TALLINNA TEHNIKAÜLIKOOL
EHITUSTEADUSKOND

Ehitustootluse instituut

KVALITEEDITEHNIKA JA TAGUCHI MEETOD KVALITEEDI TAGAMISEKS EHITUSE PROJEKTEERIMISES

QUALITY ENGINEERING AND TAGUCHI METHODS FOR QUALITY ASSURANCE IN BUILDING ENGINEERING

EPJ 60 LT

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SISUKOKKUVÕTE EESTI KEELES:

Ehitusvaldkonnas on siiani keskendutud kvaliteedile ehitusplatsil, kuid projekteerimise faas on saanud vähe tähelepanu. Kvaliteeti on aga võimalik efektiivsemalt mõjutada just projekteerimisprotsessi käigus. Seetõttu keskendus antud töö kvaliteedi tagamisele projekteerimise käigus. Töö eesmärgiks oli avardada arusaama kvaliteedikontrollist ja –juhtimisest ning pakkuda välja uusi suundi. Esmalt on toodud kirjanduse ülevaade kvaliteedimeetoditest üldiselt ning kvaliteediolukorrast ehituses. Selleks, et uurida ehitusvaldkonna kvaliteedijuhtimise trende ja võimalusi viidi läbi intervjuud timmitud ehituse ja projekteerimisvaldkonna ekspertide ning akadeemikutega. Intervjuude tulemused kinnitasid, et kvaliteet on ehituses probleemne temaatika ning meetodeid selle tagamiseks kasutatakse vähe. Pakuti välja võimalikke tulevikusuundi ja meetodeid, mida saaks ehituses kasutusele võtta projekteerimisprotsessi efektiivistamiseks.

Juhtumiuuringu näol katsetati Taguchi kvaliteeditehnika meetodit, mis seisneb sisendparameetrite leidmisel nii, et väljundis oleks esile kutsutud võimalikult väike hajuvus. Taguchi pakub optimaalsete parameetrite leidmiseks välja robustkavandamise meetodi. Tulemuste kontrolliks kasutati ka aktsiomaatilise kavandamise meetodit. Juhtumisuuringust selgus, et käesoleval juhul ei olnud ette antud süsteem robustne ning seetõttu ei saavutatud soovitud tulemust. Meetod ise on sellegipoolest ehitusvaldkonnas hõlpsasti rakendatav ja on abiks kvaliteedi sisseehitamisel ehitisse juba projekteerimisprotsessi käigus. Selleks, et Taguchi meetodi efekt oleks maksimaalne, tuleb robustsusele tähelepanu pöörata juba kontseptsiooni loomisel ehk süsteemi kavandamisel.

SUMMARY OF MASTER THESIS:

The aim of the current thesis was to broaden the contemporary view of quality management in construction. Traditionally, quality related methods have focused on quality control on the construction site, while quality in design has got less attention. Due to the numerous problems occurring in the industry, there is a need for a change in quality management procedures. For that reason, this thesis focused on quality management in the design phase. A literature review was carried out to gain knowledge of the state of the art of quality engineering and management. Based on the research, quality related methods have evolved from simple inspections to advanced methodologies, methods and techniques. The definition of quality focusing on customer satisfaction in addition to conformance to requirements is becoming more popular. Total Quality Management is the most comprehensive quality management concept which involves different methods, systems and tools for managing quality. This thesis focused on quality engineering methods; more specifically, on robust design. Quality engineering aims at building quality into the product in the first place rather than fixing existing problems. Description of the current quality situation in construction industry was also based on literature review. The industry has a bad reputation due to numerous problems occurring, including poor quality but not many methods are used to improve the situation. The current situation refers to the fact that the industry has a lot to learn in terms of quality engineering and management. There are many methods and techniques in manufacturing that could be implemented in construction if construction project delivery peculiarities are taken into account. The latter means that these universal methods and tools must be adopted to construction context. In order to discuss the current trends and opportunities in construction industry, interviews with lean and design experts and academics were conducted. The interview results revealed that in advanced practice, several quality management and engineering methods are implemented but they are not widespread. To name a few, visual management, quality circles, statistical process control were mentioned.

As the thesis focused on evaluating if quality engineering, specifically robust design methods could be deployed in building design, a case study was conducted. Taguchi's method was used to assess the macro-economic decisions in developing renewable energy strategies. The aim of the case study was to evaluate if it could also benefit the construction industry. The parameter design method provides steps to discover the best combination of product or process parameters to achieve the desired performance.

Axiomatic design's information axiom was used to control the results of Taguchi's robust design. In both cases, the most robust parameter combination was selected but the response was not as close to the target as desired. Whereas in current case the system itself was not robust, it can be concluded from the study that quality engineering and Taguchi's robust design really are applicable in building design. It was concluded from the case study that robustness needs to be addressed during the conceptual design phase in order to achieve maximum effectiveness of the Taguchi method. Future research is suggested regarding system design and the implementation of Taguchi's robust design in different construction applications, such as structural engineering or energy efficiency.