

Review of Thesis

submitted in partial fulfilment of requirements for promotion to associate professorship

Specialization: Sustainable civil engineering materials

Applicant: Ing. Jan Fořt, Ph.D.

Reviewer: Dr Seyed Ghaffar, Associate Professor in Civil Engineering, Brunel University London

Thesis title: Development and assessment of sustainable cement and geopolymer composites

Importance of topic of thesis

Comments: Low-carbon concrete and types of cement are paramount for the construction industry and the thesis prepared by Dr. Jan Fort is significantly contributing to the achievement of some of the sustainable development goals via fundamental research contributions to low-carbon engineering materials. The topic of this research is very timely and significant for the current climate emergency and discussions around net-zero construction. Utilising more eco-friendly alternative cements requires research and this thesis has done exactly that with positive contributions for others in the field to built upon.

Superior Good Average Poor Not applicable

Method of solution

Comments: The work carried out is a major contribution of Dr. Jan Fort to the development and assessment of low-carbon innovative building materials. the methodology adopted is credible and sound. The chosen strategy for the investigation of this topic is appropriate and significant results have been already obtained. Further proving the suitability of the method of solution. All of the experimental methods chosen for each of the published works are of high quality. The division of the work carried out is logical and there are five sub-sections in which high-quality research papers related to the area are presented. All of the published journal papers are in highly relevant journals with a reputable background and high impact factors.

Superior Good Average Poor Not applicable

Quality and correctness of results achieved

Comments: Excellent quality of results is evident in the papers produced by Dr. Jan Fort and his collaborators in every single contribution to the scientific field. These are plenty of new data that can significantly impact the scientific community in this field by building on this work. Moreover, industrial stakeholders and SMEs can benefit from the low-carbon mix formulations developed as the results show the potential of up-scaling the process and reaching higher Technology Readiness Levels. The presented results are accurate and correct with professional presentation and more importantly scientific interpretation. This is the most highlighted aspect of Dr. Jan Fort's work in the field. The results and discussions are logical, concise, and scientific. Replacement of cement by supplementary cementitious materials and through alkali-activation of waste brick powder are both applicable to building practice and can have potential utilisation in a circular construction approach. The valorisation of end-of-life products through material science and material engineering is the significant merit of Dr. Fort's work.

Superior	<input checked="" type="checkbox"/>	Good	<input type="checkbox"/>	Average	<input type="checkbox"/>	Poor	<input type="checkbox"/>	Not applicable	<input type="checkbox"/>
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Originality of results achieved

Comments: Through the assessment of the reuse scenarios of waste materials, original contributions have been made to the field of science. Using LCA approach and focusing on carbon dioxide emission reduction have revealed very interesting and original results. Moreover the work on brick waste alkali-activation is a novel area of engineering materials science, where original know-how has been developed by Dr Fort's work.

Superior	<input checked="" type="checkbox"/>	Good	<input type="checkbox"/>	Average	<input type="checkbox"/>	Poor	<input type="checkbox"/>	Not applicable	<input type="checkbox"/>
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Publication rate of results achieved

Comments: The publication rate along with quality and quantity is exceptional. Most importantly the quality of the published work is of high standards.

Superior	<input checked="" type="checkbox"/>	Good	<input type="checkbox"/>	Average	<input type="checkbox"/>	Poor	<input type="checkbox"/>	Not applicable	<input type="checkbox"/>
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Response to results and citation rate

Comments: The published papers from the thesis are all highly cited on Scopus and Google Scholar. Indicating the originality of the work and the high quality of the presented results. The rest of the scientific community trusts and builds upon the results of the thesis compiled by Dr. Fort.

Field-Weighted Citation Impact (FWCI) shows how well cited the papers written by Dr. Fort are when compared to similar documents. This is a metric by Scopus. A value greater than 1.00 means the document is more cited than expected according to the average. It takes into account: The year of publication, Document type, and Disciplines associated with its source. The presented journal papers in this thesis have very high FWCI. The average FWCI of the five published papers in this thesis is 2.38. This is a great achievement and highly plausible.

Superior	<input checked="" type="checkbox"/>	Good	<input type="checkbox"/>	Average	<input type="checkbox"/>	Poor	<input type="checkbox"/>	Not applicable	<input type="checkbox"/>
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Applicability of results to development in the field and for further research

Comments: This work can serve as a strong foundation to build up research proposals for Horizon Europe and there is plenty of opportunity to demonstrate the developed innovative and low-carbon materials using the EU consortiums and partnering with municipalities, consultancies, and contractors. Moreover, the developed materials in this thesis can be assessed for the feasibility of the additive manufacturing process. Modern methods of construction, e.g., 3D printed building blocks and pre-fabricated elements off-site have great potential in reducing waste and lowering the carbon emissions of the construction sector. There is good compatibility between the low-carbon materials developed in this thesis and innovative manufacturing technologies. The results can certainly be further developed in future research where demonstration projects at pilot scale and industrial scale can help to commercialise the developed solution to the global challenges.

Superior	<input checked="" type="checkbox"/>	Good	<input type="checkbox"/>	Average	<input type="checkbox"/>	Poor	<input type="checkbox"/>	Not applicable	<input type="checkbox"/>
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Applicability of results to technical practice

Comments: The obtained data and outcomes from the conclusions of the study presented in the thesis by Dr. Fort are highly applicable to current practices. There is a need to transform the construction industry through more dedicated and direct replacement of current, energy-intensive

with highly negative environmental impacts, with alternative low-carbon solutions. The thesis has exactly done that and therefore is very applicable to technical practice. Moreover, the LCA study proves the environmental feasibility of the proposed solutions (i.e., materials) for implementation in the built environment sector.

Superior Good Average Poor Not applicable

Compliance with requirements on thesis – quality of thesis

Comments: The work is fully compliant with the requirements of the thesis and the quality is outstanding. The work carried out is in-depth and comprehensive.

Superior Good Average Poor Not applicable

Comments

Overall evaluation of thesis

This is excellent work that meets all of the criteria assessed above in a superior manner. The work is original and novel and the outcomes are crucial for the construction industry to achieve lower carbon emissions.

Additional comments on the thesis and the author:

Excellent work which hopefully will continue and be expanded upon. More research proposals have to be developed on the basis of this thesis and funding should be sought from Horizon Europe with collaborators around the EU. It is highly recommended to take this work to the next stage and build a higher technology readiness level.

Promotion to associate professorship recommended

yes

no

Date:

Reviewer's signature:

