CHAIRMAN'S REPORT, Session 2 (first part)

Jan Skalny

Dear Chairman, Ladies and Gentlemen,

Dr. Idorn asked me to briefly review the contributions to those two parts of Session 2, Mechanisms of Reactions of Alkalies in Concrete, which I chaired on the first and second days of the Conference. Additional comments on the same Session will be made by Dr. Ian Sims, who acted as co-chairman.

It is extremely difficult to review in detail the most important points of papers which were given only 10-15 minutes for presentation. Therefore, I will highlight the main topics presented and then discuss some issues which reflect my concerns and which I believe are of importance to all of us interested in this subject.

All together, there were 16 papers presented in this Session. The introductory paper was given by Professor Sidney Diamond, who very ably reviewed the latest knowledge on the chemical composition of cement paste pore solutions. The most important point of this presentation was the realization that we know little about the factors influencing the composition of these solutions, and that additional data have to be generated before our understanding of effects of composition of pore solution on the alkali-silica reactions can be finalized. The subject of chemistry of pore solutions was the emphasis of three additional papers including one on the effect of additives. It is clear that the system is very complicated, there are many variables to be taken into consideration, and data are inadequate to give a clear picture of the relationships.

The products formed during reaction of alkali with silica was another topic of discussion. It can be concluded that there are several types of reaction products, their formation dependent on the materials used in the system and on the environmental conditions the structure is exposed to. Available data are inadequate to give a comprehensive mechanistic explanation.

The question of the effect of relative humidity on the rate of alkali-silica reaction came up in the discussions several times. The discussion concentrated on the validity of the humidity measurements. No conclusions or agreements have been reached.

Several authors and discussants reported their experience with the use of blending materials. There is no question that fly ash, slag, microsilica, and other materials can be beneficial in preventing or, better, decreasing, the rate of the alkali-silica reactions. However, we still hear conflicting results as to the degree of beneficial effects, and the mechanistic aspects of their action are unclear. For example, there are still questions about the relative effects of OH^-, Ca^{2+}, Na^+, K^+, silicate, and Cl^- ions on the reaction mechanisms and on the subsequent durability or lack of it. However, we know that the composition, pore size

distribution, surface area, and the "reactivity" of additives are of importance.

I could continue reviewing the other topics discussed but would like to use the short time remaining to bring up an important issue and to make a few recommendations.

The issue I would like to bring up is the question of the gap between the researchers and engineers. After listening to the three days of presentations by researchers and engineers, I find this gap growing and feel that something must be done now. Part of the problem is in communications and proper feedback. The available scientific knowledge (and there is a substantial amount of it available) has to be properly reviewed by the researcher and its meaning transferred to engineering practice. The scientists must learn to appreciate "the real world" problems and the constraints the engineers are facing in the field. The engineerng community, on the other hand, must help to focus the research efforts by better understanding the chemical aspects of the problem, the instrumental capabilities available, and must educate the researchers as to its real needs. In addition, we all have to improve our communication with experts in relevant fields, such as corrosion, materials science, etc.

In view of the above, I would like to recommend that:

1. A comprehensive review of the scientific aspects of the alkali-silica reaction mechanisms should be prepared before the next Conference in Canada. Such review (or reviews) could be published in a special issue of Cement and Concrete Research or as a special chapter in the Cements Research Progress published annually by The American Ceramic Society, and it should become compulsory reading for all participants of the next conference.

2. During the next Conference, special sessions should be held on the chemical, physical, engineering, and testing aspects of the problem followed by a well prepared and professionally managed session on technology transfer.

3. We should consider development of internationally acceptable criteria for detection, testing, and characterization of the damage caused by the alkali-silica reactions.

Mr. Chairman, this concludes my short review of the second Session. I would like to use this opportunity to thank you personally, the Organizing Committee, and all the participants for contributing to a very successful conference. Thank you.

CO-CHAIRMAN'S REPORT, Session 2 (second part)

Ian Sims

My session included six interesting papers and, in summary, I have selected one essential conclusion from each presentation.

Prof. Della Roy had discovered an apparent relationship between expansion and the ratio of alumina to silica dissolved by alkaline solutions, whereby a reduced alumina/silica ratio was associated with greater expansion. Also experiments with beltane opal and glassy basalt had confirmed the effectiveness of GGBFS at preventing expansion due to alkali-reactivity.

Dr. Frank Buttler created some controversy when he highlighted some difficulties of the mortar-bar test procedure, in particular the aspect of "leachability". This loss of alkalis during the test was less in the case of mixes containing PFA, but nevertheless PFA was found to be effective at reducing expansion.

Dr. Fred Glasser has carried out careful studies to establish the effect of various additives of the chemical composition of the concrete pore solution. PFA did not alter the pore solution, GGBFS increased the alkali content, natural pozzolan increased alkalis sharply, whilst high-surface-area silica increased sodium slightly and potassium greatly.

Mr. Harold Vivian reminded us that flyash materials are variable and only some are suitable for preventing alkali-reactivity. Comparatively large replacements are needed for complete inhibition (say 40 per cent), when other concrete properties, such as strength and durability, may be adversely affected.

Prof. Ervin Poulsen presented some examples of alkali-reactivity problems in Danish swimming pools, and emphasised the role of sodium chloride. These difficulties were not predicted by mortar-bar tests, but concrete specimens had been more reliable.

Dr. Chatterji proposed the use of cements free in calcium hydroxide to prevent alkali-reactivity. The use of a pozzolanic diatomaceous earth, to consume the calcium hydroxide, had been found to be effective at preventing expansion with reactive Danish sand, even in the presence of sodium chloride.

In conclusion, I would like to support dr. Jan Skalny's plea for more successful communication between scientists and engineers on the subject alkali-reactivity. There is also a problem of international communication: working parties in different countries each separately struggle to achieve a consensus for coping with alkali-reactivity. I wonder if there could be support for an international working party to achieve international agreement between scientists and practising engineers.