

IS THIS REALLY NECESSARY?



WHEN WE HAVE THIS?



COAL COMBUSTION PRODUCTS

- FLY ASH



- BOTTOM BOILER ASH



- CLINKER ASH



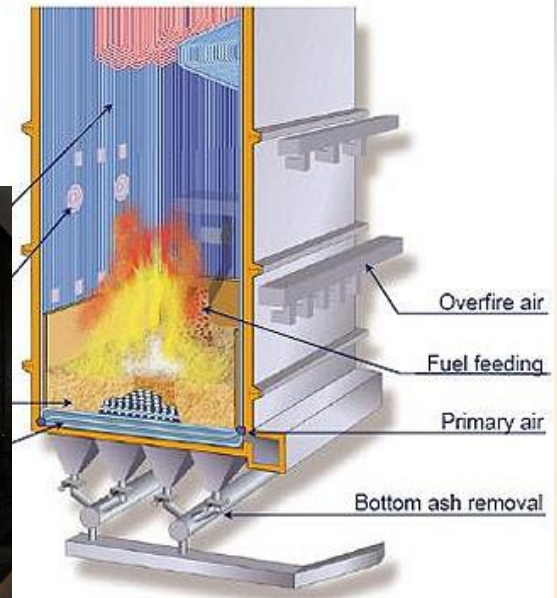
Mark Hovy

South African Coal Ash Association

CCP'S - FROM ESKOM

CCP (Coal Combustion Products)

- Fly Ash
- Bottom Boiler Ash
- Dump ash



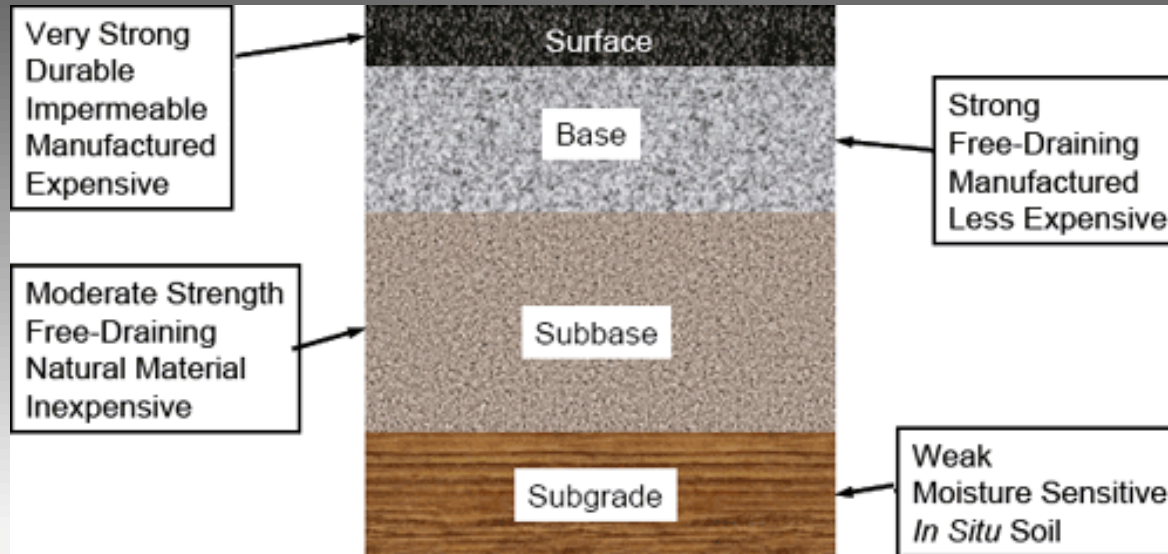
CCP - Is there enough Ash in South Africa?

A picture speaks a million words....



WHERE CAN WE FIT THIS IN?

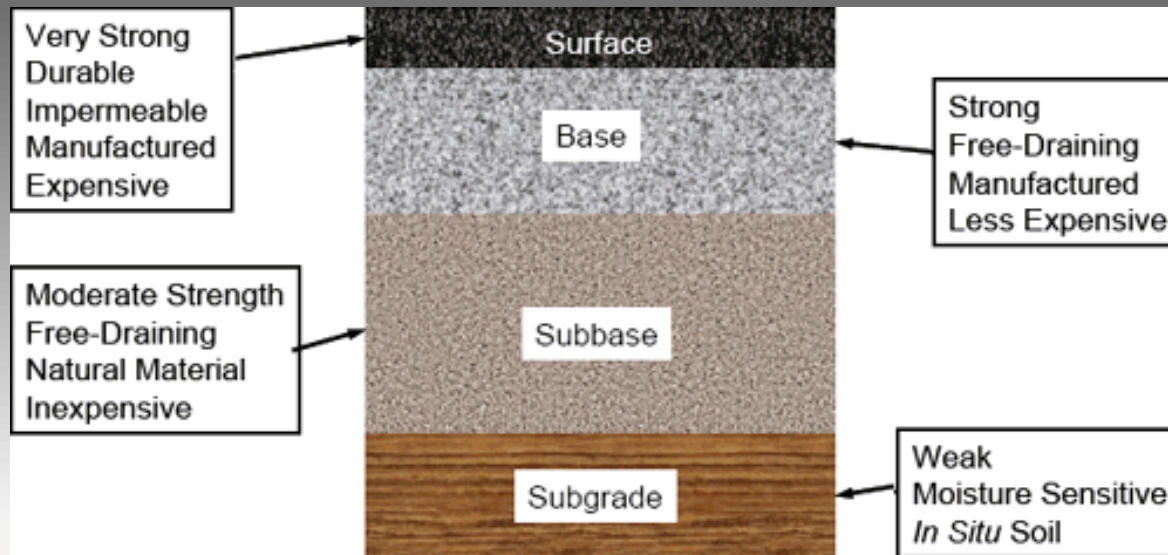
ROAD BUILDING AND EMBANKMENTS?



- Properties
- Material handling
- Legislation
- Cost

WHERE CAN WE FIT THIS IN?

ROAD BUILDING AND EMBANKMENTS?

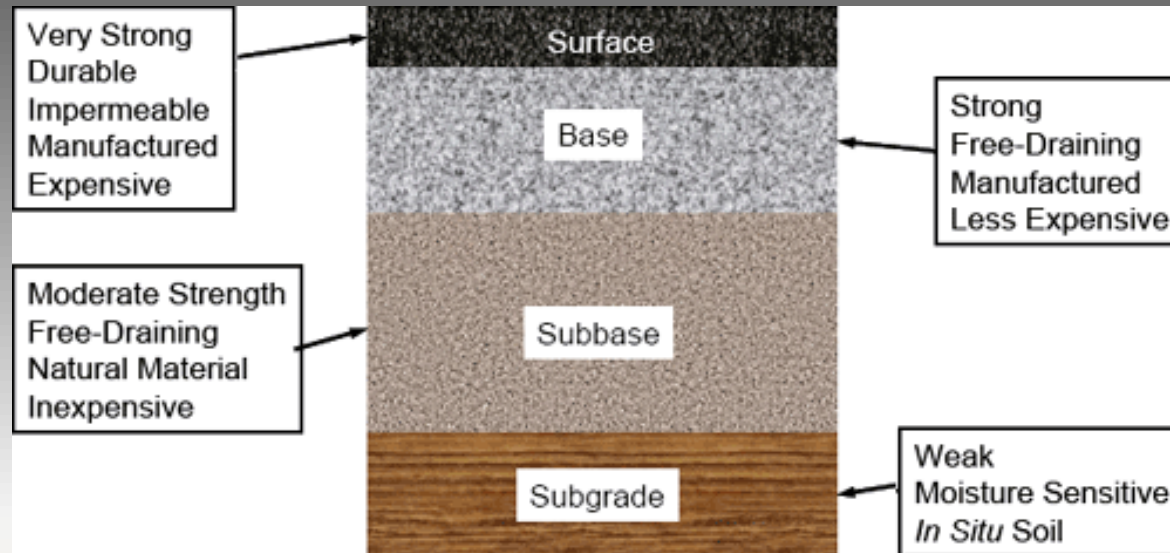


- Properties
- Material handling
- Legislation
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WHERE CAN WE FIT THIS IN?

ROAD BUILDING AND EMBANKMENTS?



- Properties
- Material handling
- Legislation
- Cost



Final say in DEA hands
Logistics

CCP – UK Solutions – UK Quality Ash Ass

Technical Data Sheet 6 - Highway Construction

Table 3: Examples of FABM with constituent proportions as a % by dry mass

<i>FABM type</i>	<i>Conditioned fly ash</i>	<i>CaO or Ca(OH)₂</i>	<i>CEM I</i>	<i>Typical water content (%)</i>
4&5	12 - 21	3-4	-	Depends on aggregate
4&5	6 - 20	-	3-5	Depends on aggregate
6	93 - 97	3-7	-	~ 20
6	90 - 95	-	5 - 10	~ 20

Best Practice Guide No.2

The Placing and Compaction of Fly Ash as Structural Fill

CCP – SA Possibilities – Embankments

- M1 Freeway junction 13 in the UK, intersection embankment creation



- 415 000 tons used
- 2500 t/day delivered

CCP – SA Possibilities – Layer works

- **A45 Packington Flyover**
 - 100 000 tons used
 - 6 weeks
 - 200mm layers compacted CAT D6M followed by vibrating roller
- **Selby bypass, North Yorkshire**
 - 390 000 tons used
 - 150mm layers bladed and scraped and compacted by vibrating roller
- **Shipping container depot, Enfield, Sydney**
 - Approx 100 000 tons used
 - Density, collapse potential
 - Settlement performance, Stiffness response, DCP, CBR

CCP – What can be done – Sasol Secunda

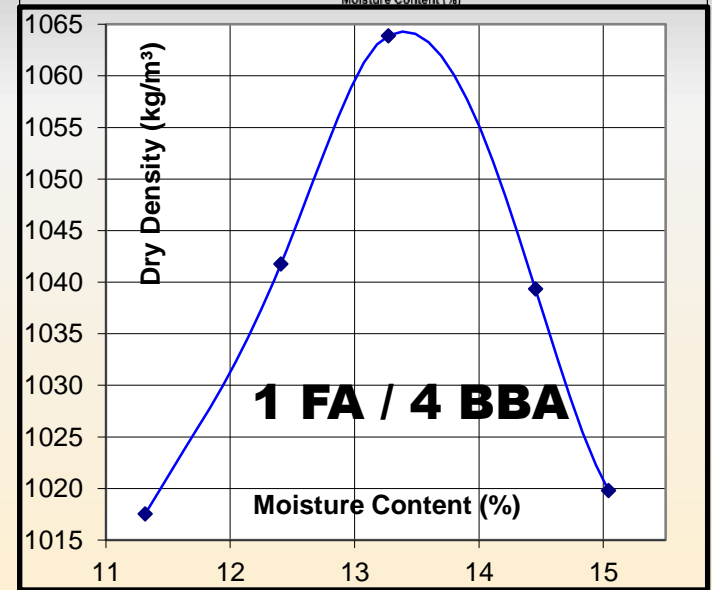
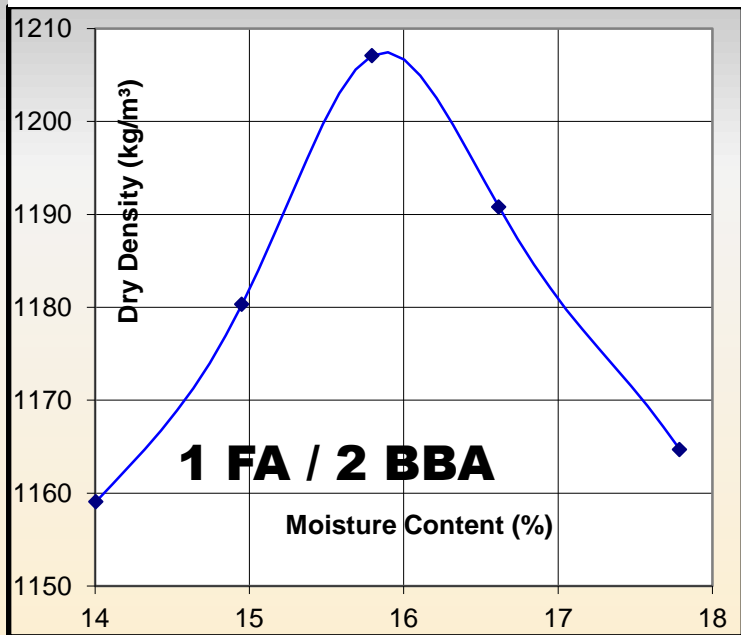
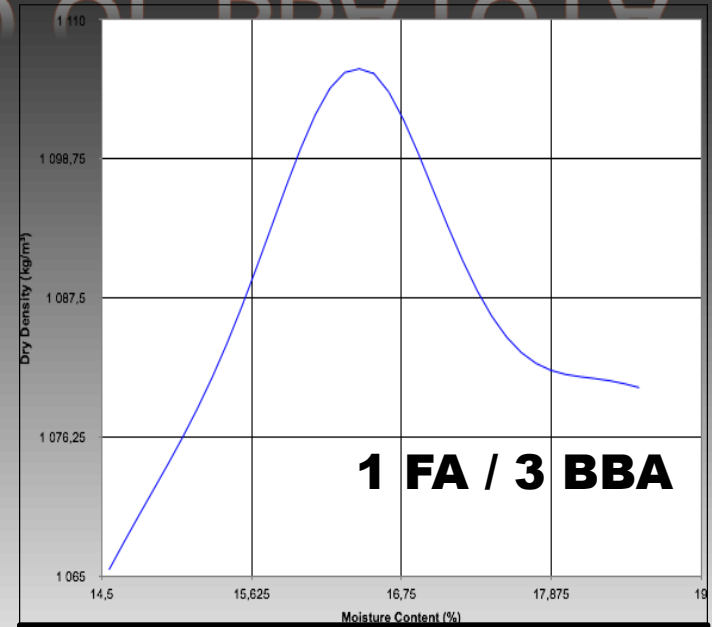
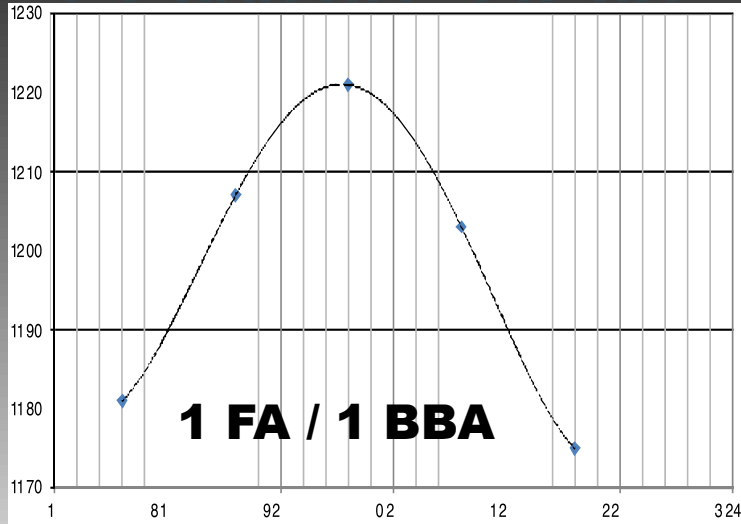
Used up to 340 000t/a

80%+ to Sasol mining (roads and backfill)
Balance to Secunda commercial

This ash is a clinker ash



COMPACTION - RATIO OF BBA TO FA



COMPACTION - RATIO OF BBA TO FA

1 FA / 1 BBA

Compaction	90%	93%	95%	98%	100%
CBR	12,4	20,9	29,6	46,1	61,9

1 FA / 2 BBA

Compaction	90%	93%	95%	98%	100%
CBR	27,2	31,2	34,5	52,4	69,2

1 FA / 3 BBA

Compaction	90%	93%	95%	98%	100%
CBR	27,5	26,4	25,7	26,1	27,5

1 FA / 4 BBA

Compaction	90%	93%	95%	98%	100%
CBR	18,5	21,1	23,1	26,5	28,2

ATTENBERG LIMITS - ACCEPTABLE?

Civilab a SANAS accredited testing laboratory, No T0062
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P O Box 82223, Southdale 2135
Tel: +27 (0)11 835-3117 • Fax: +27 (0)11 835-2503
E-mail: jhb@civilab.co.za • Website: www.civilab.co.za

Civilab

Civil Engineering Testing Laboratories

Atterberg Limits

Project	: ULULA ASH	
Project No.	: 2013-B-2431	Date : 16 JANUARY 2014

Lab. Sample Ref.	Field Sample Ref.	Depth (m)	Treatment	Liquid Limit	Plasticity Index	Linear Shrinkage	Remarks
2431-3	Mix Sample	-	2% Cemsure CEM Afrisam Cement 32.5N	NP	NP	0.0	7 Days Curing
2431-4							28 Days Curing
2431-5			4% Cemsure CEM Afrisam Cement 32.5N	NP	NP	0.0	7 Days Curing
2431-6							28 Days Curing
2431-7			6% Cemsure CEM Afrisam Cement 32.5N	NP	NP	0.0	7 Days Curing
2431-8							28 Days Curing

Remarks:

STABILIZED RESULTS - Cement + Fly Ash!?

Curing Method: 7 Days @ 22-25°C and 95-100% relative humidity

Treatment	Mod AASHTO Data	Optimum Moisture (%)	UCS Specimen Compaction Data				U.C.S. (kPa) 7 Days	
	Max Dry Density: (kg/m³)		Effort	Dry Density (kg/m³)	Compaction (%)	Moisture Content (%)	Individual	Average
2% CEM 32.5N		25,4	MOD	1198	99,5	25,4	4269	4247
	1204		MOD	1209	100,4	25,4	4225	
			PROCTOR	1091	90,6	25,4	2431	2481
			PROCTOR	1101	91,4	25,4	2532	
Treatment	Mod AASHTO Data	Optimum Moisture (%)	UCS Specimen Compaction Data				U.C.S. (kPa) 28 Days	
	Max Dry Density: (kg/m³)		Effort	Dry Density (kg/m³)	Compaction (%)	Moisture Content (%)	Individual	Average
2% CEM 32.5N		25,4	MOD	1207	100,2	25,4	4815	4756
	1204		MOD	1206	100,1	25,4	4696	
			PROCTOR	1083	89,9	25,4	2531	2563
			PROCTOR	1084	90,1	25,4	2594	

STABILIZED RESULTS - Cement + Fly Ash!?

Curing Method: 7 Days @ 22-25°C and 95-100% relative humidity

Treatment	Mod AASHTO Data	Optimum Moisture (%)	UCS Specimen Compaction Data				U.C.S. (kPa) 7 Days	
	Max Dry Density: (kg/m³)		Effort	Dry Density (kg/m³)	Compaction (%)	Moisture Content (%)	Individual	Average
4% CEM 32.5N		20,2	MOD	1180	101,4	20,1	4428	4545
	1164		MOD	1174	100,9	20,1	4662	3029
			PROCTOR	1061	91,1	20,1	2965	
			PROCTOR	1059	91,	20,1	3093	

Treatment	Mod AASHTO Data	Optimum Moisture (%)	UCS Specimen Compaction Data				U.C.S. (kPa) 28 Days	
	Max Dry Density: (kg/m³)		Effort	Dry Density (kg/m³)	Compaction (%)	Moisture Content (%)	Individual	Average
4% CEM 32.5N		20,2	MOD	1177	101,2	20,2	5045	4974
	1164		MOD	1178	101,2	20,2	4903	3136
			PROCTOR	1065	91,5	20,2	3113	
			PROCTOR	1061	91.2	20.2	3159	

STABILIZED RESULTS - Cement + Fly Ash!?

Curing Method: 7 Days @ 22-25°C and 95-100% relative humidity

Treatment	Mod AASHTO Data	Optimum Moisture (%)	UCS Specimen Compaction Data				U.C.S. (kPa) 7 Days	
	Max Dry Density: (kg/m³)		Effort	Dry Density (kg/m³)	Compaction (%)	Moisture Content (%)	Individual	Average
6% CEM32.5N		20,2	MOD	1165	100,1	20,3	5018	4999
	1164		MOD	1171	100,6	20,3	4981	
			PROCTOR	1051	90,3	20,3	2833	2916
			PROCTOR	1059	91,	20,3	2999	

Treatment	Mod AASHTO Data	Optimum Moisture (%)	UCS Specimen Compaction Data				U.C.S. (kPa) 28 Days	
	Max Dry Density: (kg/m³)		Effort	Dry Density (kg/m³)	Compaction (%)	Moisture Content (%)	Individual	Average
6% CEM 32.5N		20,2	MOD	1178	101,2	20,	5315	5355
	1164		MOD	1184	101,7	20,	5395	
			PROCTOR	1064	91,4	20,	3273	3203

CCP – SA possibilities – examples

- Site in Johannesburg, clayey soil alteration



- Road extension at Kriel

**Looking in another direction.....
We may just find viable alternatives!**

Mark Hovy
South African Coal Ash Association

