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Concluding Remarks

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I was asked to comment on the first four contributions that seem to have some relation to my introductory report "Safety - a Socio-Economic Decision Problem". The comments should stimulate the free discussion foreseen in a few minutes.

In the introductory report, some basic questions concerning the safety of structures have been put:

. What means "safe"?
. How safe are structures?
. How safe should structures be?

These questions seem to be astonishingly difficult to answer by technical experts. But nevertheless, they are probably the questions in which the general public is primarily interested in.

It looks as if we are not going to be spoilt with answers during this Congress. It is probably rather typical that the attempt to handle the safety problem in a more transparent and out-put oriented way are mainly contributions from not really traditional areas of structural safety.

The approach presented by Dr. Bamert originates from the field of fire protection. In this field, two things are maybe more obvious than in other fields of structural safety. One fact is that we have considerable damages every year. On the other hand, it is obvious that the available means will never allow us to strive for absolute safety. These may be the main reasons that in several countries fire safety has been analyzed rather consequently from an economical point of view. The experience shows that this leads automatically to a more realistic approach than purely technical approaches.

Another attempt to answer the question "How safe should structures be?" comes also from a special field of structural safety. Professor Yamada presents in his paper an approach to seismic safety for structures. Earthquakes also represent a somehow uncommon load for structures. On the other hand, they may affect a very large number of structures simultaneously, thus potentially being able to create a real catastrophe. On the other hand, it is rather obvious that we cannot afford to design all buildings for the maximum loads which have been observed. Earthquake safety is probably one of the most advanced field in structural safety.

Dr. Melchers makes reference to the introductory reports coming from still another side. We gradually realize that human errors are one of the crucial

problems remaining to be investigated if we want to improve the safety of structures. But as soon as we start to look at this problem in more detail, we realize that we will not be able to overcome it with our traditional way of thinking. Only if we are able to show the effectiveness and necessity of more controlling measures and legal sanctions, we will be able to impose more measures of this kind on the professional society.

The only paper assigned to this part of the discussion containing a basic approach to structural safety is the paper presented by Augusti and Casciati, I would like to limit my comments to this paper to one point. It is basically plausible to maximize the overall utility of a structure and deduce the optimal safety level from this. Nevertheless, this approach has produced more problems than solutions in most practical applications. The reason is that it is even more difficult to assess the social benefit of technical systems than to assess their safety. But in general, one can observe that the considerable effort which has been made in other fields concerning the safety problem has obviously not found much response in structural safety.

In the introductory report, an approach to answer the above mentioned questions is presented. The two main points are:

. We should introduce a real measure for safety. This has to be a function of the expected losses or damages of a hazardous system.

. We should more consciously be aware that safety decisions are basically social value judgements. These judgements should not be mixed up with the technnical analysis of hazardous systems.

But why should we bother about all this if we get along in the traditional way? I would like to put three questions in this context:

. Are we sure that the effort we make to reduce the different hazards of structures are distributed in a optimal way?

. How do we integrate structures in a consistent way into complex technical systems from a safety point of view?

. How do we know which effort we should make for the safety of structures as compared to the effort made to avoid other hazards?

Safety has mainly been regarded as a sub-problem of each single technical activity including hazards. The main effort was oriented to the reliability and operability of the technical system. In the future, safety may increasingly become the primary criterion for the assessment of new technical developments. In this situation, we must be able to answer questions like:

. What means "safe"?
. How safe is a given system?
. How safe should a system be?

We cannot solve the problem of structural safety just from an insider's point of view - we always get lost in more sophisticated, but nevertheless traditional - so-called safety analyses. Let's go ahead answering the above questions from a broader context, from an outsider's point of view. Maybe we get the answers quicker and clearer. I hope this Seminar - even if the answers are not given here and today - will initiate research activities in this sense.