Quality control of structural projects

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Abstract

The collapse of a structure may bring about economic losses. Besides that, it represents a tragedy if a person suffers any physical or psychological injure, either permanent or not; and the tragedy would be even greater if there is lost a single human life. This tragedy will surely affect the professional body responsible of the referred structure (structural engineers, constructors, etc.), and every person or company that was involved with any phase of the construction process (architect, manufacturer, contractors, etc.). Nevertheless, this failure might have been easily avoided. Errors perpetrated in the phase of structural design constitute a big percentage of structural failure causes; but it is important to mention that they can be avoided by means of an adequate quality control of the structural design.

In the paper, the basic concepts related to quality control are presented, and they are mainly focused on the construction industry. After briefly stating that the success of the project is the satisfaction of the user's requirements and necessities, it is then continuously remarked along the whole paper. The quality control program is to be analysed as consisting of two mechanisms, the production control and the reception control. Both mechanisms are presented, explaining their responsible professionals, characteristics and objectives. Afterwards, both control mechanisms are compared, and after noting that the objective of them both is common, their differences are identified and explained, with a few examples.

A general overview of quality control is included, specifically related to the phase of structural design, where information related to the most important factors causing lack of quality is listed. A list of responsibilities of the structural project manager is also included, where another important issue regarding quality control is introduced: the importance of documents. The quality of structural designs, as well as the architectural one, is to be perfect, for the structure will be built based on them; any error or unclear information will lead to errors when working on site.

Three are the main areas where the quality control should be implemented are the following: revision of structural projects, control of modifications and structural design software. The purpose of the revision of structural projects is to thoroughly analyse all potential errors that could happen on site, and their effect on the resulting structure. Controlling all modifications introduced to the design, either at the office or on site, is vital; the designer must be informed of any change introduced to its design, in order to authorise them. Verifying all software to be used for analysis and design purposes is necessary in order to avoid incorrect results at the calculation stage.

The paper ends with a practical guide to control the quality of structural projects. It consists of three main areas: the production control, the reception control, and the modification control. At the production control analysis, eighth aspects are reviewed:

a) Computer software: highlighting that all software must be verify for validity and precision, and listing the necessary documentation regarding the software;
b) Structural systems: where it is stated the need to check the system chosen for the structure, for the high impact it has on the overall performance and cost;
c) Structural elements: focused to statistical control of the process, i.e., analysis of the reinforcement ration for different structural members, etc.;
d) Reinforcement details: explaining the importance of having plotted details of every situation where there might arise problems on site, such as detailing of connections among beams and columns;
e) Infrastructure foresight: since the introduction of ducts might affect structural behaviour;
f) Consumption of materials: because a high or low steel consumption per concrete volume might indicate the occurrence of an error at the structural design phase;
g) Specifications: stating their importance, as well as listing some aspects to be covered; and,
h) Plans and documents: indicating that the designer should keep a complete file of the initial design, as well as of the as-built structure.

The advantages of the reception control are stated, as well as an explanation of the difficulties of its implementation. The last item is related to modification control, where it is explained why they should be informed to the designer.

The paper is closes with some final comments of the author regarding the importance of the implementation of quality control programs by engineering firms.