



DSMB CBR TESTING: NON-PLASTIC SOIL & SLAG MIXTURES

The following testing was performed by Roadlab Laboratories (Pty)Ltd in Primrose, Germiston in a joint effort between Cypher Environmental and Arcelor Mittal to evaluate the applicability of using Cypher Environmental' product Dust Stop Municipal Blend as a stabilizer and reviewing options for incorporating different percentages of the slag bi-product that is created during steel production performed by Arcelor Mittal.

There are three different slag/soil blends that were tested. A 50/50, 60/40 and 70/30 blend were all analyzed for their individual gradations and plasticity values. These tests determined the best ratio of slag to soil that would perform well in road construction, while also investigating how different application rates of DSMB will impact the different blends of the aggregate material. The rates of DSMB were 3 L/m³ and 5 L/m³ which are indicated in the "Clients Marking" section of the results. All the results below are showing the untreated test values (Page #2) and 30 day cured test values (Pages #3 and #4).

The bottom row in the 2nd and 3rd tables show the percent gain in CBR from the initial untreated values, as shown on the following pages from ROADLAB LABORATORIES LTD.

1st

Untreated CBR's		
50/50	60/40	70/30
15	42	41
25	70	67
35	99	92
50	139	127
60	135	149
85	232	205

2nd

Treated CBR's @ 3L/M (Blend B) Cured			
	50/50	60/40	70/30
90%	50	103	94
93%	89	163	141
95%	132	221	186
97%	194	300	244
98%	235	350	280
100%	346	474	367
% Gain(CBR)	307.1	104.3	79

3rd

Treated CBR's @ 5L/M (Blend A) Cured			
	50/50	60/40	70/30
90%	132	170	97
93%	166	238	147
95%	193	296	194
97%	225	373	256
98%	243	417	294
100%	283	522	388
% Gain(CBR)	232.9	125	89.3

92/01-0005/18

2018/12/06

Arcelor Mittal SA

Attention: Mrs Smangele Mothoa

Dear Sir

Test Report : PLANT-CBR TEST RESULTS

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose, Germiston.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES				
SAMPLE No.		2018/S5656 A	2018/S5657 A	2018/S5658 A
CONTAINER USED FOR SAMPLING		Client Bags	Client Bags	Client Bags
SIZE / WEIGHT OF SAMPLE		±70kg's	±70kg's	±70kg's
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist	Slightly Moist	Slightly Moist
HOLE No. / Km. / CHAINAGE		Mix Design	Mix Design	Mix Design
ROAD No. OR NAME		Not Specified	Not Specified	Not Specified
LAYER TESTED / SAMPLED FROM		50% Slag + 50% G1	60% Slag + 40% G1	70% Slag + 30% G1
DATE SAMPLED		29-11-2018	29-11-2018	29-11-2018
DATE RECEIVED		29-11-2018	29-11-2018	29-11-2018
CLIENTS MARKING		Not Specified	Not Specified	Not Specified
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Dark Grey 50% Slag + 50% G1	Dark Grey 60% Slag + 40% G1	Dark Grey 70% Slag + 30% G1
GRADING ANALYSIS - % PASSING SIEVES (SANS 3001-GR1:2010;SANS 3001-GR2:2010)				
SIEVE	100.0	-	-	-
	75.0	-	-	-
ANA -	63.0	-	-	-
	50.0	-	-	-
	37.5	-	-	-
	28.0	-	-	-
	20.0	-	-	-
LYSIS (mm)	14.0	-	-	-
	5.0	-	-	-
	2.00	-	-	-
(SANS GR1:2010)	0.425	-	-	-
	0.075	-	-	-
SANS 3001 - PR5				
Soil Mortar		-	-	-
Coarse Sand		-	-	-
Fine Sand		-	-	-
Coarse Fine Sand		-	-	-
Medium Fine Sand		-	-	-
Fine Fine Sand		-	-	-
Silt & Clay		-	-	-
Coarse Sand Ratio		-	-	-
ATTERBERG LIMITS ANALYSIS (SANS 3001-GR10:2010;SANS 3001-GR11:2010)				
ATTERBERG LIMITS (SANS GR10;GR11)	LL%	-	-	-
	P.I.	-	-	-
	LS%	-	-	-
	GM	-	-	-
CLASSIFICATION	H.R.B.*	-	-	-
	COLTO*	-	-	-
	T.R.H. 14*	-	-	-
CALIFORNIA BEARING RATIO (SANS 3001-GR30:2010;SANS 3001-GR40:2010)				
MOD AASHTO (SANS GR30)	OMC%	-	-	-
	MDD(KG/M³)	-	-	-
C.B.R.	COMP MC	7.2	8.2	8.1
	% SWELL	0.40	0.39	0.42
U.C.S (SANS GR53)	100%	85	232	205
	98%	60	165	149
	97%	50	139	127
	95%	35	99	92
	93%	25	70	67
	90%	15	42	41
MOD ITS : DRY (kPa) (GR54)		N/A	N/A	N/A
ITS @95% : DRY (kPa)		N/A	N/A	N/A
STABILISED WITH	IN LAB			
	ON SITE	Neat	Neat	Neat
TEST TYPE		CBR	CBR	CBR
SAMPLED BY		Client	Client	Client
DELIVERED BY		Client	Client	Client
SAMPLING METHOD		TMH5 - MB1	TMH5-MB1	TMH5-MB1
ENVIRONMENTAL CONDITION WHEN SAMPLED		Slightly Moist	Slightly Moist	Slightly Moist
REMARKS & NOTES		None	None	None

PAGE 1/2

Kind Regards



TECHNICAL SIGNATORY
Mr. D. Juckers / N. Herbst

Remarks :

*Opinions & Interpretations are not included in our schedule of Accreditation
The samples were subjected to analysis according to SANS Test Methods
The results reported relate only to the sample tested
Further use of the above information is not the responsibility or liability of Roadlab (Pty) Ltd
Test reports may only be reproduced or published in their full context
Compiled By : Shaney Platjies

92/01-0006/18 - 2019/01/15

Arcelor Mittal SA

Attention: Mrs Smangele Mothoa

Dear Sir

Test Report : PLANT-CBR TEST RESULTS

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose, Germiston. The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		2018/S5656 A	2018/S5656 B	2018/S5657 A	2018/S5657 B
CONTAINER USED FOR SAMPLING		Client Bags	Client Bags	Client Bags	Client Bags
SIZE / WEIGHT OF SAMPLE		±70kg's	±70kg's	±70kg's	±70kg's
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist	Slightly Moist	Slightly Moist	Slightly Moist
HOLE No. / Km. / CHAINAGE		Mix Design	Mix Design	Mix Design	Mix Design
ROAD No. OR NAME		Not Specified	Not Specified	Not Specified	Not Specified
LAYER TESTED / SAMPLED FROM		50% Slag + 50% G1	50% Slag + 50% G1	60% Slag + 40% G1	60% Slag + 40% G1
DATE SAMPLED		29-11-2018	29-11-2018	29-11-2018	29-11-2018
DATE RECEIVED		29-11-2018	29-11-2018	29-11-2018	29-11-2018
CLIENTS MARKING		Blend A(3L/M)	Blend B(5L/M)	Blend A(3L/M)	Blend B(5L/M)
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Dark Grey 50% Slag + 50% G1	Dark Grey 50% Slag + 50% G1	Dark Grey 60% Slag + 40% G1	Dark Grey 60% Slag + 40% G1
GRADING ANALYSIS - % PASSING SIEVES (SANS 3001-GR1:2010;SANS 3001-GR2:2010)					
SIEVE	100.0	-	-	-	-
	75.0	-	-	-	-
ANA -	63.0	-	-	-	-
	50.0	-	-	-	-
	37.5	-	-	-	-
	28.0	-	-	-	-
LYSIS (mm)	20.0	-	-	-	-
	14.0	-	-	-	-
	5.0	-	-	-	-
(SANS GR1:2010)	2.00	-	-	-	-
	0.425	-	-	-	-
	0.075	-	-	-	-
SANS 3001 - PR5					
Soil Mortar		-	-	-	-
Coarse Sand		-	-	-	-
Fine Sand		-	-	-	-
Coarse Fine Sand		-	-	-	-
Medium Fine Sand		-	-	-	-
Fine Fine Sand		-	-	-	-
Silt & Clay		-	-	-	-
Coarse Sand Ratio		-	-	-	-
ATTERBERG LIMITS ANALYSIS (SANS 3001-GR10:2010;SANS 3001-GR11:2010)					
ATTERBERG LIMITS (SANS GR10;GR11)	LL%	-	-	-	-
	P.I.	-	-	-	-
	LS%	-	-	-	-
	GM	-	-	-	-
CLASSIFICATION	H.R.B.*				
	COLTO*				
	T.R.H. 14*				
CALIFORNIA BEARING RATIO (SANS 3001-GR30:2010;SANS 3001-GR40:2010)					
MOD AASHTO (SANS GR30)	OMC%	7.2	7.2	8.4	8.4
	MDI(KG/M³)	2382	2382	2398	2398
	COMP MC	7.2	7.2	8.2	8.2
C.B.R.	% SWELL	0.34	0.39	0.42	0.38
	100%	346	283	474	522
U.C.S (SANS GR53)	98%	235	243	350	417
	97%	194	225	300	373
	95%	132	193	221	298
	93%	89	166	163	238
	90%	50	132	103	170
MOD ITS : DRY (kPa) (GR54)		N/A	N/A	N/A	N/A
ITS @95% : DRY (kPa)		N/A	N/A	N/A	N/A
STABILISED WITH	IN LAB				
	ON SITE	Neat	Neat	Neat	Neat
TEST TYPE		CBR	CBR	CBR	CBR
SAMPLED BY		Client	Client	Client	Client
DELIVERED BY		Client	Client	Client	Client
SAMPLING METHOD		TMH5 - MB1	TMH5-MB1	TMH5-MB1	TMH5-MB1
ENVIRONMENTAL CONDITION WHEN SAMPLED		Slightly Moist	Slightly Moist	Slightly Moist	Slightly Moist
REMARKS & NOTES		None	None	None	None

PAGE 1/2

Kind Regards

TECHNICAL SIGNATORY
Mr. D. Juckers / N. Herbst

Remarks :

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Compiled By : Shaney Plaatjies

92/01-0006/18

2019/01/15

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SAMPLE INFORMATION & PROPERTIES				
SAMPLE No.		2018/S5658 A	2018/S5658 B	-
CONTAINER USED FOR SAMPLING		Client Bags	Client Bags	-
SIZE / WEIGHT OF SAMPLE		±70kg's	±70kg's	-
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist	Slightly Moist	-
HOLE No. / Km. / CHAINAGE		Mix Design	Mix Design	-
ROAD No. OR NAME		Not Specified	Not Specified	-
LAYER TESTED / SAMPLED FROM		70% Slag + 30% G1	70% Slag + 30% G1	-
DATE SAMPLED		29-11-2018	29-11-2018	-
DATE RECEIVED		29-11-2018	29-11-2018	-
CLIENTS MARKING		Blend A(3L/M)	Blend B(5L/M)	-
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Dark Grey 70% Slag + 30% G1	Dark Grey 70% Slag + 30% G1	-
GRADING ANALYSIS - % PASSING SIEVES (SANS 3001-GR1:2010;SANS 3001-GR2:2010)				
SIEVE	100.0	-	-	-
	75.0	-	-	-
ANA -	63.0	-	-	-
	50.0	-	-	-
	37.5	-	-	-
	28.0	-	-	-
	20.0	-	-	-
LYSIS (mm)	14.0	-	-	-
	5.0	-	-	-
	2.00	-	-	-
(SANS GR1:2010)	0.425	-	-	-
	0.075	-	-	-
SANS 3001 - PR5				
Soil Mortar		-	-	-
Coarse Sand		-	-	-
Fine Sand		-	-	-
Coarse Fine Sand		-	-	-
Medium Fine Sand		-	-	-
Fine Fine Sand		-	-	-
Silt & Clay		-	-	-
Coarse Sand Ratio		-	-	-
ATTERBERG LIMITS ANALYSIS (SANS 3001-GR10:2010;SANS 3001-GR11:2010)				
ATTERBERG LIMITS (SANS GR10;GR11)	LL%	-	-	-
	P.I.	-	-	-
	LS%	-	-	-
CLASSIFI - CATION	GM	-	-	-
	H.R.B.*	-	-	-
	COLTO*	-	-	-
	T.R.H. 14*	-	-	-
CALIFORNIA BEARING RATIO (SANS 3001-GR30:2010;SANS 3001-GR40:2010)				
MOD AASHTO (SANS GR30)	OMC%	8.1	8.1	-
	MDD(KG/M³)	2425	2425	-
	COMP MC	8.1	8.1	-
C.B.R.	% SWELL	0.35	0.38	-
U.C.S (SANS GR53)	100%	367	388	-
	98%	280	294	-
	97%	244	256	-
	95%	186	194	-
	93%	141	147	-
	90%	94	97	-
MOD ITS : DRY (kPa) (GR54)		N/A	N/A	-
ITS @95% : DRY (kPa)		N/A	N/A	-
STABILISED WITH	IN LAB	-	-	-
	ON SITE	Neat	Neat	-
TEST TYPE		CBR	CBR	-
SAMPLED BY		Client	Client	-
DELIVERED BY		Client	Client	-
SAMPLING METHOD		TMH5 - MB1	TMH5-MB1	-
ENVIRONMENTAL CONDITION WHEN SAMPLED		Slightly Moist	Slightly Moist	-
REMARKS & NOTES		None	None	-

PAGE 2/2

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