Client:	**SGS Trinidad Limited**	CTL Project No.:	**382353**
Project:	**Various Testing**	CTL Proj. Mgr.:	**Xiuping Feng**
		Analyst:	**PS, WD, VS, SN, JB, MS**
Contact:	**Romell Sudama**	Approved:	*D. Droton*
Submitter:	**Romell Sudama**	Date Analyzed:	**21-Sep-16 to 24-Oct-16**
Date Received:	**16-Sep-16**	Date Reported:	**25-Oct-16**

ASTM C595-14 : TABLE 3 PHYSICAL REQUIREMENTS

	IL, IP IS(<70) IT(S<70)	IS(≥70) IT(S≥70)	CTL ID: Client ID:	**Test Results** **4305002** **Rock Hard Cement (Portugal)**
Fineness, specific surface[A]:				
No. 325 sieve, % retained	**---**	**---**		**7.3**
Air permeability test, min. m^2/kg:	**---**	**---**		**429**
Density, g/cm^3:	**---**	**---**		**3.03**
Autoclave expansion, max. %[B]:	**0.80**	**0.80**		**0.01**
Autoclave contraction, max. %[B]:	**0.20**	**0.20**		**---**
Time of Setting, Vicat test:[C]				
Initial, not less than, min.	**45**	**45**		**155**
Initial, not more than, hours	**7**	**7**		
Final, min.	**---**	**---**		**230**
Normal Consistency (wt%)	**---**	**---**		**26.2**
Air content of mortar, max volume %:	**12**	**12**		
Strength, compression, min., MPa (psi)				
Mortar flow (%)	**110 ± 5**	**110 ± 5**		**110**
1 day	**---**	**---**		**12.7**
				(1840)
3 days	**13.0**	**---**		**23.7**
	(1890)			**(3440)**
7 days	**20.0**	**5.0**		**26.3**
	(2900)	**(720)**		**(3820)**
28 days	**25.0**	**11.0**		**31.8**
	(3620)	**(1600)**		**(4610)**
Water Requirement, max wt% cement:	**---**	**---**		**48**

Special Property Designation Notes

When special properties are required the applicable limits as specified in Table 4 of ASTM C595 for the desired special property apply.

When special properties apply the cement Type as listed in Table 3 will be followed by the appropriate suffix(s) listed below:

A - air entraining is required
MS, HS - moderate or high sulfate resistance is required,
MH, LH - moderate or low heat of hydration is required,
R - resistance to alkali silica reacive aggregate expansion is required

Cements with greater than 5% limestone are not permitted as MS or HS cements

When multiple special properties are required the strength requirement for special property with the lowest 7 day strength shall apply.

General Notes:

A: Both amount retained on a 45 micron sieve and the (blaine) air permeability fineness are to be reported on all certificates requested from the manufacturer.

B: The specimens shall remain firm and hard and show no signs of distortion, cracking, checking, pitting, or disintegration when subjected to to the autoclave expansion test.

C: Time of setting refers to initial setting time in Test Method C191. Test conducted using method B of ASTM C191-08. The time of setting of cements containing a user-requested accelerating or retarding functional addition need not meet the limits of this table, but shall be stated by the manufacturer.

D: This report may not be reproduced except in its entirety.

Client:	**SGS Trinidad Limited**	CTL Project No.:	**382353**
Project:	**Various Testing**	CTL Proj. Mgr.:	**Xiuping Feng**
		Analyst:	**PS, WD, VS, SN, JB, MS**
Contact:	**Romell Sudama**	Approved:	*D. Braton*
Submitter:	**Romell Sudama**	Date Analyzed:	**25-Oct-16**
Date Received:	**16-Sep-16**	Date Reported:	**25-Oct-16**

ASTM C595-14 : TABLE 4 PHYSICAL REQUIREMENTS

	Physical Requirements for Blended Cements with Special Properties[G]						Test Results	
Special Property Designation[A]	A	MS[B]	HS[B]	MH	LH	R[C]	CTL ID: Client ID:	4305002 Rock Hard Cement (Portugal)
Air content of mortar, max volume %:								
min volume %:	**16[D]**							
max volume %:	**22[D]**	**12**	**12**	**12**	**12**	**12**		
Density, g/cm^3:	**---**	**---**	**---**	**---**	**---**	**---**		**3.03**
Strength, compression, min., MPa (psi)[E]								
Mortar flow (%)	**110 ± 5**	**110 ± 5**	**110 ± 5**	**110 ± 5**	**110 ± 5**			**110**
1 day	**---**	**---**	**---**	**---**	**---**	**---**		**12.7 (1840)**
3 days	**10.4 (1510)**	**11.0 (1600)**	**11.0 (1600)**	**10.4 (1510)**	**---**	**13.0 (1890)**		**23.7 (3440)**
7 days	**16.0 (2320)**	**18.0 (2610)**	**18.0 (2610)**	**16.0 (2320)**	**11.0 (1600)**	**20.0 (2900)**		**26.3 (3820)**
28 days	**20.0 (2900)**	**25.0 (3620)**	**25.0 (3620)**	**20.0 (2900)**	**21.0 (3050)**	**25.0 (3620)**		**31.8 (4610)**
Water Requirement, max wt% cement:	**---**	**---**	**---**	**---**	**64**	**---**		**48**
Heat of Hydration								
7 days, max kj/kg (cal/g)	**---**	**---**	**---**	**290 (70)**	**250 (60)**	**---**		
28 days, max kj/kg (cal/g)	**---**	**---**	**---**	**330 (80)**	**290 (70)**	**---**		
Drying Shrinkage, (ASTM C157) max %:	**---**	**---**	**---**	**---**	**0.15**	**---**		
Sulfate Resistance (ASTM C1012)								
expansion at 180 days, max %	**---**	**0.10**	**0.05[F]**	**---**	**---**	**---**		
expansion at 1 year, max, %	**---**	**---**	**0.10[F]**	**---**	**---**	**---**		
Mortar Expansion (ASTM C227)								
14 days, max %	**---**	**---**	**---**	**---**	**---**	**0.020**		
56 days, (8 week) max %	**---**	**---**	**---**	**---**	**---**	**0.060**		

A: These requirements apply only if specified and are designated by the appropriate suffixes A, MS, HS, MH, LH, or R as appropriate type designations IL, IP, IS(<70), IT(S<70)
The requirements for fineness, autoclave expansion, autoclave contraction and time of setting shall conform to Table 3.
B: Cements with greater than 5% limestone are not permitted as moderate (MS) or high (HS) sulfate resistance cements.
C: Compliance with this requirement shall not be required unless the cement shall be used with alkali-silica reactive aggregate.
D: These air content limits apply to cements with multiple special property requirements when one of those designations is (A).
E: When multiple special property designations are applied, the set of strength requirements for the special property designation with the lowest 7-day minimum shall apply
F: Testing of HS cement, at one year shall not be required when the cement meets the 180-day limit. A HS cement failing the 180-day limit shall not be rejected unless it also fails the one year limit
G: The naming convention was simplied in ASTM C595-14. The user is directed to clause 4.2.3 and note 4 of ASTM C595-14.

Client:	**SGS Trinidad Limited**	CTL Project No.:	**382353**
Project:	**Various Testing**	CTL Proj. Mgr.:	**Xiuping Feng**
		Analyst:	**Johnathon Bass**
Contact:	**Romell Sudama**	Approved:	*Scott Nettles*
Submitter:	**Romell Sudama**	Date Analyzed:	**September 22, 2016**
Date Received:	**September 16, 2016**	Date Reported:	**September 22, 2016**

REPORT OF CHEMICAL ANALYSIS

Client's Sample ID:	Rock Hard Cement (Portugal)
Material type:	Cement-blended
CTL Sample ID:	4305002

Analyte	Weight %
SiO_2	17.66
Al_2O_3	5.35
Fe_2O_3	3.32
CaO	57.69
MgO	1.81
SO_3	3.19
Na_2O	0.18
K_2O	0.82
TiO_2	0.26
P_2O_5	0.10
Mn_2O_3	0.05
SrO	0.09
Cr_2O_3	<0.01
ZnO	0.06
BaO	0.03
L.O.I. (950°C)[2]	8.60
Total	99.21

T-Alk (Na_2O + 0.658K_2O) 0.73

Notes:
1. This analysis represents specifically the sample submitted.
2. Sample results reported on an as received weight basis.
3. Oxide analysis by X-ray fluorescence spectrometry. Samples fused at 1000°C with $Li_2B_4O_7/LiBO_2$.
4. X-Ray Fluorescence oxide analysis meets the precision and accuracy requirements for rapid methods per ASTM C114-13. Most recent re-qualification date is 04-Nov-2017.
5. Volatile elements may be lost during high temperature ignition and fusion.
6. This report may not be reproduced except in its entirety.