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TOWARD EFFECTIVE AND EFFICIENT PROCESS IN PROJECT VALIDATION

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In Italy, following the introduction of European regulations and the updating of the national legislation on public works, the project verification and validation play a strategic rule in reducing problems and variation issues at each design phase and during the completion stage. We have the opportunity of a behind-the-scenes journey considering two early validation experiences in Italy and the phase following their tender of bidding. The first case study is the "Progetto Raddoppio" for the Politecnico di Torino, that is to say the project of extension works of the buildings for Departments and lecture halls in Turin Polytechnic: these works went to an end, and now we can evaluate pros and cons of that early validation experience on the works management and on the built product. The second case is the "Urban Center" commissioned by Comune di Torino, a large exhibition area coming from a deep renovation of the buildings formerly "Officine grandi riparazioni ferroviarie" (Railways Heavy Reparation Works). In this case, the works never begun, but the validation process was completed and some issues arisen.

Keywords: Public works, Design phases, Completion stage, Project verification, Execution management.

1 INTRODUCTION

In Italy the mandatory project validation in public works is becoming a regular step in the design process (Ciribini 2011), playing a strategic rule in reducing extra-costs for variations during the construction phase and minimizing litigations. These results have been achieved through a deep, matter-tailored inspection of whole set of documents constituting the project to be validated. We had the opportunity to work with an Inspection Authority (named PCQ and instituted by four Italian universities: Politecnico di Torino, Università di Torino, Politecnico di Milano e Università Politecnica delle Marche) and we found some case studies very interesting, above all those referred to the early stage of the inspection implementation: in facts they have led the researchers to a fine tune-up of the inspection method and validation process.

In this paper, two case studies are presented: one is referred to a new building, and the other to a heavy renovation of a former large shed previously owned by the Italian railways company. In both cases we faced good projects and good designers: as a matter of facts, the project careful verification didn't reveal any major fault, but many minor defects or omissions that could have led to several terms presented by the contractor, conditioning the completion of the construction and the budget. The

opportunity to exemplify some of the recurrent imperfections is the results of a inspection method that have been accurately tuned by researchers case by case, revealed to be robustly planned and quite easy to manage.

We succeeded in being effective without being inefficient: this was a big goal, because in the Italian Law the Inspection Authority have to support the Public Administration (Francisco 2007), represented by the Overall Procedure Manager (OPM), about the decision to validate or not to validate, ideally without slowing down the design process.

2 THE INSPECTION METHOD

The project inspection process provides for control of the project content, verified as a whole and with the same skill level of the designers' [Piantanida 2011]. The main features to be checked are:

i. Specifications adequacy
ii. Achievement of all mandatory or prescribed authorizations, expert opinions and approvals
iii. Completeness
iv. Current legal requirements compliance
v. Coherence between preliminary project data and site inspection data
vi. Transparency and traceability of project choices
vii. Legitimacy, congruency and completeness of the Contracting Agreement
viii. Completeness and correctness of the Bill of Quantities
ix. One-to-one correspondence of the Bill of Quantities to project drawings.

First, the project documentation is divided into sections corresponding to the inspectors' skills (e.g., structure, architecture, power & lighting, HVAC, environment, etc.); then each (intermediate or final) sectorial report has to be discussed with all the inspectors to check its coherence with the others; finally a global report is compiled and emitted.

The *Bill of Quantities* is controlled by sampling: we analyze items (quantity and cost) with respect to works amounting to 10% of the total for each category of production (i.e., structure, doors and windows, partitions, false ceilings, finishings, facilities, power and lighting, HVAC, etc.).

The *List of Prices* and *Price Analysis* involve the congruence verification between prices and the source assumed to calculate them (e.g., Price List), together with the reliability of market surveys. This checking is carried out in consecutive items for decreasing work totals, commencing with the highest amount, until 20% of total works value is reached. For other items, a random sample check is performed.

The *Work organization* is verified by control, on the time schedule, of timing feasibility (e.g., process duration vs. total labor ratio) for the same items involved in the verification of the List of Prices. The *Maintenance plan* is controlled in relation to the extraordinary maintenances mandatory by law.

The *Technical drawing* analysis is performed together with the specifications, verifying the technical details are fully developed and every acronym and reference applied univocally to the items in the Technical Specifications and List of Prices. The following aspects must be considered:

i. Completeness
ii. Performance adequacy
iii. Implementation
iv. Measurement standards
v. Acceptance condition
vi. Compliance with the calculation data

All the project inspection is carried out as an iterative process on the executive projects, through a cyclical close debate with the designers: each inspection leads to an Intermediate Report with all the observation by the Inspectors; on that basis, a new release of the project should be provided for a new inspection and so on, until the definite stage is reached and a Final Report could be emitted by the Inspection Authority.

Each report is addressed to the OPM and to the design team in order to favor an open debate. Anyway, in some cases we have experienced some remarks misinterpretations: the design team seemed to refer the observations to themselves instead of the project, resulting in a personal defense instead of team project revision, but usually a simple discussion was enough to make clear the inspection's aim is to improve the project, not to blame the designers.

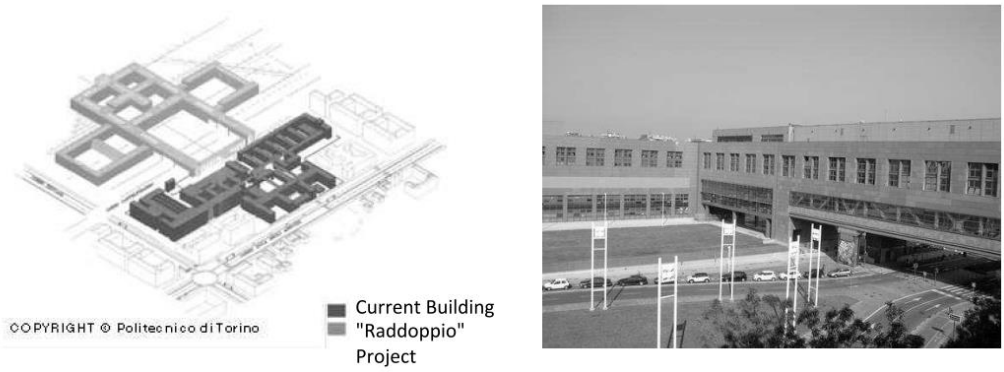

Figure 1. Torino, the Polytechnic "Raddoppio": masterplan (left) and main general view (right).

3 THE "RADDOPPIO" CASE STUDY

The main campus of Politecnico di Torino has been recently "doubled" via construction of new halls in the area once partially used by the old Italian Railway Maintenance

Service, the old sheds being demolished (Figure 1). This is a vast area behind the main campus, but it is separated by the double track railway line running from Milano to Torino: the railway tracks were tunneled underground and above them we got a new avenue done. In this context, the need to connect the two campuses without crossing the new avenue led to the design of two twin bridge building connecting the campuses with a glazed gangway and with four more floors for offices and research labs. The buildings have a stone plated ventilated façade, iron beams and reinforced concrete slabs and pillars: four consecutive executive projects were drafted over the course of two years of controls, gradually acknowledging most of the observations, except those conflicting with the Final project, to which the Executive project must conform by law. Some examples of the inspection notes on drawings are shown in the Figure 2 and 3.

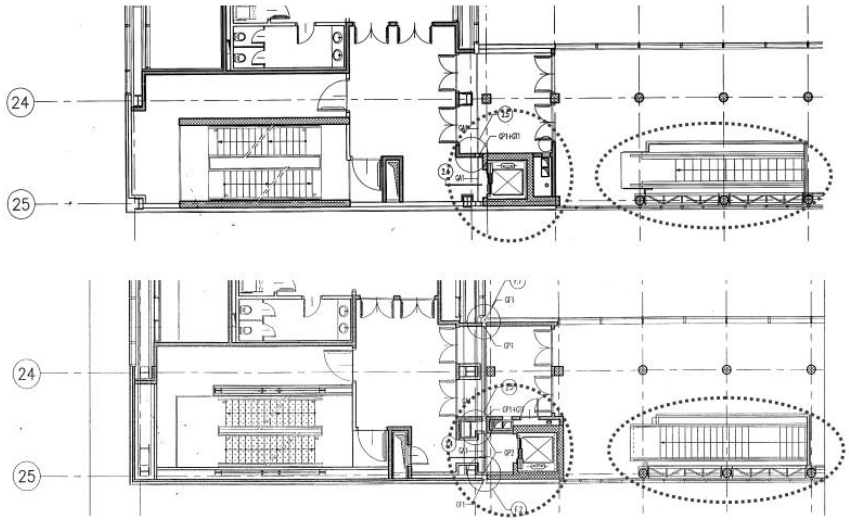

Figure 2. Incomplete congruency between architectural design and structural design; lack of accessibility for the cage of systems; hypothesis of an escalator for spaces with low attendance (above: before inspection; below: after inspection).

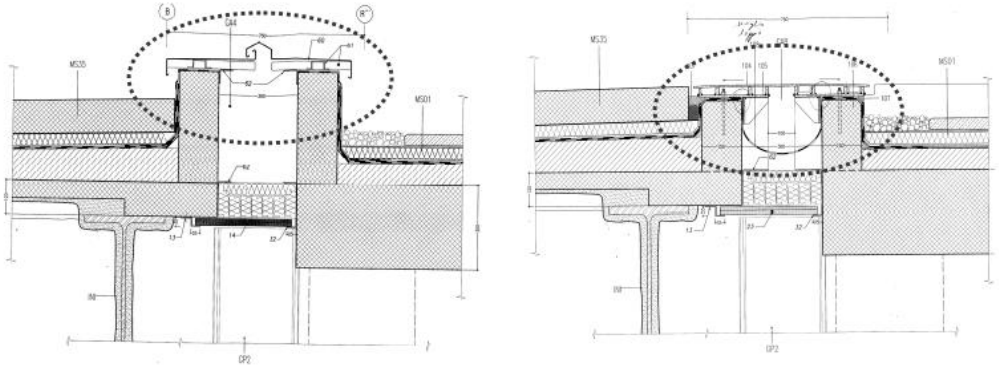

Figure 3. Terrace, roof: covering of an expansion joint, not for pedestrians and with condensation risk (left: before inspection, right: after inspection).

Figure 4. Torino, the sheds of Officine Grandi Riparazioni Ferroviarie.

4 THE "URBAN CENTER" CASE STUDY

The Urban Center" is a large exhibition area coming from a deep renovation of the buildings formerly "Officine grandi riparazioni ferroviarie" (Railways Heavy Reparation Works) in Figure 4: the project inspection was commissioned by Comune di Torino in 2005. In this case, the inspection process aroused new issues with respect to the one for new building projects. The key was how much to be confident in an adequate knowledge of the existent old buildings by the designers: in effect, before the work beginning, no significant money can be spent on an in-depth technological survey of the buildings and we have to rely on the old files only, which are very often incomplete or missing.

During the verifications, besides the predictable needs of project improvements, emerged the urge of an in-depth analysis of the old building context, based on the research and document database available at the Universities: some evanescent evidence of an underground air-raid shelter appeared from the past, leading to a revision of the construction site layout and a close bomb clearance on the area. Moreover the shed internal soil revealed to be contaminated by lubricants and dross, steering to a budget revision for soil disposal. The revised and validated project is waiting for an updated public founding.

5 CONCLUSIONS

The introduction of the validation procedure for public works gives positive results in terms of reduction of disputes and controversies. It also shows the way to a better relationship between Designers and Committing Authority and a better survey of existent buildings. The whole inspection process drive the project to an higher quality and to a more reliable cost estimation; the building process itself is becoming more unitary and its phases more integrated (Gottfried *et al*. 2006).

Last but not least, the availability of the competence of researchers and professors at various universities constituted a skill frame very effective in managing the inspection process and the cross-examination of the reports.

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