APPENDIX A (continued)

Nature of test	Requirements and guidelines of SABS 1083-1976 (amend. 1979)		
	Stone for concrete	Single-sized crushed stone for roads	
Dust content Material % (m/m) passing a 75 µm sieve	1,5 max.	1,5 max.*	
Shape (i) Voids, % (v/v)	48 max.		
(ii) Flakiness index		Stone for surface dressing and bituminous paving mixtures: 53,0 - 26,5 mm : 35 max. 19,0 - 13,2 mm : 25 max. 9,5 mm : 30 max.* : 30 max. 9,5 - 4,75 mm : 35 max.* Stone for rolled-in chips : 20 max.	
Water absorption % (m/m)	1 max.		
Los Angeles abrasion loss % (m/m)	For concrete subject to surface abrasion and for road surfaces.		40 max.
	For concrete not subject to surface abrasion and for base-course for roads		50 max.
	For railway ballast,	Class A	22 max.
		Class B	28 max.
		Class C	34 max.
Polished stone value	Stone for continuously graded mixture		40 min.
	Stone for gap graded mixture (provided that rolled-in chips are applied to the wearing course)		45 min.
	Stone for rolled-in chips		55 min.
	Stone for finished surfaces of roads carrying less than 200 vehicles/lane/day		15 min.
	200 - 600 vehicles/lane/day		50 min.
	600 - 1000 vehicles/lane/day		55 min.

* Grade S stone

APPENDIX A : Summary of some requirements and guidelines of SABS specification 1083-1976

Nature of test	Requirements and guidelines of SABS 1083-1976 (amend. 1979)	
	Stone for concrete	Single-sized crushed stone for roads
Drying shrinkage (i) % shrinkage (ii) % of reference	- 150 max.	-
Soundness % loss after 5 cycles 7 cycles 12 cycles	- - -	- - -
Aggregate crushing value of -13,2 + 9,5 mm fraction, % (m/m)	29 max.	Stone for surface dressing and rolled-in chips: Tillite: 20 max. Others: 21 max. Stone for bituminous paving mixtures: Tillite: 24 max. Others: 25 max.
10% FACT value of -13,2 + 9,5 mm fraction, kN (i) Dry	Stone for concrete subject to abrasion: 110 min. Stone for concrete not subject to surface abrasion: 70 min.	Stone for surface dressing and rolled-in chips: Tillite: 220 min. Others: 210 min. Stone for bituminous paving mixtures: Tillite: 170 min. Others: 160 min.
(ii) Wet	-	-
(iii) Durability, % ratio between wet and dry 10% FACT value.	75 min.	

SUMMING UP

Prof T L Webb*

It is quite impossible, in the time available, to sum up the contents of almost 40 papers and some very penetrating discussions on a paper by paper basis. I am therefore going to present, essentially in a general way, the most important points which emerged to me from each of the twelve sessions. I will then try and crystallize, in a simplified and brief form, ongoing action, first in respect of broad research objectives, and secondly in terms of what the engineer and/or user of suspect materials might do.

SESSION 1

OPENING

In his balanced and wide ranging keynote address, Dr Davis reviewed the incidence of, and background to, the alkali-aggregate reaction problem. He felt that we needed:

- a clearer understanding of the reaction mechanism;
- to develop a practical, rapid method of testing aggregate for reactivity;
- to make the optimum use of admixtures to control the problem; and
- to maintain a practical approach.

He compared the problem to that of shrinking aggregates and appealed for the use of sound engineering principles.

SESSION 2

ROLE OF ALKALIS IN CEMENT MANUFACTURING

Alkalis, generally as sulphates, profoundly influence the performance of cements in terms of their setting, strength and reaction with aggregate. We should be careful not to oversimplify the phenomenon, but important factors are the rate of reaction and the use of admixtures. While low alkali cement can be economically produced in dry process kilns using a precalciner and bypassing kiln gases, problems which arise are the need to handle more material, an imbalance of raw materials, a reduction in kiln and filter efficiency, possible strength reduction and increased energy consumption.

SESSION 3

ON THE INFLUENCE OF ALKALIS ON CEMENT AND CONCRETE

The influence of alkalis on cement is complex and not yet fully understood; until more is known, we should keep a balanced view. We do know that they increase the drying shrinkage, tend to result in undesirable gelatinous rather than crystalline hydrates, retard hydration and, with reactive aggregates, may result in the deterioration and cracking of concrete. The presence of alkalis is however, not entirely disadvantageous.

SESSION 4

THE ALKALI-AGGREGATE REACTION

The adverse affects of alkali-aggregate reaction can be reduced or eliminated by identifying and avoiding suspect aggregates or cements, or adding pulverised fuel ash or pozzolans. Existing tests are slow and do not necessarily reflect the performance of the aggregate or cements tested. Petrographic studies provide a useful basis for a further study of the materials concerned. While glasses of a wide range of compositions can react extensively with cements, even those with low alkali contents, a high alkali content or a porous structure enhances such reactivity. Glass-alkali reaction differs from that of the reactive, more porous aggregates and neither Pyrex glass nor Beltane opal model the behaviour of alkali-susceptible aggregates in concrete. Alkali-aggregate reaction in South Africa was confirmed in 1976 and its extent has been investigated, aggregates and cements have been evaluated and tentative criteria for their assessment and for the effectiveness of admixtures have been developed. Practical preventive and remedial measures to combat the problem have been made known and further studies of the phenomenon will be undertaken.

SESSION 5

ON THE TESTING FOR POTENTIAL REACTIVITY OF AGGREGATES AND CEMENTS

The diffusion controlled rate of expansion of cement bonded products is basically related to their ultimate expansion. The minimum rates of expansion above which materials cause deleterious effects have been established. The optimum test method depends on the type of aggregate, but is generally based on an appropriate accelerated prism test. The results of chemical tests, while promising, are difficult to interpret. Neither Pyrex glass nor Beltane opal prism tests are either reproducible or dependable criteria of the behaviour in practice of cements. For Malmesbury hornfels aggregates, the good relationship between expansion and the available alkali of cements is a promising criterion. The suitability of Tygerberg aggregates cannot be established by ASTM criteria and further work is needed. In New Zealand, it has been found that while petrographic methods and the ASTM method C 289 are useful, the ASTM C 586 test is not applicable to greywackes and expansion measurements

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