WHY DECONSTRUCTION IS NOT ADEQUATELY CONSIDERED IN PORTUGUESE BUILDING REFURBISHMENT

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In Portugal, the sustainability of construction has been looked into over the past few years, especially where quality, safety and natural/energetic resource-saving technologies are concerned. Now, there are studies under way whose purpose it is to lessen the quantity of debris that are by-products of the construction process. On the other hand, is known the enormous patrimony that is waiting to be rehabilitated, as many of these buildings are sorely in need of interventions. However the deconstruction process is practically unused and unknown. Deconstruction paves the way for the revaluation and reuse of construction materials and elements which would otherwise be treated as worthless debris and removed to storage spaces which are often not legally authorized to hold such materials. An interviewer opinion collected process has been carried out with a set of selected Portuguese construction process participants. Its aim was to present their view on implementation and viability of deconstruction as an innovative technique in the process of refurbishment, thereby contributing towards the economic sustainability of said process. The reasons why deconstruction benefits aren't considered are also discussed.

Keywords: Sustainability, refurbishment, deconstruction, reuse, waste management.

INTRODUCTION

There are now over 5 million houses in Portugal. 3,5 million are inhabited, 1 million is comprised of second or holiday homes and half a million are empty. Yet the construction industry is reluctant to adapt. From 1999 through 2002, 106,000 houses were built per year, and municipal zoning plans anticipate, in the north region of the country alone, houses enough for 15 million residents when the population is only about 3,5 millions (Teixeira and Couto 2002). Considering population density, Portugal has the most houses per resident in Europe and still is the country where more homes are built. The 2001 census listed 5,019,425 buildings, of which 1,222,280 were built before 1960 and constitute about one fourth of the total (Entrepreneurs Council for Sustainable Development 2004).

There is, then, this enormous patrimony that is waiting to be rehabilitated, as many of these buildings are sorely in need of interventions. Paradoxically enough, very little rehabilitation takes place in our country - indeed it is under 10%, whereas in other European countries it climbs to about 50%. The lack of interest in rehabilitation underpins behaviours that do not allow for sustainability in the construction sector. Partly, the attitude is connected to the fact that building rehabilitation involves knowledge of building materials and techniques that have been superseded. More

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often than not, rehabilitation of a building will stop at the preservation or restoration of the facade, disregarding the reuse of the materials inside, even though in some cases it can be recovered and employed in the new intervention. No-holds barred demolition produces an enormous quantity of debris which will, in most cases, only add to the pile of material to be used for landfills. Due to community concerns over potential impacts to the environment in developed areas, it is becoming more and more difficult to have landfills at such sites. On the other hand, having landfills in areas further away from human activity raises transport and power costs. An alternative to packing off these materials and constructive materials to a landfill is to choose deconstruction over the more common habit of demolition.

Deconstruction is the process of taking a building or structure apart, selectively dismantling and removing materials before the structure is demolished, or avoiding demolition altogether, and disassembling the entire structure, in the reverse order in which it was constructed (Hagen 2007). Deconstruction is a concept that emerged due to the rapid increase of demolitions and growing environmental concerns expressed throughout society. Yet deconstruction processes are still perceived as interesting way to cut down on the production of debris but one that fails to garner general understanding and acceptance. For this to come about, environmental rules and regulations must be promoted. Deconstruction processes and techniques need to be developed and promoted. It is necessary to raise awareness about the importance of deconstruction with the parties involved in the construction industry, especially owners, project designers and contractors (Liu et al. 2003).

DECONSTRUCTION AS IMPORTANT TOOL IN BUILDING REHABILITION

In Portugal, often enough, in order to rehabilitate a building, some of its elements are demolished. This because they are either quite derelict or because new functions demand that elements be replaced. However, little or no reuse of materials and constructive elements has been taking place. Instead, selective demolition is the preferred method. Rehabilitation and deconstruction are concepts that fit the overall framework of sustainability in construction, as they both focus on the valuation of existing resources.

To rehabilitate a building means, basically, that we restore qualities to it that will allow for safe, comfortable use in a durable building appropriate to the goals in mind. There can be two sides to rehabilitation, whether talking about general-purpose contemporary buildings or those that constitute cultural and historic patrimony. In the first case, RICS (Royal Institution of Chartered Surveyors) concept may be adopted. Rehabilitation is: the extensive repair, renovation and modification of a building to have it suit economic or functional criteria equivalent to those expected of a new building that serves the same purpose. It may involve putting in place installations and service systems, means of access, natural lighting, equipment and finishes, using but the bare bones of the old building (Entrepreneurial Council for Sustainable Development 2004).

The rehabilitation of buildings clearly dovetails with the concept of sustainable development. By valuing the recovery of existing buildings, the need for new construction is diminished. As a consequence, urban sprawl has less impact on surrounding areas whose environmental, ecological and agricultural value is often considerable. Deconstruction paves the way for the revaluation and reuse of

construction materials and elements which would otherwise be treated as worthless debris and removed to storage spaces which are often not legally authorized to hold such materials. Furthermore, by valuing construction materials and elements, procurement of raw material is diminished, as well as the need to process and transport raw materials. The need to manufacture new components and products is also lessened, which has economic and environmental advantages (Couto 2002) (Couto and Couto 2006).

PRELIMINARY DECONSTRUCTION NATIONAL APPROACH

Recently, in scope of PhD thesis program it has been carried out an interviewer opinion collect process to experts and researchers connected with refurbishment activities. Then, were consulted 2 public owners representing URS (Urban Rehabilitation Societies), 2 speciality contractors on buildings rehabilitation, 1 OHC (Office Historic Centre) represent and 2 rehabilitation consultants.

The aim was to understand and collect the most problems and worries of National rehabilitation construction process related.

The interviews were structured as follows:

- To discuss and to get opinions about rehabilitation state of art.
- To collect recommendations to improve the rehabilitation process.
- Which are the mains consequences and results to the recently waste legislation?
- To get opinions about importance and benefits of deconstruction process. What will be its importance to rehabilitation, environmental challenges and economics influences?
- What are the main barriers to implemented deconstruction processes?

Following are present the mains conclusions of this interviewer process about C&D waste:

- An unsuitable waste management continues to be the most inconvenience of construction activities (Couto 2002) (Teixeira and Couto).
- There is not Portuguese legislation on C&D waste. The application universal waste legislation to construction sector manifested insufficient.
- The new legislation about C&D waste that will come into force soon is enough ambiguous, is not as clear about waste hierarchy as legislation adopted in others countries which encourages the adoption of managing waste in the following order of priority:

1. Waste should be prevented or reduced at source as far as possible.

2. Where waste cannot be prevented, waste materials or products should be reused directly, or refurbished before reuse.

3. Waste materials should then be recycled or reprocessed into a form that allows them to be reclaimed as a secondary raw material.

4. Where useful secondary materials cannot be reclaimed, the energy content of waste should be recovered and used as a substitute for non-renewable energy resources.

5. Only if waste cannot be prevented, reclaimed or recovered, it should be disposed of into the environment by landfiling, and this should only be undertaken in a controlled manner.

Construction waste management should move increasingly towards the first of these options, using a framework governed by five key principles promoted by the EU:

- The proximity principle.
- Regional self sufficiency.
- The precautionary principle.
- The polluter pays.
- Best practicable environmental option.

Clearly, reuse of building elements should take priority over their recycling, wherever practicable, to help satisfy the first priority of waste prevention *at source (*Morgan and Stevenson 2005).

- Incomprehensibility that legislation not considers the selective demolition and ignores, for that, the international propensity.
- The most designers are not sensible for deconstruction. They think to design for deconstruction process limit their mental conception; they are not interested in international guidelines to design for deconstruction developed from several research projects as Crowther (2000) or SEPA (Scottish Environmental Protection Agency) (Morgan and Stevenson 2005).
- The owners are not also aware of deconstruction benefits.
- The environmental associations ignore or not to know the advantages of deconstruction process.
- There is the perception that environmentally-sound business practices necessarily will increase costs and decrease profits.

BARRIERS AND OPPORTUNITIES FOR DECONSTRUCTION

There are a number of areas where the authorities may influence design and planning strategies at an early stage. These include fiscal incentives such as the maintenance of a fixed price for recovered products or increased costs for waste disposal through the landfill tax. Incorporation of deconstruction techniques into material specifications and design codes on both a National and European level would focus the minds of designers and manufacturers. Education of the long-term benefits of deconstruction techniques for regulators and major clients would provide the necessary incentive for the initial feasibility stage. Design for deconstruction is not, however, solely an issue for the designers of buildings. The development of suitable tools for the safe and economic removal of structural elements is an essential pre-requisite of the more widespread adoption of deconstruction.

A recent study by BRE (Building Research Establishment) has shown what the industry has known for decades; that there are keys factors that affect the choice of the demolition method and particular barriers to reuse and recycling of components and materials of the structures. The most factors are physical in terms of the nature and design of the building along with external factors such as time and safety. Future

factors to consider may well include the fate of the components, the culture of the demolition contractor and the 'true cost' of the process. For the latter, barriers to uptake include the perception of planners and developers, time and money, availability of quality information about the structure, prohibitively expensive health and safety measures, infrastructure, markets quality of components, codes and standards, location, client perception and risk.

The demolition industry is already very knowledgeable about recycling components of a building which have a fiscal value. The market for these items is very competitive and the demand and supply for the different items is constantly changing. This makes it very difficult for the demolition companies to plan and budget in advance. A more stable market and perhaps a guaranteed minimum price for each type of component would aid greatly in this process. According Hurley and Hobbs (2004) the main barriers in the UK to the increased use of deconstruction methods within construction include:

- Lack of information, skills and tools on how to both deconstruct and design for deconstruction.
- Lack of a large enough established market for deconstructed products. A similar scheme to the BRE's Materials Information Exchange would assist this.
- Lack of design. Products are not designed with deconstruction in mind.
- Reluctance of manufactures, which always prefer to purchase a new product rather than to reuse an existing one.
- Composite products. Many modern products are composites which can lead to contamination if not properly deconstructed or handled.
- Legal obstacles. Allocation of risk and responsibility has to be considered when using 'second-hand' components. Adequate factors of safety and certification also have to be considered.
- Joints between components are often designed to be hidden (and therefore inaccessible) and permanent.

The main opportunities which require development include:

- The design of joints to facilitate deconstruction.
- The development of methodologies to assess, test and certify deconstructed elements for strength and durability, etc.
- The development of techniques for reusing such elements.
- The identification of demonstration projects to illustrate the potential of the different methods.

The greatest benefit will be achieved by incorporating deconstruction issues into the design and feasibility stage for all new construction. Each case can then be judged on its merits in terms of the potential cost of recovery and recycling or reclamation and reuse of construction materials.

DECONSTRUCTION BENEFITS

The benefits from deconstruction are significant. Deconstruction offers historical, social, economic and environmental benefits. Older buildings often contain craftsmanship, which have significant historical value. Deconstruction can carefully salvage these important historical architectural features because materials are preserved during removal. Deconstruction is more time consuming and requires more skill than simply demolishing a structure. Although the extra time required could act as a detriment, the additional jobs that can be created benefit the community. Deconstruction provides a market for labor and sales of salvaged material. More important, deconstruction puts back into circulation items which may be directly used in other building applications, reducing the amount of waste sent to landfills. Currently there are few incentives to break the historical practice of landfilling debris. The occasionally higher cost of selected demolition can be offset by the increased income from salvaged materials, decreased disposal costs, and decreased costs from avoided time and expense needed to bring heavy equipment to a job site.

Ignore deconstruction means create a pile of debris that can’t be viable to reuse. Deconstruction permits the resorting procedures that enable separation and recovery of debris and by-products.

Deconstruction allows to:

- Reuse and recycles materials: materials salvaged in a deconstruction project can be reused, remanufactured or recycled (turning damaged wood into mulch or cement into aggregate for new foundations (Hagen 2007).
- Foster the growth of a new market - used materials: recovered materials can be sold to a salving company. The market value for salvaged materials from deconstruction is greater than from demolition due to the care that is taken in removing the materials in deconstruction process.
- Environmental benefits: salvaging materials through deconstruction helps reduce the burden on landfills, which are already at capacity in many localities. By focusing on the reuse and recycling of existing materials, deconstruction preserves the invested energy embodied in materials, eliminating the need to expend additional energy to process new materials. By reducing the use of new materials, deconstruction also helps reduce the environmental effects, such as air, water and ground pollution resulting from the processes of extracting the raw materials used in those new construction materials. Deconstruction results in much less damage to the local site, including soil and vegetation and generates less dust and noise than demolition.
- Create jobs: deconstruction is a labor-intensive process, involving a significant amount work, removing materials that can be salvaged, taking apart buildings, and preparing, sorting, and hauling the salvaged materials.

COST SAVINGS

The economic benefits of deconstruction are substantial. One of the biggest challenges to "greening" businesses is overcoming the false perception that environmentally business practices necessarily will increase costs and decrease profits. Deconstruction is helping break that myth:

- Deconstruction is cost-effective. Not only can buildings be deconstructed more cheaply than they can be demolished, but deconstruction provides construction companies with low-cost materials for reuse in their own building projects.
- Deconstruction is an ideal training ground for the construction trades. In showing workers how to take a building apart, they learn how it's put together. And, of course, they learn crucial safety, math, and tool/equipment handling skills. Trained workers are then ready for immediate entry into the workforce, helping meet the C&D industry's highly publicized demand for skilled, trained workers.
- Because funding often is available to cover training costs, industry training costs are reduced, the "learning curve" is almost eliminated, and new employees become income generators.
- Deconstruction is increasingly in demand in government projects. In some instances, it helps agencies meet requirements that projects include community development components. In other cases, deconstruction is seen as a means of reducing waste generation and disposal, and therefore meeting environmental mandates. This has prompted the authorities to promote deconstruction, rather than demolition. Thus, integrating deconstruction into their corporate menu allows C&D companies to access contracts that might otherwise be unavailable to them.

The most important conclusions of a preliminary research for a pilot project by the U.S. Environmental Protection Agency (EPA) and the National Association of Home Builders (NAHB) Research Center (developed with the Baltimore Development Corporation and the Housing Authority of Baltimore) indicate deconstruction may cost 30 to 50 percent less than straight demolition (CEPA, 2001). Although labor costs can be higher due to the nature of the work, they are offset by lower equipment costs. Because deconstruction does not require as much heavy equipment but rather relies primarily on hand tools and small machinery, equipment rental costs are lower.

Research shows that the market value for salvaged material is greater when deconstruction occurs instead of demolition, because of the care taken in removing materials. Money made through salvaging can be used to offset other redevelopment costs. Lastly, disposal costs are lower with deconstruction because the process reduces the amount of waste produced by up to 75 percent.

CONTRIBUTION TOWARDS INCREASED COMPETITIVENESS OF COMPANIES

As is generally known, the competitiveness of the construction sector relies on the entrepreneurial capabilities of its companies, whose goal it is to provide quality, innovative service. This work aims to foreground knowledge in the fields of rehabilitation and reconstruction, giving companies an edge as far as deconstruction techniques are concerned. These techniques are preferable to undifferentiated demolition and meet legislative demands on reuse and recycling of materials; to which construction companies do not yet pay much heed. The pre-project on construction and demolition by-products and debris proposes implementation of debris and by-product management plans at the project design stage. This seems to be a correct, effective way to foreground the importance of debris management and to get all

participants involved, beginning with the design stage and all the way down to implementation.

The plan specifications contemplate an estimate for the debris and by-products resulting from construction work. It then becomes necessary, at the design stage, to be more and more aware of the debris that will be produced. Adequate logging and shipping are also considered in this legislative document. These attitudes do indicate the path to follow.

It is very likely that, in the near future, much as is happening all over Europe now, new technologies for material reuse and recycling will be chosen over old habits. We hope this work will bring companies knowledge to help them adopt environmentally-sound attitudes; they will not only benefit economically but also in terms of their public image. Environmentally-sound positions are a great promotion tool, especially if you consider the many problems the world is going through right now that can be chalked up to our thinking in exclusively economic terms.

ADDRESSING DISINCENTIVES TO DECONSTRUCTION

Future efforts should focus on addressing disincentives for deconstruction. One disincentive may be the low landfill tipping fee for construction and demolition debris. A possible solution is support for salvaged-materials collection centers that provide incentives for contractors to seek alternatives to demolishing structures and disposing of debris.

Other disincentives to deconstruction include timing problems. After waiting a lengthy period of time for a demolition permit, contractors face financial pressure to demolish the structure quickly and proceed with redevelopment in order to recoup some of the money lost while waiting for the permit. The longer period of time required for many deconstruction projects (compared to demolition projects) provides further disincentive. Streamlining the permit process, especially in regard to deconstruction projects, could make deconstruction of a project more feasible.

SCHEDULED INVESTIGATION PROJECTS

The production of legal documents that encourage more environmentally behaviour, that is, that raises awareness and indeed makes the construction industry handle its debris and by-products more carefully, is vital to the sector, if it is to contribute at all to sustainable development, an obligation that is shared by everyone. Special mention must be made of the mandatory waste/debris/by-product management plan at the design stage. It seems to be a correct and effective way to highlight the importance of waste management and to get all the participants involved, from the design to the construction stage.

The change, however, must be accompanied by public awareness campaigns. It is not enough to stress that the plan is mandatory. The plan’s importance must be addressed. It will be easier to reach the goals if everyone knows the advantages and importance of such a plan. Divulge and collect opinions from several participants in the constructive process.

With a view to help to reach those objectives the authors are now participating in research projects. The main goals are to:

- Collect and analyze data on old buildings with strong masonry scattered across urban centers in Portugal, namely, their constructive characteristics and more frequently used construction materials.
- Collect and analyze deconstruction techniques that help achieve sustainable rehabilitation of such buildings.
- Propose methodologies for the implementation of deconstruction techniques that are adequate to the type of rehabilitation intended that will allow for valuation of construction materials and elements (components) already in place, so that they are not randomly, indiscriminately or unnecessarily removed, so as to make them reusable.
- Follow and conduct building rehabilitation experiments so as to analyze and validate the methodologies proposed for implementing deconstructive techniques.
- Divulge and collect opinions from several participants in the constructive process.

CONCLUSIONS

The environmental impact of construction activity has gained increasing importance in the last few years and become a key challenge for sector. This will surely contribute towards the reduction of debris and by-products created by the sector. However no matter how effective the changes made to constructive processes with a view to cut back on costs and debris generated, there will always be debris.

Add that to demolition debris and by-products and you will still have a sizable amount of waste. On the other hand, work entailing total or partial demolition of buildings tends to occur more and more often as a result of adaptation and improvement of said buildings. They must be refitted to meet new quality and comfort standards. New demands will be placed on older buildings, therefore.

So it is that research into practical solutions for the reuse of materials and components will combat the urban problem created by illegal landfills - bringing environmental improvement - and introduce new materials into the market that have great potential for use. Then, the deconstruction process appears as an adequate answer for these challenges and with a significative potential for exploitation in Portuguese building refurbishment.

Deconstruction has social, economic and environmental benefits. Deconstruction can assist in the rebuilding of dilapidated neighbourhoods, provide employment for relatively unskilled workers, provide low cost building materials and greatly reduce the amount of waste sent to landfills. As a result, landfill space is preserved ultimately saving the local governments the costs associated with closing existing landfills. In reality there are many valuable building materials that can be and are salvaged from buildings slated for demolition. Deconstruction provides an environmentally friendly alternative to recapture the value of these materials for reuse.

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