ibid.)

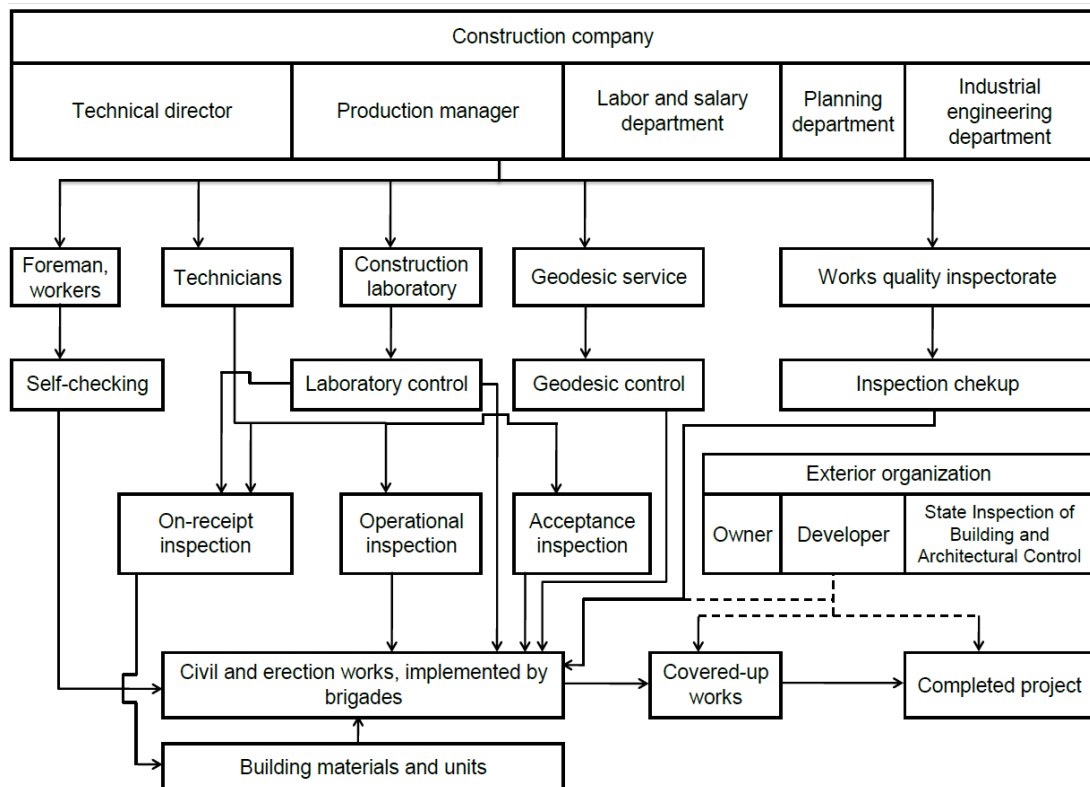


Figure 7.1 Quality control system scheme



Figure 7.1 shows the structure of the quality control system of construction company. The main functions of construction company employees are:

- Technical director (chief engineer) realizes general direction and control and organizes the study of SNIP's requirements by all engineers and workers.
- Production manager organizes preparation of construction works and provides the improvement of work implementation organization, takes part in operational inspection and preparing of quality improvement measures.
- Labor and salary department solves tasks of material stimulation of labor flaw-free work.
- Planning department plans the measures aimed at quality improvement.
- Industrial engineering department coordinates technological sequence of work implementation, takes care of preparation of construction implementation and supplies the executors with necessary project documentation.
- Geodesic service carries out control geodesic measurements, provides accuracy of erection and watches over the settlement of the building.
- Construction laboratory analyses concrete, solutions, mastics and selects recommended formulas of mixes; makes tests of various structures and samples; takes part in flaws and failures reasons commissions.
- Technicians (engineers, supervisors) organize implementation of necessary quality level civil and erection works and carry out quality production control. They have to provide acceptance and storing of materials, structures and parts; observe the technology of works implementation in compliance with normative requirements; make acts on covered-up works; accept works implemented by brigade and check their quality in accordance with SNIP.
- Brigades execute works with demanded quality level; take part in on-receipt inspection, operational inspection, acceptance inspection and

self-checking. Responsibility for quality of construction is taken by administrative and industrial engineering personnel, and direct executors of works.

## 8.2 Methods of quality control on a building site

There are two types of quality control:

**Internal control.** The quality of construction is defined by the results of production control and estimated in accordance with the quality of assessment manual. Results of control should be registered in a work journal. Types of internal control are listed in Table 7.2.

Table 7.2 Types of internal control

Types of internal control	
Control type	Content
By time of inspection	
On-receipt	Incoming materials inspection
Operational	Visual inspection and measuring during work process
Acceptance	Acceptance of finished works and composing covered-up works report
By amount of inspections	
Complete	Checking of every work
Selective	Checking of some work
By periodicity of inspections	
Continuous	Checking during all time of works
Periodic	Checking with time intervals
Casual	Episodic checks
By method of inspection	
Visual	Checking without measuring instrument
Measuring	Checking with measuring instruments
Registration	Checking by analyzing plans and certificates

An on-receipt inspection considers checking accordance to the certificates of materials supplied on the building site. Building laboratory, engineers and the manufacturer should take part in the on-receipt inspection. Operational control should be done during implementation of works and provide timely defect detection and methods of their repair. Main documents used in this type control are operational quality control schemes. An acceptance inspection is held to check and estimate quality of finished and covered-up works. All covered-up works should be accepted with making of acts.

**External control** is executed by state and departmental authorities. A designer's supervision is executed by the developer and engineering supervision by the owner. These parties should cooperate with each other and check accordance of implemented civil and erection works to plans, budget, SNIPs and state standards. Owner's engineering supervisors are responsible for poor quality of works accepted from builders. (Nanasov 2005)

## **9 PROJECT CLOSURE**

The final step in the construction process is the project closure. This is the stage where all the loose ends get taken care of as the construction team readies the facility for occupancy by the end users. This is the time when the contractor turns the building over to the owner. However, before the owner actually takes possession of the facility, there are a number of sequential steps that must be performed by the contractor. The construction management team must complete the following list of final standard procedures:

- Project punch out
- Substantial completion
- Final inspection
- Certificate of Occupancy
- Commissioning
- Final documentation
- Final completion

### **9.1 Acceptance of the finished construction project**

The contractor which has completed all works under the contract agreement sends to the owner a written notice together with a set of documents. The owner upon receiving a message about contractor's completion of the construction of the facility and a set of documents must immediately begin the checkup of the erected object readiness for acceptance of it into operation by the state acceptance committee. The readiness checkup is carried out by the working committee, appointed by the owner within a period not exceeding five days from receipt of written notice from the contractor about completion of the construction of the object. The working committee includes:

- Responsible representative of the builder (owner, investor) - Chairman of the commission

- Responsible representative of the developer of project documentation
- Responsible representative of the contractor (general contractor, subcontractor)
- Responsible representatives of the user
- Responsible representatives of the state sanitary and epidemiological supervision, the state fire supervision, other supervision organizations – at their discretion.

The readiness checkup for acceptance into operation is carried out at the expense of the builder (owner). In the process of the checkup the working committee performs the following operations:

- Verifies the completeness, content of documentation provided by the contractor (general contractor, subcontractors)
- Performs the conformity assessment of finished constructions to requirements of project documentation
- Performs testing of equipment and engineering systems
- Checks the performance of the comments and instructions from the technical and designer's supervision, state supervision organs listed in the technical journals and supervision and the overall history of work
- Can perform verification of compliance with the requirements for the reliability of the results of monitoring, measuring and testing
- Can make the control of the reliability of provided by contractor executive geodesic schemes, if this control has not been carried out at intermediate acceptance of constructions

As a result of a checkup the working committee makes the conclusion of the readiness of the object to the acceptance into operation. Upon finding aberrations from the requirements of the project and normative documentation in structures, equipment, engineering networks, finishing and improvement of surrounding areas the working committee makes the conclusion of incomplete readiness of the object to acceptance into operation and applies to it the list of detected defects. (SNIP 3.01.04-87)

The conclusion of the working committee is given to the owner with the above-mentioned list of detected defects, if any. The owner presents the list of detected defects to the contractor to remove them in the terms defined in consultation with the contractor. After defect correction the owner presents the finished construction object to the state acceptance commission in order to get the certificate of occupancy. Simultaneously, the owner gives the commission a set of documents received from the contractor. (ibid.)

## **9.2 Procedure of the acceptance of objects into operation**

Acceptance into operation of the constructed object by the state acceptance commission is carried out only upon its full completion in accordance with the approved project and the positive resolution of the working committee. In some cases, acceptance into operation of the constructed object is held by the owner (investor, developer) independently. Operation of the constructed object without a positive decision of the state acceptance commission is not allowed. (SNIP 3.01.04-87)

The act of the state acceptance committee about acceptance of the finished construction object into operation (certificate of occupancy) is the sole point of reference in the registration of property rights for the finished building product. (ibid.)

The certificate of occupancy is liable to be adopted. The adoption is carried out by the authority that had constituted the state acceptance commission. For the date of acceptance into operation of the finished construction object is considered the date of signing of the certificate of occupancy. The adoption of the certificate of occupancy is held:

- Industrial objects – not later than one month from the date of signing
- Civil objects - not later than seven days from the date of signing

### 9.3 Acceptance of construction works

In this work it is shown how the final inspection of a building was carried out in order to facilitate the process of getting the certificate of occupancy. Of course acceptance of these works is not the only thing that should be done when preparing the project closure but it helps to avoid delays at the end of the project.

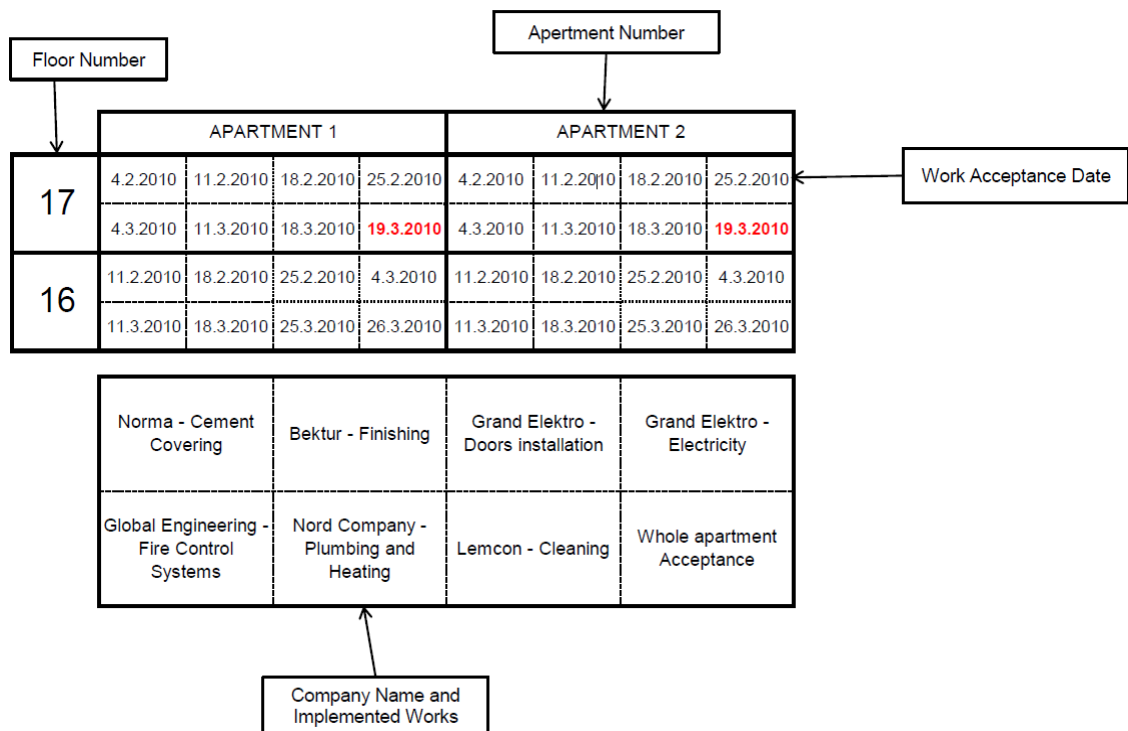


Figure 8.1 Work acceptance schedule

First, based on the construction calendar plan the schedule of work acceptance was prepared (Figure 7.1). The current construction stage considers implementation of sections 6-11. The whole building consists of 11 sections. For each section a separate work acceptance schedule is made. The principle of schedule compilation is simple: works of each subcontractor in the apartments of the same floor should be completed at the same date, the interval between the works on different floors is one week, and also the same interval is between the works of different subcontractors. The total acceptance of the apartments on one floor is made in one day after the last works are finished. After that

apartments are sealed until the state accepting commission. This schedule should be approved by each subcontractor and signed. The copy of schedule is given to subcontractors.

As the general contractor's engineering supervision I was responsible for the acceptance of works from subcontractors. When the subcontractor is ready to complete the works, his representative should warn me about it. After that inspection of the finished apartments is carried out and a list of damages and defects is made with signatures and dates of possible termination of the defects. The plan of the apartment is attached to the list of defects. After all damages were repaired the second inspection is held and the notes about it are made in the list of defects. A copy of this document is given to the subcontractor.

At the end of the project each apartment will have its own folder with lists of defects and information about all subcontractors. These folders will help to facilitate and speed up the work of the state accepting commission. After project closure they will be given to apartment owners.

Advantages of this method of work acceptance are:

- Improvement of total organization of works
- Avoiding conflicts between the general contractor and subcontractor about completion delays by determining the strict date of work acceptance
- After one subcontractor's work is accepted the next one cannot appeal that mistakes or damages were done by the previous subcontractor

The main disadvantage of this method is that a delay of one subcontractor can cause schedule shifting of other subcontractors. This system reminds a chain: if one link is broken, then the whole chain is broken too.



## **10 WORKS IMPLEMENTATION GUIDANCE AND SCHEMES OF OPERATIONAL QUALITY CONTROL**

This section contains information from SNIPs, GOSTs and other normative documents that regulate the requirements for different construction works that were implemented and controlled on a building site.

### **10.1 Roll waterproofing of the floor**

#### **Works implementation guidance (SNIP 3.04.01-87 s.2.2, 2.3, 2.6, 2.14, 2.15)**

Before arranging waterproofing, the following works should be done:

- Cementing of the joints between the prefabricated elements;
- Mounting of embedded elements;
- Plastering of vertical surfaces of masonry structures to the height of contiguity of the insulation.

Before gluing roll materials should be put at the place of installation, apportionment of waterproofing stripes should ensure the values of their overlaps when gluing. Mastics shall be pasted on primed base. The priming of the surface should be made continuously. Mastic shall be applied uniformly, continuously and without gaps. Hot mastic should be applied to the base immediately before attaching the stripes. Cold mastic should be applied to the base in advance. Between the application of mastic and gluing of stripes technological time breaks must be kept, providing strong bonding of waterproofing material to the base.

#### **Materials quality requirements (GOST 2889-80, GOST 10923-93\*)**

For the waterproofing of building structures bitumen felts RPP-300A and RPP-300B are used. Bitumen felts are produced in rolls width 1000, 1025 and 1050

mm, permissible deviation in width  $\pm 5$  mm. The total area of the roll should be  $20 \pm 0.5$  m<sup>2</sup>. The warranty shelf life is 12 months from the date of shipment to the consumer (manufacturing).

Mastic appearance should be uniform, without any foreign particles and filler particles which are not coated with bitumen. It should firmly glue together felt materials. Acceptance and delivery of the mastic is made in batches. It can be packed in steel barrels with removable bottoms, wooden barrels and drums. The package should be marked with:

- Name of the manufacturer
- Grade of mastic
- Name of the filler

The warranty shelf life of mastic is one year from the date of manufacture. Upon expiration, mastic should be checked for quality.

#### Technical requirements (SNIP 3.04.01-87 s. 2.17, tables 3, 7)

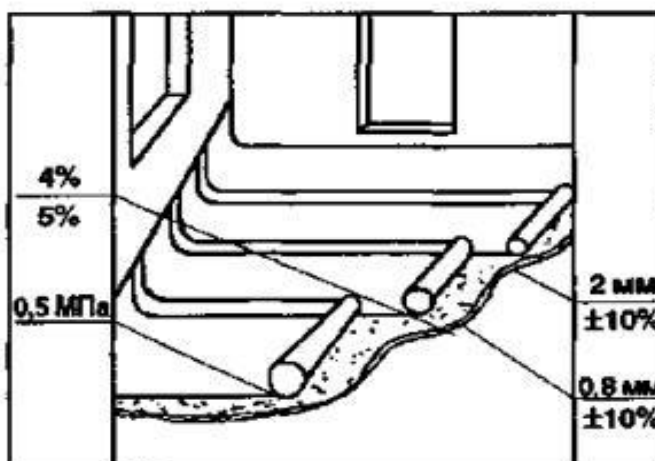


Figure 10.1 Technical requirements. Roll waterproofing of the floor

Technical requirements for implementation of roll waterproofing of the floor are shown on Figure 10.1. Permissible substrate moisture content during application of adhesives must not exceed: for concrete - 4%; cement-sand,

gypsum and gypsum-sand - 5%. The overlap of felt stripes should be not less than 100 mm. The strength of adhesion to the base of the carpet on a continuous waterproofing mastic adhesive should be at least 0.5 MPa. Temperature during the application of hot mastic: for bitumen mastics - 160 ° C; for tar mastics – 130 ° C. The thickness of mastic layer: hot mastic – 2.0 mm ± 10%; cold mastic – 0.8 mm ± 10%.

### Operations and means of control

Table 10.1 Operations and means of control. Roll waterproofing of the floor

Work stages	Controlled operations	Control (method, amount)	Documentation
Preparatory works	Check: <ul style="list-style-type: none"> <li>• Quality of materials</li> <li>• Purity and moisture content of the bases</li> <li>• Surface flatness</li> <li>• Priming quality</li> <li>• Chalk layout (guides for stripes of waterproofing)</li> </ul>	Visual, technical inspection Visual Visual, measuring Visual, test gluing Visual	Certificates, journal of works
Waterproofing	Control: <ul style="list-style-type: none"> <li>• Correctness of mastic application (layer thickness, mastic temperature)</li> <li>• Stripes pressing tightness, carefulness of clothes ironing</li> </ul>	Measuring, not less than 5 measurements every 70 - 100 m <sup>2</sup> in places determined by visual inspection Technical inspection	Journal of works

Work stages	Controlled operations	Control (method, amount)	Documentation
	<ul style="list-style-type: none"> <li>• Correctness of joints</li> </ul>	Visual	
Acceptance of finished works	Check: <ul style="list-style-type: none"> <li>• Strength of gluing</li> <li>• Cloth overlaps size compliance</li> <li>• Absence of bubbles, pimples, tears, dents, blubs</li> </ul>	Technical inspection Same Visual	Covered-up works report
Measuring tools: ruler, measuring tape, drymeter, two meter plank.			
On-receipt and operational control is carried out by: foreman, engineer (tester) – during work process. Acceptance control is executed by: quality supervisor, foreman, owner's quality supervisor.			

## 10.2 Plastering

### Works implementation guidance (SNIP 3.04.01-87 s. 3.1, 3.3, 3.7-3.11, 3.15, 3.17, 3.18)

Plastering shall be made with a indoor and plastered surfaces temperatures not less than 10 ° C and humidity 60%. Such a temperature in the room must be maintained around the clock at least 2 days before and 12 days after work. Finishing must be carried out in accordance with a work production plan (PDP). Before starting the finishing work the following works must be completed:

- Environmental protection
- Waterproofing, thermal and sound insulation and cement covering
- Sealing of joints between blocks and panels

- Sealing and isolating of windows and doors
- Glaring of area lights
- Mounting of embedded parts, testing of plumbing and heating systems

The implementation of plaster coating on the bases with rust, wall saltpetres, grease and bitumen stains is not allowed. Dedusting of surfaces should be done before applying each coat of plaster solutions. The strength of the base should not be less than the strength of the surface finishing. Abutting architectural details, joints of wooden surfaces with stone, brick and concrete structures should be plastered with use of steel net attached to the plastered surface.

The interior surfaces of stone and brick walls erected by a freezing method, should be plastered after thawing of the masonry from inside not less than for half of the wall thickness. When plastering the walls of brick with ambient temperature of 23 ° C and above the surface before applying the solution must wet. When executing single layer coating the surface should be leveled immediately after applying of solution, in the case of using finishing machines - after setting of the solution. When executing multilayer plastering, each layer must be applied after setting of the previous one. Leveling of the primer should be done before its setting.

**Material quality requirements (GOST 28013-98, SNIP 3.04.01-87 table 8)**

Plaster solutions delivered to the construction site must meet the following requirements:

- Pass through a grid with mesh sizes:
  - Solutions for spraying and priming - 3 mm
  - Solutions for fining coating and single layer coatings – 1.5 mm
- Flowability within – 5-12 cm
- Peeling no more than 15%
- Water retention - not less than 90%
- Designed strength

Plaster must be prepared with sand of fineness modulus size from 1 to 2, it should not contain grains larger than 2.5 mm in the solutions for spraying and priming and more than 1.25 mm for finishing layers. Plaster must be accompanied by a quality document, which must include: date and time of mixing, the grade of solution, type of binder, the amount of the mixture, the flowability of the mixture, the designation of the standard. Delivered to the construction site of plastering mortar mix must be unloaded in a loader-mixer or other containers while maintaining the specified properties of the mortar mix.

**Technical requirements (SNIP 3.04.01-87 Tables 9, 10)**

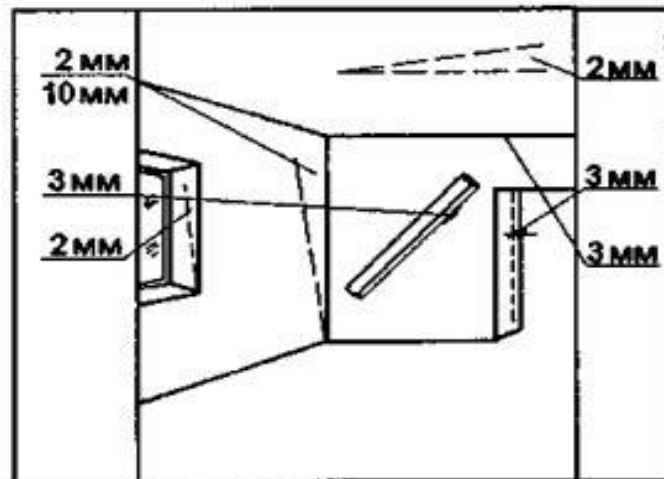


Figure 10.2 Technical requirements. Plastering

Permissible deviations for the geometrical parameters of surfaces are shown on Figure 10.2. Explanations are shown in the list below:

- Deviation from vertical at 1 m length – 2 mm
- At full height of the room – no more than 10 mm
- Unevenness of smooth contours surfaces (at 4 m<sup>2</sup>) – no more than two with depth (height) up to 3 mm.
- Window and door slopes, pilasters, columns, etc. from the vertical and horizontal (mm at 1 m) – 2 mm
- Radius of curved surfaces (for the whole element) – 7 mm

- The horizontal surface at 1 m length – 2 mm
- The width of the slop – 3 mm

The humidity of brick and stone surfaces when plastering should be less than 8%.

The thickness of each layer in the multilayer coverings without polymer additives:

- Spraying stone, brick, concrete surfaces – up to 5 mm
- Spraying wood surfaces, including the thickness of lathing – up to 9 mm
- Cement primer – up to 5 mm
- Lime, lime-plaster primers – up to 7 mm
- Fining coat – up to 2 mm
- Fining coat of decorative finishes – up to 7 mm

Adhesion strength of plaster solutions:

- For internal works – not less than 0.1 MPa
- For outdoor use – not less than 0.4 MPa

Plaster delamination, cracks, cissings, wall saltpetres, traces of trowelling tool are not allowed.

### Operations and means of control

Table 10.2 Operations and means of control. Plastering.

<b>Work stages</b>	<b>Controlled operations</b>	<b>Control (method, amount)</b>	<b>Documentation</b>
Preparatory works	Check: <ul style="list-style-type: none"> <li>• Report of acceptance of previously completed works</li> <li>• Certificate for the incoming</li> </ul>	Visual  Same	Previously completed works acceptance report, certificates, journal

Work stages	Controlled operations	Control (method, amount)	Documentation
	solution and its quality <ul style="list-style-type: none"> <li>• The removal of dirt, dust, soot, grease and bitumen stains</li> <li>• Installation of removable marks and screeds</li> <li>• Execution of ranging vertical and horizontal surfaces</li> <li>• Humidity of the walls and the air temperature (in winter)</li> </ul>	- » -  - » -  Visual, measuring  Measuring	of works
Plastering works	Control: <ul style="list-style-type: none"> <li>• Quality of plastering solution</li> <li>• Average thickness of plastering</li> <li>• Verticality and horizontality of plastered surfaces</li> <li>• Quality of plastered surfaces</li> </ul>	Laboratory control  Visual, measuring  Same  Visual	Journal of works
Acceptance of finished works	Check: <ul style="list-style-type: none"> <li>• Adhesion of plaster to the base</li> <li>• Quality of plastered surface</li> </ul>	Visual  Measuring	Finished works acceptance report
Measuring tools: plumb line, steel ruler, lute, template.			
Operational control is carried out by: foreman, tester (engineer) – during work process.			
Acceptance control is executed by: quality supervisor, foreman, owner's quality			



Work stages	Controlled operations	Control (method, amount)	Documentation
supervisor.			

### 10.3 Cold and hot water supply pipework

#### Works implementation guidance (SNIP 3.05.01-85 p. 3.1, 3.9, 3.10)

Detachable joints on pipelines should be carried out at the fittings and, where necessary due to conditions of building pipelines. Detachable joints, fittings, inspection junction and tube clearing holes should be located in areas accessible for maintenance. Testing of insulated pipelines should be carried out before applying the insulation. Heating systems, heating, hot and cold water supply, boiler pipes at the end of their installation should be rinsed with water until it comes without mechanical suspensions. Washing systems for household and drinking water is considered complete after the water meets the requirements of GOST 2874-82 "Drinking water".

#### Material quality requirements (GOST 3262-75\*)

Maximum variations in the pipe size should not exceed the values specified in the Table 10.3.1. Maximum variations in the mass of pipes should not exceed 8%. The curvature of pipes at 1 m in length shall not exceed: 2 mm with nominal width of 20 mm inclusive; 1.5 mm with nominal width exceeding 20 mm.

Table 10.3.1 Permissible deviations of pipelines.

Pipe size	Permissible deviation for the pipes of manufacturing precision	
	normal	high
Outer diameter with nominal width:		
Under 40 mm inclusive	+0.4 mm, -0.5 mm	+0.4 mm
Over 40 mm	+0.8 mm, -1.0 mm	+0.8 mm
Wall thickness	-15 %	-10 %

**Technical requirements (SNIP 3.05.01-85 p. 3.2 - 3.5, 3.7, table 2)**

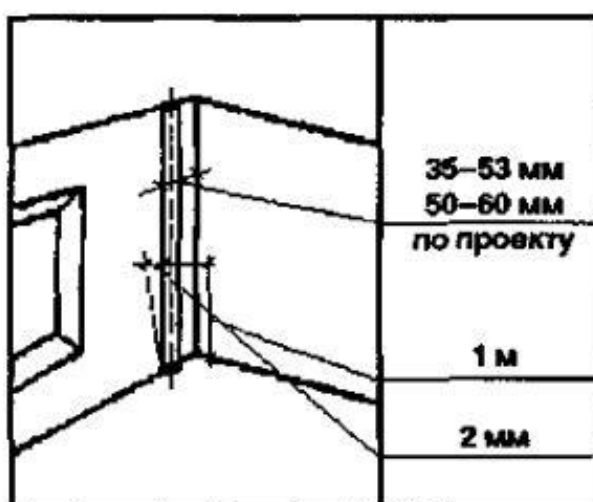


Figure 10.3 Technical requirements. Pipelines.

Technical requirements for pipelines are shown in Figure 10.3. Vertical piping shall not deviate from the vertical by more than 2 mm per 1 m in length. The distance from the surface of plaster or revetment to the axis of uninsulated pipelines should be (depending on the nominal width):

- Up to 32 mm inclusive – from 35 to 55 mm
- At 40-50 mm – from 50 to 60 mm
- With more than 50 mm – as designed

The distance from the pipeline and heating appliances with heat-transfer agent temperature above 105 ° C to structures of combustible materials shall not be less than 100 mm. Fastenings of steel uprisers in residential and public buildings with a height of floor under 3 m are not installed, if floor height is more than 3 m it should be installed at half-height of the floor. Feed pipes with a length more than 1.5 m should be fixed. Permissible distance between the fastenings in the horizontal direction shown in the table 10.3.2:

Table 10.3.2 Permissible distance between the fastenings of pipelines.

Nominal width, mm	Maximum distance between fasteners	
	uninsulated	insulated
15	2.5	1.5
20	3	2
25	3.5	2
32	4	2.5
40	4.5	3
50	5	3
70, 80	6	4
100	6	4.5
125	7	5
150	8	6

### Operations and means of control

Table 10.3.3 Operations and means of control. Pipelines.

Work stages	Controlled operations	Control (Method, amount)	Documentation
Preparatory works	Check: <ul style="list-style-type: none"> <li>Quality certificates</li> <li>Accordance of used materials to plans, standards and technical</li> </ul>	Visual Visual, technical inspection	Journal of works, certificates

Work stages	Controlled operations	Control (Method, amount)	Documentation
	requirements <ul style="list-style-type: none"> <li>• Preparing of places for mounting pipelines</li> </ul>	Technical inspection	
Pipework	Control: <ul style="list-style-type: none"> <li>• Quality of pipe connections</li> <li>• Quality of pipe fastenings</li> <li>• Verticality of pipelines</li> <li>• Distance between axis of pipeline and surface of the wall</li> </ul>	Technical inspection Visual, measuring Measuring Same	Journal of works
Acceptance of finished works	Check: <ul style="list-style-type: none"> <li>• Compliance of the actual situation of the mounted pipeline to project requirements</li> <li>• Quality of pipe connections and fastenings</li> </ul>	Technical inspection, measuring  Same	Finished works acceptance report
Measuring tools: caliper, plumbline, metal measuring reel, level tube.			
Operational control is carried out by: foreman Acceptance control is executed by: quality supervisor, foreman, owner's technical supervision.			

## 10.4 Electrical wiring

### Works implementation guidance (SNIP 3.05.06-85 s. 2.2, 2.4, 2.13)

When wiring hidden under a layer of plaster or in thin (80 mm) partitions, wires should be laid parallel to the architectural and construction lines. Distance between horizontally laid wires and the floor slab should not exceed 150 mm. In building structures with thickness over 80 mm wires must be routed along the shortest possible routes. Wiring (cables) with shells made of flammable materials and exposed wiring in enclosed niches, in the cavities of building structures, in channels with the presence of flammable structures necessary to protect the wires and cables with a continuous layer of noncombustible material from all sides. The ends of the wires that are joined to lamps, automatics, panels and wiring accessories must have a reserve in length, sufficient to reconnect in case of breakage. Necessary openings, grooves and niches in building structures for the installation of electrical equipment and wiring accessories shall be made by general contractor. Holes with a diameter less than 30 mm, which cannot be considered in the development of drawings, are made by mounting organization. After the electrical works the contractor must carry out sealing of holes, slots, niches and cavities.

### Technical requirements (SNIP 3.05.06-85 s. 2.4, 2.24, 2.25, 3.32 – 3.35, 3.39, 3.40)

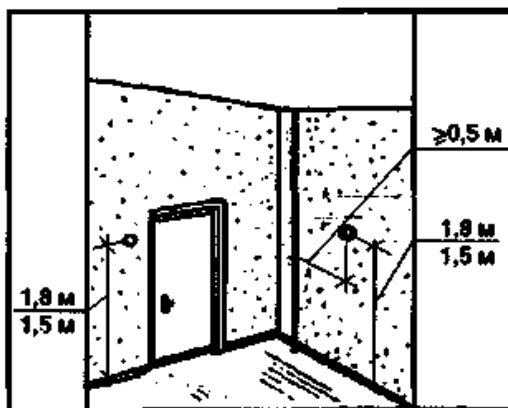


Figure 10.4 Technical requirements. Electrical wiring.

Technical requirements for pipelines are shown in Figure 10.4. The height of the switch on the wall: In schools and institutions, in the premises for a stay of children – 1.8 m above the floor; in other rooms – 1.5 m from the floor. From the grounded parts (pipes, sinks) outlets shall be located not less than 0.5 m. Fixing flat wire in a hidden strip must ensure their tight fitting to building structures. Channels for wires should have smooth surface. The thickness of the protective layer over the channel (pipe) should be not less than 10 mm. The length of the channel between the niches or boxes should be no more than 8 m. Electrical meters must be installed on walls, in niches, as well as panels and boards, with rigid structure. Electrical meters installed in floor electrical cabinet shall be located at a height of 0.8 – 1.7 m from the floor to the box clamp of meters.

The following positions are not allowed when doing electrical works:

- Installation of sockets in bathrooms, showers, locker rooms with showers, a soap bath rooms, laundry rooms
- Installation of switches in bathrooms, lavatories, in the soap bath rooms, laundry rooms;
- Electrical wiring on the heated surfaces;
- Installation and assembly of flat wires at temperatures below -15° C
- Through-holes, designed for wiring accessories, in wall panels of adjacent apartments without fireproof material sound insulation pads.

Table 10.4 Operations and means of control. Electrical wiring.

<b>Work stages</b>	<b>Controlled operations</b>	<b>Control (Method, amount)</b>	<b>Documentation</b>
Preparatory works	Check: <ul style="list-style-type: none"> <li>• Quality certificates</li> <li>• Package contents of materials</li> <li>• Protection against</li> </ul>	Visual  Same  - » -	Certificates, acceptance report, journal of works

Work stages	Controlled operations	Control (Method, amount)	Documentation
	corrosion of metal parts <ul style="list-style-type: none"> <li>• Presence of structural elements for fixing</li> <li>• The readiness of premises for wiring works</li> <li>• Markup</li> </ul>	- » -  Technical inspection  Same	
Wiring works and installation of the lighting fixtures	Control: <ul style="list-style-type: none"> <li>• Mounting height of electrical meters, switches and sockets</li> <li>• Quality of wiring and fixing</li> </ul>	Visual, measuring  Same	Journal of works, covered-up works report
Acceptance of finished works	Check: <ul style="list-style-type: none"> <li>• Quality of wiring and installation of electrical equipment</li> <li>• Presence of reports about measuring of insulation impedance</li> <li>• Correctness of ignition and burning of lamps</li> </ul>	Technical inspection  Visual  Same	Checking report of electrical network ignition  Report of putting in commission of electrical network
Measuring tools: steel ruler, steel micrometer, ammeter, pilot lamp, ohmmeter.			
Operational control is carried out by: foreman Acceptance control is executed by: quality supervisor, foreman, owner's technical supervision.			

## 11 CONCLUSION

Close co-operation between partners is the most important element for successful implementation of tasks. The supervisor has responsibility for the stage of operation and that is why he has to know work methods all-round. The quality supervisor has to watch over the results of the work and he has to interfere possible problematic situations.

Weekly meetings with subcontractors are a good practice to control their work. All problems and needs of the project team and subcontractors can be solved during those meetings. The supervisor should direct the meetings and facilitate the group's interaction to best serve both the project and each individual subcontractor.

The building work acceptance time schedule is not a common practice in construction projects in Russia. The time schedule that was made during work on the building site helped to organize the acceptance of works and there were no problems at the end of the projects, because all works were accepted in a few days after their completion.

Most Russian construction companies do not care about good quality of their projects, do not pay attention to acceptance of works and think that subcontractors will do all the works as mentioned in contracts without control from the construction company representatives. As can be seen in practice, this is not a good idea, because almost all construction projects in this case have huge delays in the project closure time.



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