Ecoconcrete

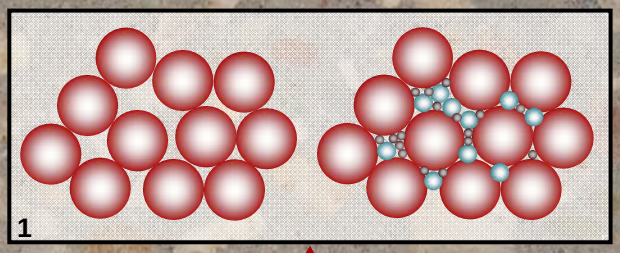
Optimizing concrete for ecology and economy

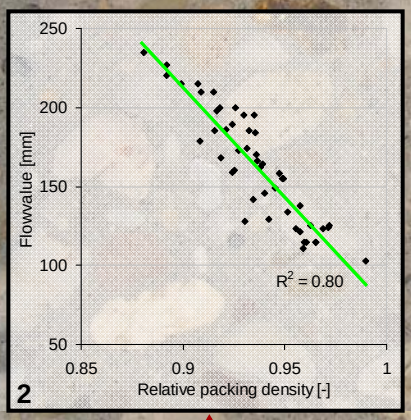
RESEARCH SCHOOL
INTEGRAL DESIGN OF STRUCTURES

Speerpunt BOUW

Subject

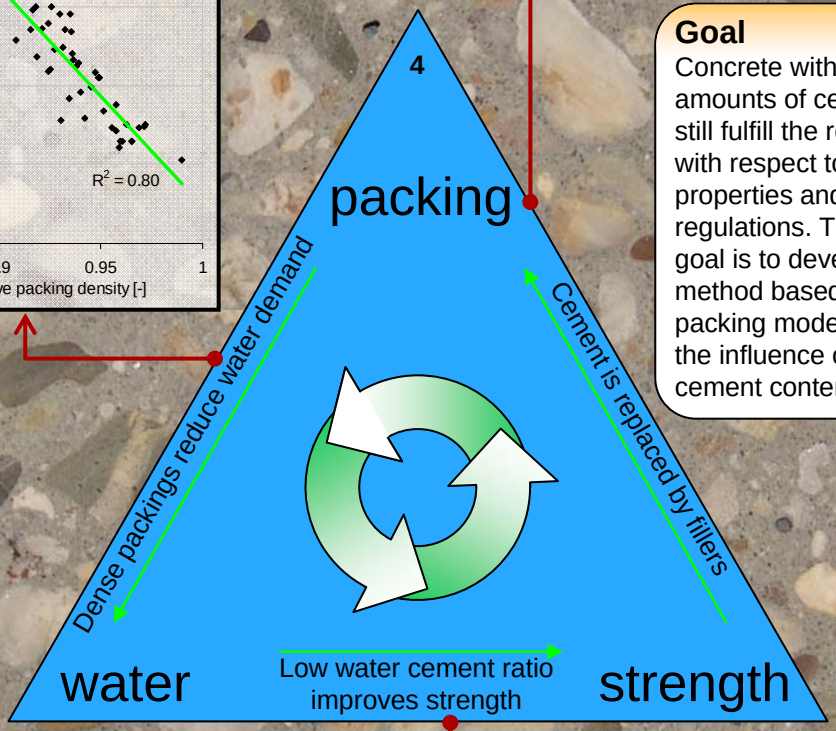
Concrete production is responsible for 3-5% of the total yearly CO_2-emissions. To reduce the environmental impact of concrete, cement can be replaced by secondary materials from other industries.





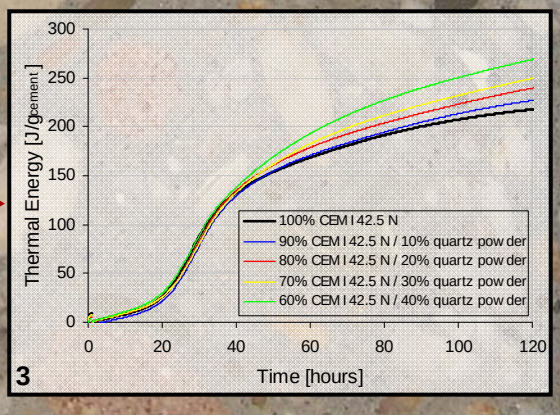
Goal

Concrete with lower amounts of cement should still fulfill the requirements with respect to material properties and safety regulations. Therefore, the goal is to develop a design method based on particle packing models to predict the influence of a decreased cement content in concrete.



Results

1. Improved packing model to optimize packing density of ecological concrete.
2. Increased packing density leads to increased workability or a lower water demand.
3. Combining cement with fine fillers increases thermal energy and strength.
4. Design cycle to optimize ecological concrete.



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Subject

Concrete production is responsible for 3-5% of the total yearly CO_2-emissions. To reduce the environmental impact of concrete, cement can be replaced by secondary materials from other industries. However, concrete with lower amounts of cement should still fulfill the requirements with respect to material properties and safety regulations.

Goal

Developing a design method based on particle packing models to predict the influence of a decreased cement content in concrete.

Research Question

How can particle packing models be used to predict the mechanical properties of ecological concrete from its basic components?

Strategy

Particle packing models are evaluated and an improved model, including micro-particles, is developed. Experiments on the packing of micro-particles are used to develop an optimized design procedure for ecological concrete mixtures. A number of optimized ecological concrete mixtures will be tested on strength, modulus of elasticity, shrinkage and creep.

Result

A design method based on particle packing models to optimize ecological concrete is developed. An improved packing model is used to optimize the packing density of ecological concrete. Replacing the cement by fine fillers increases packing density, which leads to a lower water demand. Combining the cement with fine fillers increases thermal energy and concrete strength. The design cycle is used to optimize the cement content until strength and material requirements are fulfilled.

Preferred Partners Applications / Sponsors

The research project is funded by STW. Cooperation exists with TNO Building and Environment and Heijmans Infrastructure. The results are useful for contractors, cement and concrete producers, material suppliers, consultancy and engineering firms, research institutions, governmental organisations, and universities.

Prime Publication

Fennis, S.A.A.M, Walraven, J.C., Uijl, J.A. den. (2009) The use of particle packing models to design ecological concrete. Heron, Vol. 54, Sept. 2009. pp 185-204

Research Period

2005 - 2010