Building Materials Reuse and Recycle

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Abstract: The building industry has not only become a major consumer of materials; it ha salso become a source of polluttion.. Environmental integrated production and reusing and recycling is of great importance for the competitev position in EU Member States. EU Member States shall ensure that the technical, environmental and economic feasibility of alternative systems is considered and is taken into account before construction starts . The article focuses on Reuse Building Materials as a way for environment protection and sustainable development. Integrated environmental management integrates the requirements of sustainable development and LCA. There are many methods used to reduce waste and increase profits through salvage, reuse, and the recycling of construction waste. Sustainable development as a tool to continual improvement cycle and with processes innovation the need to save money in the processes via reduced resources and utility costs. This article demonstrates that alternatives to modern building materials are available.

Key words: environment, management, reuse, salvage, sustainable development

1 Introduction

All systems recycle. The biosphere is a network of continually recycling materials and information in alternating cycles of convergence and divergence. As materials converge or become more concentrated they gain in quality, increasing their potentials to drive useful work in proportion to their concentrations relative to the environment. As their potentials are used, materials diverge, or become more dispersed in the landscape, only to be concentrated again at another time and place. Fitting the patterns of humanity to these material cycling pathways has become paramount in importance as our numbers and influence on the biosphere increases [11].

Directive 2002/91/EC on the energy performance of buildings (the EPBD) requires several different measures to achieve prudent and rational use of energy resources and to reduce the environmental impact of the energy use for buildings. This is to be accomplished by increased energy efficiency in both new and existing buildings. One tool for this will be the application by Member States of minimum requirements on the energy performance of new buildings and for large existing buildings that are subject to major renovation (EPBD Articles 4, 5 and 6). Other tools will be energy certification of buildings (Article 7) and inspection of boilers and air-conditioning systems (Articles 8 and 9).

A basic requirement for measures in Articles 4, 5, 6 and 7 is the existence of a general framework for a methodology of calculation of the total energy performance of buildings, as set out in Article 3 and the Annex to the Directive [1].

Directive 2002/91/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCILof 16 December 2002 on the energy performance of buildings in article 5 says:

Member States shall take the necessary measures to ensure that new buildings meet the minimum energy performance requirements referred to in Article 4. For new buildings with a total useful floor area over 1 000 m2, Member States shall ensure that the technical, environmental and economic feasibility of alternative systems such as:

- decentralised energy supply systems based on renewable energy,

- CHP,
- district or block heating or cooling, if available,
- heat pumps, under certain conditions,

is considered and is taken into account before construction starts [2].
In order to stop the global warmth due to the CO_2 concentration, the energy use should be decreased. The investment of building construction industry in Japan is about 20% of GDP. This fraction is much higher than in most developed countries. That results the Japanese building construction industry including residential use consumes about one third of all energy and resources of the entire industrial sectors. In order to save energy as well as resource, the recycle of the building materials should be urgent to be carried out [12].

2 Environmental Management and Strategies for building material reuse and recycle

Leaders of successful, high-growth companies understand that innovation is what drives growth, and innovation is achieved by awesome people with a shared relentless growth attitude and shared passion for problem solving and for turning ideas into realities. Companies that continuously innovate will create and re-invent new markets, products, services, and business models – which leads to more growth. Innovation is founded on your enterprise's ability to recognize market opportunities, your internal capabilities to respond innovatively, and your knowledge base. So, the best thing to do to guarantee growth is to build a sustainable innovation organization around the following components:

1. Vision and strategy for innovation
2. Culture supporting innovation
3. Processes, practices and systems supporting innovation
4. Top management team leading innovation
5. Cross-functional teams mapping innovation road
6. Empowered employees driving innovation [14].

Reuse and recycling of building material is a growing area of interest and concern in many parts of the USA. Current practices and trends in the building material waste management area are examined from a building life cycle standpoint or cradle to reincarnation concept. Strategies include zero waste, integrated recycling, international approaches, reuse of materials, resource optimisation, waste reduction, and deconstruction. Examination of the waste management hierarchy and life cycle management of material is used to improve the understanding of reuse and recycle opportunities. Other considerations include cost, economic factors, social factors and environmental factors. All of these assessments are needed to develop a comprehensive waste management plan for a specific project [13].

It is important to recognize that the sustained growth in reuse efforts, as well as the sustained interest of the reuse industry, derives in large measure from the solid waste reduction hierarchy: Reduce, Reuse, then Recycle. It is best to reduce first, reuse as a second option, then to resort to recycling. Reuse is recognized as being distinct from recycling, both in doctrine, and in the handling of the materials this unique industry diverts from the waste stream. Recyclers have successfully kept materials out of the landfill by collecting, segregating, processing and manufacturing their collected goods into new products. Reusers, on the other hand, with little or no processing, keep materials out the waste stream by passing the goods they collect on to others. There are also forms of managing materials that are not quite reuse and not quite recycling.

- **Repair** is a method of taking an item, which may appear to have lived its useful life, and fixing it so that it can still be productive.

- **Remanufacturing** and **refurbishing** are ways of taking some used components and some new components to "rebuild" an item. For instance, toner cartridges are often used, then sent to a manufacturer to be broken down and rebuilt using some of the original parts that are reusable, and some new parts. Other items commonly repaired or rebuilt include engines, "single-use" cameras, appliances and electronic equipment [15].

Reuse is a means to prevent solid waste from entering the landfill, improve our communities, and increase the material, educational and occupational wellbeing of our citizens by taking useful products discarded by those who no longer want them and providing them to those who do. In many cases, reuse supports local community and social programs while providing donating businesses with tax benefits and reduced disposal fees [15].

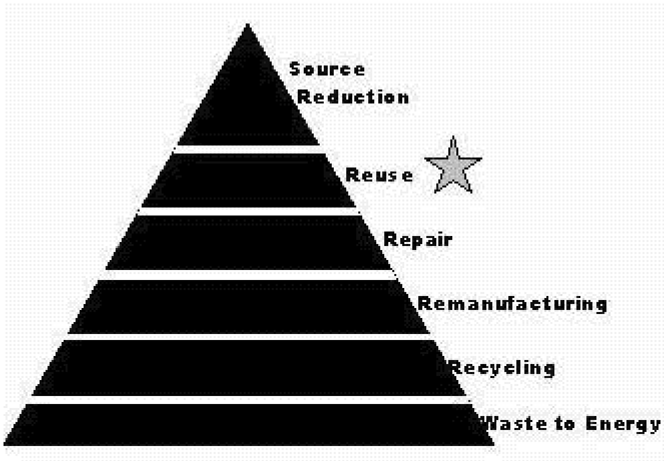


Figure 1: Reuse in waste reduction hierarchy [15].

Benefits of Reuse:

- Environmental Benefits

Many reuse programs have evolved from local solid waste reduction goals because reuse requires fewer resources, less energy, and less labor, compared to recycling, disposal, or the manufacture of new products from virgin materials. Reuse provides an excellent, environmentally-preferred alternative to other waste management methods, because it reduces air, water and land pollution, limits the need for new natural resources, such as timber, petroleum, fibers and other materials. The US Environmental Protection Agency has recently identified waste reduction as an important method of reducing greenhouse gas emissions, a contributing factor to global warming.

- Community Benefits

For many years, reuse has been used as a critical way of getting needed materials to the many disadvantaged populations that exist. Reuse continues to provide an excellent way in which to get people the food, clothing, building materials, business equipment, medical supplies and other items that they desperately need. There are other ways, however, that reuse benefits the community. Many reuse centers are engaged in job-training programs, programs for the handicapped or at-risk youth programs.

- Economic Benefits

When reusing materials, instead of creating new products from virgin materials, there is less burden on the economy. Reuse is an economical way for people of all socio-economic circles to acquire the items they need. From business furniture to household items, from cars to appliances, and just about anything else you could think of -- it is less expensive to buy used than new[15].

3 Green Building

Sustainable design and construction, or "green building," is a holistic approach that minimizes environmental impact, reduces maintenance, and creates a more desirable workspace for the building occupants. Green building focuses on siting issues, energy and water efficiency, recycled content building materials, minimizing local and global environmental effects caused by buildings, and indoor environmental quality. The goal is to transform the market of public funded construction, so that all projects will be designed and constructed reflecting green building principles [3].

The Directive 2002/91/EC (EPBD) was adopted by the European Parliament on 16th December 2002 and entered into force on 4th January 2003. All Member States have had a period of three years in order to build up relevant systems and measures to transpose and implement the requirements.
The EPBD is set to promote the improvement of energy performance of buildings with four requirements to be implemented by the Member States:

1. General framework for a methodology of calculation of the integrated performance of buildings

2. Setting of minimum energy standards in new and existing buildings

3. Energy certification of buildings

4. Inspection and assessment of heating and cooling installations.

The EPBD is foremost a measure that concerns a very large number of actors on all levels and with different impacts and different motivations: designer, housing associations, architects, providers of building appliances, installation companies, building experts, owners, tenants, essentially all energy consumers in the European Union. On 4th January 2006, the minimum requirements for energy performance should be legally binding in Member Sates, Energy Certificates should be required and inspections for heating and cooling devices should be organised under an established system. The most important component of the EPBD is energy certification (labelling) of buildings. Member States are obliged to ensure that when buildings are constructed, sold or rented out, an Energy Performance Certificate is made available to the owner or by the owner to the tenant or potential buyer. The certification shall also include advices and information on how to improve energy performance, and may, for larger public buildings, provide for the display of the current temperature and of the recommended indoor temperature [23]. Table 1 shows the energy efficiency trend for the sales refrigerators & freezers, washing machines and dishwashers after the coming into force of the relevant implementing labelling directive [23].

Years	Energy efficiency classes								
	A++ (%)	A+ (%)	A (%)	B (%)	C (%)	D (%)	E (%)	F (%)	G (%)
Refrigerators & Freezers									
1994	0	0	3,2	16,9	27,2	23,1	13,2	9,5	6,8
1995	0	0	3,8	19,8	28,8	21,7	12,1	8,0	5,7
1996	0	0	5,5	23,7	28,8	17,8	11,1	8,0	5,1
1997	0	0	5,6	23,9	29,9	17,5	10,6	7,6	4,8
1998	0	0	13,3	31,4	28,0	12,1	6,5	5,5	3,2
1999	0	0	15,3	35,5	35,0	6,2	4,9	2,4	0,7
2000	0	0	24,4	40,2	28,4	4,6	1,7	0,5	0,3
2001	0	1,8	32,8	41,4	20,9	2,4	0,7	0,08	0,02
2002	0	3,1	43,6	35,8	14,5	2,2	0,9	0	0
2003 (EU25)	0,12	7,6	44,8	33,3	11,2	1,9	0,9	0,1	0
Washing Machines									
1996		0	1,3	44,2	37,5	9,9	1,3	2,6	3,2
1997		0	3,4	50,8	32,7	8,4	1,0	1,6	2,1
1998		0	11,7	46,2	32,0	6,1	0,8	0,8	2,5
1999		0	23,0	38,5	34,2	4,3	0	0	0
2000		0	38,0	32,4	26,8	2,8	0	0	0
2001		0	51,5	27,3	18,5	2,7	0	0	0
2002		0	63,0	16,0	19,3	1,7	0	0	0
2003 (EU15)		0	78,1	11,5	9,2	1,2	0	0	0
Dishwashers									
1999			9,1	25,2	32,5	28,7	4,6	0	0
2000			25,1	20,8	33,0	20,6	0,5	0	0
2001			37,2	26,7	26,3	9,6	0,2	0	0
2002			55,4	24,5	17,4	2,6	0,1	0	0
2003 (EU15)			72,9	17,4	9,0	0,6	0	0	0

sources: SAVE/MONITOR I-III studies, CECED, GfK

Table 1: Energy efficiency trend of the mainhousehold appliances sold in the EU in 1995-2003 [23]

Buildings will have an impact on long-term energy consumption and new buildings should therefore meet minimum energy performance requirements tailored to the local climate. Best practice should in this respect be geared to the optimum use of factors relevant to enhancing energy performance. As the application of alternative energy supply systems is generally not explored to its full potential, the technical, environmental and economic feasibility of alternative energy supply systems should be considered; this can be carried out once, by the Member State, through a study which produces a list of energy conservation measures, for average local market conditions, meeting cost-effectiveness criteria. Before construction starts, specific studies may be requested if the measure, or measures, are deemed feasible [2].

Incorporating reusable/recyclable/biodegradable building materials in your project can reduce waste, pollution, and energy use. Some examples of reusable/recyclable/biodegradable building materials include:

- Wood (reusable/recyclable/biodegradable)
- Earthen Materials (reusable/biodegradable)
- Steel, Aluminum, Iron, Copper (reusable/recyclable)
- Bricks (reusable/recyclable)
- Concrete (may be crushed and recycled)
- Gypsum/Drywall (recyclable, sometimes biodegradeable)
- Straw Bale Insulation (biodegradable)
- Wool Carpet (biodegradable)
- Linoleum Flooring (biodegradable) [16].

Building materials composed of one substance (e.g, steel, concrete, wood, etc.), or that are readily disassembled into individual materials, are generally easiest to reuse or recycle. Materials composed of many ingredients, such as vinyl siding or wood chipboard are generally not readily reusable, recyclable, or biodegradable. Evaluate materials carefully. Are they the best choice for the application? Are they durable? Can they be readily disassembled for reuse, recycling, or biodegrading at the end of the useful life of the building [16]?

The extraction, manufacture and transport, and disposal of virgin building materials pollutes air and water, depletes resources, and damages natural habitats. Construction and demolition are responsible for roughly 30% of the U.S. solid waste stream and real-world case studies by the Alameda County Waste Management Authority have demonstrated more than 85% of that material, from flooring to roofing to packaging, is reusable or recyclable. The extraction, manufacture and transport, and disposal of virgin building materials pollutes air and water, depletes resources, and damages natural habitats. Construction and demolition are responsible for roughly 30% of the U.S. solid waste stream and real-world case studies by the Alameda County Waste Management Authority have demonstrated more than 85% of that material, from flooring to roofing to packaging, is reusable or recyclable[16].

4 Minimize Construction Waste Impacts

The following considerations can minimize waste impacts on any size project. From the broad influences of design to the specific methods used on the job-site, all play a roll in the prevention of waste.

A. Design to Prevent Waste.
Design with standard sizes for building materials.
Specify materials and assemblies that can be easily disassembled at the end of their useful life.
Design precast concrete members for concrete (Tilt-up) construction.
Choose durable non-toxic interior finishes or materials.
Design spaces to be flexible for changing uses.
Consider reusing materials (on-site) or installing salvaged materials from off-site sources.

B. Plan for Waste Prevention.
Target specific waste producing practices for waste prevention.
Include waste prevention measures in a Waste Management Plan. See Waste Management Plan and Reporting Form.
Communicate your waste management plan at meetings, post it on-line, and promote the result.

C. Use Construction Methods that Prevent Waste.
For wood construction, use advanced framing techniques (e.g. 24" on-center, and insulated headers), trusses for roof or floor framing, finger-jointed studs and trim, and engineered wood products.
Consider using wood frame wall panels prefabricated off-site.

D. Practice Job-Site Waste Prevention Methods.
Set up central cutting areas for wood and other materials.
Reuse concrete forms or choose reusable metal or fiberglass forms.
Clearly mark areas key to waste prevention, such as the material storage, central cutting, and recycling stations.
Practice material storage and handling procedures to prevent loss or damage.

E. Purchase to Prevent Waste.
Purchase salvaged, recycled, or recycled-content materials and equipment.
Check to ensure the correct amount of each material is delivered to site.
Maintain an up-to-date material ordering and delivery schedule to minimize the amount of time that materials are on-site and reduce the chance of damage.
Replace toxic materials with less toxic or non-toxic products to reduce hazardous packaging.
Choose products with minimal or no packaging.
Ask suppliers to deliver supplies using sturdy, returnable pallets and containers. Have suppliers pick up pallets and empty containers.
Require suppliers to take back or buy-back substandard, rejected, or unused items [3].

How to recognized tips for Construction Waste Reduction:

- Walk through your local used building materials store to see what they carry and accept.
- Plan Ahead. Make a waste reduction or recycling plan before starting work, and communicate it to all parties. Create a system of where things go so you handle materials as little as possible to save labor.
- Remove salvage items early in the process.
- Re-use scrap on the job. Use one centralized wood-cutting station to promote reuse.
- Look for materials on the materials exchanges (VBMX, NH Materials Exchange).
- Use standard dimensions to reduce cut-off waste.
- Get a grant from the State to create your own innovative project [17].

What is a green building product or material? Green building materials are composed of renewable, rather than nonrenewable resources. Green materials are environmentally responsible because impacts are considered over the life of the product (Spiegel and Meadows, 1999). Depending upon project-specific goals, an assessment of green materials may involve an evaluation of one or more of the criteria listed below [18].

Resource Efficiency can be accomplished by utilizing materials that meet the following criteria:

- Recycled Content: Products with identifiable recycled content, including postindustrial content with a preference for postconsumer content.
- Natural, plentiful or renewable: Materials harvested from sustainably managed sources and preferably have an independent certification (e.g., certified wood) and are certified by an independent third party.
- Resource efficient manufacturing process: Products manufactured with resource-efficient processes including reducing energy consumption, minimizing waste (recycled, recyclable and or source reduced product packaging), and reducing greenhouse gases.
- Locally available: Building materials, components, and systems found locally or regionally saving energy and resources in transportation to the project site.
- Salvaged, refurbished, or remanufactured: Includes saving a material from disposal and renovating, repairing, restoring, or generally improving the appearance, performance, quality, functionality, or value of a product.
- Reusable or recyclable: Select materials that can be easily dismantled and reused or recycled at the end of their useful life.
- Recycled or recyclable product packaging: Products enclosed in recycled content or recyclable packaging.
- Durable: Materials that are longer lasting or are comparable to conventional products with long life expectancies [18].

Product selection can begin after the establishment of project-specific environmental goals. The environmental assessment process for building products involves three basic steps. (Froeschle, 1999):

1. Research. This step involves gathering all technical information to be evaluated, including manufacturers' information such as Material Safety Data Sheets (MSDS), Indoor Air Quality (IAQ) test data, product warranties, source material characteristics, recycled content data, environmental statements, and durability information. In addition, this step may involve researching other environmental issues, building codes, government regulations, building industry articles, model green building product specifications, and other sources of product data. Research helps identify the full range of the project's building material options.

2. Evaluation. This step involves confirmation of the technical information, as well as filling in information gaps. For example, the evaluator may request product certifications from manufacturers to help sort out possible exaggerated environmental product claims. Evaluation and assessment is relatively simple when comparing similar types of building materials using the environmental criteria. For example, a recycled content assessment between various manufacturers of medium density fiberboard is a relatively straightforward "apples to apples" comparison. However, the evaluation process is more complex when comparing different products with the same function. Then it may become necessary to process both descriptive and quantitative forms of data.

A life cycle assessment (LCA) is an evaluation of the relative "greenness" of building materials and products. LCA addresses the impacts of a product through all of its life stages. Although rather simple in principle, this approach has been difficult and expensive in actual practice (although that appears to be changing).

One tool that uses the LCA methodology is BEES (**B**uilding for **E**nvironmental and **E**conomic **S**ustainability) software. It allows users to balance the environmental and economic performance of building products. The software was developed by the National Institute of Standards and Technology's Building and Fire Research Laboratory.

3. Selection. This step often involves the use of an evaluation matrix for scoring the project-specific environmental criteria. The total score of each product evaluation will indicate the product with the highest environmental attributes. Individual criteria included in the rating system can be weighted to accommodate project-specific goals and objectives [18].

The ReEPNP 2005-2012 lays down that the components of the Environment Protection National Programme as regards waste shall be accounted for by the following operational programmes (OPs): (i) Operational programme for waste disposal with the aim of reducing the quantities of disposed biodegradable waste, (ii) Operational programme for hazardous waste management (currently in preparation), (iii) Operational programme for collection of municipal waste (currently in preparation), (iv) Operational programme for packaging and waste packaging management, (v) Operational programme for waste oil management, (vi) Operational programme for battery and accumulator management, (vii) Operational programme for disposing polychlorinated biphenyls and polychlorinated terphenyls, (viii) Operational programme for construction waste management, (ix) Operational programme for reducing and preventing pollution due to titanium dioxide production waste, and (x) Operational programme for waste electric and electronic equipment management [19].

5 Reuse Lightweight Concrete

The process of reusing and recycling begin by product design and development. Some of these benefits may include: lower costs, stimulation of innovation, new business opportunities, and improved product quality [21]. Strategies for recycling building materials:

- Set a goal
- Select a contractor with proven recycling experience
- Use a Construction Waste Management Specification
- Monitor the waste reduction program [22].

If you look at the recycling facts, you will see that since 1990, the United States has improved dramatically in their recycling activities. Recycling facts report that fifteen years ago, the U.S. recycled roughly fifteen percent of our waste materials, which today has doubled to thirty percent! The following recycling facts are both interesting and fun bits of information to increase your knowledge on the art of recycling [4]. The process of recycling begin by product design and development. Some of these benefits may include: lower costs, stimulation of innovation, new business opportunities, and improved product quality [5]. Strategies for recycling building materials:

- Set a goal
- Select a contractor with proven recycling experience
- Use a Construction Waste Management Specification
- Monitor the waste reduction program [6]

Up until now, issues of modelling and improvement of heat protection and efficient use of energy in buildings have not been adequately addressed as it is required by sustainable development approach. Ecological concerns provided the need for intensive research of recycling of waste. Why is such kind of study important? Because of environmental protection:

- by minimizing waste,
- saving of fossil fuels due to recycling,
- to improving recycling process,
- optimized use of available resources,
- improved intellectual capital,
- optimized, effective and efficient processes,
- enhanced organizational performance, credibility and sustainability
- reduced costs [7].

A variety of raw materials are used to produce concrete from lightweight aggregates. One of them is Poraver®. The raw material for Poraver® is glass or – to be more precise – recycled glass, of which millions of tons are collected in the Federal Republic of Germany every year employing – to all intents and purpose – a perfect recycling system. Poraver® makes use of only the valuable raw material which for technical reasons cannot be utilised by the glass industry to manufacture new glass products, e.g. fine glass shards. Poraver® thus makes a decisive contribution to perfecting the glass recycling process, at the same time protecting natural resources. Apart from its areas of use in the classic building materials and additional building materials industry, Poraver® is also gaining popularity in special applications [8].
The objective of this study was to investigate recycling of construction waste of concrete from lightweight aggregates (density fromca 600 kg/m^3). A commercially available concrete from lightweight aggregates Poraver® was selected for this investigation. Volume of the reactor, dimensions 150 x 150 x 150 mm, was charged with rest, construction waste material of concrete from lightweight aggregates Poraver® and rest of volume with new raw materials of concrete from lightweight aggregates Poraver® used as binding. We made the new step as a recycling crushed construction waste from concrete from lightweight aggregates Poraver® and fresh concrete from lightweight aggregates as a binding. Recycling follow next activity by normal room condition:

a) assembling rest construction waste from concrete from lightweight aggregates Poraver® ,

b) crumbling into small pieces (Figure 2),

after that we took crumbled construction waste of concrete from lightweight aggregates Poraver® (mechanical reprocessing), as a raw input material in the processing line to the reactor,

c) charging of reactor volume with “new” raw material,
d) binding reaction between new raw materials of fresh concrete from lightweight aggregates Poraver® and rest material of construction waste from concrete from lightweight aggregates Poraver® ,
e) binding process,
f) cooling,
g) quality control.

Prescription of raw materials of concrete from lightweight aggregates Poraver® was used from producer. Granular size [mm] of crumbled waste concrete from lightweight aggregates Poraver® presents figure 2. From the results it can be seen that recycled “new” recycled material, concrete from lightweight aggregates Poraver® has characteristics as presents table 2.

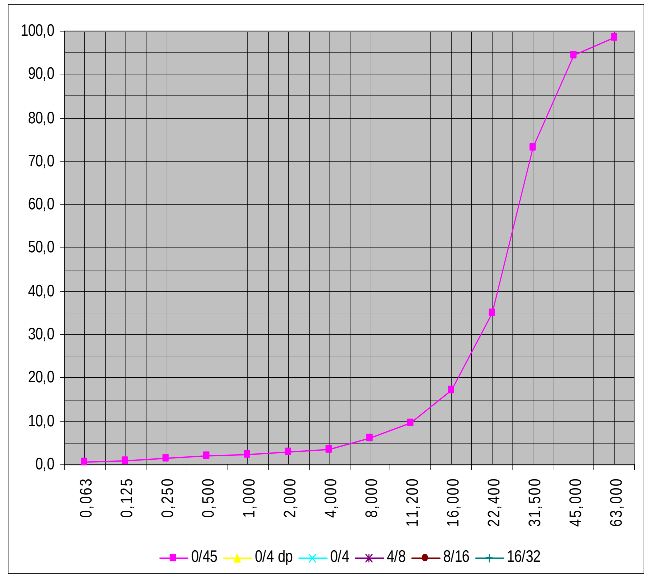


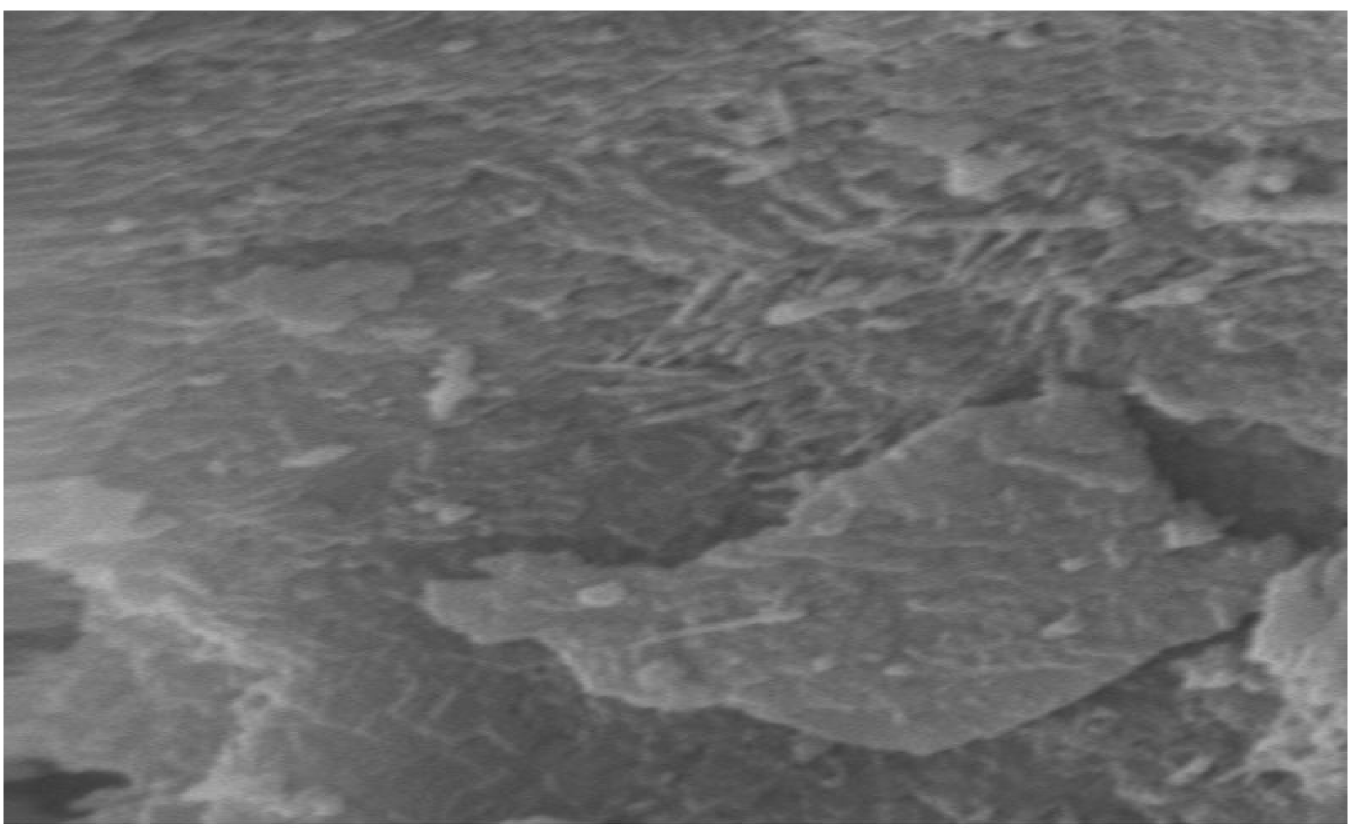
Figure 2: Granular size [mm] of crumbled from waste concrete from lightweight aggregates Poraver®

Test cube	-	Mass of LWC kg	Density kg/m^3	Compressive strength N/mm^2	Thermal conductivity W/mK
1	-	1,93	571,9	4,44	0,18
2	-	1,95	577,8	4,67	0,18
3	-	1,99	589,6	4,36	0,18
	Mass of waste LWC kg	Mass of recycled LWC kg	Density kg/m^3	Compressive strength N/mm^2	Thermal conductivity W/mK
4	0,2	2,15	637,0	4,31	0,19
5	0,2	2,14	634,1	4,22	0,19
6	0,2	2,18	645,9	4,04	0,19
7	0,4	2,12	628,2	3,33	0,21
8	0,4	2,12	628,2	3,64	0,21
9	0,4	2,13	631,1	3,82	0,21

Table 2: Characteristics of recycled material, concrete from lightweight aggregates Poraver®

Figure 3 and 4 present recycled material from concrete from lightweight aggregates Poraver®

Figure 3: Recycled “new” material from lightweight aggregates Poraver®



10000 x   3 µm

Figure 4: Recycled material from concrete from lightweight aggregates Poraver® scanning electron microscope

6 Conclusion

Construction Waste Management is a part of a growing movement toward a sustainable world. Sustainability or "green" management techniques are designed to protect the environment, save resources, and conserve energy. The use of construction waste management techniques which rely on salvage, recycle and reuse of materials have proven to have economic benefits for the construction industry [9]. In our contribution we propose a model of recycling construction materials, made of lightweight concrete, with aggregates containing expanded glass. The scope of the aforementioned model is to plan construction with minimum of waste and to improve energy efficiency in buildings. NSDS follows the general principle of the Renewed EU Sustainable Development Strategy and its key objectives. It covers its key challenges to a satisfactory degree as well and at the same time it integrates the Lisbon goals with the national setting. Slovenia is well aware of the fact that the principle of sustainable development necessitates to be perceived as a continuous process (and not as a one-time document) that has mechanisms set up for monitoring, reporting and adapting of the strategy if necessary. The theory on the basis of the practical experiences envisages sustainable development planning as a process of continuous improvement [20].

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