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1.3.4. REPORT ON THE POSSIBILITIES TO REUSE OR RECYCLABILITY OF BUILDINGS MATERIALS IN SPAIN

OERCO2

ONLINE EDUCATIONAL RESOURCE FOR INNOVATIVE STUDY OF CONSTRUCTION MATERIALS LIFE CYCLE

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This report provides a studies compilation at a national level, with a view to show the possible destination of the buildings materials at the end of their life cycle. Within the objectives proposed in this project, this report fits in the partial objective that aims to the sharing of different items related to the methodology for calculation of CO_2 at European level, during the buildings processes and along the life cycle of the materials. Specifically, it focuses on the end of the life cycle of the materials, when they become construction and demolition waste (RCD) and that arises what will ultimately happen to them and the possibilities for reuse or recyclability.

Operate in this final phase is a key strategy to achieve sustainability in the construction sector, to do this the existing concept of waste exchange should be transformed into the traditional open productive model (major waste and emissions generator), to give way to consider this waste stream as a materials resource that aimed at progressing towards a closed productive model, that feeds on itself, reducing the high consumption of natural resources as well as the generation of gas emissions associated with its transformation (Cuchí, A. et al. 2007).

The current building situation in Spain, is characterised by the massive use of stone materials, over 50% by weight (González-Vallejo, P. et al. 2015), because of the predominant use of concrete like a base material of the buildings. This massive use, united to their condition of non-renewable material, converted it into the purpose of many studies with regard to the recycled of these materials by ensuring the closing of the material's cycle, limiting to the maximum its generation as waste. To achieve this objective, various investigators analyses proposals about potential destinations for this waste, the most common one is the use of this waste to take recycled aggregates to concrete manufactures. It is not to increase the amount of recycled aggregates in the structural concrete composition, because EHE just takes into account the use of recycled aggregates from rubble of concrete into their coarse fraction, be left outside the Annex 15 concretes with fine aggregates, as well as concretes produced with recycled aggregates from ceramic materials, asphalts among others. Consequently, the study consists of the evaluation of the use of recycled aggregates of mixed category to create concrete for the pre-fabrication of non-structural elements (De Gutiérrez Báez, A. 2013).

In the pre-fabrication of constructive elements line, researchers from the University of Sevilla have developed and quantified the minimising environmental impact caused by the execution of

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certain typologies of facades, through the replacement of material with major impact (ceramic brick factory) by pre-fabricated elements made with buildings wastes. Specifically, have been developed prefabricated slabs with recycled concrete, replacing the natural sand of the composition by fine aggregate (50 %p) and the gravel by coarse aggregate (30 %p), resulting the percentage of final waste weight the 80% and the remaining 20% is concrete.

The investigation follows that the energy cost of the brick factory facade is 99,44 MJ/m^2, while facade made with prefabricated reinforced concrete plates is reduced to 8,58 MJ/m^2, CO_2 emissions are reduced proportionally (Marrero, M. et al. 2013).

Despite concrete dominant presence, other traditional buildings materials as ceramic materials, standard constructive systems are characterized by its presence, which represent the 20% of the weight (González-Vallejo, P. et al. 2015). The considerable amount of clay material used in these materials, that during thermal processing (700 °C – 1000 °C) acquire the baked clay characteristic, that makes it an ideal waste to elaborate cements, this is explained by presenting pozzolan activity and properly granulometry, reducing CO_2 emissions associated with high temperatures in Clinker formation (Sánchez de Rojas, M. et al. 2014 y Puertas, F. et al. 2006).

Another authors experience on others uses for ceramic wastes, which united to extruded polystyrene (XPS) wastes, serve as additives to change the physical-mechanical characteristics of construction gypsum, reducing the dry density of the material and the absorption by capillarity, may in some cases reduce thermal conductivity and step up its surface hardness (Rodríguez Rodríguez, Y.J. et al. 2015).

New researches are developed in order to meet the gypsum capacity for recycling, a well-established material in construction and so far, it does not have its way within the waste stream as a material resource. The first step has been to analyse the environmental feasibility of gypsum recycling, drawing a comparative between the impact made by recycled gypsum and gypsum from raw materials. Process gypsum wastes are applied by the same recycling technical used in ceramic and concrete, through shredding process, laboratory testing has been carried to study recycled gypsum properties, to be employed as base plaster in walls or as new cements

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components. In energy terms, the results regard to CO_2 emissions show that recycled gypsum (0,036 kgCO_2 eq/kg) saving on 49,8% of the emissions, against gypsum from raw materials (0,073 kgCO_2 eq/kg), showing equivalent results respect primary energy consumption, because recycled gypsum consumption (0,688 MJ/kg) saves a 50,1% against primary gypsum (1,372 MJ/kg) (Silgado, S. S. S. 2014). Another analysis advance in the development of experimental works about reuse of residuos from gypsum plasterboards, adding polyurethane foam residues and reinforce with polypropylene fibres, the results show that it is possible recycling this kind of material with a favourable final mechanical behaviour (Alameda, L. et al. 2015).

Another RCD that stands out among generated wastes is the steel, than by the weight representation (1,42% of weight), the impact caused by incorporated energy in their transformation process (20% of total incorporated energy) (González-Vallejo, P. et al. 2015), showing as positive aspect the very high recyclability as metal that permits a maximum use of this material resource in any sector (Cuchí, A. et al. 2007).

The rest of materials presented in construction account for 16% of total weight (González-Vallejo, P. et al. 2015), between these materials aggregates stand out, despite that their use is intensive, have the advantage of being subject to a small transformation process they do not require a high environmental impact, in contrast, other materials such as asphalt, widely used for road pavements, are associated with high energetic consumption. That is why be developed studies to quantify the generation of these type of wastes as well as to comparative different management scenarios, encouraging recovery and reuse of them, obtain environmental benefits such as natural aggregates consumption reduction, reduction of production and deposited in the waste landfill, as well as the reduction of CO_2 emissions produced by the transport lorries among other (Solís-Guzmán, J. et al. 2014).

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