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**Autor:** Turkstra, Carl J.  
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## Closing Discussion

- Moderator: Carl J. Turkstra, Prof. Dr.  
Polytechnic Inst. of New York; New York, NY, USA
- Panelists: Bernd Hillemeier, Dr.-Ing.  
Hochtief AG, Frankfurt, Fed. Rep. of Germany  
Franz Knoll, Dr. sc. tech.  
Nicolet, Chartrand, Knoll + Associés; Montréal, PQ, Canada  
Robert E. Melchers, Senior Lecturer  
Monash Univ.; Clayton, Vic., Australia  
K. Srisikandan, Chief Highway Eng.  
Dep. of Transport; London, UK  
Yoshio Yokoyama, Dir.  
Ohbayashi Corp.; Tokyo, Japan

**C.J. TURKSTRA, USA, MODERATOR**

I would like to begin this discussion once again with a very brief comment from each of the panelists.

The theme of these quoting comments should be: What have we all learned in this conference, what are our impressions and what we think are the things that should be done and the best directions for future activities.

One curious aspect of this conference from my point of view was the rather surprising rebirth of a concept that I thought we had buried 15 years ago - the concept of absolute safety or the idea that could we build a building that has no probability of failure. Experience suggests that this is clearly false. Apparently there is still a residual apprehension concerning reliability analysis which I think is unfortunate because we have so much experience now. We know what reliability analysis can do for us. We also know what it cannot do for us and all of us in the business are aware of its limitations.

We have also learned that people are not optimizers. We are all try to do the jobs that we have as well as we can, working within the constraints that we have. We have learnt that we sometimes don't do as well as we would like, but we are not in a position to find optimal solutions to our problems because of very many uncertainties and a great lack of information. Personally I think that one of the greatest benefits of this conference has been to see how different organizations and different societies approach the problem of organizing the construction system.

Here I have a slide which represents the American system with the owners and designers and contractors fighting it out while the lawyers sit perched on our shoulders, ready to do what they have to do. It was very interesting to see how the Japanese seem to solve these problems of conflict by ensuring cooperation between components of conflictual situations. From a personal point of view, this international conference in Tokyo has been very educational.

**F. KNOLL, Canada**

I have two comments and they concern what I have been asked to look at and to say by one of my colleagues this morning: It is to look into the future for our academic and engineering endeavours. I would see two tasks for us to go on working, concerning quality assurance, one of them is analytical in a classical sense, it is to go on developing the models for the construction process and perhaps of the errors and their occurrence and make them ready for the study of practical cases, which, they are presently not, as we all learnt.

The second task would be quite related to the first one, but would be more of a synthetic or creative nature in the sense of design if one wishes: it is to develop strategies for the improvement of the quality of systems, it is the development of checking techniques, improvement of management systems and the human background that people are working in.

I was also asked to say something about what type of conferences should be held in the future on the theme and two distinct types are outstanding in my memory at the moment; that was the conference on the Rigi 3 years ago and the present conference in Tokyo and I believe both had their merits and both should be held and repeated,



maybe in a somewhat modified form. The conference on the Rigi was a gathering of people, of a high degree of information on the subject, where research opinions were exchanged. The meeting in Tokyo was perhaps more oriented towards dissemination of that knowledge. I think both are of the essence.

**B. HILLEMEIER, FR Germany**

In my opinion, IABSE can be the most effective international platform for gathering evaluation feedback of information in construction engineering. We, here as the delegates of our countries, companies and institutions, are the link for that feedback to our people at home.

Differences and similarities between the different countries in assuring safety and quality should be evaluated to improve one's own organizational and technical measures for ensuring quality.

We should also look for quality assurance measures to obtain more durable structures. Construction in my opinion means permanent struggle against water. Bad durability ruins the good reputation of construction works and of our profession. Durability is evidently one of those properties that cannot be obtained by checking only, as we all know. Here more must be done that goes into design, materials and maintenance and asks for quality assurance.

**R. MELCHERS, Australia**

I want to make two comments. The first is, that my impression is very much that the attitudes we take towards quality assurance are dominated by our legal systems or the legal framework, within which we work in each country and that reflects the cultural system of the country in which we operate. The experience in one country is not necessarily immediately useful for that in another, because we cannot easily change culture. But we ought to consider seriously whether to change the legal system as it affects engineers. It seems to me this is a political act and it is an extravert type of action, which is not the sort of thing which engineers generally tend to take. Of course we can also optimize within the existing legal situation and that is very much the sort of discussion which we have been having today and over the last few days.

As an academic I believe it is important to pursue the sort of comments that Carl Turkstra made in the beginning and that we ought to, as a profession, look more seriously at modern decision making tools, risk analysis, reliability theory, cost benefit analysis and so on, as that relates to risk and reliability. I have a suspicion that the message is not quite getting through to much of the engineering profession.

**Y. YOKOYAMA, Japan**

In the opening discussion I outlined the Japanese way of quality assurance by integration of people in the departments concerned. In the various sessions this has been explained from different points of view. After listening to various impressive reports and the discussions, I personally realised that there are some differences between the ways of quality assurance in various countries. For example, the checking systems for design and construction was one of the major topics in this Symposium. I learnt that most speakers, other than Japanese, seem to prefer checking by outside organizations. However, in the Japanese way, checking to prevent error is



made within the group which is responsible for the design and the construction. I got the strong impression that our system is only justifiable or acceptable in the Japanese climate under the present business circumstances. I believe that the Japanese engineers and contractors cannot be isolated from the rest of the world, and when working overseas, I think Japanese organizations should consider employing some checking system which the people under different traditions or different social structures can feel confident in. - In this sense I learnt a lot in this Symposium and I believe most fellow attendants from my country obtained a similar understanding from this conference.

**K. SRISKANDAN, UK**

I am here representing a public authority and in the opening panel discussion I stated that one of my concerns was to determine, how much resources should be devoted to the control of quality and how these should be divided between the various stages of the building process. From what has been said at this Symposium, I am led to conclude that it will be a considerable time before any reliable scientific information becomes available and, therefore, we will have to continue in the same pragmatic way as we are now.

In talking to colleagues in other governments, they were also asking the same question, and the only thing that seems to be different between the various countries is that we are all working within different legal, social and environmental constraints. But otherwise, I think, we have to continue as we have and learn as we go along.

**MODERATOR**

Thank you very much. Perhaps one or two members of the panel might react to some of these comments. I have been struck at this meeting by what I feel to be strong support for the concept of gathering data on errors and trying to deal with them in a more academic way, in a more organized scientific way and, as a Professor, I find that very encouraging. I would perhaps ask Dr. Knoll, who is a practicing engineer, if he thinks this line of research can be productive and if we can theorize and construct useful models of these problems.

**F. KNOLL, Canada**

Thank you Carl for throwing me the ball. I would like to say that I have seen a number of efforts that have already started in the field of gathering information about errors in their own ways. In the Western society these efforts are usually hampered by the implications of the legal system and the insurances etc. which make for some incentives to keep data secret. Recently this climate has improved a little and what I hear from people running AEPIC for instance, the US system of collecting data on accidents, is that they feel that they have easier access to the data, than they used to have. So there is some hope that we are going to have the data and then of course the data will have to be worked on and will have to be put into a presentable form so that the practice can profit from this effort.

**MODERATOR**

Specifically, is it an activity that lends itself to mathematical abstraction? Can it be modelled?



F. KNOLL, Canada

We have seen a number of tries to model it and I liked those efforts and every one of them, in my opinion, has its merits. What I think should be the end product we are hoping to get, is a unified approach of the scientific community towards the problem of human error and quality assurance, so that we will be able to talk in one common language on the theme, rather than having everybody doing his own thing.

MODERATOR

Would anyone else on the panel have another comment?

K. SRISKANDAN, UK

In the earlier discussions Prof. Melchers said that before we start to model this and get to scientific information, we must first find out whether it is worth doing it. What we should do is to determine the cost of the research and the incremental benefits that would come from it, and then decide, whether it is worth doing the research.

MODERATOR

Is there another comment?

Well in keeping with the wonderful tradition of this conference, we are finishing on time. I bring this panel discussion to a close and invite Professor Maeda, the Chairman of the Scientific Committee, to begin the Symposium Summary.

Thank you.

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