

# Cement Stabilization Issues, Supply and Specifications

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# Outline

- Introduction
- Cement statistics and logistics
- Availability
- Specifications
- Conclusion

# Statistics and logistics

- In 2008 SA produced 14,7 million tons of cementitious material
- From 11 factories, 12 milling and blending/milling units and 11 depots spread around South Africa
- Extenders supplied primarily from producers themselves (limestone), Eskom (flyash) and Mittal (ggbs)

# Statistics and logistics



**AfriSam**

**AfriSam South Africa (Pty) Ltd.**



**LAFARGE**  
SOUTH AFRICA

**Lafarge South Africa (Pty) Ltd.**



**NPC** CEMENT  
CONCRETE  
AGGREGATE  
CIMPOR

**NPC-Cimpor (Pty) Ltd.**



**PPC**  
CEMENT

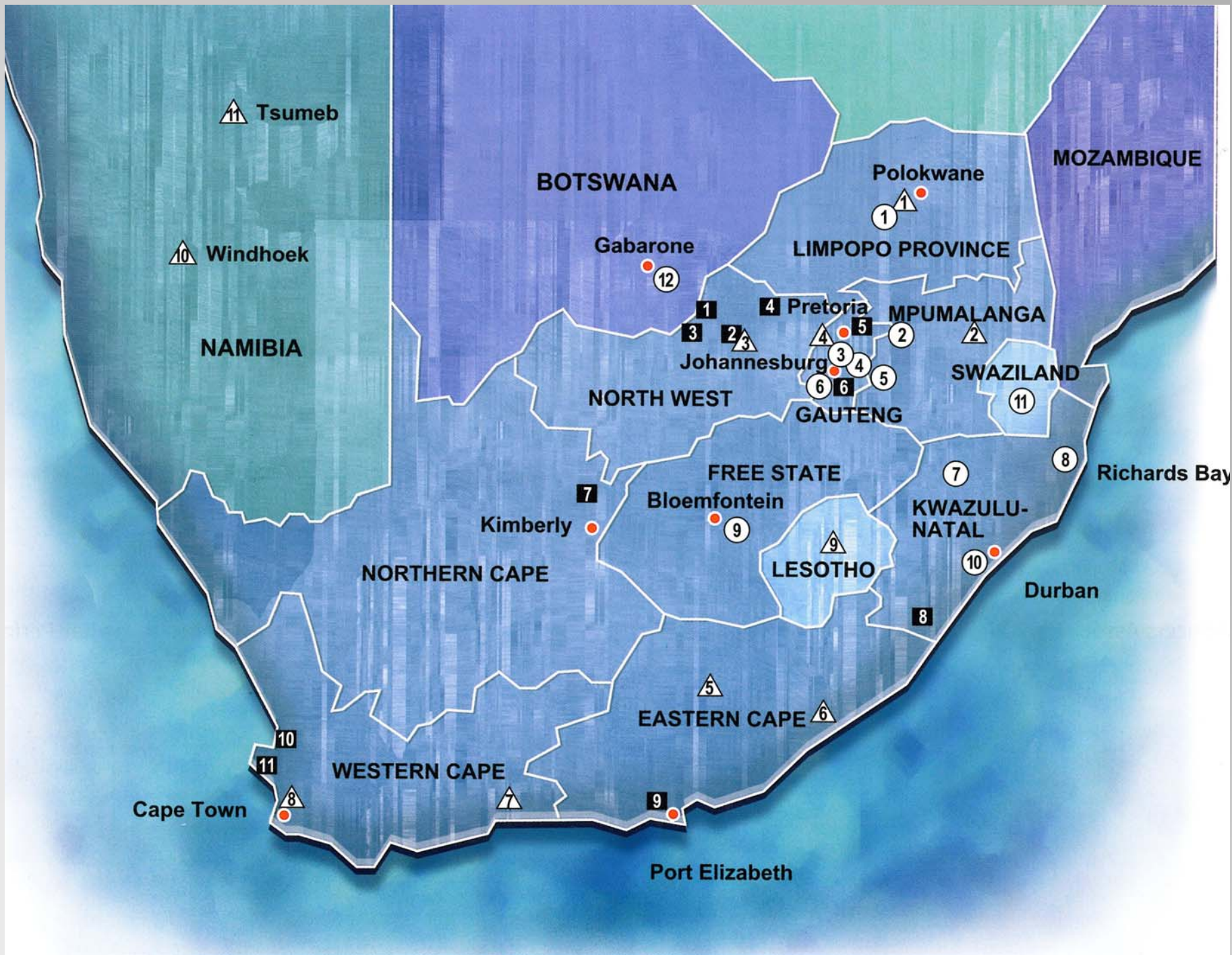


PPC STRENGTH  
GUARANTEED

**Pretoria Portland Cement (Pty) Ltd.**



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# Statistics and logistics

CEM I	3 320 000
CEM IIA	3 176 000
CEM IIB	3 439 000
CEM III/CEM IV/CEM V	3 477 000
GGBS	507 000
Flyash	302 000
Other	586 000
<b>Total</b>	<b>14 700 000</b>

# Statistics and logistics

- Of the 14,7 million tons, 55% in bags and 45% in bulk
- 27% direct to end users and 73% to resellers/blenders/readymix
- Exports about 1%

# Statistics and logistics

- Residential  $\pm 50\%$
- Non-residential  $\pm 30\%$
- Infrastructure  $\pm 20\%$

# Statistics and logistics

- Total infrastructure about 3 million tons
- Stabilization estimate 0,3 to 0.5 million tons
- Stabilization 2 to 3%

# Sustainability issues

- Worldwide, cement industry is responsible for approximately 5% of man-made CO<sub>2</sub>
- 40% from burning coal and 60% from calcination of limestone

# What is the Cement Industry (ACMP) doing...

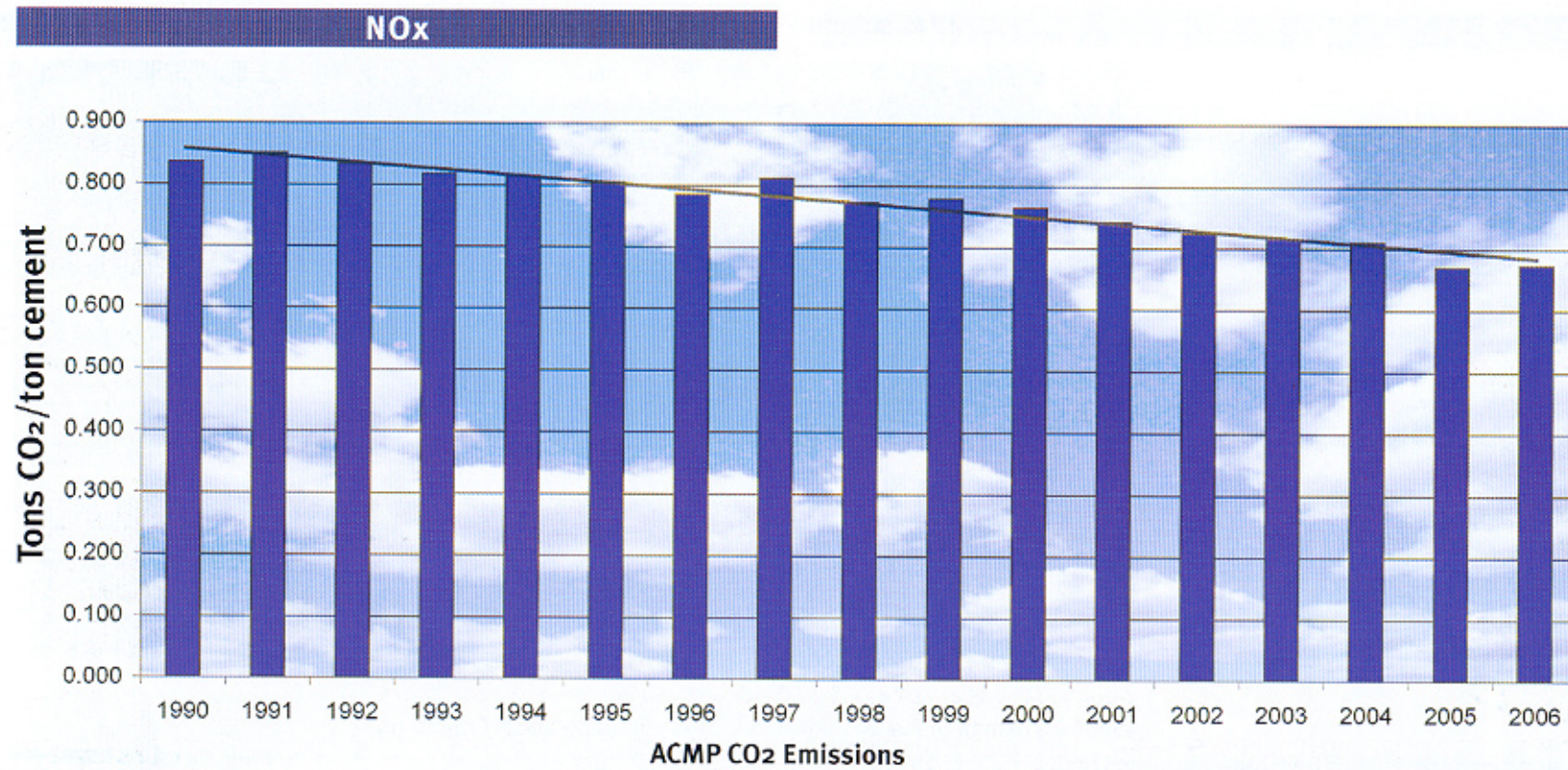
- Reducing usage of raw materials
  - Use of blended cements can reduce clinker factor by 40%
  - Use of extenders such as ggbs, flyash, silica fume, ground limestone
  - Synthetic gypsum from fertilizer and sulphuric acid industries

# What is the Cement Industry (ACMP) doing...

- Reducing energy consumption
  - Reduce use of non-renewable fossil fuels (> 1 million tpa)
  - Introduction of modern technology and equipment
  - Target reduction in energy used for mining by 15% by 2015 (>50% by end 2007)
  - Use of alternative fuels including Hazardous waste

# What is the Cement Industry (ACMP) doing...

- Reducing energy consumption (cont.)
  - Use of waste tyres in kilns
    - Coal – 96 kg CO<sub>2</sub> per GJ energy consumed
    - Tyres - 85 kg CO<sub>2</sub> per GJ energy consumed
    - Steel provides source of iron
    - No ash



# Summary

- Maximising extender use where appropriate
- Shortage of extenders
  - Not all are suitable
  - Not all are available geographically
  - Not all are available eg Mittal and quotas
- Small volumes widely spread

# South African Cements

- SANS 50197 for Common cements
- SANS 50413 for Masonry cements

Table 1.1: Common cements: SABS EN 197-1

Main types	Notation of products (types of common cement)		Composition, percentage by mass <sup>(a)</sup>												
			Clinker	Blast-furnace slag	Silica fume	Pozzolana		Fly ash		Burnt shale	Limestone		Minor additional constituents		
						natural	natural calcined	siliceous	calcareous		L	LL			
K	S	D <sup>(b)</sup>	P	Q	V	V	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 <sup>(c)</sup>	CEM II A-M	80 - 94	←----- 6 - 20 -----→												
	CEM II B-M	65 - 79	←----- 21 - 35 -----→												
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 <sup>(c)</sup>	CEM IV A	65 - 89	-	←----- 11 - 35 -----→										
		CEM IV B	45 - 64	-	←----- 36 - 55 -----→										
CEM V	Composite cement <sup>(c)</sup>	CEM V A	40 - 64	18 - 30	-	←----- 18 - 30 -----→									
		CEM V B	20 - 39	31 - 50	-	←----- 31 - 50 -----→									

**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.

# Cement Classification

- Code
  - Gives details regarding content
  - Gives details regarding performance
- Breakdown of code
  - First - alphabetical letters
    - CEM means general purpose - suitable for most applications
    - MC means for use in mortar & plaster only

– Second - Roman Numeral

- I means no extender - so called pure cement
- II, III, IV and V indicate composite cements

– Third - alphabetical letter

- A, B or C indicates the proportion of extender which is different for different classes

– Fourth - alphabetical letter

- S means blastfurnace slag
- V or W means fly ash
- L means limestone

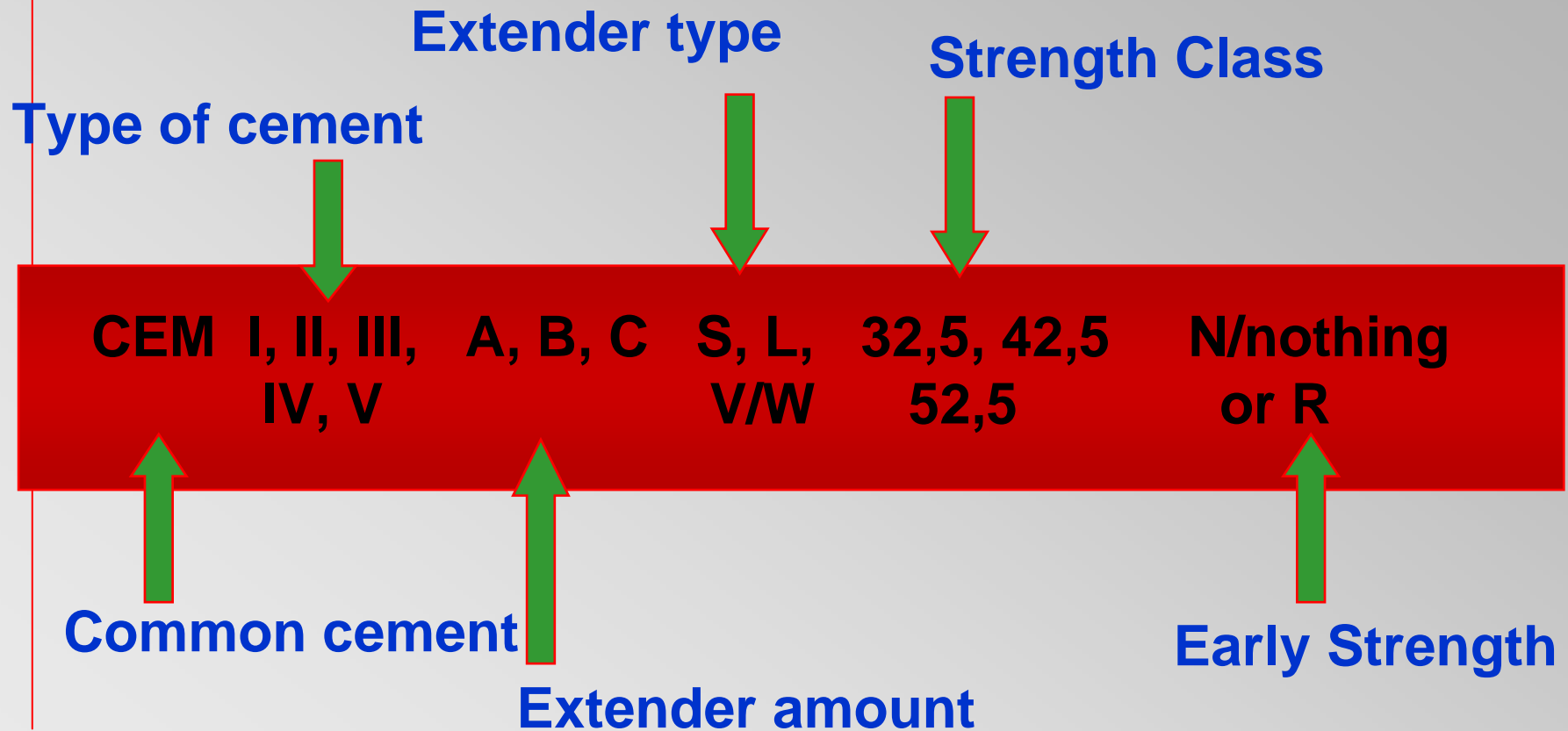
– Fifth - number

- Indicates performance with three grades namely 32.5; 42.5 and 52.5
- Letter R indicates a higher early strength for each grade

- Examples

- CEM III A-S 32.5N
- CEM II A-V 32.5N
- CEM I 42.5N
- CEM II A-L 32.5N
- CEM II A-S 42.5N
- CEM II B-S 42.5N-

# Common Cement



# Strength for Common Cements

Strength Class	Compressive Strength MPa			
	Early Strength		Standard Strength	
	2 days	7 days	28 days	
32,5	-	$\geq 16$	$\geq 32,5$	$\leq 52,5$
32,5R	$\geq 10$	-		
42,5	$\geq 10$	-	$\geq 42,5$	$\leq 62,5$
42,5R	$\geq 20$	-		
52,5	$\geq 20$	-	$\geq 52,5$	-
52,5R	$\geq 30$	-		

# Cement Availability

- Not all products are available everywhere
- Not all manufacturers supply all products all the time
- Dependant on raw material availability, demand by customers
- Products may change with time

# Conclusions

- Understand the specifications and what they mean
- Understand the drivers in the cement industry
- Determine likely availability of products when your project is likely to happen
- Test a number of cements and combinations



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Thank you for your attention!