

building engineer manual:

visual guide for
working instructions

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editorial Universitat Politècnica de València

Esther VALIENTE OCHOA

Building Engineer and Architect graduate from the Polytechnic University of Valencia.

Began her professional career as work site manager in a building company, swiftly progressing to Quality Director of the same company.

Subsequently she has been, for several years, Chair of Quality Control & Innovation in building process as well as Head of Building Department on business groups in the construction sector.

As an independent professional, she has worked in the field of building quality, in both public building works as well as private developments as a member of the site management team responsible for building works execution.

Designer Architect of public and private building and urban designs, she has been a finalist and winner of several architecture and town planning competitions at both national and international level.

Currently combining the workload of architecture & engineering offices with the academic activity as lecturer giving classes in the department of Architectural Construction in the Technical School of Building Engineering at the University Polytechnic of Valencia.

She has published several books the most notable of which are the present collection "building engineer manual" with other titles "quality control of building materials" and "visual guide for building inspections", and others as: "Quality in Building construction and its Control"; "Quality in Building construction: foundation and basic principles" and "Medieval Architecture Workshop: the Cistercian Monastery of Santa María de Bonaval" and "Rural architecture in the village of San Miguel". She is also the author of several papers, the most notable of which are: "The New Architecture of Valencia" and "Sustainability Architecture: a glance at Algeria and Spain".

To my parents.

First edition, april of 2012.

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The result of a long term investigation process requires a detailed experimental method that brings together, systematically, the reasons, causes, characteristics, variables and final results, sometimes in agreement and sometimes conflicting. This path is present in our professional practice in such a way that the signs of experience and years of dedication to a discipline, allows us to study the results obtained and broaden knowledge for all professionals that, on a daily basis, work in the same field.

From this perspective, this manual is a clear example of empirical investigation, whose professional path concludes in a catalogue of great value for all professionals that engage in the construction process ,and that acts as a documentary guide for managing in a holistic way the building process.

I would like to encourage our colleagues who are already qualified and the rest of technicians, to continue investigating and sharing their practical results with all the agents involved. This all-purpose system of our researchers, contributes to the Polytechnic University of Valencia progressing extraordinarily towards an expansion of knowledge.

PhD. Amparo CHIRALT BOIX

Vice Rector of Investigation. University Polytechnic of Valencia. Spain.



The control of the execution of any building work is a complicated task that requires in-depth training, constantly updated, as both regulations as well as the process are in constant flux so as to better meet, the social demand of moving within environments which are ever more comfortable, practical and of the highest quality possible.

The work that lecturer Valiente has been developing has been recognized for some time in this field and it is the culmination of her experience, attained over more than a dozen years.

Distant in terms of time but, fresh in the memory, that bright & hardworking student that I had the pleasure of having in my class. One could already detect what that person would be capable of achieving. Today, with this publication embodying simplicity in its exposition but, without forgetting the rigors of its content, it reflects the personality of the author, it could not be otherwise.

The affection and respect that I feel for that person has made it impossible to remain totally impartial in the assessment of this publication. However, I believe that am not mistaken in saying that its usefulness will become evident shortly and surely any professional connected to this sector will be grateful for its existence.

I trust that this "manual" will be but the beginning of a long series of publications that allow students and professionals to get to know the experience of the author, contributing in that way to the improvement of the advancement of this sector.

PhD. Jose Carlos AYATS SALT

Vice Rector of Employment Policy. University Polytechnic of Valencia. Spain.



Placing a prologue to a book is always a pleasant task: the effort, a great one on this occasion, is undertaken by the author and in writing it we focus on the most notable and interesting aspects. On this occasion, it is even easier to carry out this task. The author, Esther Valiente Ochoa, has carried a great work of synthesis of her broad professional experience in order to be able to offer to the offer the students of Building Engineering and Architecture a much needed work in scientific literature of the architectural construction: the execution of building work.

The market for this book is full, perhaps saturated, of very interesting works on construction focused on the regulative aspects such as the technical building code, its application, treatises on construction ranging from the most classical to the most current which however, maintain similar structures to those that came before. On the other hand, the manuals that are published are almost always, specifically related to a material or construction unit, leaving a gap which is filled by this manual which covers the execution of the building work from a visual perspective, fast, direct and complete.

The “Building Engineer Manual: Visual Guide for Working Instructions” that is presented to us by its author covers the units of building work present in the vast majority of the current constructions. It is a documentary reflection of the current situation of construction in Spain and, for this reason; we must all congratulate Esther Valiente on her successful choice. Also, we must be thankful for her awareness of the current state of university knowledge, her independence from her legitimate individual interests and her academic vocation.

PhD. Javier BENLLOCH MARCO

Cathedral of Architectural Constructions of the University Polytechnic of Valencia. Spain.



Many of the memories that my parents have of my childhood, showed my appreciation of architecture and engineering, which has manifested itself in many ways in my life, anecdotes and many building works.

Later it would be the Faculty of Constructing Architecture, today Faculty of Building Engineering, and the Faculty of Architecture at the Polytechnic University of Valencia, Spain, which would train me through contact with good teachers, great masters and, since a long time, better colleagues.

The passage from my academic training to my professional career was made thanks to the Vice Rector of Employment Policy at the UPV, PhD. Carlos AYATS SALT, lecturer and friend, and the active collaboration of PhD. Javier BENLLOCJH MARCO, who helped me on a career that is still going today.

This manual is the fruit of more than twelve years of work in building site management, technical supervision and quality control of a great number of buildings, alongside a group of professionals whose interdisciplinary collaboration has given me a global perspective of the profession of Building Engineering. Thanks to the experience of each and every colleague with whom I have shared a never ending list of building works, experiences and situations during the development of the projects and the holistic management of building work, this book has been made possible. I would like to thank them all*.

It's nothing more than the synergy stemming from the academic training and the empirical assimilation of daily work, which brings us closer to competence in our profession. Always with different denominations, the Building Engineer has always been a master constructor, whose common objective is the realization of projects with complicated time limits, low budgets and material and human resources, and heterogeneous characteristics. Despite that, the profession has always demonstrated its multi-talented management capacity, through the global control of building works with a view towards achieving the highest quality objectives.

This control process is what I have strived to present in this book, through examples of supervision of all the units in the execution process of construction work on a building, identifying the principal check-points and aspects to verify technically, with the stipulated tolerances in the relevant regulations, with the objective of creating a reference document that serves as a guide in the study of the most common noncompliances in building work, thus avoiding future pathologies in our buildings.

This document is aimed at, Constructing & Building Engineers, Architects, and Engineers of any speciality that collaborate in the design and management of work buildings, as well as to all those professionals in the sector, whose professional training or experience could benefit from it.

Esther VALIENTE OCHOA

*The data and sequence collection that appear in this publication has been thanks to the collaboration of many colleagues is, friends, students and my family, without whom this work would never have taken place.

Thanks to Meri, Ana, Juanmi, Jose, Javier, Juan Ricardo, Pascual, Carla...to my brothers; and to you, Ismael.



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01 introduction



General overview

The global management for the building engineer in a building project, should be through the following phases:

1. Prior information and stages to the beginning of the building work

- project study and analysis
- documental and administrative management
- economic management of work process
- work organization, planning and processes
- quality control plan of the building works
- quality plan from the contractor company
- health and safety plan

2. Execution phase: study, analysis and control of building work

- management of all agents involved
- documentation of building work management
- economic monitoring, deadlines, costs and payment
- quality control plan management
- planning management
- safety plan management
- supervision of site work changes

3. Final phase previous delivery

- final check of building work
- delivery documentation
- delivery contract and customer service

With regard to these processes, we are going to concentrate on those related to the actual execution of work, whose final quality is obtained through diligent control of materials and execution. It is therefore essential to inspect and document these two large groups, in order to ensure the result, starting from the parameters set forth in the project material plan.

One of the most important tools that help us with inspection and documentation are programs of Inspection Points. These documents for review are listed in a table of checking that allows us to control the various stages of execution of each of the activities involved in a constructive process, providing a written record. They are part of the total quality plan of the work, even if they constitute a tab inspection recommended for all technicians involved in the construction process.

This document is of a voluntary nature but is highly recommended and whose content should relate to the characteristics and type of applicable rules and regulations, and be appropriate to the supplementary specifications of each project. In any case, it implies a justification of future conformity before any legal process.

Project control

The execution design is formally expressed in the documentation of the architecture to be built, fulfilling both the explicit and implicit needs of the promoter.

It should describe the building and define the work units in sufficient detail to enable them to be evaluated and interpreted unequivocally during its execution and to meet the requirements relating to the safety, functionality, durability and protection of the environment established by the applicable regulations (see the regulations from each country).

It is essential to perform a quality control of the project as one of the first activities to be performed on the building work, planning in several phases: internal control of production by the designers, external control by work site managers and the supervision control companies. By those measures we will try to guarantee that:

- The proposed solutions are technically justified in accordance with the specifications required by the technical regulations applicable.



When the project is to be developed or completed through sub-projects, technical documents on specific technologies or other changed aspects of the building, must be maintained between all agents to ensure the necessary coordination without any deception in the documentation.

- All the necessary documentation to bring the project to completion is defined.
- All specifications and necessary data to carry out the execution of the building works will be able to be assessed to accurately gauge the work required for the project. It is essential that the documentation that is included in the project does not include contradictions.

The execution of the building works derived from good project management documentation will have a greater fluidity and final quality in the construction, it is a living document that must reflect all the changes in building work and possible modifications proposed by the involved agents that have been approved by the building developer.

In any case, the final project will be included into the documentation to be delivered to the owner, along with a manual for use and maintenance which will be annexed to the Book of the Building, in which the final reality of the construction will be reflected.

Materials control

For the use of the materials in the building work, it is necessary to perform a complete and detailed quality control plan, which specifies the totality of the prescriptions, programming and technical conditions to carry out the project, and prior to its technical reception. The Plan will contain the detailed specification of a batch of materials to be tested and the marks of quality due to each one of them, following the obligatory standards.

To carry out the programming to the quality control, there is a regulatory infrastructure that allows us the selective characterization of each material according with the requirements stipulated in it.

The CE mark of construction products is a mark of conformity to the European Directive 89/106, as amended by 93/68/EEC, which guarantees free movement of the product which pertains to the European Union.

This certificate guarantees the fulfillment of minimum legal requirements and technical security, but not the quality. New products are regularly being adopted which require to carry the quality mark, so product databases need to be frequently updated. This is a continuous process, and there is a period of time between the product's recognition, and its inclusion into the European Countries Standards.

The DITE (Document of European Technical Approval) is the technical evaluation that certifies the suitability of a product for the assigned use, based on examinations, tests, and an evaluation by the agencies authorized for their concession.

In addition, there are a series of quality voluntary marks such as:

The QUALICOAT mark given by the Association for Quality Control in the Lacquering, Painting and Coating Industry which has as its objective to improve and establish quality standards for the industry of the lacquered, aluminum products and alloys.

The AITIM mark in accordance to the UNE norms has, the objective to certify the quality of the products manufactured and services provided by the timber industry.

The quality mark EWWA/EURAS is the result of an agreement between the European Association for aluminum (EAA) and the European Association of Anodizes (EURAS) for the constitution of the Association for Quality controls in the anodized materials industry. The agency responsible for granting the mark is Qualanod International through the licensing of each of the countries and the management of the mark.

With this regulatory infrastructure, the site management, on behalf of the property, has the obligation to verify compliance with the standards established in the quality control plan, as an integral document of the whole project, of the products received in the building site and, in particular, those other elements which join the same on a permanent basis.

The acceptance of materials will require a control documentary of the characteristics of all materials by following the marks and tests before, during and after their supply.

01

For this, the building works contractor will collaborate in the reception of the documents of supply and control, making them available to the Work Manager.

The laboratories and certification bodies must be accredited to issue any certificate for products, processes, personnel and services as the service tests.

Regardless of the above, those laboratories and agencies of quality control that are not accredited by notified bodies, may not be notified by the European Directive to certify in the field of assessment systems for compliance for the CE mark of construction products.

Finally, all the documentation should be reflected with the changes that may have occurred, in the quality control plan final version, which, in turn, will be incorporated into the "Building Book" which will be delivered to the owners.

Execution units control

The building construction must be carried out subject to the project and its authorized modifications by the head site management subject to approval of the building promoter, the applicable law, the standards and the good practice guidelines.

For a proper control of the execution of the building works, it is necessary to have a good quality control plan that, in which, once again, we detail the performance specifications of all the activities in each of the phases of construction.

The site manager is obliged to carry out the control of the execution process, by checking the records of the self-control of the builder and by carrying out a series of inspections in accordance with the provisions of the local standards.

Based on the levels of control, the plan should divide the building work into batches, to establish the inspection units that, in principle, should coincide with the maximum dimensions of verifiable activity in a site inspection, and to indicate in each batch the frequencies of verification.

The inspection of all the activities can be reflected in the programs of inspection points, detailing the typology of the point to inspect, the person in charge for its verification, and criteria for acceptance or rejection. Once made, it is imperative that they are documented, in order, to have a control over them, throughout the lifespan of the building.

Note

All the specifications in the field of safety and health are indicated in general terms without comment, as its full detail would be the subject of another independent document to this guide to quality control of building works.

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