

# Quality systems remodelling with the site works preparation method and proactive co-ordination: a French experience

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## Abstract

Over the last years, all around the world construction players have worried about implementing quality management principles in construction firms and sites. During this period, organisational barriers were observed in this implementation process and, particularly, managers found it difficult to transfer internal quality efforts to on-site activities. There is a range of reasons for this; nevertheless, the insufficient interaction between design and production and the lack of co-ordination of production teams during on-site works are amongst the main ones.

This paper presents and discusses a process to translate into Brazilian projects a supplementary phase to develop design and specification analysis, before starting production, which in France is called “site works preparation”. In addition, the French have an experimental practice named “proactive site works co-ordination”, which is also discussed.

Case studies carried out over a year and a half in France, as well as some others in Brazil illustrate the relevance and potential benefits of the proposals mentioned above. As a result, proposals related to management methods are presented for adoption in real estate and building firms, along with guidelines for implementation.

## Keywords

Building; quality; construction sites; quality management

## 1. Introduction

In Brazil, the lack of integration between design and site teams causes several problems concerning waste in the production process and building performance in use. Non-compatible or non-co-ordinated design parts (e.g., architectural and structural design) as well as insufficient or inadequate design detailing lead to “last minute” decisions and then non-optimised solutions are adapted to solve on-site problems. This can be considered a typical statement in the construction sector and it is closely related to deficient management methods; however, what should be done to improve management and prevent interaction between construction players?

In the analysis of case studies, an important dissociation was observed between construction players’ objectives and a large inefficiency in communication and documentation processes, which results from deficient co-ordination of design and site teams. Thus, a lot of detailed information was not useless and low-qualified people decided on technical solutions.

Delayed execution due to lack of information in design, changes in previously planned activities, estimated cost increase, late achievement of works, for example, are systematically found in construction and this shows how inadequate classical communication methods adopted to establish design-execution interaction are. The impossibility of anticipating interfacial problems, which are essential to production efficiency, is a long-standing phenomenon but its solution can be found in very simple procedures. The solution is linked to the promotion of a specific interaction activity between design and site teams.

It is well known that an integration effort is needed to identify inconsistent design solutions, putting designers and contractors together, e.g. to plan how to better execute the project. This kind of consideration was made by the researchers of the Construction Industry Institute (CII, 1987) and by Melhado’s Doctorate thesis (1994). These authors state that decision taking must be anticipated to prevent resorting to bad solutions to solve urgent problems.

In France, “all the construction professionals know that the lack of a site preparation phase leads to risky and improvised situations, which have a questionable cost and human energy consumption due to rework needs”, as synthesises a paper written by the Agence Qualité Construction (AQC, 1996).

In Brazil, this notion has also been increasingly accepted. Although very recent, a change in attitude is noticed in the Brazilian construction sector towards the improvement of quality and productivity. In this scenario, a belief concerning the importance of jointly organising and planning the production process, before starting execution, has spread. Practical application of this, nevertheless, is not yet in practice, so rework is still significant.

Aware of a similar difficulty, and having the support of some institutional groups, French construction has developed a methodology and experimentally implemented it in the sites. Amongst these methods, the authors have chosen the methods called “motivating site co-ordination” and “site preparation” to be adapted to Brazilian conditions, as they seem to be applicable in their national circumstances and faced up to their improvement needs.

“Site preparation” means “the organisation of project chosen location and the co-ordination of the players’ actions in order to ensure that the whole production structure runs, with the contractual objective of materialising this designed project” (AQC, 1996).

In brief, site preparation and site co-ordination motivation aim to reach five important results in construction (AQC, 1996): to prevent poor quality; to improve professional relations; to manage building schedule and to prevent additional delays; to manage construction costs as well as operation costs; to preserve human health and safety and to protect the environment.

Definitely, it is not a matter of solving every potential site problem, but the principles of this management philosophy can help to achieve better work conditions and also to anticipate and prevent predictable situations.

## **2. Construction sites in France and in Brazil**

Nowadays, in France, there are predominantly small-sized contractors and subcontracting is quite frequent. Regarding the latter point, the amount of subcontracting in French construction is now twice as big as that of fifty years ago, according to the data of an inquiry involving thousands of contractors. Thus, in that country, the scenario of construction sites involves a big number of players working on site simultaneously, and following quite compressed schedules – total delays do not usually exceed twelve months – at the same time that several standards and legal requirements must be taken into consideration.

It is important to mention that, since the sixties, there has been a specific function in French projects, which is called “OPC” (*ordonnancement, pilotage et coordination*) and can be translated as “site co-ordination”. Site co-ordinators in France have as basic responsibilities: the subdivision of the execution process into elementary tasks and the analysis of interference among them (*ordonnancement*); the allocation of resources needed to produce these tasks in time; the follow up of execution progress and the intervention in case of interface problems or increased delays that require re-scheduling. In small-sized projects, site co-ordination is normally attributed to the main contractor or associated with the design co-ordination function (*maîtrise d'œuvre*).

Another important function concerns technical control (*contrôle technique*), which was introduced in France in the sixties, too, and, even if not compulsory, it is very frequently found since it allows to get reduced project assurance costs.

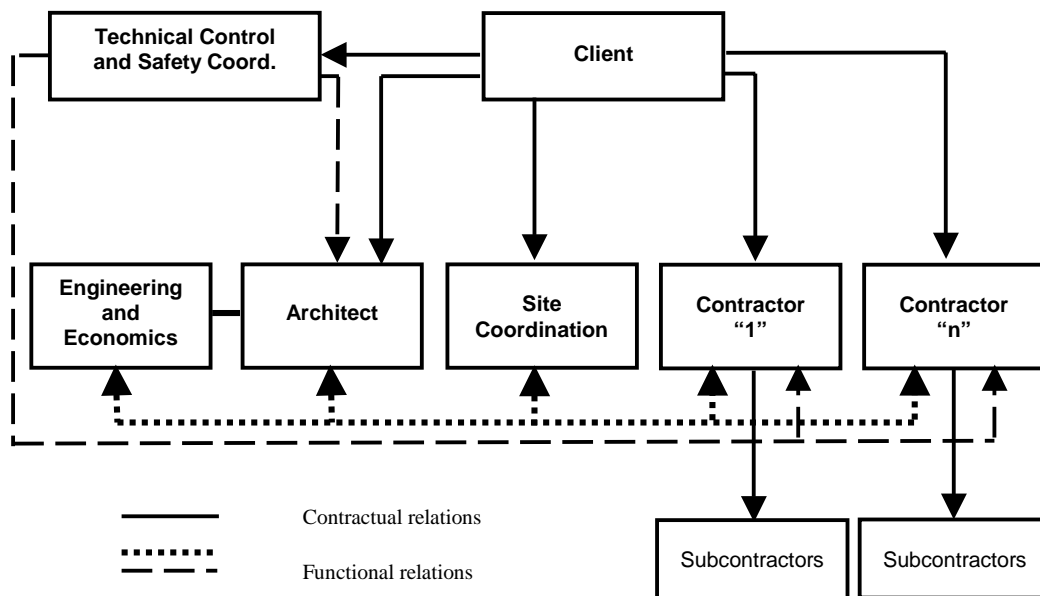
The role of technical control begins in the design phase and keeps very active during execution. In the design phase, technical control has the role of design solutions checking according to technical standard requirements, which is not usual in Brazil, where designers are intended to be responsible for checking standards by themselves; after this, the main technical control task is related to quality control on site, similarly to equivalent practices found in Brazilian sites, but a bit more comprehensive.

Moreover, since 1994, a “safety and health co-ordination” was made compulsory to every construction project in order to prevent safety and health problems on site (concerning the use of equipment and collective protection) and also related to the building in use (e.g. it includes safety and health in maintenance operations). Thus, design must interact with safety and health co-ordination to adequate building specifications and detailing to satisfy all requirements defined by standards and legislation, preventing difficulties of facade cleaning, ceiling accessibility or floor slipping and the safety and health co-ordinator has the ultimate decision in this kind of discussion. During site phase, he has an equivalent power that allows to stop execution if safety and health conditions are not acceptable.

In fact, sometimes, the site co-ordination and the safety and health co-ordination can have opposite objectives related to schedule, for example. In addition, design detailing is a joint responsibility of suppliers, contractors and design professionals. This means site co-ordination effectiveness depends on the co-operation of suppliers and contractors but it also depends on the participation of design co-ordination, which must validate technical solutions proposed by contractors. French legislation clearly attributes the main responsibility of detailing execution to contractors, rather than consider this as a design component, since they are intended to be better skilled to establish the solutions that ensure quality in project execution.

Thus, French architects have the responsibility of supervising project execution to ensure the conformity to design but they must interact with contractors to develop consistent solutions in detailing. Particularly, in the case of interface problems involving two or more contractors, the architect and the site co-ordinator will provide the necessary specifications or plans to guide execution.

Figure 1 illustrates a typical project arrangement in France. In Brazil, project arrangement is different, especially in terms of roles and division of responsibilities amongst players. Brazilian design professionals rarely participate in the execution phase and there is no similar site co-ordination, since site managers perform a similar role; also, there is no technical control, safety and health co-ordination during the design phase.



**Figure 1: French project typical arrangement.**

The Brazilian site manager is always on site and he is responsible for technical, administrative and safety co-ordination. This site manager is commonly on site everyday and, depending on the firm, he counts - or not - on the help of a technical manager. Finally, technical control is clearly less extensive than in France and assurance systems are not compulsory. Figure 2 illustrates typical project arrangement in Brazil. The most important deficiency concerns the relationship between client and contractor, and the relationship between contractor and designers. Differences and similarities apart, French and Brazilian realities present some identical challenges: restart the sector growth; change of competitive parameters; increasing importance

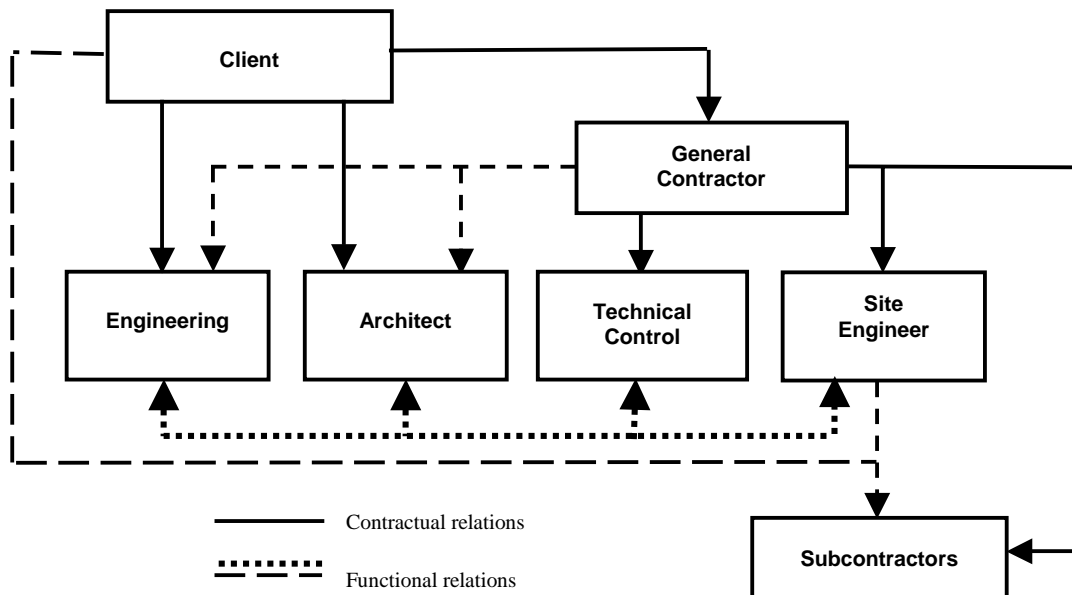
given to financial management and production management; quality certification dissemination.

### 3. Site preparation and site co-ordination motivation

#### 3.1 Site preparation

Site preparation is defined as an activity that is placed after the project definition phase and establishes the beginning of its effective management, being a transition between the main design activities and the execution phase. An important characteristic of site preparation is that it begins exactly before the moment when real expenses start to replace production costs estimation.

Site preparation requires a weekly meeting between project players, to analyse the project particularities, to review design specifications and to discuss each contractor's or subcontractor's contribution to design detailing and technical problems solving. The philosophy of site preparation also has as one of its main aims the understanding of product design and technological choices, thus allowing the participation of non-prepared contractors or subcontractors.



**Figure 2: Brazilian project typical arrangement.**

Its adoption in the French projects is increasingly common and, even in the case of small-sized ones, where a period of at least four weeks is necessary to previously examine each of the execution tasks and all the interfaces among them. This work, however, does not finish after these four weeks of preparation; in fact, it must be conducted along execution while interface problems still exist.

The total duration of site preparation depends on the project size and nature and this activity during execution shall not be misinterpreted as being the same that motivates site co-ordination. Site preparation means working in groups and producing design detailing and design for production, which will lead to collective decisions and provide very oriented information to ensure quality during execution, in a co-operative ambience and without conflicts or unpredictable problems. During the site preparation

phase and according to one of its main principles, trust relations may be established between all players concerned. This preparation period may also contribute to identify and solve non-answered design questions, to obtain the commitment of each participant and to well understand final product quality requirements.

The concept of “Project-Firm” (Descours et al., 1996) is essential to define objectives, actions and procedures co-ordinated by the same person in charge. Those authors state the need of an ephemeral but strong organisation founded on quality management principles that emphasise motivation and commitment, throughout the execution phase.

The meetings are jointly co-ordinated by the design co-ordinator (generally, the architect), the site co-ordinator and a client representative, who will discuss with a number of contractors (up to fifteen contractors each meeting). The safety and health co-ordinator and the technical controller will be present, if necessary.

Site preparation intends to anticipate and solve execution difficulties, saving time and, then, joint decisions are scheduled. About this specific matter, French public projects are compelled to develop site preparation and a large portion of the private construction sector also performs it.

In the Brazilian context, similar procedures should be implemented so as to reduce waste, promote national standards development, encourage quality certification, etc.

### **3.2 Motivating site co-ordination**

After several case studies in France involving the implementation of site preparation, three relevant deficiencies were identified: lack of integration between product design and production; problems due to information transmission; lack of co-ordination during site execution. Efforts made during past stages do not assure production efficiency.

The method proposed aims to contribute to the implementation of very good decisions during site preparation. For this purpose, motivating site co-ordination involves: the management of decision-taking; emphasis on quality control and the integration of cost control and safety control into quality management; delay respect; efficiency of information system to avoid the risk of non-compatibility in design..

The method of motivating site co-ordination intends to establish trust among construction players, which can prepare to control the execution by themselves, to internally verify quality, etc. This kind of procedures can eliminate several control forms to be filled in, such as their correspondent analysis, thus reducing the need of very specialised personnel to perform classical “quality control”.

Site co-ordinator must participate in different stages of design, in order to optimise final solutions: design review and validation; choice of subcontractors; site preparation; execution; final building acceptance.

Despite the increasing number of quality-certified firms, there are a lot of French contractors that still work without a consistent organisation and who lack internal management procedures – in these situations, motivating site co-ordination has an important role concerning management of sub processes in harmony with the whole project management.

### **3.3 The meetings during site preparation**

During site preparation meetings, information transfer and obscure points related to design are jointly organised by the design co-ordinator and the site co-ordinator. All the data are registered in technical reports or meeting minutes.

According to the orientation of a well-recognised French guide (Club..., 1993), site preparation must include three main stages, thus involving at least three general meetings (and several other meetings without some of the project players):

- a) **First stage (site preparation opening) – basic matters:** the design introduction by the design team to site personnel, highlighting its most important characteristics, the difficulties involving execution and technical solutions adopted, which can be criticised and modified by contractors proposals; the elucidation of each player's role and responsibility, stressing the necessary formality concerning decision-taking; the introduction of procedures that will guide site preparation as well as communication resources and forms that will be adopted; the evaluation of players' expectations and wishes concerning the project; the constitution of work teams (e.g., structure and building systems; internal partitions and piping; finishing) to design detailing, interface analysis and site lay-out development; the proposal and validation, after discussion, of an interface check list.
- b) **Second stage (harmonisation and evaluation meeting) – basic matters:** the validation of the design for production detailing, based on work teams proposals; if necessary, the constitution of a special work team in charge of complex items detailing; the evaluation of partial results from site preparation and work teams synergy; the formal report of completed and uncompleted activities, in order to commit people with predefined objectives.
- c) **Third stage (site preparation completing) – basic matters:** the checking of site preparation completion; the validation of all documents produced; the discussion and validation of site preparation results and signature of meeting minutes.

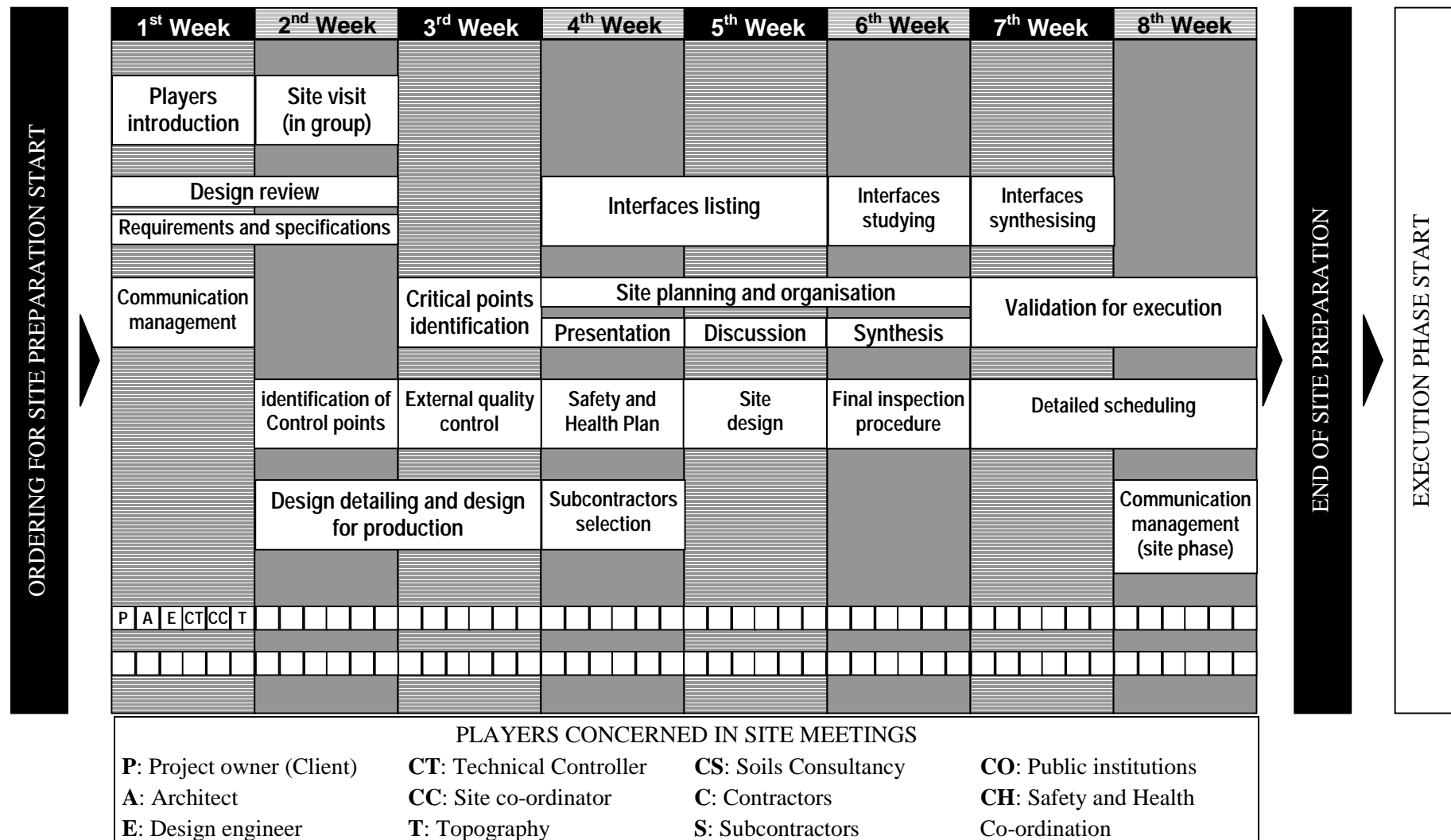
Surely, large-sized or very complex sites require more detailed site preparation than ordinary ones; contractors' and subcontractors' characteristics are also influencing factors, since well-organised firms are capable of good design detailing; in case of very small contractors' organisations, designers' participation on detailing shall be dominant.

Figure 3 shows a typical sequence of meetings, during the phase of site preparation (Club PACA, 1997).

#### 4. Case studies

In France, four case studies were carried out for a year, aiming to evaluate the results deriving from the implementation of the site preparation methods and of motivating site co-ordination, which were developed by the Construction Quality Club of Isère (Club..., 1993 and Masure; Henry, 2000). Concerning these four projects, we followed all the meetings related to site preparation, besides the methods and tools that were used to solve problems, as well as the results achieved by site co-ordinators. There were, amongst these cases, three public construction projects and a private one.

In France, architects are not only responsible for construction product design, but they also participate on site and keep very active until the building construction ends and is accepted by the client. Although most architects would not be able to solve some production-related problems, this deficiency may be counterbalanced by integration and co-operation skills in teamwork. As nobody is fully skilled at technology or production management, it is precisely there that quality management concepts can be brought to bear. As design co-ordinator, the architect significantly helps during all the site phase of the project.



**Figure 3 General planning of typical meetings during the site preparation phase.**



It was observed that, sometimes, the design co-ordinator could also be the site co-ordinator in French projects. In brief, the three possibilities that were identified concerning this role show that an engineer from the main contractor, an architect issued from the architectural office that designed the building or an independent engineer can all be site co-ordinators, thus leading a team that includes a client representative, designers, contractors, subcontractors, the technical controller and the safety and health co-ordinator.

In these case studies, even if each project has particular characteristics, such as size, complexity and contractors' organisation degree – from a well organised, quality-certified contractor to small-sized and informally organised ones, general results were positive in all the cases. One of the reasons for these favourable results concerns hard work performed by site co-ordinators, determinedly supported by clients. The results they achieved include interfaces number dropping, productivity improvement, initial scheduling followed and rework decrease. The improvement in terms of relationship among players must also be emphasised, specially concerning design co-ordinator and site co-ordinator, the enlarged motivation of personnel and increased designers commitment.

Site preparation meetings were performed on site and, aiming to communicate decisions properly and helping to register construction development, co-ordinators wrote minutes that were quickly distributed to all players concerned. As true “round tables”, site meetings ensured better-anticipated comprehension of design specifications, buildability and interface problems. Similarly, motivating site co-ordination ensured execution according to decisions taken during site preparation, leading contractors and subcontractors to apply standards and procedures and to perform pre-established controls. It must be highlighted that project players, even having conflicts, were organised as genuine quality teams, with clear objectives, mutual respect and collective sense.

In Brazil, three case studies, carried out for a year and a half, showed that the evolution occurred along two years, when certification programs started to definitely influence the construction sector, which is not yet enough to facilitate site organisation and control. The lack of national standards of building performance, the lack of accurate design and execution procedures, the lack of clients' commitment to quality, undefined responsibilities of each player and construction-specific culture remain significant.

Nevertheless, relevant evolution was internally observed in Brazilian contractors, concerning design process co-ordination and the standardisation of execution procedures, albeit without solving the integration between design and execution. Although each site has a full-time engineer to co-ordinate execution, designers do not systematically contribute to site decisions and very rarely go to the site aiming to solve design detailing problems. At the same time, site managers are not systematically involved in design development, even if the projects studied are built by private project owners where estate developers and construction managers work together in the same firms.

In Brazilian projects, there is not a specific phase of multidisciplinary site preparation, as observed in France. Design plans arrive very late and site managers only have few days to prepare execution. This means a situation of great uncertainty that leads to rework and additional costs. A very important difference was found in terms of legal and contractual precision, which can block some management initiatives. Brazilian construction remains fond of informality and exceptions prior to the rules.

## **5. Preliminary guidelines to the Brazilian translation of some French practices**

Considering the Brazilian construction context, which comprises construction-specific culture of the players and construction industry deficiencies – like the lack of professional skills, the lack of production know-how, the lack of standardisation and the lack of subcontractors qualification – it must be highlighted that changing processes first require all favourable conditions in terms of clients', designers' and contractors' attitudes; thus, a successful application of the guidelines presented above in the text requires players' motivation and commitment to implement the proposal.

Some basic steps of this implementation are: review of French management tools with regard to the Brazilian context; motivation of representatives in construction associations to implement these French concepts and tools; surveying of “experimental” projects where the concepts can be applied and where these players shall participate; evaluation of first results and review, analysis of limitations and of the proposal applicability; diffusion of the motivating co-ordination method, associated to an evolution concerning definition of players' roles (contractor, subcontractor, architects and engineers).

### **Guidelines concerning the client**

It is proposed that clients must be committed to quality management and must have a more active participation during all the project phases, especially after legal approval, aiming to: adopt the multidisciplinary approach, throughout anticipated contract of all design specialities; contract designers to introduce design principles faced up to site teams, to visit the site and contribute to collective decisions; precisely define players roles and responsibilities.

### **Guidelines related to contractors and designers**

Motivating site co-ordination must be performed by skilled professionals and the specific project factors, such as contract type, size, or client requirements can influence the choice of a professional. In Brazil, he/she should be typically the site manager, but an independent manager will eventually be preferable, according to the situation.

In all cases, the constitution of a site team is essential from the very beginning of site activity and the definition of periodic, well-organised and well-documented site meetings.

The design detailing called “design for production” should be performed by building designers (architects or engineers) and consultants but also by the site manager, the subcontractor or the supplier, according to the situation.

### **Guidelines to site preparation and site co-ordination motivation**

Some of the most important elements concerning this are: collective site visit to start site preparation; discussion, development and validation of design detailing; critical points identification, through the analysis of interface problems; self control preparation, in order to simplify quality control; clear and concise minutes and fast communication of decisions taken; feed-back implementation involving all project players, in order to achieve continuous improvement.

## 6. Conclusion

This paper presented a brief discussion on some French management concepts that can improve the relationship between design and site teams, based on a comparative analysis of French and Brazilian construction contexts (considering social, economic and legal aspects). Case studies helped to develop a process of observation, analysis, reflection and formalisation aiming to contribute to the translation and adaptation of French proposals to the Brazilian context.

Albeit in France the management philosophy presented was created to be applied in public construction projects, the same guidelines would be also valid in private projects, if particular characteristics of the client and the main contractor, as well as the project strategy requirements, are considered.

An innovative management procedure requires changes in attitude from all players concerned. The fear of changing is natural but necessary to overcome rejection of collective work and joint decisions, seeing evolution as an opportunity of professional growth. As construction projects lead to team renewal, the risk of losing information, methods, and management tools, must be fought by collective work and systematic documentation.

The definition of subcontractors from the very beginning of the project execution is also essential to the success of the method. Because of this, we propose procurement systems that consider not only tendered prices, but also experience and commitment to quality. It is thus useful to include management and execution procedures and quality control requirements in the contracts.

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