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New Technologies and Teaching Methods

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The effort for taking advantage of new inventions in building and for the construction of monuments and great scale works dates since the Assyrian, Egyptian and Ancient Greek era. For instance, in the Parthenon (and world-wide admitted) the accuracy, the methodicalness, the fidelity and the consistency in perfect adjustment of shapes, dimensions and strength, is impressive. In this way we want to show that the evolution in technology is not independent from culture of the human being but is the result of a very long process of work and of discovery steps and counts since the prehistoric era. Evolution progresses simultaneously as a result of culture, science and technology. Thus, in every historical moment designing, materials and construction detailing of major works go together with the total exploitation of every possibility and capability of modern technology. When talking for the reality of our country, today, in the information and the techno-electronical era, building construction is one of the few sections where new technology has not been applied widely.

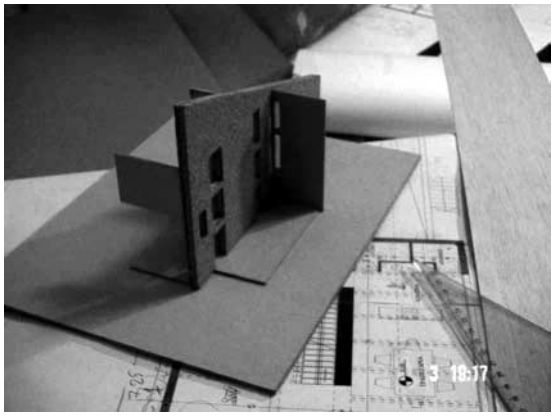
The problem begins even since the five-year basic training of architect students. Here, students take only few and carefully selected modules where very randomly are called to solve complicated construction problems. Furthermore they never face real problems as these emerge in every day practice. In today's hard and very competitive labour market, the architect does not have the luxury to get trained but he has to be ready and competent to stand on his feet and start a career. In practice, it is proved that graduate architects can not take on board complex projects and therefore they become simple designers in big constructing schemes. Professionals have already realized that an architect has to be a supervisor himself of the constructing phase of his own designs. He has to be capable of recognizing construction problems that have to do with the builders and their manipulation, with the constructing procedure and the materials to be used. Especially for the latter, he has to decide which material he has to use according to its nature, its durability, its aesthetics, its compatibility to other materials or to hard weather conditions and according to "extraordinary" designing. For instance, it is not enough for an architect to choose an impressive glass panel which he discovered in a fashion magazine-sometimes the only training for some architects. Choosing a material like this, initiates a whole procedure. He has to contact with the manufacturer, to check its cost, its properties, its resistance in difficult conditions, its aesthetics and its compatibility to the other materials and the correct ISO guarantee. And if he still desires its use, he has to know the constructing details for its application in order him to guide the workers and not let things going in any way. In a few words, even a new architect should be ready to hold a project manager position, capable enough to manipulate the different working teams and construction companies in order to complete perfectly his project.

So, comes as self-evident that the target in architects' education should be the production of properly trained scientists in both architectural synthesis and construction, capable enough to supervise the application of plans during construction procedures, having the best knowledge in materials and construction details. They should be fully experienced and be aware of qualities, characteristics and descriptions of structural materials, structural elements and their application techniques that modern technology offers in order to evaluate and use the most appropriate.

The aim of this presentation is not only to discuss the relationship between architectural synthesis and technology but mainly to re-evaluate the methods and the quality of introducing modern technology in an academic architectural curriculum.

Although, technology is taught at architectural schools in Greece, practically graduates are not capable enough of practising construction and they have to be trained, working in big construction companies, wasting time from their own career. Changes in industry of modern materials and construction elements have influenced construction methods used to materialize an architectural plan. In ordinary constructions, continuous evolutions do not change essentially the classical method of teaching construction. However, in building of special demands and prescriptions the applications have shifted away from traditional materials.

It is primarily important for students to understand the relationship between architecture and knowledge of technology. Every expression of art needs technology in order to be done well. Any architectural project as marvelous as it may becomes, disdains a bad structure. The same exists for the structure, because if a construction is technically competent but has no value in architecture-no concept and emotion, then it is completely useless. The architects-to-be, acting according to the international standards, focus to the unique aim of the ambitious level of synthesis ignor-



ing-due to lack of contact to the "construction" reality, the demands and the rules of modern market- that a "brilliant" synthesis can be achieved and completed following two steps: the first step is to have and complete the "inspiration" and the ideas. The second step is to "filter" this intellectual work through a thorough detection of materials that will enforce and support the idea-in both theoretical and practical level. When the architect has a full-scale knowledge of materials, when he/she is able to choose, among the plethora of products, those ones that are compatible with the synthesis materials, when ISO checked products guarantee the quality in construction then it is certain than the second step is completed. A successful choice of materials is a guarantee that a proper construction will follow. Unfortunately, academic studies fail to recognize and support the above steps. On the contrary, they worsen the defect in technological knowledge and practice since they are built in the prospect of creating the "competent" composer, independently from the construction skills.

Currently, in our university, the level of studies in technology know-how aims in covering briefly those elements considered necessary for the students in order him to have the basic knowledge of the construction methods concerning the separate elements of a building while academic lectures support the designing exercise. At the end of the technology lessons students should have knowledge of: a) basic materials, b) ordinary and commonly used construction methods and c) application of methods in designing-return and updating of designing plans.

During the second semester of the first year of studies, it is attempted the students to become familiar with the idea of "materiality" of architectural synthesis. Using examples, students learn how someone can use a single design and produce different structures. They also learn that using different materials can make a single structural element. By the end of this period students should be able to create these structural elements proving that he fully understood this procedure. Students should understand that the same basic architectural element could be different depending on the material proposed each time. The exercise is supported by a series of lectures that give the theoretic part of the course. During these lectures a number of basic building materials such as concrete, masonry, timber, steel, glass etc. is presented. Finally, during this stage, defects in basic knowledge on purely designing level- essentials in organizing plans such as dimensions of tables, symbols etc.- are covered.

During the second year of studies, students focus on creating a complete designing project. This annual exercise concerns the designing of a small dwelling(fig.1) at the first semester and its construction – design of details at the second semester(fig. 2,3,4). At lectures it is presented the construction details and structure of external and internal walls-light panels, stairs, roofs and balconies,floors, wall coverings, electrical and mechanical networks, WC, kitchens e.t.c. The main characteristics and typologies of the above are analyzed at each lecture.

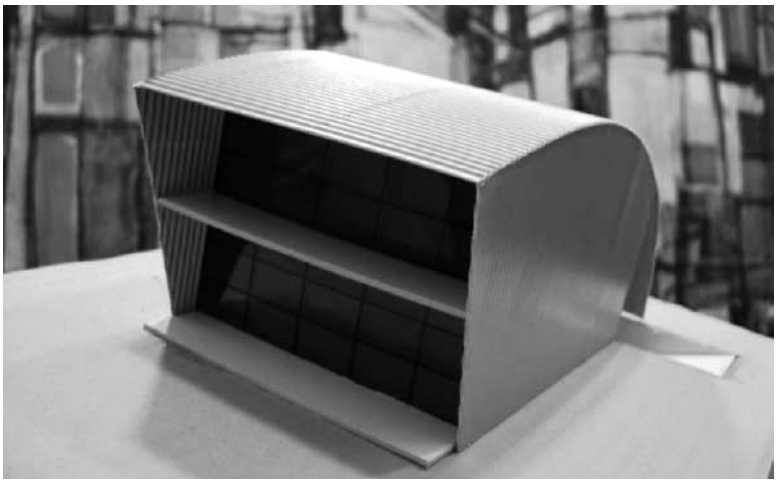


fig. 1

Contact of students with ordinary materials like concrete and metal structures is limited to a general knowledge of these materials without entering in practical skills that can be gained only through practice.

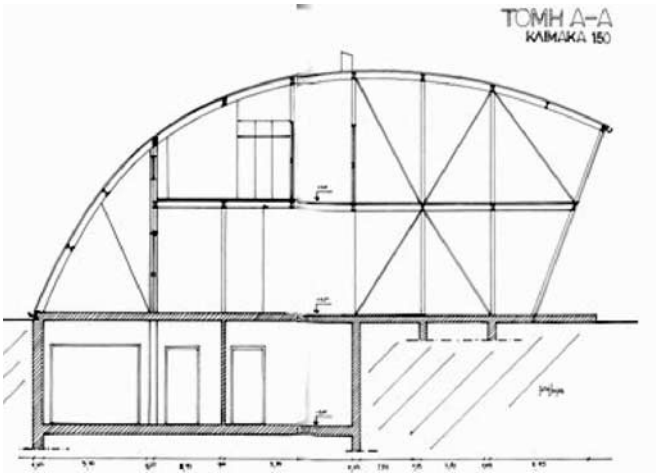


fig.2

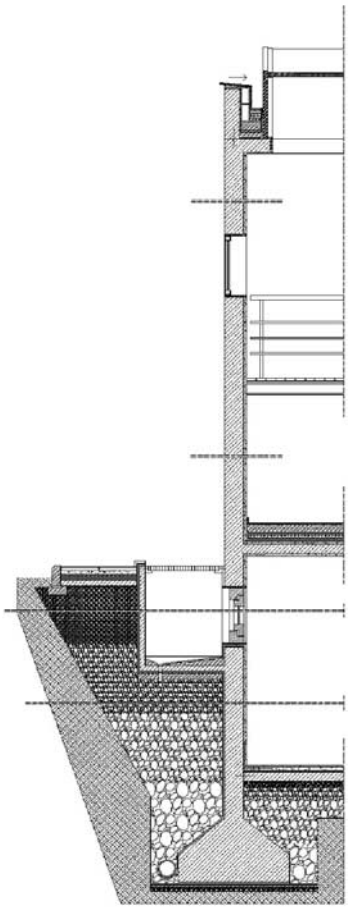
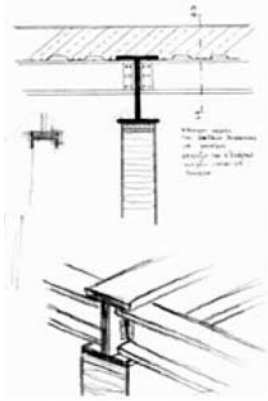


fig.3



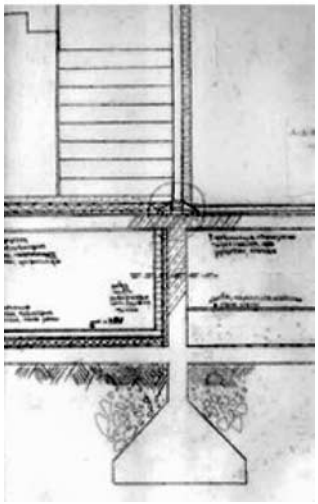


fig.4

Contact of students with ordinary materials like concrete and metal structures is limited to a general knowledge of these materials without entering in practical skills that can be gained only through practice.

Experience shows that students feel anxious when they deal with construction details because they believe-probably due to insufficient information- that someone else is responsible for the animation of their project.

Contact with reality, proves indisputably that achievement of balance between architectural synthesis and application, theory and empirical applications is the golden standard for the creation of mature architect-composer-engineers and is the condition that should be posed within the completed educational procedure.

The aim is to redefine the educational program, in order the modern education to-be-adapted-to the new demands. Thus, properly educated architects can emerge, capable to get through the modern increased demands of the globalized labor market – and the everlasting research and self-training-need. Students should understand that the knowledge of usage, properties, utility of new structural materials and of the application techniques that modern technology offers, is the powerful design tool which defines the profile of a modern and properly educated composer-architect who achieves the "proper" structure, completing the "brilliant" synthesis and vice-versa. At the same time, new prospects for the increasingly demanding user are created. Changes in material and structural element industry have influenced building methods. As a result, the classical method of teaching architectural technology should be reconsidered, especially for buildings of great complex, demands and strict prescriptions where the construction methods and applications are not only different from the conventional ones but also very complicated on both material selection level and constructional detail application level.

The role of the teacher for the architects-to-be: teaching in a modern technology era

Standard teaching of ordinary should not be abandoned but, on the contrary, should be enriched with new knowledge and experience on both theoretical and application level. Classical teaching of technology should continue to present the conventional and widely used materials and the ordinary building methods. Students should continue learning how to solve constructing problems that seem "simple" at first sight but are proved to be very difficult and important. Problems with moisture, thermal and sound protection, relations between building and ground or weather and in general the building materials and the load bearing elements, the concrete or steel structure.

All academic lectures about materials and construction should be supported and connected, directly and specifically, by laboratories (indoor or outdoor) where theory will applied in practice. Bibliographic research and research in big constructing companies where real construction happens are essential complimentary methods in teaching. At the same time theoretical lessons should be oriented in helping solving the problems that emerge when students try to complete their exercises in laboratories and not just describe things that students have to find by themselves. It is

important and essential that insufficient knowledge in construction should not become the brake that will stop an architect in his career. The architect has to understand the complimentary and interactive relation of composing procedure to the completed knowledge of proper construction. Construction is not an accessory to architecture or something that happens afterwards. It is at the very core or essence of architectural thought.

The architect of the next day has to learn to function through a continuous demand and search of new technologies that will act as a "dictionary" in his hands. New technologies and materials have to be understood and used in the best way by architects-composers.

In our modern era of information and marketing, the contribution of industry is determinant to all levels: in research, designing and production of complex building elements and in networks of products distribution which help in information and knowledge of the characteristics of each product and building element.

The approach and appropriation of industry by the students and the discreet contact-introduction in an educational system contributes determinately to the completion of the educational aims. This approach should be done either by representatives of big companies or factories that produce quality products or by visiting such industries where experts will explain the way quality products are produced, their properties, the little secrets someone can use in order to detect quality by himself and finally the indications someone may use in order to have the best selection. In fabrication and new technology era, the contribution of industry is determinant in all levels-research, designing and production of complex structural elements and materials. Of great importance is the continuous information and contact not only with visual and designing presentation of structural elements but also with the fully understanding of their prescriptions, technical characteristics and utilities and simultaneous knowledge of the research results and the laboratory measurements which concern the static of the construction – as a result of combination of different elements and materials.

Conclusively, what is proposed is the direct link of the architectural synthesis-laboratories to the architectural technology-laboratories and construction areas (where students can have their first application experience such as construction area organization, management, measurements, problems in construction, emergencies and solutions etc) but, as well, to a number of already constructed buildings where students can "palpate" the construction problems. It is also proposed to be linked to research laboratories, to production chains (visits and guidance to industries where they can be informed for new technologies but also establishment of a way of access to updated information), to measurements laboratories, to the production and control systems of quality and prescriptions. Furthermore, it is proposed not only the contact but even the organization, function, control and management of the ISO systems, by the university laboratories for the whole of the building section. In this way, university will contribute to products research, will drive forward the development and use of new technologies and materials in construction, will be the reference point for the creation and management of the quality control systems, will give the experienced human resources for the inspection of constructions and even for the creation of a national list for constructing companies. It is proposed the creation of a system that will interchange knowledge and information with all relative European

institutions-in a spirit of mutual support and cooperation- and at the same time will inform by every accessible information the public-consumer about the way to enjoy safe and nice-looking products.