Abstract

Buildings of underground utility and traffic infrastructure are often technical and cost-intensive construction projects. In terms of technology, efficiency and sustainability, they provide high demands on the planning process. This applies particularly when in their basic functionality several equivalent appearing construction methods compete in terms of technical and economical criteria. As part of a holistic approach also ecological and socio-cultural constraints are considered increasingly. The planning development of a structural infrastructure is the individual result of the interaction between complex planning factors, specific objectives, heterogeneous factors and personal decisions by involved project participants. A shortcoming of the current approach is that a decision on the basis of an insufficiently documented planning process and the missing confirmability of the evaluation results is often not testable and therefore not transparent. The consideration of holistic aspects in an evaluation method and the addition of project-specific relevant assessment criteria promotes the transparency of a made decision, so that besides building owner and planners, also groups of public and policy can track the planning process. The ability to monitor, control and reconstruct the planning decision is a prerequisite for an efficient decision-making process. A goal of this work is the development of such transparent decision making method to determine the best construction method. An efficient and transparent planning phase occurs when the planner has a tool that combines the heterogeneous targets taking into account the economic, environmental, technical and socio-cultural constraints. In this work the analyzed multi-criteria decision-making methods are based on mathematical foundations and a stringent approach. The specification of a methodology allows to follow up the full insight into the criteria and their weighting in the decision-making process. This control mechanism of such a multi-criteria methodology promotes the transparency of the made decision. Thus, the occasion for the development of a holistic decision analysis model is based on the barely missing application of these methods to date. In this work, the multi-criteria decision making method AHP (Analytic Hierarchy Process) is used as a scientifically recognized procedure for solving complex decision situations. Through pooling of expertise and by incorporating elements of the fuzzy set theory, individual decision constellations are represented as information. The immanent uncertainties and risks of major projects will also be included into the decision model by using uncertain and fuzzy data. In this work, first classical decision models are studied with respect to their adaptability for the present problem. Subsequently, the decision analysis model is developed which is extended by factors of uncertainty and fuzziness. The research goal of this work is the development of a Decision Analysis model, which ensures a sustainable and transparent decision for the choice of a construction method by integration of fuzzy and uncertain aspects. The developed model has made in the development of self-programmed software DEMUS², which is validated to a project. In the long term the application of the decision model is to make the planning process more effective and leads to an increase of the project acceptance. Project participants get a method that can unify the diverse objectives and different perspectives in one decision model in terms of technical, economical and sustainable aspects in compliance with economical risks so that a transparency of the decision-making process is given.