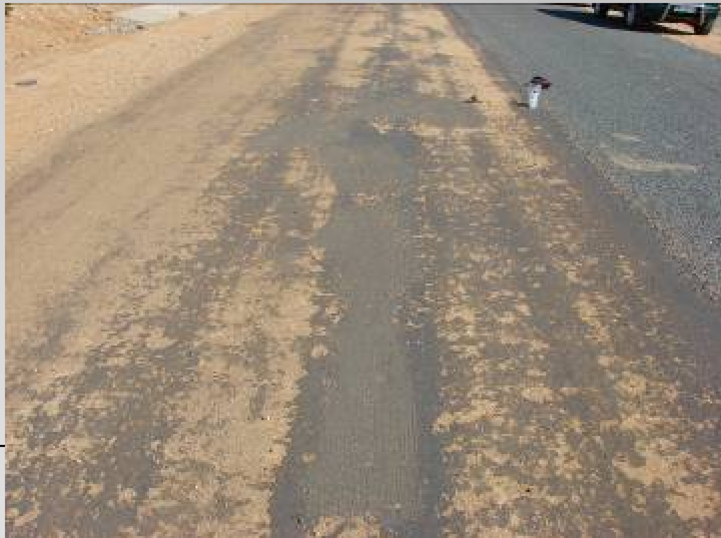
RPF CEMENTITIOUS STABILIZATION COMMITTEE

cement & concrete institute

CSIR
our future through science

Status quo

- Developed and circulated protocol for collecting information to assist with identifying optimum cement types and construction requirements
- Little response
- RPF stabilization sub-committee !



cement & concrete institute

RPF Sub Committee

- Discussions in early 2008
- Way forward
  - Virtual (email) subcommittee
  - Led by P Paige-Green
  - Regular email contact to identify ongoing and new projects
  - Will obtain as much relevant information as possible
  - Visit roads where possible and collect samples and test data
  - Develop data base directly

RPF Sub Committee

- Currently includes:
  - CSIR and C&CI
  - SANRAL
  - Provinces (Gautrans, Limpopo)
  - Consultants (VKE, BKS, SSI, Africon)
  - Suppliers (AfriSam)

- Anyone else who is keen and can contribute meaningfully? Let us know!

Design Issues

- Durability guidelines
- Importance of UCS vs ITS
- ICL vs ICC vs ICSA
- Fatigue relationships
- Cementation vs modification
- Material grading and strength vs shrinkage

Design Issues

- Prediction of post cracked state
- Laboratory properties vs design inputs

Construction Issues

- Processing time
- Curing
- UCS vs ITS (reproducibility)
- Mixing with small % stabilizer
- Changes in cement type and source
- Compaction
- Durability

Construction Issues

- Effect of cracking
- Specification limits
- Lab results vs field performance

Material Issues

- Supply of cement and extenders is
  - Logistics dependent (Transnet)
  - Raw material dependent (Mittal)
- CO_2 reduction pressures
- Total cement production approx 16 mil tons
- Use for stabilization estimate 250 000 to 500 000 tons

Material Issues

- Lack of understanding of cement specification

Historical product range in South Africa

- OPC - SABS 471
- RHC - SABS 471
- PBFC - SABS 636
- PC15 (SL or FA) - SABS 831
- PFAC - SABS 1466

Cement extenders

- SANS 1491 Parts 1 to 3 cover the quality of extenders (ggbs, flyash and silica fume) for use at the mixer

- Proposed new Part 4 for Supplementary Cementitious Material

SABS adopts new cement standards in 1996

- SANS 50197 covering “Common Cements”
- SANS 50413 covering “Masonry Cements”

Main types	Notation of products (types of common cement)		Composition, percentage by mass[a]										
			Clinker	Blast-furnace slag	Silica fume	Pozzolana		Fly ash		Burnt shale	Limestone		Minor additional constituents
						natural	natural calcined	siliceous	calcareous				
			K	S	D[b]	P	Q	V	W	T	L	LL	
CEM I	Portland cement	CEM I	95 - 100	-	-	-	-	-	-	-	-	-	0 - 5
CEM II	Portland-slag cement	CEM II A-S	80 - 94	6 - 20	-	-	-	-	-	-	-	-	0 - 5
		CEM II B-S	65 - 79	21 - 35	-	-	-	-	-	-	-	-	0 - 5
	Portland-silica fume cement	CEM II A-D	90 - 94	-	6 - 10	-	-	-	-	-	-	-	0 - 5
	Portland-pozzolana cement	CEM II A-P	80 - 94	-	-	6 - 20	-	-	-	-	-	-	0 - 5
		CEM II B-P	65 - 79	-	-	21 - 35	-	-	-	-	-	-	0 - 5
		CEM II A-Q	80 - 94	-	-	-	6 - 20	-	-	-	-	-	0 - 5
		CEM II B-Q	65 - 79	-	-	-	21 - 35	-	-	-	-	-	0 - 5
	Portland-fly ash cement	CEM II A-V	80 - 94	-	-	-	-	6 - 20	-	-	-	-	0 - 5
		CEM II B-V	65 - 79	-	-	-	-	21 - 35	-	-	-	-	0 - 5
		CEM II A-W	80 - 94	-	-	-	-	-	6 - 20	-	-	-	0 - 5
		CEM II B-W	65 - 79	-	-	-	-	-	21 - 35	-	-	-	0 - 5
	Portland-burnt shale cement	CEM II A-T	80 - 94	-	-	-	-	-	-	6 - 20	-	-	0 - 5
		CEM II B-T	65 - 79	-	-	-	-	-	-	21 - 35	-	-	0 - 5
	Portland-limestone cement	CEM II A-L	80 - 94	-	-	-	-	-	-	-	6 - 20	-	0 - 5
		CEM II B-L	65 - 79	-	-	-	-	-	-	-	21 - 35	-	0 - 5
		CEM II A-LL	80 - 94	-	-	-	-	-	-	-	-	6 - 20	0 - 5
		CEM II B-LL	65 - 79	-	-	-	-	-	-	-	-	21 - 35	0 - 5
	Portland-composite cement[c]	CEM II A-M	80 - 94	◄				6 - 20				►	0 - 5
		CEM II B-M	65 - 79	◄				21 - 35				►	0 - 5
CEM III	Blastfurnace cement	CEM III A	35 - 64	36 - 65	-	-	-	-	-	-	-	-	0 - 5
		CEM III B	20 - 34	66 - 80	-	-	-	-	-	-	-	-	0 - 5
		CEM III C	5 - 19	81 - 95	-	-	-	-	-	-	-	-	0 - 5
CEM IV	Pozzolanic cement[c]	CEM IV A	65 - 89	-	◄		11 - 35		►	-	-	-	0 - 5
		CEM IV B	45 - 64	-	◄		36 - 55		►	-	-	-	0 - 5
CEM V	Composite cement[c]	CEM V A	40 - 64	18 - 30	-	◄	18 - 30 ►		-	-	-	-	0 - 5
		CEM V B	20 - 39	31 - 50	-	◄	31 - 50 ►		-	-	-	-	0 - 5

Notes

(a) The values in the table refer to the sum of the main and minor additional constituents.

(b) The proportion of silica fume is limited to 10%.

(c) In portland-composite cements CEM II A-M and CEM II B-M, in pozzolanic cements CEM IV A and CEM IV B, and in composite cements CEM V A and CEM V B, the main constituents other than clinker shall be declared by designation of the cement.

Nomenclature

- CEM I, II, III, IV and V
    - I - Portland cement
    - II - Portland ……… cement
    - III - Blastfurnace cement
    - IV - Pozzolanic cement
    - V - Composite cement
- A, B or C
    - indicates level of extender e.g. in CEM II A is 6-20% and B is 21-35%

Nomenclature (cont.)

- Extender type
    - S - Blastfurnace slag
    - D - Silica fume
    - V or W - Fly ash
    - L - Limestone
    - M - Composite

Nomenclature (cont.)

- Strength grade

Strength Class	Compressive strength, MPa			
	Early strength		Standard strength	
	2 days	7 days	28 days	
32,5N	-	≥16,0	≥32,5	≤52,5
32,5R	≥10,0	-		
42,5N	≥10,0	-	≥42,5	≤62,5
42,5R	≥20,0	-		
52,5N	≥20,0	-	≥52,5	-
52,5R	≥30,0	-		

Nomenclature (cont.)

- Example CEM II B-W 42,5
  - Portland fly ash cement
  - Containing 21 to 35% fly ash
  - 2-day-strength > 10 MPa
  - 28-day-strength > 42,5 and < 62,5 MPa

Main types	Notation of products (types of common cement)		Composition, percentage by mass[a]										
			Clinker	Blast-furnace slag	Silica fume	Pozzolana		Fly ash		Burnt shale	Limestone		Minor additional constituents
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			K	S	D[b]	P	Q	V	W	T	L	LL	
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CEM II	Portland-slag cement	CEM II A-S	80 - 94	6 - 20	-	-	-	-	-	-	-	-	0 - 5
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	Portland-pozzolana cement	CEM II A-P	80 - 94	-	-	6 - 20	-	-	-	-	-	-	0 - 5
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		CEM II A-Q	80 - 94	-	-	-	6 - 20	-	-	-	-	-	0 - 5
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		CEM II B-W	65 - 79	-	-	-	-	-	21 - 35	-	-	-	0 - 5
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		CEM II B-T	65 - 79	-	-	-	-	-	-	21 - 35	-	-	0 - 5
	Portland-limestone cement	CEM II A-L	80 - 94	-	-	-	-	-	-	-	6 - 20	-	0 - 5
		CEM II B-L	65 - 79	-	-	-	-	-	-	-	21 - 35	-	0 - 5
		CEM II A-LL	80 - 94	-	-	-	-	-	-	-	-	6 - 20	0 - 5
		CEM II B-LL	65 - 79	-	-	-	-	-	-	-	-	21 - 35	0 - 5
	Portland-composite cement[c]	CEM II A-M	80 - 94	◄				6 - 20				►	0 - 5
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		CEM III B	20 - 34	66 - 80	-	-	-	-	-	-	-	-	0 - 5
		CEM III C	5 - 19	81 - 95	-	-	-	-	-	-	-	-	0 - 5
CEM IV	Pozzolanic cement[c]	CEM IV A	65 - 89	-	◄		11 - 35		►	-	-	-	0 - 5
		CEM IV B	45 - 64	-	◄		36 - 55		►	-	-	-	0 - 5
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Material Issues

- Lack of understanding of cement specification
- Same nomenclature different performance from different factories
- Brand names confusing – use proper nomenclature
- Test cements likely to be available
- Specify full nomenclature

Way Forward

- Workshop in 2009 to address issues
- Possibly around RPF in May
- Will use RPF database for invites

RPF Sub Committee

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