The importance of visuals in communicating engineering knowledge to architects

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Decision support for large-scale remediation strategies by fused urban metabolism and life cycle assessment

Purpose: This paper seeks to identify the most environmental friendly way of conducting a refurbishment of Broendby Strand, with focus on PCB remediation. The actual identification is conducted by comparing four remediation techniques using urban metabolism fused with life cycle assessment (UM-LCA) in combination with information relating to cost and efficiency of the compared techniques. The methodological goal of our paper is to test UM-LCA as a decision support tool and discuss application of the method in relation to large refurbishment projects. Methods: To assess the environmental performance of PCB-remediation techniques, the UM-LCA method was applied. By combining UM and LCA methodologies, the total environmental impact potentials of the remediation techniques were calculated. To build an inventory for each technique, we contacted and interviewed experts and studied existing literature, cases, and projects in order to compile information on practical details of the techniques. To process the collected inventory data, we used the simplified product system modeling software Quantis Suite 2.0 (QS2.0). In order to validate the results from the simplified software, we carried out the exact same analysis using a more complex toolâ€”OpenLCA 1.5. Based on the assessment results, we compared the remediation techniques and identified the techniques with the smallest and largest environmental impact potentials. Results and discussion: The results obtained are presented, and the technique with the smallest impact identified. A comparison between the two software tools applied is made, and differences between the two are discussed in detail. Further discussed is how possible inventory errors affect the results and if any assumptions should be considered as critical for the final results. Furthermore, are the remediation efficiencies of each technique and the cost of each method considered and compared. Finally, UM-LCAâ€™s ability to work as a tool for decision support is discussed and possible ways of implementing the method in sustainable decision-making is considered. Conclusions: In this study, it is found that the most environmental friendly PCB-remediation technique is thermal desorption, whereas the technique with the largest environmental impact potential is sand blasting, due to the environmental impacts induced in relation to disposal of the building waste. It is concluded that the UM-LCA method can be applied as a tool for decision support, and if economic aspects are incorporated, the UM-LCA approach could be an essential approach for designing
sustainable buildings.

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How does sustainability certification affect the design process? Mapping final design projects at an architectural office

The context of the study is the very strict regulation of energy consumption for operating buildings in Denmark. It is difficult to meet the requirements by system optimisation in the final design phase, so recent research has focused on ways of meeting the target by adapting the whole design process and informing the industry of them. This has led to optimised design processes such as Integrated Energy Design, in which many decisions related to energy consumption and indoor climate are made in the early design stages. The current tendency is to use an expanded notion of sustainability, derived from the sustainability certification system itself, and to apply it even in the early design process. This perspective emphasises all phases of the life cycle of a building. The goal of the present study was to map how a Danish architectural office approached sustainability in the projects they undertook in the course of a year. All the projects concerned were intended to conform to the German Sustainability Certification System DGNB. We developed a mapping tool to document these case projects and found that different sets of certification criteria were used in each project. This demonstrates the complexity of using them as design parameters in practice, but also that it was successfully achieved.

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Integrated design processes – a mapping of guidelines with Danish conventional ‘silol’ design practice as the reference point
This research maps various Integrated Design Processes (IDPs) with Danish conventional silo Design Practice as the reference point. The intention was to identify generic elements that are common among IDPs. The mapping was based on a literature study of a number of IDP guidelines. Eight IDP guides from the last two decades were selected for mapping. The Danish Description of Services functions as a typical representation of a conventional silo Design Practice (CSDP) and as a ‘scale’ against which to map the selected IDP guides. The results indicate a limited consensus on what constitutes an IDP but a possible consensus core that is shared by them all. One commonality is that technical knowledge must inform design decisions, and not simply be used to validate them, but on the other hand, it should not drive them. Another main trait is the interdisciplinary character of these processes, where several professions must be a part of the process from the beginning. The study also found that all IDP guides have a ‘black box problem’, where the desired inputs and outputs of the process are known but no explanation is given regarding the mechanisms of how the integrated design decisions are to be made or how to facilitate this decision-making in an interdisciplinary design team. These findings can explain the slow adoption of IDPs in the building industry and they can be used to improve IDPs and increase their implementation in integrated building design.

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Integrated Energy Design and Life Cycle Assessment in Design Processes for Refurbishment

This paper investigates the state-of-art for using the DGNB Sustainability Rating System, Life Cycle Assessment, and Life Cycle Costing in the Danish building industry, and how well this use is aligned with the Integrated Energy Design process in refurbishment projects. An optimal method for including all aspects of sustainability in the design process is developed based on a literature review, interviews of professionals, and a mapping of design processes at a Danish architecture firm that specializes in sustainable architecture. Finally, the paper reflects upon the final design process presented in this work, considers what is needed to implement this design process, and envisages the impact of this practice on the building industry.

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Mapping one year’s design processes at an architecture firm specialized in sustainable architecture - How do sustainability certification systems affect design processes?

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