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Ambient-adequacy, a Missing Requirement

"Compatibilité avec l'environnement": une exigence manquante

Umwelt-Verträglichkeit, eine fehlende Anforderung

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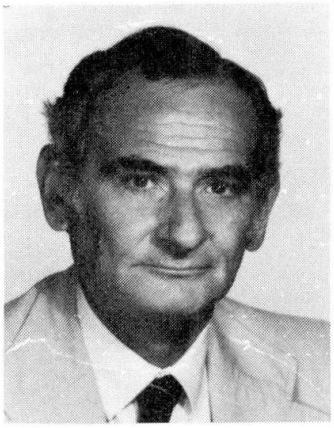

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SUMMARY

The ambient-adequacy concept is presented and proposed for introduction into Codes. It leads to refer the requirements of safety and serviceability not to the structures but to the persons (users) and to make a distinction between direct and indirect users as well as between direct and indirect hazards. It also points out the importance of the very early stages in the construction process and the need of dealing with such stages in current Codes.

RESUME

Le concept de la "compatibilité avec l'environnement" est présenté. L'auteur en recommande son introduction dans les normes. Selon ce concept, les exigences de sécurité et de serviciabilité ne sont pas posées aux constructions mais à ses utilisateurs. Il fait une distinction entre utilisateurs directs et indirects, de même qu'entre danger direct et indirect. Le concept souligne également l'importance des premières phases dans le processus de construction, ce dont il faudrait tenir compte dans les normes actuelles.

ZUSAMMENFASSUNG

Das Umwelt-Verträglichkeits-Konzept wird vorgestellt und zur Einführung in Normen empfohlen. Das Konzept soll dazu führen, dass die Anforderungen für Sicherheit und Gebrauchstüchtigkeit nicht für Bauwerke, sondern für den Menschen aufgestellt werden, und dass zwischen direkten und indirekten Benützern als auch zwischen direkten und indirekten Gefahren unterschieden werden soll. Das Konzept betont ebenfalls die Wichtigkeit der allerersten Phasen innerhalb des Bauprozesses und Notwendigkeit, diese in Normen adäquat zu behandeln.

1. INTRODUCTION

Codes will be written increasingly in form of performance criteria. The concept of performance demands a clear definition of the requirements a building is expected to meet. In the structural field, basic requirements traditionally considered are Safety, Serviceability and Durability. At another level, Economy and Aesthetics are sometimes added.

Three simple examples will show that an important basic requirement is missing.

1.1 Example 1

A new highway is constructed, just fulfilling all requirements in present Codes. Years afterward, an extraordinary flow of water coming from unusual raining is deviated by the embankement of the highway. As a consequence, inundations occur in a village where never such a problem arised before, with the corresponding losses in lives and goods. Safety failed.

1.2 Example 2

A new tall building is erected, just fulfilling all requirements in present Codes. As a consequence, wind regime is modified in the neighborhood, this producing a disturbing vibration in existing tall buildings of the area. Serviceability failed.

1.3 Example 3

A new construction provokes a derivation of underground stream of agressive water, this producing a decrease of Durability in another existing structure.

It is evident that new constructions must not interfere negatively the existing constructions nor the ambient. This is a basic requirement that, up to now, has not been explicitely introduced in Codes. In the following, the wording ambient-adequacy will be used to cover the idea. Several considerations are to be made around this concept.

2. DEFINITION OF AMBIENT-ADEQUACY

To define ambient-adequacy is not easy. Obviously, the definition must cover the idea of not producing a significant decrease of safety, serviceability and durability in existing constructions. But two problems immediately arise, the first one concerning quantification, the second one concerning extension.

2.1 Quantification

What is the meaning of "significant decrease"? How much decrease are we prepared to accept? It is evident that asking for a zero decrease is not reasonable. Can the decrease be quantified?

2.2 Extension

When defining ambient-adequacy, the condition of "not interfere the existing constructions" is only a first approach. In a wider sense, ambient-adequacy must also cover negative influences in the zone. In other words, the quality of life in the area should not be decreased by the new construction. How far

Codes must go in the description of possible damages and where to establish the border line are both difficult points.

2.3 Examples

Again some examples can illustrate the difficulties:

A tall building is constructed near an airport. Air traffic can be affected. //. A quiet zone in a small village is used by people to rest and chat in sunny days. A building is constructed, just shadowing the zone. //. Tall buildings at the sea-side usually disturb the quality of life of inhabitants. //. Are nuclear power plants degradating quality of life? .//. Should ambient-adequacy cover ecology?

3. HOW TO INTRODUCE AMBIENT-ADEQUACY IN CODES

A first possibility in order to cover it in Codes is to introduce a new limit state for structures. Codes could then say that:

"Structures must be designed in such a way that they fulfill the requirements of safety, serviceability, durability and ambient-adequacy".

This is not a perfect solution for two reasons. First, the condition of ambient--adequacy refers to safety, serviceability and durability at the same time (see examples in item 1) and therefore can not be placed at its same level. Secondly, ambient-adequacy has to be taken into account from the very beginning of the building process (promoting-planning), the design stage being often too late to avoid disturbances.

A convenient solution is to refer the present requirements (or limit states) not to the structure as present Codes do but to the users and to clarify that there are two kinds of users:

- Direct users, who directly benefit of the building; and
- Indirect users, who are direct users of sourroundings constructions and even the community, which can be affected by the building.

In a correlative way, a differentiation must be made, when analyzing hazards, between direct hazards (which mean hazards for the structure and relate mainly to direct users) and indirect hazards (which mean hazards because the structure and relate to indirect users).

This solution leads to include in Structural Codes a clause with the following (or alike) wording:

> "The aim of the building process is to safisfy a human need, expressed by means of basic requirements. To fulfill the basic requirements, structures must ensure an appropriate degree of safety and an adequate performance in normal use, during a reasonable period of time, to all users, not only direct users (who directly benefit of the building) but also indirect users (who are direct users of sourrounding constructions) and the community. To fulfill the structural requirements, adequate decisions have to be taken at each stage of the construction process: promoting, design, materials choice, execution and use".

4. THE IMPORTANCE OF QUALITY ASSURANCE (QA)

Hazard analysis and, in particular, indirect hazard analysis, is of paramount importance at the promoting stage. This points out the concern of QA concepts, as they permit to deal with all stages of the construction process in an integrated way. As said in item 1.3 of (1), until now engineers have been confined in the three intermediate stages of the process, design, materials and execution. As a matter of fact, most of Codes are divided in three main chapters dealing with these three activities. But it is evident that quality depends not only on these phases but also on the other two, promoting and use. In particular, the promoting stage is of utmost importance as in it a great deal of main decisions are taken with a direct influence in the final quality. This is illustrated in Fig. 1 taken from (2).

Ambient-adequacy has to be taken into account when adopting basic, performance and design decisions. Therefore, ambient-adequacy affects not only the promoter (owner, client) but also the structural designer.

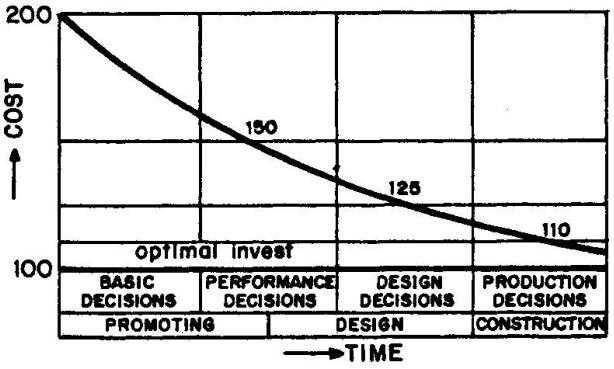

Fig. 1 Cost of wrong decisions

On the other hand, QA approach emphasizes the figure of the user, which is the only one giving a sense to the construction process. The user will perform an increasing relevant role in the technical literature. This has been already recognized when introducing the performance concepts in new Codes, as performances are no other thing than translation of a human need into a technical language.

The fact that the term user covers also indirect users must be emphasized everywhere in the future. We all are users of all constructions (we look at them, we live with them). The ugliness of most of our cities is probably due to the fact that, up to now, the term user has been considered as synonimous of direct user, just forgetting indirect users and the community.

The ambient-adequacy requirement permits to open the door of the technical field to social values of growing concern -such as ambient impact and ecology- and aggrandizes the social dimension of our profession.

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