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Le Vie dei Mercanti | X Forum Internazionale di Studi

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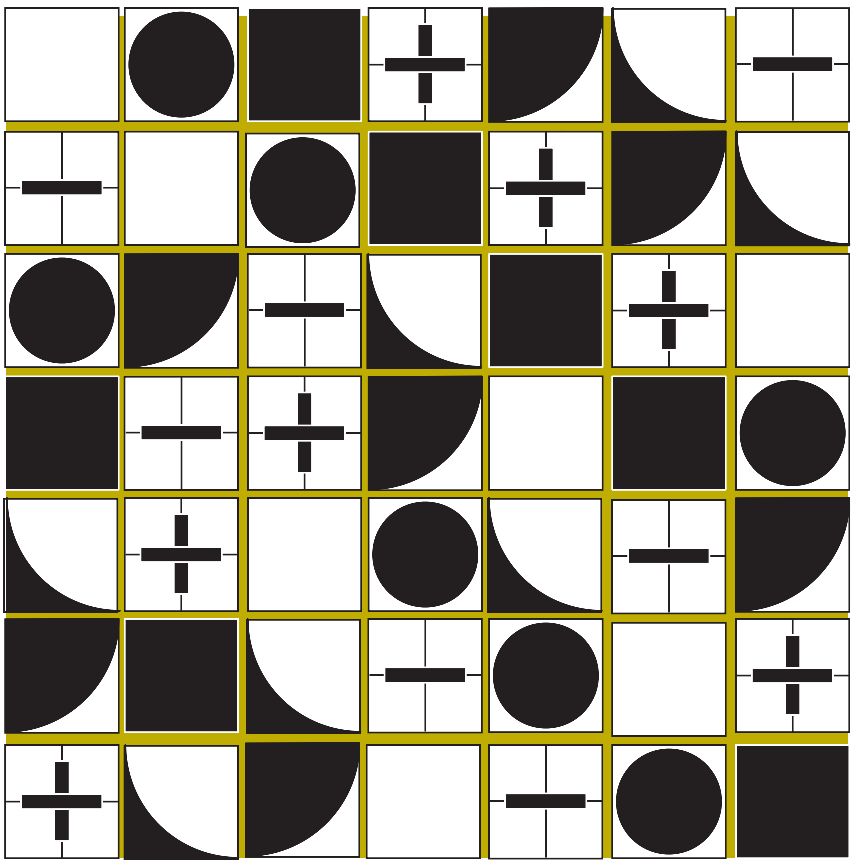
architecture design landscape

Carmine Gambardella



La scuola di Pitagora editrice

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Collana fondata e diretta da **Carmine Gambardella**

Less More Architecture Design Landscape

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Carmine GAMBARDELLA

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Carmine Gambardella (a cura di)
Less More Architecture Design Landscape
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X Forum Internazionale di Studi

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Peer review

Scholars has been invited to submit researches on theoretical and methodological aspects related to Architecture, Industrial Design and Landscape, and show real applications and experiences carried out on this themes.
Based on blind peer review, abstracts has been accepted, conditionally accepted, or rejected.
Authors of accepted and conditionally accepted papers has been invited to submit full papers.
These has been again peer-reviewed and selected for the oral session and publication, or only for the publication in the conference proceedings.

Conference report

220 abstracts received from:

Algeria, Brazil, Bulgaria, China, Cuba, Denmark, Egypt, Estonia, France, Germany, Greece, Holland, India, Indonesia, Iran, Italy, Japan, Jordan, Kosovo, Malaysia, Malta, Mexico, Netherlands, New Zeland, Poland, Portugal, Puerto Rico, Russia, Saudi Arabia, Spain, Taiwan, Turkey, United Arab Emirates,
United Kingdom, USA

More than 350 authors involved.

163 papers published.

Preface

Less, often leads us to reducing considerations and its linguistic application, generally, characterizes a condition of inferiority, decay or deprivation. If we make reference to the scope of our researchers, Architecture, Industrial Design, Landscape and to their deeper meanings, and if we use "less" before them we might involve a critic situation, or homologate a century.
An example is from the historical period we are living in, where Western economies are generically dealing with their budgets by cutting down on expenses rather than investing on their own heritage in order to create richness and workplaces.

On the contrary, our Researchers, Scholars, Businessmen and Civil Services Representatives want to use less to promote a shareable cultural reflection about the reduction of the waste of goods (raw materials, human resources, assets). That's why we are going to arrange the X International Forum "Le Vie dei Mercanti". In this perspective Less does not mean less investments or cuts, but to identify a hierarchy of relevant sustainable investment funds based on the search for the know-how.

Less in Architecture, Less in Industrial Design, Less in Landscape subsumes more if we are able to supply regenerative models based on integrated system visions.
Consequently, More research in Architecture, More research in Industrial Design, More research in

Landscape if Local Human Resources are set up to create an efficient training education to be involved in the management, protection and regeneration of raw materials and human needs.

All along the past editions of the Forum I have drawn people's attention on our heritage as expression of "actual developing" (modernity).
Modernity, in fact, is an integrating part of history, an inexhaustible mine supplying raw materials to the Factory of Know-how which, as mentioned above, must get the same local phisycal geometric connotation as the generative humus about the production of fascinating items for Architecture, Industrial production, Landscape.

The projects our Faculty has dealt with, "Pompei Fabbrica della Conoscenza 0079/2013" or "l'Atlante del Cilento", witness as by sizing tangible and intangible heritage we can give rise to a productive factory aiming at art works and competitive Cultivated products and services.

So, scientific contributions aiming at collecting and spreading out the best practices and paradigmatic sustainable projects about system activities and elaborated in an assembly International dimension, are expected. Such contributions must be useful at enhancing an increasing Research process characterized by a constant learning and a great Know-how passion.

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Which drawing to deliver more information?

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Abstract
The paper explores the potential of methods and languages designed to facilitate the communication of appropriate information content for the different levels of detail required in the creation of an architectural design, levels with different purposes, but nevertheless co-ordinated.
Within this thesis, the many different facets of drawing and the language of graphics are confirmed as agents of intellectual mediation, as a support for expression and also as dynamic cultural and evolving factors. In order to reply to the new demands of performance, due to the increasing fragmentation of responsibility for design, some adjustments in the workflow are needed, essential to support renewed practices; in fact, supporting this dynamic, the representation seems to have recovered a role of increased visibility and importance, regaining an effective recognition through a reconfirmation that remarks the delicate function of communication, interpretation and criticism.
The added value of the BIM methodologies (Building Information Modeling), is not limited by the ability to handle graphical representations at different scales with a single 3D model, but it answers to some requests connected by the data complexity inherent with the design and construction, actively supporting the engineering process: this means to relate actors or the building process to each other in a new way, reforming the assets and the processing modes, requiring explicit coordination for activities and procedures.
At this regard, we analyze new operational workflow through a brief description of some designs carried out through the collaboration between DISEG (Department of Structural, Geotechnical and Building Engineering) and the Building Service of the Politecnico di Torino [1], speaking about drawings and representations.

Keywords: Building Information Modeling, database, drawing, representation

1. Foreword

It is always very hard speaking of architectural design ; on the other side, talking about some kind of work that may occur during the process that takes place between the moment of conception till its complete realization it could be paradoxically easier. Indeed, this statement is useful to limit the area of interest of the following arguments, having the contribution that is declared in the title: being able to identify some critical aspects of the working-out processes, focusing the attention on those methodologies that are best suited to manage the complexity information of the design representation. [2]
The theme is not certainly new, but the purpose is to update some mentioned thoughts with the comments suggested by the latest operating procedures, in order to present some experiences conducted directly on the field. We are inspired by the intention “to exert ourselves”, in order to critically analyze and to abstract some principles of methodological value; this seems to be still the task of our way of doing research, looking at the drawing and the representation techniques as media collaborating for a deeper knowledge. It is required a renewed focus on other forms of knowledge and of action, as well as a position of listening to the needs that are expressed by other actors involved in the design process. During this process the Representation field is involved as a dynamic agent, stimulating action and collecting instances, working to

produce ideas that, responsibly, must be evaluated and verified through a series of tests. In order to better operate, those checks ask for an ever higher quality and quantity of data.
Are there some advanced tips to improve the efficiency and effectiveness of this complex process? We will try to answer by addressing to topic issues such as the role of the use of digital technologies, evolved from more established practices and based on a systemic and relational approach. We examine the limits and the virtues, exploring new communication languages and investigating the diffusion levels [3]; while we are still working on it, we anticipate some evaluations that could be discussed, deriving new demands from the debate, surely an essential topic for future studies. [4]
Digital graphics processing has become standard practice in recent years: it is a compulsory stage in design today. On the other hand the tool is not considered equally efficient in reducing the risk of omissions and errors. The reasons are to be sought in the limitations of the software, such as for example the types of Computer Aided Design (CAD) applications used, largely employed for the production of two dimensional drawings. The inefficiency perceived by users is the direct consequence of a certain difficulty in using the tools compared to the simpler interfaces found for office automation. The division of a drawing into classes of layers has always been a topical argument for the standardisation of information and methods of use and always an important subject for study by international standards authorities. One of the most significant international models is that drawn up by the American Institute of Architects (AIA),the BS1192 standard for Great Britain, the French System Unitary de Communication (SUC) of the 1990s and the Swedish CAD Guidelines Bygghandiingar 90 - SIS 1999.
Although BIM software applications in current practice ensure results of a much higher standard than those of traditional two dimensional CAD software applications, structured use of them can further improve the conception and design processes as well as the construction and maintenance processes. Often the BIM concept is associated with a quicker method of virtual modelling, which definitely guarantees faster results and higher quality, but it is not yet able to fully unleash the potential which a database for data of a different nature inside it possesses.
Here too standards must be adopted: at this regards, we mention the National BIM Standards Committee (NBIMS), based on standards for the interoperability of data and on the relative taxonomies and they put the various information sets into hierarchies following an approach that is appreciably different from those of the past, including classification systems, guidelines and best practices. Today's construction scenario contains a plurality of positions behind which lie just as many cultures which represent different conceptual approaches to design.
This paper explores the capabilities of the latest languages (both the analytical and/or the synthetical ones) of the new methodologies, connected to the preparation of the architectural design.[5] These techniques, exploiting the opportunities offered by parametric calculations, improve the communication of content using correct information for the various levels of detail. The increasing complexity of the project actions, often shared by a plurality of subjects, must be highly coordinated.
So, there is therefore the Uselful Drawing, [6] which is pragmatic and functional, whose results exceed the drawn architecture characterized by information systems organized in a database constantly interrogated and quickly changed. Here the updating processes foresee automatic controls, overcoming the traditional analogical representation forms, adapting themselves in more dynamic ways. In other words, it is therefore a less sequential Drawing, and a more relational one.Within this complex background, the many different facets of drawing and the language of graphics, a broader concept and perhaps a more preferable term here, are investigated. They are confirmed as agents of intellectual mediation, as a support for expression and also as dynamic cultural and evolving factors, which have frequently been adapted, to contribute to a renewed quality of the design process, thereby recovering a role of greater visibility and effective relevance.
According to this view, the representation role seems to have recovered a role of greater visibility and importance, regaining an effective general recognition that has substantiated the delicate function of communication, interpretation and criticism. The surplus value of BIM methodologies is in fact not only connected by the ability to handle graphical representations at different scales using a single three-dimensional model; moreover, it seems to answer to some urgent requests moved by the complexity of design and construction. In fact, this approach actively supports the engineering process relating professionals to each others in a new system, reforming the processing mode, requiring more explicit coordination of activities and procedures, particularly through the management of *parameters*.

2. The importance of being Parameter

At a time when professional practice is demanding increasingly specific competencies and extremely tight timescales, a tendency is emerging for software technologies to be used in a more deliberately structured

way, in a continual quest – one which is at times laborious, at others more fruitful – for procedural strategies that enable the use of shared platforms. At the same time, the market is responding by offering a large number of applications devised to resolve the various specific requirements. The term *parameter*, from which some of the considerations in this book are derived, assumes different connotations depending on the context in which it is applied. Whereas in mathematics it represents an arbitrary constant used in systems, formulae and equations, in a design environment it can take on other, different shades of meaning. This is a good opportunity, then, to unravel this terminological tangle: unlike parametric software, BIM object-oriented software has more in common with architectural design, where the internal libraries available are actually classified by building element type. So there are software applications in which the parameter is central to a system of associated dimensional relations and is given flexibility by procedures that facilitate not only the formal conception but also the changes occurring in the subsequent construction stages, which is fertile ground for experimenting with programming code. In other contexts, the same term refers to the control of a certain number of variables (geometrical, relational and other ones) that enable a particular process (design, construction, management, etc.) to be managed. [7]
For computer science, a parameter is a value that a function expects to receive in order to do its job. In other words, the function, the program itself and the operating system expect (values) and want to know (what to do), because the programmer has expressly envisaged that information be supplied for those purposes, i.e. by requiring that parameters be defined. In the familiar context of design software packages, the process of constructing relationships and generating objects via modelling procedures is often carried out using a programming environment provided within the individual applications that is known as scripting. This refers to a programming language available within a software application that enables it to be tailored from the inside, by customising the tools and creating new ones.
These tools have made functions available to designers that were previously inaccessible (or required special, complex operations), thus enhancing not only the modeling procedures but as a result also making it easier to use shared formats to exchange information. The purpose of this is to enable interoperability within the individual products, Both parametric and object-based software are moving toward this common objective, on parallel paths: For the former (in terms of the most authoritative names on the international scene), we are seeing new operating processes being developed in which the professional works closely with the programmers, creating tailored applications as and when required. As for object oriented software applied to the architectural design sector, the most effective use of software tools enables some procedures to be customized, as discussed earlier, through an ongoing search for shared methodologies for organizing the data that are managed by the system.

3. BIM: Building INFORMATION Modeling

Current technology has useful virtual alternatives to offer, then, such as the adoption of three-dimensional models for display, simulation, analysis and calculation purposes. If, on the one hand, there is a risk of making the control of some highly sensitive procedures more complex, on the other, the BIM approach, whose potential is yet to be fully realised, has the power to confine traditional CAD tools to the role of producing series of drawings. Although two-dimensional drawings are certainly able to convey the designer's intention, they are often blighted by errors, omissions or inconsistencies, which can easily be identified using automatable checks. It 's definitely a less poetic Drawing if compared to some representations of the past, but its contents are highly informative.
Although a host of design studies are taking an interest in these issues, few are using this methodology to best effect. These tools enable significant changes to be introduced throughout the traditional architectural design process; in particular, the benefits can be estimated using a multi-functional diagram that compares the effort made by professionals to produce the design documentation in the various phases of the process with the time required to do so. The diagram provides a comparison of the distribution of the technicians' efforts through the various phases in a traditional CAD environment (graph 3) with how it looks when basing the design process around the use of a BIM (graph 4). The impact of later alterations to the design can also be assessed: it can be seen that the effort needed to make these changes is equal to, if not greater than, the effort required in the initial decision-making stages (graph 1). What's more, the impact of the costs of the subsequent alterations increases exponentially throughout the process. To that end, it is useful to refer to the procedure proposed by Lachmi Khemlani [8] in which, as the author suggests, "*[…] minor variations from this sequence can occur from time to time, but the essence of it remains as shown".*

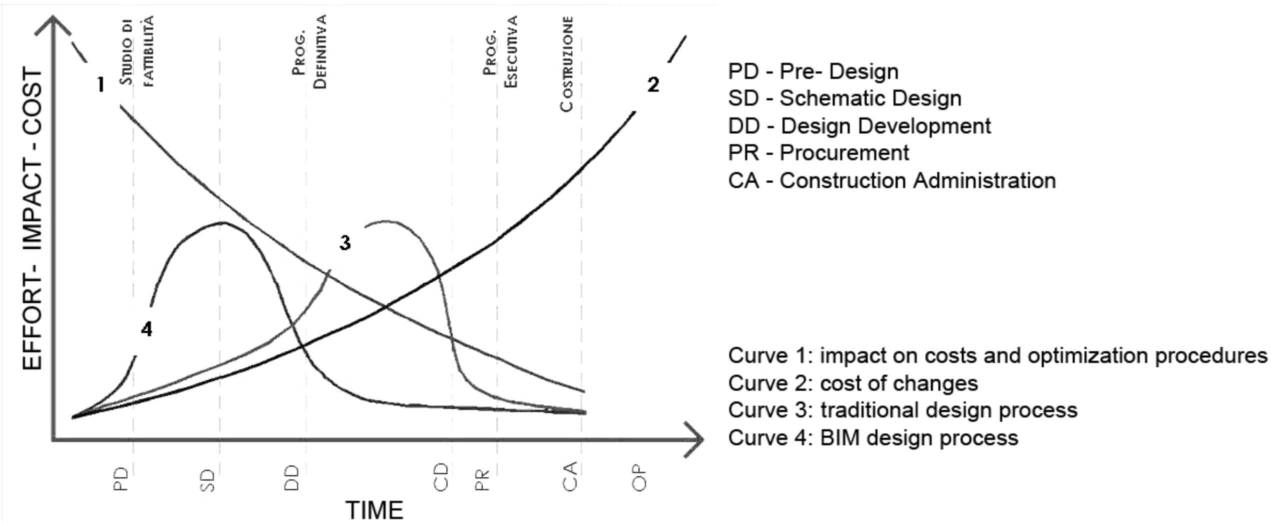


Fig. 1: Macleamy curve comparing the course of the current design process with the results of using a BIM approach in terms of effort, timescales and costs

In architecture, the process of progressive automation has taken and continues to take a path that is well-trodden in the history of the evolution of software, as most of the applications were primarily intended to support a process known as *Drafting*, including the initial forays into computer-aided drawing. The use of the third dimension in the representation of architectural designs and a systematic recourse to three-dimensional modelling have established a subsequent stage, known as *Modelling*.

The design process typical of the drafting stage is not affected by the use of three-dimensional modelling software, as the two-dimensional design phase is followed by a three-dimensional modelling phase, independently of the Monge representation. For this very reason, the three-dimensional model is very often developed outside the design team and only after the design development stage has been completed, as a natural “dead end” of the design process, one which is used only for the purposes of disseminating the design.

The process of progressive automation moved on with the introduction onto the market of the first “object-based” architectural software packages. Indeed, the introduction of the BEMs or Building Element Models, in place of abstract geometrical entities, represents the main step forward with the BIM philosophy: whereas the Drafting applications made possible the two- and three-dimensional geometrical representation of any architectural construction, the Modelling software applications make it possible to build it, albeit in the form of a virtual building. Hence the term *Designing*, for a tool dedicated to design in a completely innovative environment.

The automation of some of these processes will lead to the point when all the design information will be created and handled digitally, thus maximising the benefits of this new “virtual format”. In other words, we will have a digital model of a building, one that is not just geometrically accurate but can support completely different kinds of information. For this reason, the final stage is called *Collecting*, which corresponds to the design of the architectural construction in a purely BIM context. The introduction of BIM has brought a radical change in the management of the design process, and it is crucial to understand the impact that this has had, and will continue to have, in the construction industry. The very concept of the BIM is based on the possibility of incorporating meta-design information of a non-graphical nature, such as numerical and tabular data, into the 3D model.

Here the Drawing and the Representation roles are completely renovated, being able to coordinate and control the entire design process, through the management of complex procedures.

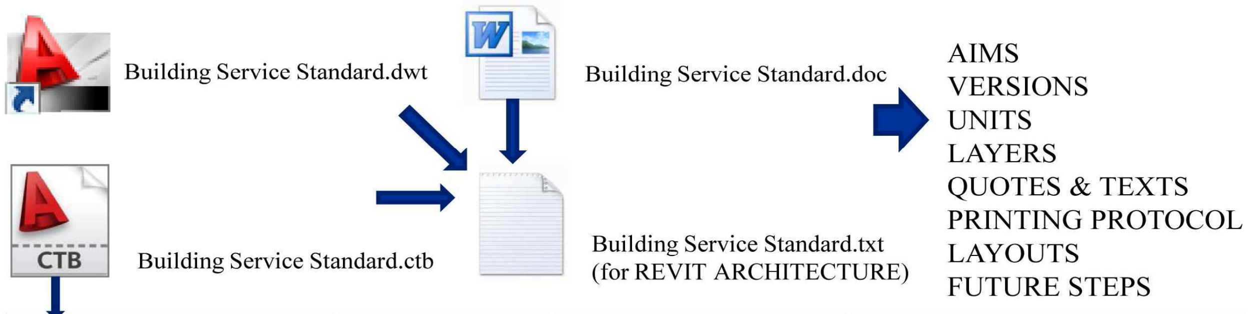
4. BEM: Building ELEMENT Model or Building ENGINEERED Modeling?

As previously stated, the BEM acronym stands for Building Element Models, a digital representation of the architectural elements that are introduced and used within the BIM environment for the creation of 3D models. At the same time we propose a new sense of BEM, in which the meaning of Element could be approached by the term *Engineered*, underlining the need for engineering process for new technologies, making them more efficient.

Information flows in the building industry to today are compared with the continuous return or feedback of that same information, given the need to relate different types of data to each other and take account of their reciprocal influence. The concept of "*quality*" in the building sector defines particular aspects of the building process for which a direct relationship between requirements and performance is necessary. At this regard, Drawing has always constituted a privileged means of communication, but the subject of "design as a measure of quality" does not end with the communication of the ideas or with the specification and verification of the ideas with regard to those who implement them.
The monolithic character of traditional building is flanked today by the requirement for an analytical dimension that can be broken down, the design of which results from the overlap and reciprocal co-ordination of the various sub-systems and the use of BIM tools seems to be the best answer to these requirements. We can talk of out-and-out codes for design drawings, constituted by a set of rules that allow to "regulate" the graphic data communication. Below there is a summary of the main procedures that maximize the concept of engineered model.

4.1 Process engineering and standardization of procedures: the case of the design of new student residences

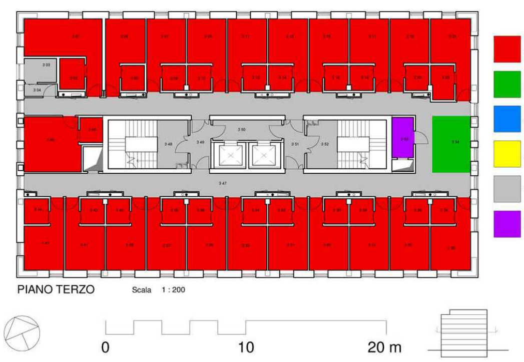
The engineering procedure is well defined referring to the process performed to design of new university residences (Ministerial Announcement for the construction of new residences for students - Law n.338/2000, published in Official Journal, the 28th of April, 2011 n. 97). This case study is particularly interesting for the organization of work carried out by adopting standard codes, easy to understand and easy to use in order to effectively implement the dialogue among designers of different expertise.
In practice, it was drawn up prior document for the designing phase, greatly simplified compared to the international protocols, in order to capture two aims: firstly, to harmonize the procedural expertise to the same basic level, ensuring that professionals could adopt it in a shared environment; then, to update standards and procedures to those experienced in the BIM environment. Doing that, it is possible to enter and extract data from CAD applications, allowing less critical information workflows.

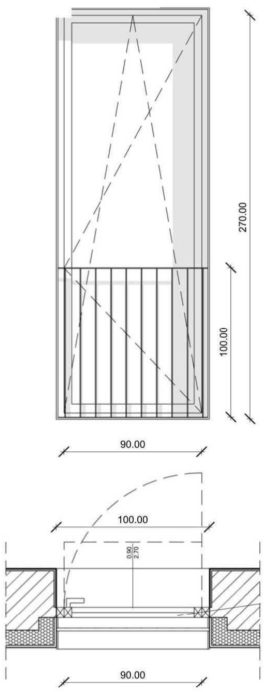


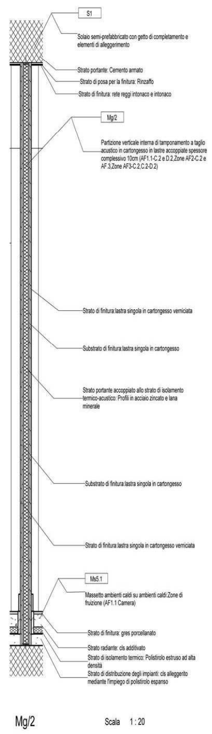
CAD Color	Printed color	Weight	% Filled	Contents
1 – Red	Black	0,1 mm	100%	Quote systems, layout
2 – Yellow	Black	0,1 mm	100%	Elevation lines, not sectioned lines
3 – Green	Black	0,15 mm	100%	Frames
4 - Cyan	Black	0,09 mm	100%	Sectioned Walls, Structures
5- Blue	Black	0,4 mm	100%	Ground line
6 – Magenta	Black	0,05 mm	90%	Furnitures
7 – Black	Black	0,1 mm	100%	Layout lines
8 – Dark grey	Black	0,05 mm	70%	Hatches
9 – Light grey	Black	0,05 mm	80%	Edile per impiantisti/linee molto sottili
10 – Red for Construction	Black	0,25 mm	100%	New elements
50 – Yellow for Demolition	Yellow	0,25 mm	100%	Demolished elements
Other colors	By color	0,4mm	100%	HVAC, electrical, plumbing systems

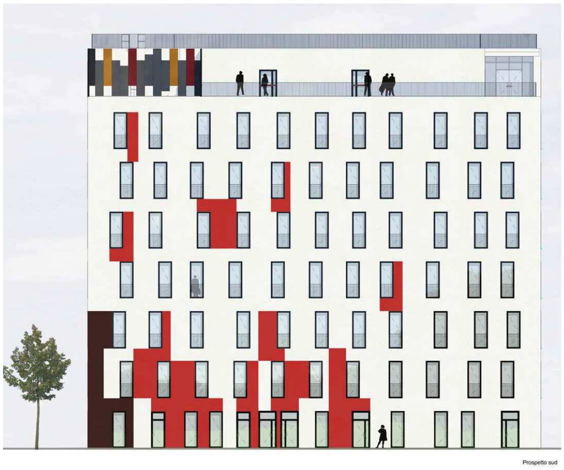
Fig. 2: Proposal for standardization protocols: the scheme summarizes the connection between CAD and BIM standard used for new architectural design of the Politecnico di Torino.

Shortly, the protocol includes a set of prescriptive guidelines that contain elements of unification for the management of the projects, specifically dedicated to its representation such as layout templates, layers, text size and pen thickness. We tried to use standardized naming and symbols, also available for CAD drawings and for the treatment of processed data in a BIM environment. Moreover, this work had as intermediate target a gradual upgrade of staff training for the Building Service working group. The future goal is to extend BIM methodologies to all areas of design process. A radical change has seemed, at present, impractical, especially for those sectors that use CAD applications like graphical representations derived from computational algorithms run by other applications (as in the case of plant design).









Abaco dei massetti	
Nota chiave	Tipo
	RU_Partizione orizzontale_Strato portante_Solaio gettato portante vasche interrate 30 cm
Ms1.1	RU_Massetto su ambienti non riscaldati_Aree connettivo_25 cm
Ms1.3	RU_Massetto su ambienti non riscaldati_Aree servizi igienici/spogliatoi_25 cm
Ms1.4	RU_Massetto su ambienti non riscaldati_Aree comuni_25 cm
Ms2.1	RU_Massetto di copertura_Zone tecniche praticabili_25 cm
Ms2.3	RU_Massetto di copertura_Terrazzi_27 cm
Ms2.6	RU_Massetto di copertura_zone interne di connettivo_27 cm
Ms2.7	RU_Massetto di copertura_zone interne bagni comuni e spogliatoi_27 cm
Ms2.8	RU_Massetto di copertura_zone interne aree comuni_27 cm
Ms2.9	RU_Massetto di copertura_zone tecniche interne_27 cm
Ms4.1	RU_Massetto su ambienti non riscaldati_Aree tecniche_25 cm
Ms5.1	RU_Massetto di interpiano_Camera_20cm
Ms5.2	RU_Massetto di interpiano_Bagno_20cm
Ms5.3	RU_Massetto di interpiano_Aree comuni_20cm
S1	RU_Partizione orizzontale_Strato portante_Solaio gettato portante 31.5cm
S3	RU_Riempimento_igloo e completamento

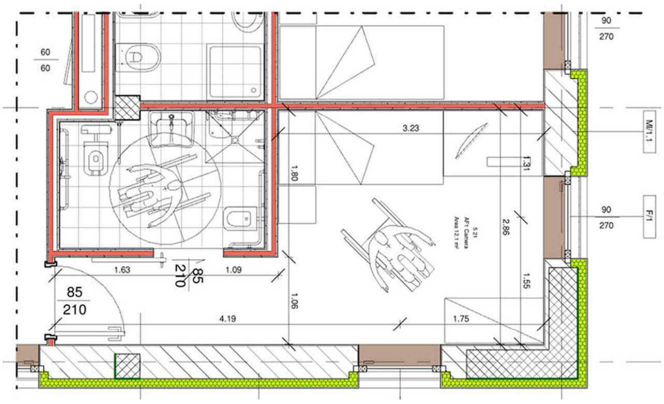


Fig.3. Different drawings taken from the 3D model: thematic drawings, 3D views, schedules and some details obtained from the BIM model. (Authors of the virtual model of the Codegone residence: eng. G. Cangialosi and eng. M. Lo Turco).

Even in these cases, which present specific and non interoperable information, procedures can be organized by adopting particular protocols, so as to guarantee the efficiency and effectiveness of technical communication.
Also within the BIM platform, the second topic was the adoption of various templates according to the different types of intervention (referring to different levels of design: master plan, preliminary, final or executive designs, new or existing buildings…). The time constraint seemed the perfect opportunity to put into practice certain procedures till now known only in theory.
The two design project, although characterized by different plan distributions, show remarkable similarities in relation to manufacturing technologies, components and building materials chosen for walls and floors, reducing the time used for drafting of construction details, quantity take-off and its evaluation of economic costs and exposure. From the operational efficiency viewpoint it is important to decide in advance the view models, such as the standards for the visualization of the project at different scales (1:200-1:100-1:50, in order to speed the transcription of drawings at different scales, equipped with some topics expressly required by the announcement. It was organized an information system based on relations between some parts and the entire design project, thanks to a graphic representation organized through a unique model. This methodology is destined to bear the complexity that occurs whenever it is needed to start from the conceptual phase up to the construction one, working as the product of data processing and, at the same time, being challenging and fascinating if collectively shared.

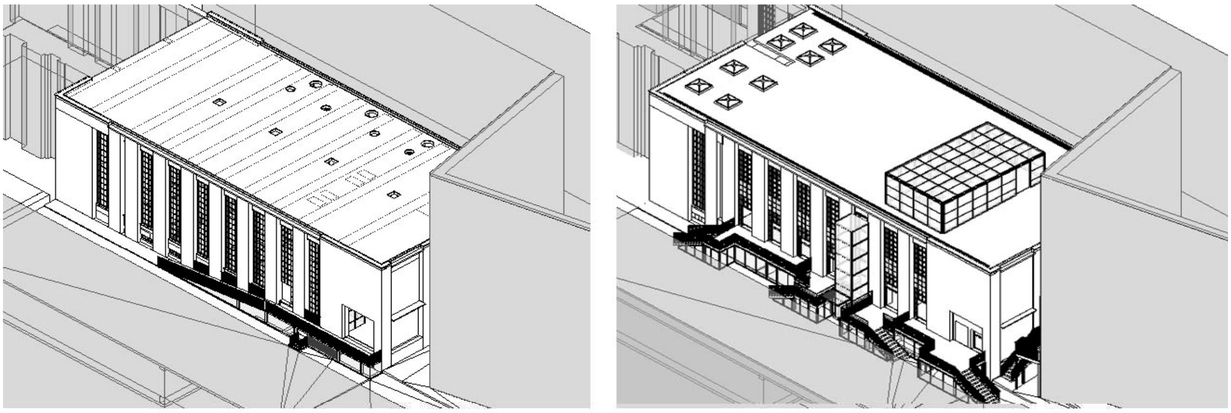
4.2 Teamwork: the case of the reutilization of a heating station into new classrooms

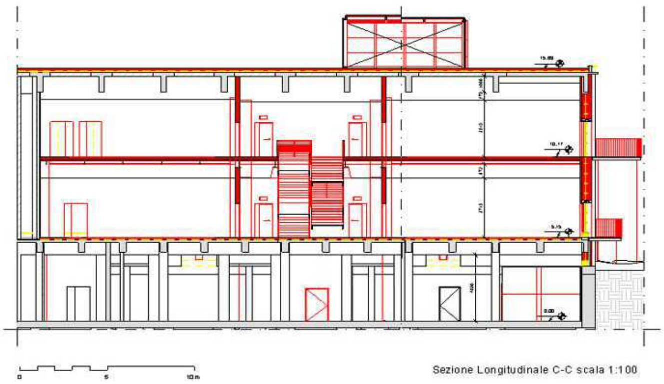
Each new project provides interesting ideas to carry some innovations in the working methodology, maintaining the desire of doing research and trying to compare results issued from previous experiences. In the mentioned case study, some areas will be converted into new classrooms; it was decided to adopt a working system that would allow multiple users to work concurrently, using the same file. The goals of the trial were to assess how and whether it was possible to:
- maximize efficiency production through adopting a coordinated and consistent BIM working approach;
- define the standards, settings and best practices that ensure high quality results and uniform drawing output across an entire project;
- ensure that digital BIM files are correctly structured, in order to enable efficient data sharing working in a collaborative environment.

There are several methods to enable collaborative working in a BIM environment, including working practices and team management. This topic deals with the principles of subdividing a model for the purposes of:

- multi-user access;
- operational efficiency on large projects;
- inter-disciplinary collaboration.

We must honestly remark that each project carries out a period of knowledge and testing able to improve the traditional workflow. Doing that, each new project means an improvement of the traditional workflow. Till now, the information sharing technology was done using external references (linking) in order to split the architectural part (Revit Architecture) from the structural one (Revit Structure).
The design of new classrooms was the ideal chance to progress in the trial: also in this case it was carried out on the basis of international experience, first of all the example of AEC (UK) BIM Standard for Revit, a workable implementation of the AEC (UK) BIM Standard for the Architectural, Engineering and Construction industry in the UK. This Standard is aligned with BS1192:2007 Collaborative Working, which defines the process for project collaboration and efficient data sharing. Focusing the attention on collaborative environments, we have defined specific processes aimed at effective data sharing in real time.
Regarding to this, the technology called Worksets allows multiple users to simultaneously make entry on a single template file, called central file, which is frequently updated by implementing multiple local copies.
The use of worksets is useful when the design phase is already far from the initial stages, in a phase in which it is requested the production of a significant amount of executive drawings that can hardly be quickly delivered by one person.
The work is then divided into different skills (structural, construction, engineering ones) so that the individual professional is responsible for a particular scope.





_DC_Abaco delle porte demolite _DC				
Famiglia e tipo	Larghezza	Altezza	Area	Nota chiave
CT_Por 1Anta FC: CT_SF_5cm Infisso	1.19	2.33	2.78 m²	Po/11
CT_Por 1Anta FC: CT_SF_5cm Infisso	1.23	2.33	2.86 m²	Po/11
CT_Por 1Anta FC: CT_SF_5cm Infisso: 2			5.64 m²	
CT_portone ingresso: 395x400	3.95	4.00	15.80 m²	
CT_portone ingresso: 395x400: 1			15.80 m²	
CT_Uscita interrato: 85x210	0.85	2.10	1.79 m²	
CT_Uscita interrato: 85x210: 1			1.79 m²	
porta interna: porta 70x210cm	0.70	2.10	1.47 m²	Po/2
porta interna: porta 70x210cm	0.70	2.10	1.47 m²	Po/2
porta interna: porta 70x210cm	0.70	2.10	1.47 m²	Po/2
porta interna: porta 70x210cm: 3			4.41 m²	
porta interna: porta 90x210cm	0.90	2.10	1.89 m²	Po/3
porta interna: porta 90x210cm	0.90	2.10	1.89 m²	Po/3
porta interna: porta 90x210cm: 2			3.78 m²	
Totale generale: 9			31.41 m²	

Fig.4. The variable time can be effectively managed within the BIM, as demonstrated by the following documents that compare the status of fact, the future project, demolition and construction section view and extract theme of schedule. (Authors of the virtual model of new classroom design: eng. G. Cangialosi and eng. M. Lo Turco).

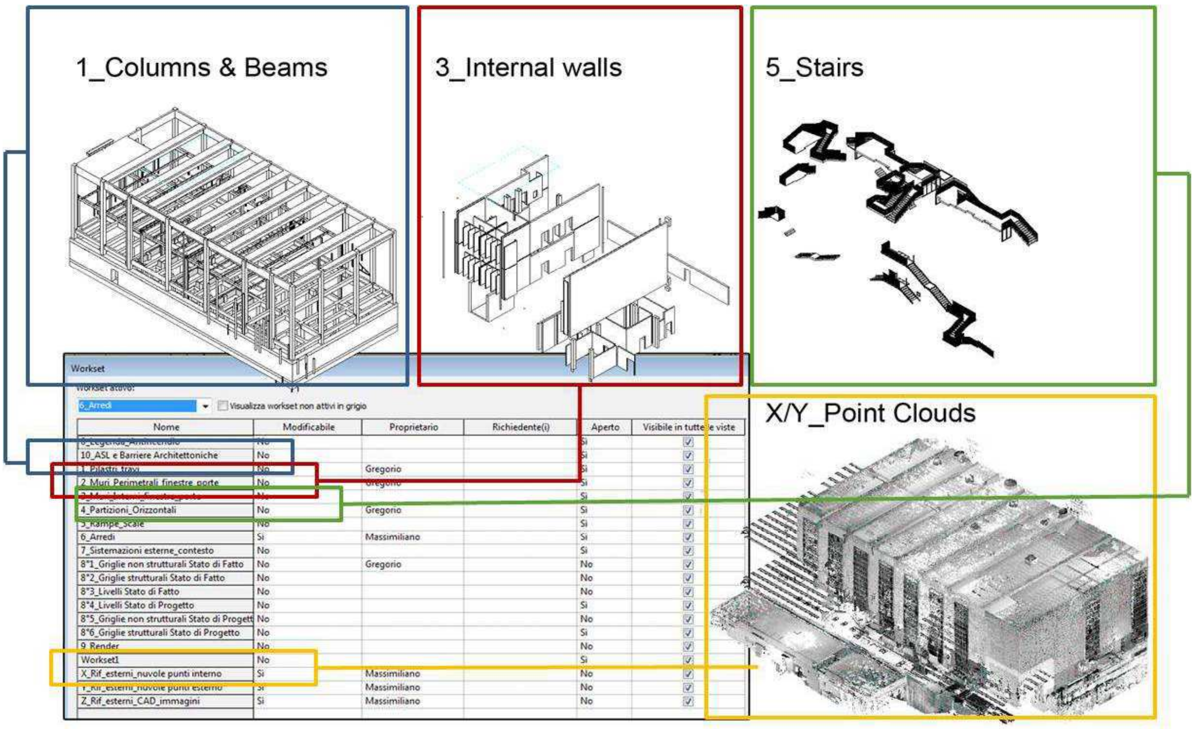


Fig.5. Through the workset management based on a set of simple rules that govern the interactions between the owner of a particular area (structures, walls, horizontal elements, point clouds,...) and some applicants, it is possible the current work using the same virtual model.

It is also possible to keep track of different changes applied to the model so that we can have a record of undertaken actions. This work is an excellent example of integration between the various professionals, both for the survey made by 35 laser scans directly imported into the parametric software, and for the planning, dividing the digital model into several worksets, as shown in fig.5.

5. Conclusion and future proposals

The adopted methodology has seemed very productive, as it has greatly reduced the design time and the number of errors, especially those related to interference between architectural and structural elements, (identified in both graphical and tabular views) contained within the shared platform. The most obvious benefit is the permanence of information of different nature: this is a topic element not only for the success of the design process but also for an equally controlled and organic process of management /maintenance.
As for purely design aspects, future versions of the standard are intended to enlarge the skills involved, including other actors, such as plant engineers, builders, contractors.
From the operational point of view, Politecnico di Torino created a dedicated department to deal with the integration of processes and information systems (known as IPSI), which, under the guidance of the Board of Directors, launched the Politecnico’s Facility Management (FM) plan in autumn 2009.
The plan aims to optimise the management of the University’s internal processes, by providing an information system containing the data on the various activities, thus creating a single database as a reference point for sourcing information and carrying out subsequent analyses.
It is a “time Drawing ", able to handle a before, a during and an after, not only in the design process than with the capability of the database to be associated with design changes over the time. A drawing, therefore, apparently less iconic, but with strong information contents.

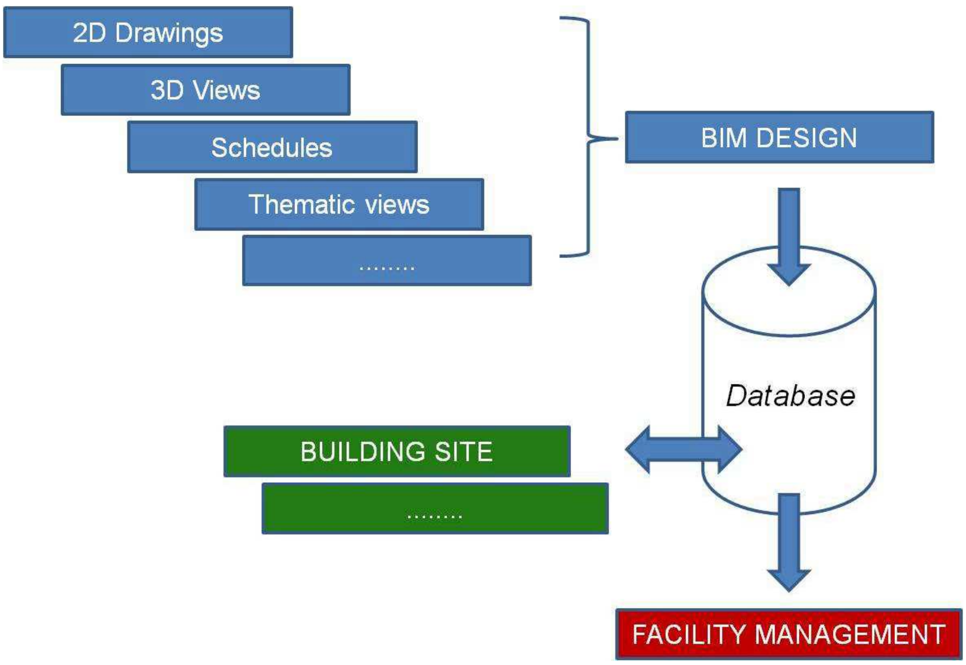


Fig.6. The diagram shows the main themes that constitute the design phase, ordered and managed by the database that is used again in the construction phase and for subsequent management applications.

The availability of an information system of this kind makes it possible not only to manage the data but also to devise and administer effective working and procedural processes. The technology can also be used in combination with BIM software and can facilitate an interoperable exchange of information between the two.
For the FM project only, the basic virtual model will gradually replace the traditional CAD plans. This change will be no mean feat, as it will bring a real quantum leap in quality, one that will require the whole logistic area to adopt the BIM methodology. This change will encourage greater interaction between the parametric software systems and the FM applications, such that all the analyses can be carried out against linkable data, thus ensuring greater control over the processes and eventually enabling full data interoperability to be achieved. [9]

Finally, the methodology represents a new way of thinking about Drawing, in a fresh and renewed role, which organizes, arranges and manages a multitude of possible representations, constantly comparable: so, data sharing of different expertises enrich the relational database proper of the new systems.

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