TEACHING STUDENT ARCHITECTS ABOUT RECONSTRUCTION – A SYSTEMS APPROACH

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Abstract

Reconstruction after natural disasters requires a broad view of the issues and the possibilities; it cannot be reduced to the single levels of techniques or of social issues, taken in isolation, demanding instead the mobilization of efforts of analysis and synthesis, coupled to organizational and physical design. Architect students potentially possess the ability to take a broad-scope view of an environmental design problem, but habitually focus primarily on technical and esthetic design issues rather than broadly including organizational and process design as the systems approach suggests.

At the School of Architecture, University of Montreal, we offer the opportunity for students to broaden their view of their future domain of professional responsibility, by harnessing their skill and enthusiasm to the humanitarian problem of post-natural-disaster reconstruction in developing countries. The scenario within which they work comprises two phases: (i) developing the conditions of a competition (in the form of a performance specification) and (ii) developing a technical and logistical response accompanied by an organizational design.

Through the students' work, several principles underlying post-disaster reconstruction have emerged, such as its open-ended time-frame, the need to broaden what "housing" includes, the importance of organizational design and the scope for a systemic view of local involvement.

Keywords: architectural education; design processes; logistics; organizational design; project management

INTRODUCTION

Tackling the complex issues of post-disaster reconstruction requires a combination of knowledge, experience and skills – skills in synthesizing the disparate inputs and in coordinating the heterogeneous participants. In an educational setting, coordination skills are acquired in project management courses; synthesizing skills can only be acquired through experimentation of the sort that architecture students are exposed to in their design studios, learning as they go how to cope with often irreconcilable project requirements.

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In a university setting and in parallel with our long-term research into understanding the complex problems of reconstruction after natural disasters in developing countries, we devote efforts to “teaching” about post-disaster reconstruction. However, *teaching* is hardly the best word to use, since our students approach this *problématique* in a cluster of coordinated courses and a studio, forming a systemic program of activities. The studio is the focus of this paper.

Objectives and methods

Our initiative addresses the need to form as many competent professionals as possible to cope with the surge in catastrophes, to recognize vulnerabilities beforehand and to plan for the right levels of intervention. As we have mentioned, the program of work hinges around a studio, where students learn about and experiment with the indispensable link between technical and organizational design, and the importance of logistics.

The studio is carefully designed to simulate a hypothetical but plausible situation under the theme of “Reconstruction after natural disasters in developing countries”. The scenario supposes that the Canadian International development Agency (CIDA) wishes to integrate Canadian professionals and firms with other organizations working overseas. For this purpose, CIDA (hypothetically) organizes a competition to propose a plan of action for post-disaster housing reconstruction in developing countries.

As a first step (which takes the first five to six weeks), the students - working as teams of about six members – prepare the *competition conditions* (in the form of a functional and performance specification document); to do so, they carry research into local conditions (culture, standard of living, resources, climate, building techniques etc.). In other words, they take a systemic view of the up-front steps of the design process, particularly functional analysis, identification of required conditions and establishment of performance criteria, consistently covering the three areas of technical design, organizational design and logistics. This activity forces the students to understand, as best they can, what are the on-the-spot conditions within which reconstruction takes place, and what are the constraints and resources (technical, social, political and economic) to be worked with.

In the second step (which takes the remaining nine to ten weeks of the semester), the students – working as teams of two – change roles and *respond* to the competition conditions (i.e. the performance specification that they generated in step one) and produce adaptable and locally-appropriate shelter designs, accompanied by organizational and logistics proposals.

Their proposals include housing and housing insertion (within damaged communities or as new peripheral communities), provision for small businesses and certain basic community facilities. Their proposals also anticipate the long-term evolution of the quick-response shelters as the recovery process gets under way, possibly by using the shelters as the cores for more extended and eventually better-quality houses. The organizational design aspect (to which we attach equal importance) considers the roles of, and relationships between the communities, companies and institutions involved - the ‘who does what’ in the reconstruction process. Students also consider

logistics, such as how to transport materials to the site and where they will be stored, taking into account the timeline for the project. Questions they think about may include: how much can a mule or a camel carry? What happens if a key component is lost en route? What sorts of skills are available in the receiving community? And can they be mobilized to produce disaster-resistant dwellings?

RESULTS

As mentioned above, the students, collectively, first prepare a proposal call in the form of a specification, which includes requirements for technical performance, organization and logistics. Then, working in small groups, they prepare responses, which address issues such as:

- Technical designs of the housing units, including details of construction components, local manufacturing methods and assembly. The projects usually employ a mix of locally available and imported materials.
- Layouts of the settlements, taking into account the needs for privacy (especially in Islamic cultures), as well as the evolution of the site and the units over time.
- Organizational design, portraying the relationships between the organizations involved in financing, manufacturing, design and logistics for the project.
- Analysis of internal and external risks in the project.

Project 1: Post disaster housing for Iran (year 2004)

In this project, IKEA which now manufactures building components and a large Québec construction company form a partnership to build minimum cost housing units to respond to the Bam, Iran, earthquake. The settlement and unit designs take specially into account work activities within the home, the needs for privacy, and rooftop sleeping arrangements which are common to the Bam culture.

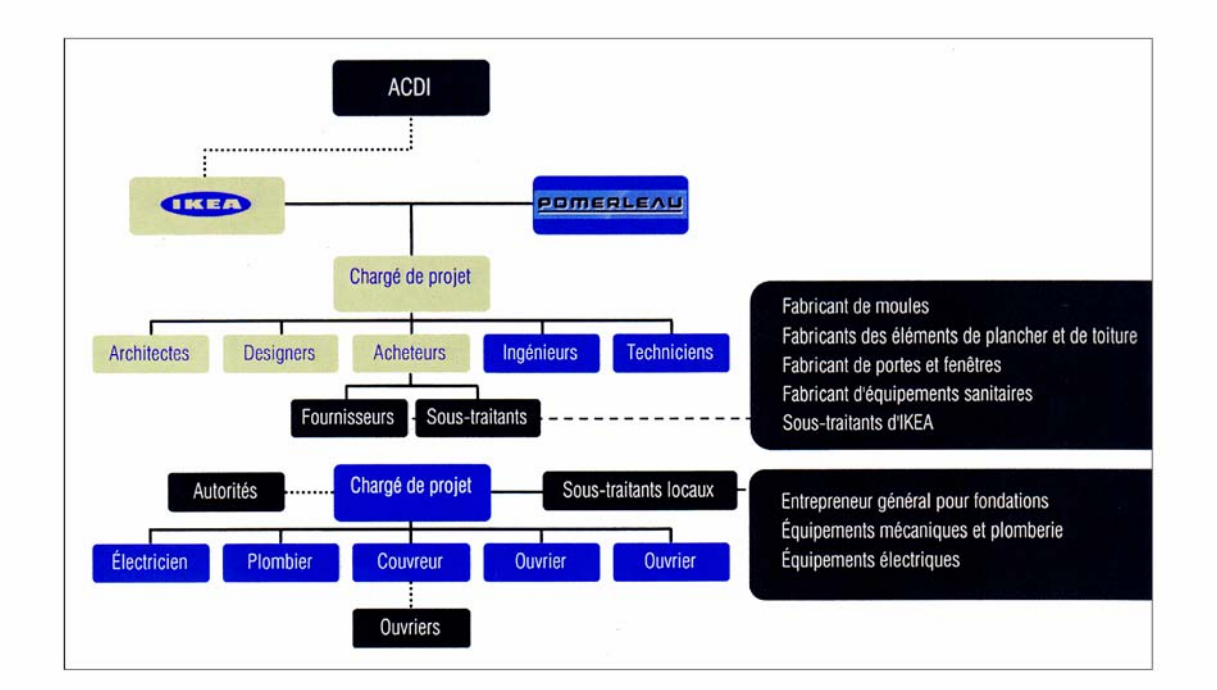
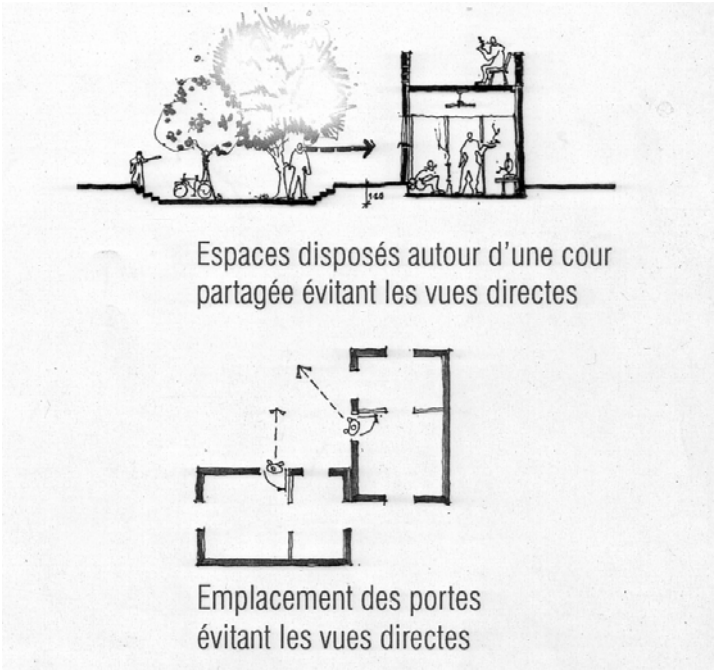


Figure 1. Project 1: organizational design.



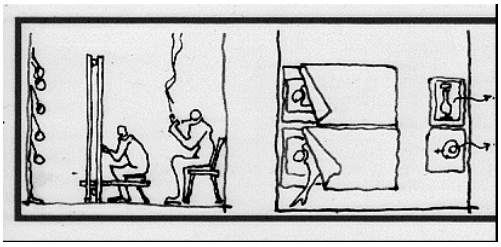


Figure 2. Project 1: study of domestic activities and the culturally appropriate use of spaces.

These studies (figs 1 and 2) provided the basis for a simple technical design based on dry-laid interlocking masonry units.

Figure 3. Project 1: technical design: elevations of a cluster of houses.

Project 2: Post-disaster housing for Central America (year 2003)

Figure 4. Project 2: left: logistics, right: plan of the basic housing unit.

This project is proposed by a design company that acts as a central organization liaising with funding agencies, manufacturers and local volunteers to build post-disaster housing projects in Central America. Simple and lightweight construction components can be transported by hand if necessary, and walls can be in-filled with a multitude of locally available materials.

Figure 5. Project 2. View of the units and the proposed clusters after completion by the users.

Figure 6. Project 2: some of the pieces in the catalogue of construction components.

Project 3: Post-disaster housing for Central America (year 2002)

A prefabricated sanitary core offering a basic kitchen and bathroom facility is supplied along with an easily assembled framed structure complete with roof and floor. The structure is designed for earthquake and hurricane resistance. The walls may be finished with locally available materials.

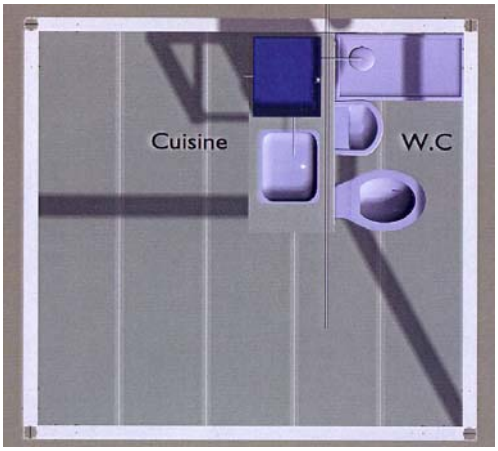


Figure 7. Project 3: top: view of the unit before being completed by the users; bottom left: house plan, bottom right: water service core.

DISCUSSION

Our experience with working with students on post-disaster reconstruction has been positive at a number of levels, for the students, evaluated against the criteria of student success (measured, for example, in grade-point averages and obvious student interest), and for us (because of the lessons we have been able to draw from these five years of studio experiments).

In effect, the students – through their studio projects – show that they have come to grips with understanding the requirements for reconstruction projects and, more importantly, have learnt how to tackle this kind of task. They learn about international competitions and the scope for using the performance approach, and then they produce systemic proposals, including, as we have mentioned, technical and organizational designs plus logistics plan.

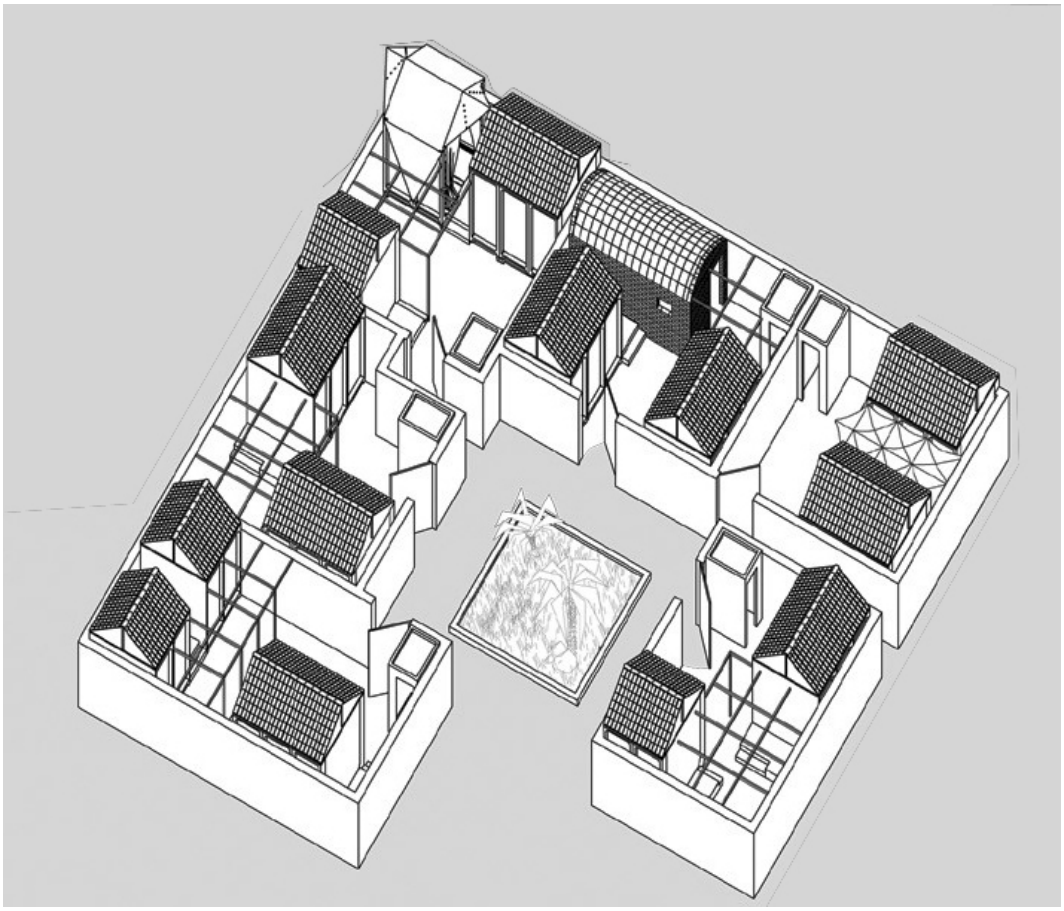


Figure 8. Post-disaster reconstruction in Bam, Iran; view of a cluster of units after completion by the residents.

Quite apart from the benefit for the students, this series of studio projects enables us to propose and tentatively validate various hypotheses, such as:

- Post-disaster housing reconstruction challenges the traditional definition of a ‘project’ the ‘official’ reconstruction project may have a limited time-frame, but the community re-development does not have a clear end; the units initially provided will probably be completed over a long period of time by the occupants. This aspect is often underestimated by NGOs, which necessarily work within a limited time frame and cannot take a long-term strategic view of the reconstruction/development process.
- Housing solutions require a complex understanding of relationships at the ‘urban’ scale. In this regard, the house itself is not enough if it does not fit into a solution at the scale of the settlement, both in terms of neigborhood design and the provision of facilities for micro-businesses. This is crucial for the feasibility of re-establishing local economic activities (and income generators).
- Community participation is not really the key to performance in reconstruction. Many other aspects such as logistics, organizational design, communication, etc. seem to be more influential in the overall performance of the

reconstruction/development process.

- The feasibility of technical solutions depends on appropriate organizational design, involving merging both local and external resources in a coordinated way.
- A better coordination between local organizations and local manufacturers is required for obtaining innovative and appropriate solutions for post-disaster reconstruction.

In some of the students' projects, their work validates these hypotheses; in other cases, their work serves at least to propose the pertinence of proposing them.

ACKNOWLEDGEMENTS:

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