



# COLTO SPECIFICATIONS - MARCH 1998

Review 27 November 2009

PROPERTY	G1	G2	G3	G4	G5	G6	G7	G8	G9
<b>DESCRIPTION OF MATERIAL</b>	Sound rock from an approved quarry, or clean, sound mine rock from mine dumps, or clean sound boulders	Sound rock, boulders or coarse gravel		Natural gravel, or natural gravel & boulders which may need crushing	Natural gravel, or natural gravel & boulders which may need crushing or crushed rock	Natural gravel, or natural gravel & boulders which may need crushing or crushed rock	Natural material (soil, sand or gravel)	Natural material (soil, sand or gravel)	Natural material (soil, sand or gravel)
<b>ADDITIONAL FINES</b>	Only fines crushed from the same sound parent rock may be added for grading correction provided that added fines shall have a LL not exceeding 25 and PI not exceeding 4	May contain up to 10% by mass of approved natural fines not necessarily obtained from parent rock. Added fines shall have a LL not exceeding 25 and PI not exceeding 6	May contain up to 15% by mass of approved natural fines not obtained from parent rock. Added fines shall have a LL not exceeding 25 and PI not exceeding 6	May contain approved additional fines not obtained from parent rock. Added fines shall have a liquid limit not exceeding 25 and a plasticity index not exceeding 6	May contain approved natural fines not obtained from parent rock.	May contain approved natural fines not obtained from parent rock.	-	-	-
<b>NOMINAL MAXIMUM SIZE</b>	37.5mm	37.5mm	37.5mm / 26.5mm	Uncrushed 53mm : crushed 37.5 or 26.5mm	Uncrushed 63mm : crushed 53mm before compaction	Uncrushed : 2/3 compacted layer : crushed 63mm before compaction	Uncrushed : 2/3 compacted layer : crushed material: 75mm	2/3 compacted layer	2/3 compacted layer
<b>FLAKINESS INDEX</b>	Flakiness Index, determined in accordance with TMH1 method B3, shall not exceed 35 on each of the -26.5+19mm fraction and the -19+13.2mm fraction			As per TMH1 B3 shall not exceed 35 on each of the -26.5+19mm fraction and -19+13.2mm fraction	-	-	-	-	-
<b>FRACTURED FACES</b>	All faces shall be fractured faces	For crushed materials at least 50% by mass of the fractions retained on each standard sieve 4.75mm and larger shall have at least one fractured face.		Alluvial & colluvial gravels shall be crushed so that at least 50% by mass of the fractions retained on each standard sieve 4.75mm and larger shall have at least one fractured face	Alluvial & colluvial material shall be crushed so that at least 50% by mass of the fractions retained on 4.75mm shall have at least on fractured face	-	-	-	-
<b>GRADING</b>	* see reverse	* see reverse	* see reverse	* see reverse	* see reverse	-	-	-	-
<b>GRADING MODULUS</b>	-	-	-	-	2.5 ≥ GM ≥ 1.5	2.6 ≥ GM ≥ 1.2	2.7 ≥ GM ≥ 0.75	2.7 ≥ GM ≥ 0.75	2.7 ≥ GM ≥ 0.75
<b>ATTERBERG LIMITS (-0.425mm FRACTION)</b>	LL shall not exceed 25 PI shall not exceed 5 LS shall not exceed 2% In addition the arithmetic mean of the PI's for a lot (min 6 tests) shall not exceed 4	LL shall not exceed 25 PI shall not exceed 6 LS shall not exceed 3% In addition the arithmetic mean of the PI's for a lot (min 6 tests) shall not exceed 4.5	LL shall not exceed 25 PI shall not exceed 6 LS shall not exceed 3% In the case of calcarete the PI shall not exceed 8. (% passing 0.425mm sieve) LS ≤ 170	a) All materials except calcarete LL shall not exceed 25 PI shall not exceed 6 LS shall not exceed 3% b) Calcarete LL ≤ 25 PI ≤ 8 (% passing 0.425mm sieve ) LS ≤ 170	a) All materials except calcarete LL shall not exceed 30 PI shall not exceed 10 LS shall not exceed 5% b) Calcarete LL ≤ 30 PI ≤ 15 LS ≤ 6 (% passing 0.425mm sieve ) LS ≤ 320	PI shall not exceed 12 or a value equal to 2 times the GM plus 10, whichever is the higher value. LS shall not exceed 5%. In the case of calcarete the PI shall not exceed 15 provided the LS does not exceed 6% and (% passing 0.425mm sieve) LS ≤ 320	The PI shall not exceed 12 or a value equal to 3 times the GM plus 10, whichever is the higher value. In the case of calcarete the PI shall not exceed 17 provided that the LS does not exceed 7% and (% passing 0.425mm sieve) LS ≤ 320	The PI shall not exceed 12 or a value equal to 3 times the GM plus 10, whichever is the higher value. In the case of calcarete the PI shall not exceed 17 provided that the LS does not exceed 7%	The PI shall not exceed 12 or a value equal to 3 times the GM plus 10, whichever is the higher value. In the case of calcarete the PI shall not exceed 17 provided that the LS does not exceed 7%
<b>ATTERBERG LIMITS (-0.075mm FRACTION)</b>	The PI shall not exceed 12. If the PI exceeds 12 the material shall be chemically modified. After chemical modification the PI of the minus 0.075mm fraction shall not exceed 8.		If chemical modification is required, the PI of the 0.075mm fraction after modification shall not exceed 10	-	-	-	-	-	-
<b>DURABILITY</b>	The material shall comply with the requirements in columns 3, 4 and 5 of table 3602/2 (COLTO)			The material shall comply with the requirements in table 3402/3 (COLTO)	Mudrock shall have a wet 10% FACT value of not less than 90 kN, and a wet/dry Venter test class of I or II	Mudrock shall have a wet 10% FACT value of not less than 80 kN, and a wet/dry Venter test class of I or II	Mudrock shall have a wet 10% FACT value of not less than 60 kN, and a wet/dry Venter test class of I, II or III	Mudrock shall have a wet 10% FACT value of not less than 60 kN, and a wet/dry Venter test class of I, II or III	Mudrock shall have a wet 10% FACT value of not less than 60 kN, and a wet/dry Venter test class of I, II or III
<b>SOLUBLE SALTS</b>	See additional requirements (COLTO)			The material shall comply with the requirements in clause 3602 (COLTO)					
<b>STRENGTH (CBR)</b>	-	-	-	CBR at 98% of modified AASHTO density shall not be less than 80%	CBR at 95% of modified AASHTO density shall not be less than 45%	CBR at 95% of modified AASHTO density shall not be less than 25%	CBR at 93% of modified AASHTO density shall be at least 15%	CBR at 93% of modified AASHTO density shall be at least 10%	CBR at 93% of modified AASHTO density shall be at least 7%
<b>SWELL (MAXIMUM)</b>	-	-	-	Swell at 100% modified AASHTO density shall not exceed 0.2% for all materials except calcarete for which the swell shall not exceed 0.5%	Swell at 100% modified AASHTO density shall not exceed 0.5%	Swell at 100% modified AASHTO density shall not exceed 1.0%	Swell at 100% modified AASHTO density shall not exceed 1.5%	Swell at 100% modified AASHTO density shall not exceed 1.5%	Swell at 100% modified AASHTO density shall not exceed 1.5%
<b>COMPACTION REQUIREMENTS</b>	Minimum Of 88% of apparent relative density	Minimum of 85% of bulk relative density	98% or 100% of modified AASHTO density (as specified)	98% or 100% (as specified) of modified AASHTO density for natural materials	The density requirements of the layer in which the material is used, shall be applicable. (See subclause 3402(b)(COLTO) In restricted areas the in situ dry density of gravel material shall comply wuth the requirements in the project specifications.				
<b>Strength</b>	10% fines aggregate crushing value (10% FACT), determined in accordance with TMH1 method B2, shall be not less than the appropriate value in table 3602/2, column 3. The Aggregate Crushed Value (ACV), determined in accordance with TMH1 method B1, shall not exceed the appropriate value in table 3602/3.								
<b>COARSE SAND RATIO (SEE DEFINITION IN SUBCLAUSE 3602( c)(i)(5))</b>	Shall not be less than 35% and shall not exceed 50% in respect of the target grading	Shall not be less than 35% and shall not exceed 50% in respect of the target grading	Shall not be less than 35% and shall not exceed 50% in respect of the target grading						

## GRADING OF GRADED CRUSHED STONE

	NOMINAL APERTURE SIZE OF SIEVE (mm)	G1	G2	G3		G4			G5	
		PERCENTAGE PASSING SIEVE BY MASS	PERCENTAGE PASSING SIEVE BY MASS	PERCENTAGE PASSING SIEVE BY MASS		PERCENTAGE PASSING SIEVE BY MASS				
		37.5mm	37.5mm	37.5mm	26.5mm	CRUSHED		UNCRUSHED		
						37.5mm	26.5mm			
<b>GRADING</b>	<b>53.0</b>									The percentage by mass passing the 2.00mm sieve shall not be less than 20% nor more than 70%
	<b>37.5</b>	100	100	100		100		100	85 - 100	
	<b>26.5</b>	84 - 94	84 - 94	84 - 94	100	84 - 94	100		-	
	<b>19.0</b>	71 - 84	71 - 84	71 - 84	85 - 95	71 - 84	85 - 95		60 - 90	
	<b>13.2</b>	59 - 75	59 - 75	59 - 75	71 - 84	59 - 75	71 - 84		-	
	<b>4.75</b>	36 - 53	36 - 53	36 - 53	42 - 60	36 - 53	42 - 60		30 - 65	
	<b>2.00</b>	23 - 40	23 - 40	23 - 40	27 - 45	23 - 40	27 - 45		20 - 50	
	<b>0.425</b>	11 - 24	11 - 24	11 - 24	13 - 27	11 - 24	13 - 27		10 - 30	
<b>0.075</b>	4 - 12	4 - 12	4 - 12	5 - 12	4 - 12	5 - 12		5 - 15		

### 10% FINES AGGREGATE CRUSHING VALUES (Table 3602/2)

Rock Type	Matrix	Dry (min.)	Wet (min.)	Wet / Dry (min.)
Arenaceous rocks	Non-siliceous cementing material	140kN		75%
	Siliceous cementing material	110kN		75%
Diamictites (tillites)		200kN		70%
Argillaceous rocks		180kN	125kN	-
Other rock types		110kN		75%

### DURABILITY REQUIREMENTS FOR G4 MATERIAL (Table 3402/3)

GROUP	MEMBERS OF GROUP	DURABILITY MILL INDEX (MAX.)	% PASSING 0.425mm SIEVE AFTER DURABILITY MILL TEST (MAX.)
Basic crystalline rock	Basalt Dolerite Gabbro	125	35
Acid crustaline rock	Gneiss Granite	420	35
High silica rock	Chert Hornfels Quartzite	420 (clay mineral kaolin)	35
Sandstone	Arkose Conglomerate Sandstone Siltstone	125	35 (increase from original not more than 15%)
Mudrock	Mudrock Phyllite Shale etc	125	35
Carbonate rock	Dolemite Limestone Marble	not applicable	not applicable
Diamictities	Greywacke Tillite	125	35
Pedogenic material	Calcrete Ferricrete Silcrete	480	40

### AGGREGATE CRUSHING VALUE (Table 3602/3)

Rock Type	ACV, max.
Arenaceous: without siliceous cementing matrix	27%
Arenaceous: with siliceous cementing matrix	29%
Diamictites (tillites)	21%
Argillaceous rocks	24%
Other rock types	29%



*for more detailed information and interpretations see latest COLTO*