

Using a higher fraction of inert construction and demolition waste in precast elements made economically and environmentally sound – The VEEP project

Finding ways to re-employ concrete coming from construction and demolition waste is a key priority for the precast concrete industry in order to reduce the need for natural aggregates and to phase out landfilling. Such ways should both be environmentally sound (from a Life Cycle Analysis - LCA - perspective) and economically attractive.

Starting from a LCA perspective, the best use of recycled aggregates coming from concrete construction and demolition waste is in most cases for road base foundations and other geotechnical works. Compared to their use in the manufacturing of concrete (elements), this is due to the fact that recycled aggregates:

- provide a residual binding capability (useful as stabilising effect) for unbound applications like road base foundations;
- need less processing (grinding, sorting etc...) for their use;
- usually travel shorter distances (directly from the construction site to the geotechnical work site) and often do not need storage space.

Compared to the performances of other materials, the use or recycled aggregates in geotechnical works is not a "downscaling" of aggregates, because both uses achieve the same objective: the reduction of the need for natural aggregates. Considering that both concrete production and geotechnical works need aggregates (natural or recycled) and that recycled aggregates yearly available represents around 20-25% of the total needs, it is clear that at a large scale the use of recycled aggregates in concrete is not the most optimal solution. However, at a more local level (a City, a Region or even a Country), there are cases where these considerations are not valid anymore; for example, in high-densely populated areas with limited need of new infrastructure and difficult access to high quality natural raw materials. In such cases, the economic and environmental balance may lead to the satisfactory use of recycled aggregate in concrete manufacturing. In order to make this choice also economically attractive, further research is necessary. That's why BIBM decided to join

the project VEEP, funded under the Horizon 2020 research programme of the European Union - grant agreement n. 723582.

What is VEEP?

VEEP stands for "Cost effective recycling of Construction and Demolition Waste (CDW) in high added value energy efficient prefabricated concrete components for massive retrofitting of our built environment". In practice the project aims at developing two precast concrete panel solutions (for new and existing buildings) with excellent thermal performances (to reduce energy consumption) and manufactured with a high content of recycled inert materials (both for the concrete and the insulation material).

Ambition

The ambition of the VEEP project relates to different aspects as shown below: from the technological to the new processes development; from new materials to products development.

- Technologies
- Materials
- Manufacturing
- Products



Technological development

VEEP aims at developing the following advanced recycling technologies:

1. Advanced Drying Recovery (ADR) redesigned for modular construction and efficient onsite transportability and light weight (LW) concrete recycling;
2. Innovative mobile Heating-Air classification System (HAS) Pilot Plant (3ton/hour);

3. Combined ADR + HAS technology for simultaneous production of recycled concrete particles;
4. Ultra-fine wet grinding and health-safety refining technology.

Materials development

VEEP aims to enable the incorporation of higher levels of CDW inorganic recycled materials in new concrete. Today's most sustainable buildings are the result of partial or total replacement of natural aggregates or clinker with recycled aggregates and cementitious supplementary materials. Less than 5% of recycled concrete aggregates are currently used in new concrete manufacturing. Still replacement levels are typically limited to 20% to 30% of the coarse fraction of the recycled NW concrete aggregate. The use of ADR technology can lead to higher quality coarse recycled concrete aggregates and higher comprehensive strength up to 100% of the virgin coarse aggregate (50% of the total concrete weight) can be replaced by coarse recycled concrete aggregate without detrimental effect.

VEEP aims to develop, optimize and validate the following concrete containing diverse C&DW recycled fractions, under pilot manufacturing process and pilot execution conditions:

1. new green NW concrete containing at least 75% C&DW recycled materials
2. new green LW concrete recipes containing at least 75% of C&DW recycled materials.

VEEP will also develop, optimize and validate new aerogel composites formulations by incorporating at least 80% (by weight) silica containing CDW recycled material guaranteeing 40% reduction in energy consumption and costs (compared to existing solutions).

Manufacturing development

VEEP aims at integrating 3 manufacturing steps into an interconnected flexible pilot plant aiming to produce cost-effective sustainable aerogel composites guaranteeing thermal conductivities of 0.015 W/mK & reduction in energy consumption and consequent cost.

VEEP foresees also the introduction of plastic elements that will be embedded into Precast Concrete Elements solutions. By combining in fact hybrid traditional and 3D printing technology VEEP will create plastic sides and shuttering pieces for the horizontal formworks. The introduction of plastic elements in the formworks preparation will contribute to increase 15% productivity a day. Those plastic pieces will be used also to produce matrixes for textures.

Product development

Two novel cost-effective energy efficient precast concrete panel solutions containing high level (>75% by weight) of CDW recycled materials will be developed through the smart combination of concrete, cost-effective aerogel and plastic sides and shuttering pieces. The 2 Precast Concrete Elements solutions will be conceived both for new building envelope and for building refurbishment.

The Partners and the role of BIBM

Under the coordination of RINA Consulting Group (formerly known as D'Appolonia), 14 partners from 8 different countries collaborate to the success of the project. The consortium is mainly composed of industrial partners with a strong support of research organisations and academic institutions (the full list of partners can be found in the project dedicated website).

The role of BIBM is twofold:

- On one side, it brings the expertise of the precast concrete industry (in terms of needs for market, product and process development) to fulfil the objectives of the project;
- On the other side, it plays a major role in the dissemination of the project results within the precast concrete industry throughout Europe.

The project started in October 2016 and will deliver its results by September 2020. The first International Workshop was organised by BIBM on 17 May 2017 in Madrid, at the occasion of the BIBM Congress. The reason for organising a first event at the very beginning of the project was to engage with relevant stakeholders and steer together the research to be performed. This approach revealed to be a win-win success. On one side because relevant stakeholders can really be involved in the project as from the very beginning. On the other side because VEEP partners can take profit from the experience of external people and institutions acting in the field of energy and resource efficiency for an easier achievement of the project objectives.

Full information about the project can be found on: <http://www.veep-project.eu/>

Registration to the newsletter is possible here: <http://www.veep-project.eu/Register.aspx>

FURTHER INFORMATION



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