IV-5-2 TABLE OF SOIL TEST

Table of Soil Test (Sheet 1 of 2)

		Borrow area No. 1																															
Name of test pit		TP-101		TP-101		TP-102		TP-102		TP-102		TP-103		TP-103		TP-104		TP-104		Average		TP-201		TP-201		TP-201		TP-202		TP-202		TP-	
Date of test		Oct.26/70		Sept.30/70		Nov.7/70		–		Sept.30/70		Oct.28/70		Sept.30/70		Oct.26/70		Sept.30/70		–		Nov.9/70		Feb. /71		Sept.30/70		Sept.30/70		–		Oct.2	
Depth of sampling (m)		–		3.00		–		–		3.00		–		3.00		–		3.00		–		3.00		3.00		3.00		3.00		3.00		3.(	
Classification U.S.C.E		no plastic		MH		MH		MH		MH		SMu		SM		MH		MH		–		MH		ML		ML		ML		MH		MI	
Gradation analysis	4.76mm> (%)	100		–		100		100		–		99.93		–		100		–		99.99		97.82		100		–		–		100		99.(	
	2.0 mm> (%)	99.22		99.99		100		100		99.37		98.06		99.66		99.98		99.82		99.57		97.65		99.11		99.09		99.44		99.86		99.(	
	0.42mm> (%)	94.49		99.00		99.81		98.36		97.96		88.19		92.07		99.72		98.17		96.42		96.24		96.53		96.70		96.98		98.49		97.:	
	0.149mm > (%)	89.02		–		97.65		97.90		–		76.51		–		97.94		–		91.80		92.46		91.38		–		–		96.45		91.(	
	0.074mm > (%)	83.03		92.16		94.85		94.41		89.17		57.26		79.00		94.26		91.52		86.18		85.71		86.42		84.25		88.53		94.56		87.7	
Atterberg's limits	LL (%)	–		61.0		61.0		67.00		60.0		–		–		67.0		61.0		62.83		58.3		46.30		40.0		47.5		78.75		50.(	
	PL (%)	–		45.4		47.5		60.83		41.0		–		–		52.6		45.9		48.87		39.9		39.28		30.0		37.4		64.50		37.(	
	I_p (%)	–		15.6		13.5		6.17		19.0		–		–		14.4		15.1		13.96		18.4		7.02		10.0		10.1		14.25		12.(	
	I_L	–		2.42		0.72		-2.08		0.74		–		–		0.97		1.42		0.70		0.16		1.14		1.08		0.35		-0.65		0.:	
	I_c	–		-1.42		0.28		3.08		0.26		–		–		0.03		-0.42		0.30		0.84		-0.14		-0.08		0.65		1.65		0.	
	G	2.69		2.69		2.60		2.71		2.72		2.36		–		2.58		2.58		2.62		2.42		2.53		2.47		2.45		2.37		2.:	
ω natural (%)		49.13		83.1		57.2		48.0		55.0		102.0		76.2		66.51		67.3		67.16		42.9		47.3		40.8		40.9		55.3		48.:	
e natural																																	
Sr. natural (%)																																	
Compaction test	Standard *1)	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P
	ω optimum (%)	–	–	–	42.0	–	45.0	43.5	41.5	–	38.0	–	–	–	–	–	46.3	–	41.9	43.5	42.4	–	38.1	33.0	32.0	–	26.9	–	30.3	39.0	44.0	–		
	γ d. max (g/cm³)	–	–	–	1.20	–	1.19	1.18	1.20	–	1.25	–	–	–	–	–	1.14	–	1.22	1.18	1.20	–	1.30	1.30	1.31	–	1.42	–	1.33	1.22	1.25	–		
	e optimum	–	–	–	1.24	–	1.18	1.30	1.26	–	1.18	–	–	–	–	–	1.26	–	1.11	1.22	1.18	–	0.86	0.95	0.93	–	0.74	–	0.84	0.94	0.90	–		
	Sr. optimum (%)	–	–	–	91.1	–	99.1	90.7	89.3	–	87.6	–	–	–	–	–	94.8	–	97.4	93.4	94.1	–	95	87.9	87.1	–	89.8	–	88.4	98.3	95	–		
Consolidation test	inicial	1.51		–		1.55		1.39		–		2.91		–		1.40		–		1.75		1.00		0.90		–		–		1.05		1.0	
	final	1.30		–		1.36		1.25		–		2.18		–		1.24		–		1.47		0.88		0.80		–		–		0.98		0.8:	
	a_v	0.037		–		0.025		0.028		–		0.150		–		0.025		–		0.053		0.012		0.01		–		–		0.023		0.0:	
	C_v	0.0096		–		0.0341		0.0119		–		0.0103		–		0.0056		–		0.0143		0.0132		0.008		–		–		0.0129		0.0(	
	m_v	0.015		–		0.0098		0.012		–		0.038		–		0.0104		–		0.0170		0.006		0.0053		–		–		0.01122		0.0	
	K	1.42×10^{-4}		–		3.3×10^{-4}		1.4×10^{-7}		–		4×10^{-4}		–		4.7×10^{-5}		–		1.8×10^{-4}		7.9×10^{-5}		4.2×10^{-8}		–		–		1.4×10^{-7}		6.6x	
Unconfined compression Strength q_u (kg/cm²)		–		2.06		1.40		1.52		3.25		–		–		2.26		2.22		2.12		2.40		2.02		2.92		4.5		1.87		–	
Triaxial compression test	C (kg/cm²)	–		–		0.10		0.25		–		–		–		0.75		–		0.37		0.5		1.0		–		–		1.5		–	
	φ (°)	–		–		40		55		–		–		–		22		–		39		51		49		–		–		33		–	
	tan φ	–		–		0.839		1.43		–		–		–		0.404		–		0.810		1.23		1.15		–		–		0.649		–	
Direct shear test	C (kg/cm²)	0.1		–		0.00		0.20		–		0.18		–		0.12		–		0.12		0.08		0.22		–		–		0.19		–	
	φ (°)	40		–		40		36		–		30		–		32		–		36		34		43		–		–		39		–	
	tan φ	0.839		–		0.839		0.726		–		0.577		–		0.625		–		0.726		0.674		0.932		–		–		0.810		–	

Note: 1) P --- PROCTOR Standard, H --- HARVARD Standard
2) This soil test was conducted by Universidad Del Cauca responding to the request of CEDELCA.

Table of Soil Test (Sheet 1 of 2)

area No. 1																																										
-102	TP-103		TP-103		TP-104		TP-104		Average		Borrow area No. 2																														TP101 TP204
											TP-201		TP-201		TP-201		TP-202		TP-202		TP-202		TP-203		TP-203		TP-204		TP-204		Average								Average
t.30/70	Oct.28/70		Sept.30/70		Oct.26/70		Sept.30/70		—		Nov.9/70		Feb. /71		Sept.30/70		Sept.30/70		—		Oct.27/70		Nov.4/70		Sept.30/70		Sept.30/70		Oct.31/70		—								—
.00	—		3.00		—		3.00		—		3.00		3.00		3.00		3.00		3.00		3.00		3.00		3.00		3.00		3.00		—								—
4H	SMu		SM		MH		MH		—		MH		ML		ML		ML		MH		MH		SMu		SM		SM		SMu		—								—
—	99.93		—		100		—		99.99		97.82		100		—		—		100		99.92		99.88		—		—		100		99.60								99.78
.37	98.06		99.66		99.98		99.82		99.57		97.65		99.11		99.09		99.44		99.86		99.62		97.20		99.96		98.66		99.98		99.06								99.30
.96	88.19		92.07		99.72		98.17		96.42		96.24		96.53		96.70		96.98		98.49		97.25		76.20		98.67		90.98		79.37		92.74								94.48
—	76.51		—		97.94		—		91.80		92.46		91.38		—		—		96.45		91.97		50.23		—		—		59.25		80.29								85.52
,17	57.26		79.00		94.26		91.52		86.18		85.71		86.42		84.25		88.53		94.56		87.79		34.65		90.47		67.84		51.54		77.18								81.44
.0	—		—		67.0		61.0		62.83		58.3		46.30		40.0		47.5		78.75		50.0		—		—		—		—		53.48								58.15
.0	—		—		52.6		45.9		48.87		39.9		39.28		30.0		37.4		64.50		37.4		—		—		—		—		41.41								45.14
.0	—		—		14.4		15.1		13.96		18.4		7.02		10.0		10.1		14.25		12.6		—		—		—		—		12.07								13.01
.74	—		—		0.97		1.42		0.70		0.16		1.14		1.08		0.35		-0.65		0.87		—		—		—		—		0.49								0.60
.26	—		—		0.03		-0.42		0.30		0.84		-0.14		-0.08		0.65		1.65		0.13		—		—		—		—		0.51								0.40
.72	2.36		—		2.58		2.58		2.62		2.42		2.53		2.47		2.45		2.37		2.53		2.46		2.66		2.58		2.59		2.52								2.56
.0	102.0		76.2		66.51		67.3		67.16		42.9		47.3		40.8		40.9		55.3		48.3		87.8		58.4		107.2		178.0		70.69								69.02
H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H
38.0	—	—	—	—	—	46.3	—	41.9	43.5	42.4	—	38.1	33.0	32.0	—	26.9	—	30.3	39.0	44.0	—	—	—	—	—	—	—	—	—	—	—	—	36.0	34.3	38.5	38.7				
1.25	—	—	—	—	—	1.14	—	1.22	1.18	1.20	—	1.30	1.30	1.31	—	1.42	—	1.33	1.22	1.25	—	—	—	—	—	—	—	—	—	—	—	—	1.26	1.32	1.23	1.26				
1.18	—	—	—	—	—	1.26	—	1.11	1.22	1.18	—	0.86	0.95	0.93	—	0.74	—	0.84	0.94	0.90	—	—	—	—	—	—	—	—	—	—	—	—	1.00	0.91	1.08	1.03				
87.6	—	—	—	—	—	94.8	—	97.4	93.4	94.1	—	95	87.9	87.1	—	89.8	—	88.4	98.3	95	—	—	—	—	—	—	—	—	—	—	—	—	90.7	95.0	91.3	96.2				
	2.91		—		1.40		—		1.75		1.00		0.90		—		—		1.05		1.01		2.34		—		—		5.19		1.92				1.84			
	2.18		—		1.24		—		1.47		0.88		0.80		—		—		0.98		0.83		1.97		—		—		4.56		1.67				1.58			
	0.150		—		0.025		—		0.053		0.012		0.01		—		—		0.023		0.02		0.044		—		—		0.055		0.027				0.039			
	0.0103		—		0.0056		—		0.0143		0.0132		0.008		—		—		0.0129		0.0066		0.0131		—		—		0.0049		0.0098				0.0118			
	0.038		—		0.0104		—		0.0170		0.006		0.0053		—		—		0.01122		0.011		0.0132		—		—		0.0089		0.0093				0.0128			
	$4x10^{-4}$		—		$4.7x10^{-5}$		—		$1.8x10^{-4}$		$7.9x10^{-5}$		$4.2x10^{-8}$		—		—		$1.4x10^{-7}$		$6.6x10^{-5}$		$1.7x10^{-4}$		—		—		$4.4x10^{-5}$		$0.6x10^{-4}$				$1.2x10^{-4}$			
5	—		—		2.26		2.22		2.12		2.40		2.02		2.92		4.5		1.87		—		—		—		—		—		2.74				2.40			
	—		—		0.75		—		0.37		0.5		1.0		—		—		1.5		—		—		—		—		—		1.0				0.68			
	—		—		22		—		39		51		49		—		—		33		—		—		—		—		—		44				42			
	—		—		0.404		—		0.810		1.23		1.15		—		—		0.649		—		—		—		—		—		0.966				0.900			
	0.18		—		0.12		—		0.12		0.08		0.22		—		—		0.19		—		0.0		—		—		0.50		0.20				0.16			
	30		—		32		—		36		34		43		—		—		39		—		40		—		—		23		36				36			
	0.577		—		0.625		—		0.726		0.674		0.932		—		—		0.810		—		0.839		—		—		0.424		0.726				0.726			

) the request of CEDELCA.

Table of Soil Test (Sheet 2 of 2)

		Headrace tunnel				Dam site No. 2	Borrow area No. 1			Borrow area No. 2			Dike sites: Dike No. 1	Dike sites: Dike No. 2			DH2 D.DH2
Name of drill hole		DH-2	DH-2	DH-2	DH-2	DH-203	DH-6	DH-6	DH-6	DH-7	DH-7	DH-7	D.DH-1	D.DH-2	D.DH-2	D.DH-2	Average
Date of test		Nov. 25/70	Nov. 25/70	Nov. 25/70	Nov. 25/70	Nov. 25/70	Oct. /70	Oct. /70	Oct. /70	–	–	–	May 5/71	May 5/71	May 5/71	May 5/71	–
Depth of sampling (m)		5.00 to 6.00	10.00 to 11.00	15.00 to 16.00	20.00 to 21.00	6.00 to 7.00	6.00 to 7.00	10.00 to 11.00	15.00 to 16.00	5.00 to 6.00	10.00 to 11.00	16.00 to 17.00	20.00	5.00	10.00	20.00	–
Classification U.S.C.E		MH	MH	ML	–	–	MH	MH	ML	MH	ML	–	ML and gravel	ML	ML	ML	–
Gradation analysis	4.76 mm>(%)	–	–	100	99.88	97.31	–	–	–	–	99.94	99.63	64.75	100	100	99.97	95.72
	2.0 mm>(%)	99.92	99.97	99.98	99.86	95.11	99.90	–	99.86	99.95	99.87	99.17	55.61	99.72	99.55	98.46	96.21
	0.42 mm>(%)	99.15	99.40	96.31	94.34	81.39	99.34	99.13	98.40	99.17	99.24	97.07	45.83	98.73	98.13	87.01	92.84
	0.149 mm>(%)	93.97	96.20	86.00	80.08	68.58	96.82	94.33	92.68	94.84	93.30	85.87	35.74	93.17	92.75	73.92	85.22
	0.074 mm>(%)	89.00	94.25	82.80	74.37	65.86	92.42	90.12	88.15	89.81	86.92	74.24	34.98	81.61	84.86	63.44	79.52
Atterberg's limits	LL (%)	56.0	67.0	35.0	32.8	–	66.5	56.5	42.5	62.0	47.5	–	38.50	63.00	58.00	58.00	52.56
	PL (%)	40.3	52.6	26.9	28.8	–	51.6	44.3	32.8	44.4	31.5	–	37.97	56.28	50.61	50.26	42.18
	Ip (%)	15.7	14.4	8.1	4.0	–	14.9	12.2	9.7	17.6	16.0	–	0.53	6.72	7.39	7.74	10.38
	I_L	1.55	1.68	1.25	2.33	–	1.68	1.16	1.01	0.80	0.98	–	17.88	1.98	0.85	3.38	1.26
	Ic	-0.55	-0.68	-0.25	-1.33	–	-0.68	-0.16	-0.01	0.20	0.02	–	-16.88	-0.98	0.15	-2.38	-0.26
	G	2.58	2.43	2.49	2.5	2.60	–	–	–	–	–	–	2.59	2.62	2.74	2.66	2.58
ω natural (%)		64.7	76.8	37.0	38.1	37.4	76.7	58.5	42.6	58.4	47.1	42.3	47.45	69.60	56.9	76.39	55.33
γ natural (g/cm^3)		1.72	1.65	1.89	1.85	–	–	–	–	–	–	–	–	–	–	–	1.78
e natural		1.47	1.60	0.80	0.87	–	–	–	–	–	–	–	–	–	–	–	1.25
Sr. natural (%)		95<	95<	95<	95<	–	–	–	–	–	–	–	–	–	–	–	95 <
Unconfined compression strength q_u (kg/cm^2)		1.42	0.71	–	–	–	1.63	1.34	4.04	1.17	0.70	0.87	0.72	1.93	2.7	0.49	1.48

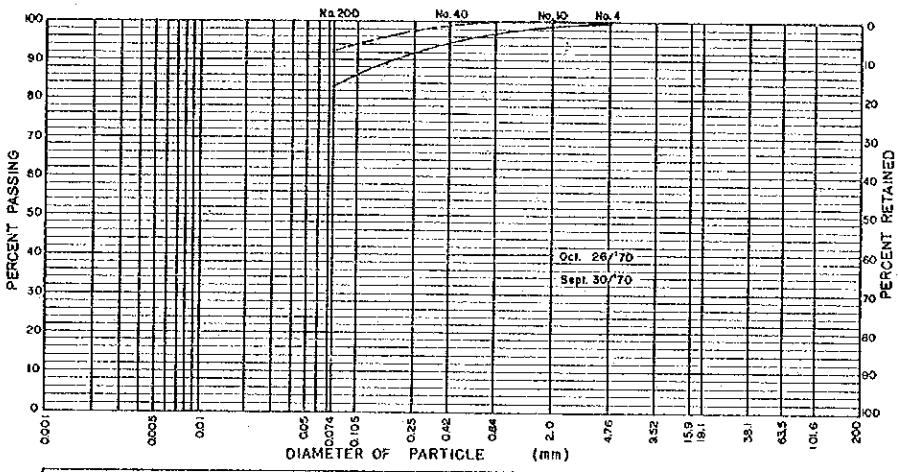
Note 1) This soil test was conducted by Universidard Del Cauca responding to the request of CRDELCA.

IV-5-3 GRADATION ANALYSIS

Site	Location Drill Hole or Test Pit	Depth (m)	Date of Testing	Classification of Soil*	Page	Remark
Borrow Area No. 1	TP-101	–	Oct. 26, '70	non-plastic		Test Pit
	TP-101	3.0	Sep. 30, '70	MH		
	TP-102	–	Nov. 7, '70	MH		
	TP-102	–	–	MH		
	TP-102	3.0	Sep. 30, '70	SMu		
	TP-103	–	Oct. 28, '70	SM		
	TP-103	3.0	Sep. 30, '70	MH		
	TP-104	–	Oct. 26, '70	MH		
	TP-104	3.0	Sep. 30, '70	MH		
Borrow Area No. 2	TP-201	3.0	Nov. 9, '70	MH		Test Pit
	TP-201	3.0	Feb. '71	ML		
	TP-201	3.0	Sep. 30, '70	ML		
	TP-202	3.0	Sep. 30, '70	ML		
	TP-202	3.0	–	MH		
	TP-202	3.0	Oct. 27, '70	MH		
	TP-203	3.0	Nov. 4, '70	SMu		
	TP-203	3.0	Sep. 30, '70	SM		
	TP-204	3.0	Sep. 30, '70	SM		
	TP-204	3.0	Oct. 31, '80	SMu		
Headrace Tunnel	DH-2	5.0 to 6.0	Nov. 25, '70	MH		Drill Hole
	DH-2	10.0 to 11.0	Nov. 25, '70	MH		
	DH-2	15.0 to 16.0	Nov. 25, '70	ML		
	DH-2	20.0 to 21.0	Nov. 25, '70	–		
Julumito Dam Site	DH-203	6.0 to 7.0	Nov. 25, '70	–		Drill Hole
Borrow Area No. 1	DH-6	6.0 to 7.0	Oct. '70	MH		Drill Hole
	DH-6	10.0 to 11.0	Oct. '70	MH		
	DH-6	15.0 to 16.0	Oct. '70	ML		
Borrow Area No. 2	DH-7	5.0 to 6.0	1 –	ML		Drill Hole
	DH-7	10.0 to 11.0	–	ML		
	DH-7	16.0 to 17.0	–			
Dike No. 1	DDH-1	20.0	May 5, '71	ML with gravel		Drill Hole
Dike No. 2	DDH-2	5.0	May 5, '71	ML		Drill Hole
	DDH-2	10.0	May 5, '71	ML		
	DDH-2	20.0	May 5, '71	ML		

*Classification and group smbols are originated by ASCE.

Gradation Analysis Curve TP-101 (Sheet 1 of 23)



SAMPLE NO.	TP-101 Oct 26/'70	TP-101 Sept 30/'70	
4.76 mm (%)	100	—	
2.0 mm (%)	99.22	99.99	
0.42 mm (%)	94.49	99.00	
0.149 mm (%)	89.02	—	
0.074 mm (%)	83.03	92.16	
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

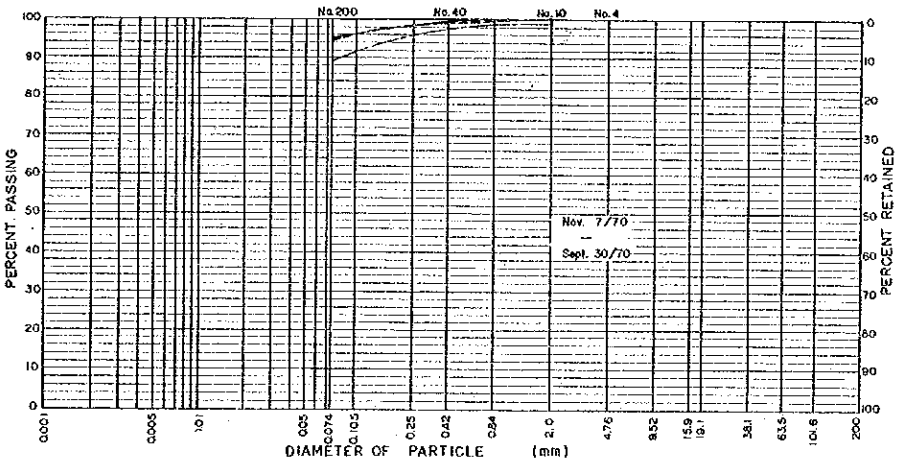
$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$: COEFFICIENT OF CURVATURE

SAMPLE NUMBER	SAMPLE DEPTH (m)	SOIL CLASSIFICATION UNIFIED SYSTEM	SOIL CLASSIFICATION REVISED P.R. SYSTEM	SPECIFIC GRAVITY Maximum dry unit weight (g/cm³)	SPECIFIC GRAVITY Optimum water content (%)	ATTERBERG LIMITS LL	PL	PI	SL
TP-101 (Oct 26/'70)	—	—		—	—	—	—	—	—
TP-101 (Sept. 30/'70)	3.00	MH		H 1.20	H 42.0	61.0	45.4	15.6	—

P : PROCTOR
M : MODIFICADA
H : HAVARD

Gradation Analysis Curve TP-102 (Sheet 2 of 23)



SAMPLE NO.	TP-102 Nov. 7/'70	TP-102 —	TP-102 Sept 30/'70
4.76 mm (%)	—	—	—
2.0 mm (%)	100	100	99.37
0.42 mm (%)	99.81	98.36	97.96
0.149 mm (%)	97.65	97.90	—
0.074 mm (%)	94.85	94.41	89.17
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

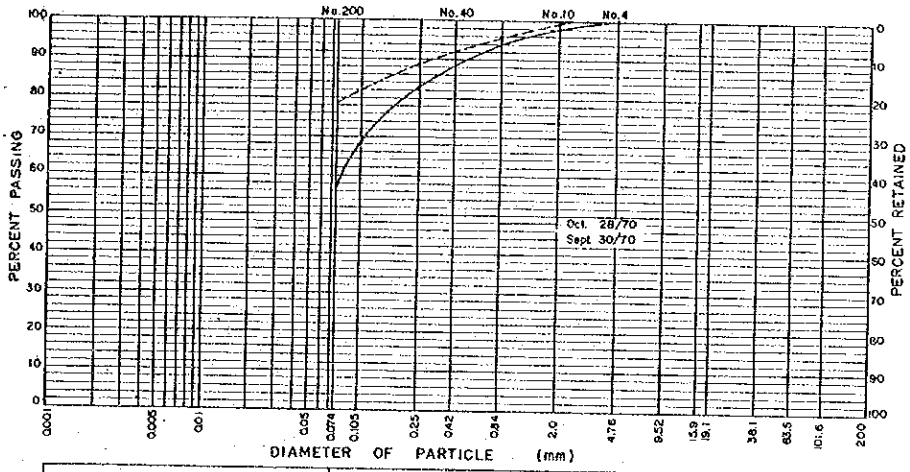
$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$: COEFFICIENT OF CURVATURE

SAMPLE NUMBER	SAMPLE DEPTH (m)	SOIL CLASSIFICATION UNIFIED SYSTEM	SOIL CLASSIFICATION REVISED P.R. SYSTEM	SPECIFIC GRAVITY Maximum dry unit weight (g/cm³)	SPECIFIC GRAVITY Optimum water content (%)	ATTERBERG LIMITS LL	PL	PI	SL
TP-102 (Nov. 7/'70)	—	MH		H 1.19	H 45.0	61.0	47.5	13.5	—
TP-102	—	MH		P H 1.18 1.20	P H 43.5 41.5	67.0	60.8	6.2	—
TP-102 (Sept. 30/'70)	3.00	MH		H 1.25	H 38.0	60.0	42.0	19.0	

P : PROCTOR
M : MODIFICADA
H : HAVARD

Gradation Analysis Curve TP-103 (Sheet 3 of 23)



SAMPLE NO.	TP-103 Oct 28/70	TP-103 Sept 30/70	
mm 4.76(%)	99.93	—	
mm 2.0 (%)	98.06	99.66	
mm 0.42(%)	88.19	92.07	
mm 0.149(%)	76.51	—	
mm 0.074(%)	57.26	79.00	
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

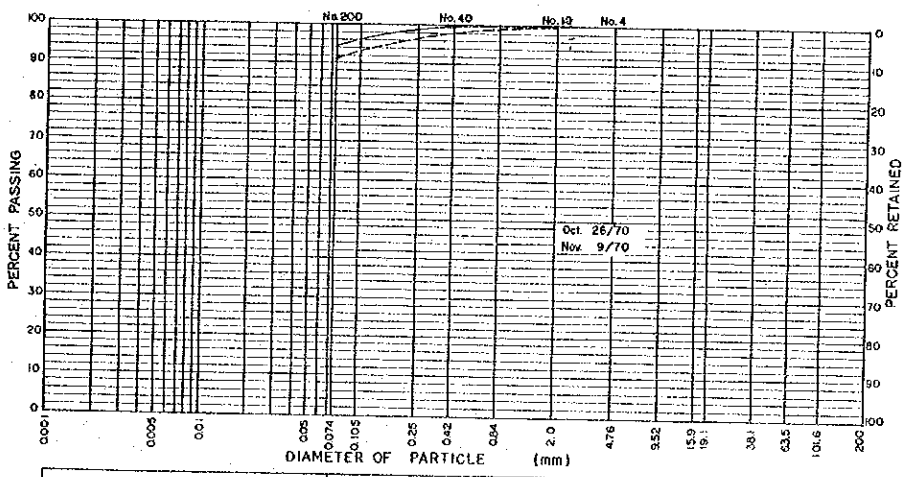
$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$: COEFFICIENT OF CURVATURE

CLAY (PLASTIC) ~ SILT (NON-PLASTIC)	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

SAMPLE		SOIL CLASSIFICATION		SPECIFIC GRAVITY		ATTERBERG LIMITS			
NUMBER	DEPTH (m)	UNIFIED SYSTEM	REVISED P.R. SYSTEM	Maximum dry unit weight (g/cm³)	Optimum water content (%)	LL	PL	PI	SL
TP-103 (Oct. 28/'70)	—	SMu		—	—	—	—	—	—
TP-103 (Sept. 30/'70)	3.00	SM		—	—	—	—	—	—

Gradation Analysis Curve TP-104 (Sheet 4 of 23)



SAMPLE NO.	TP-104 Oct 26/70	TP-104 Nov 9/70	
mm 4.76 (%)	100	—	
mm 2.0 (%)	99.98	99.82	
mm 0.42 (%)	99.72	98.17	
mm 0.149 (%)	97.94	—	
mm 0.074 (%)	94.26	91.52	
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

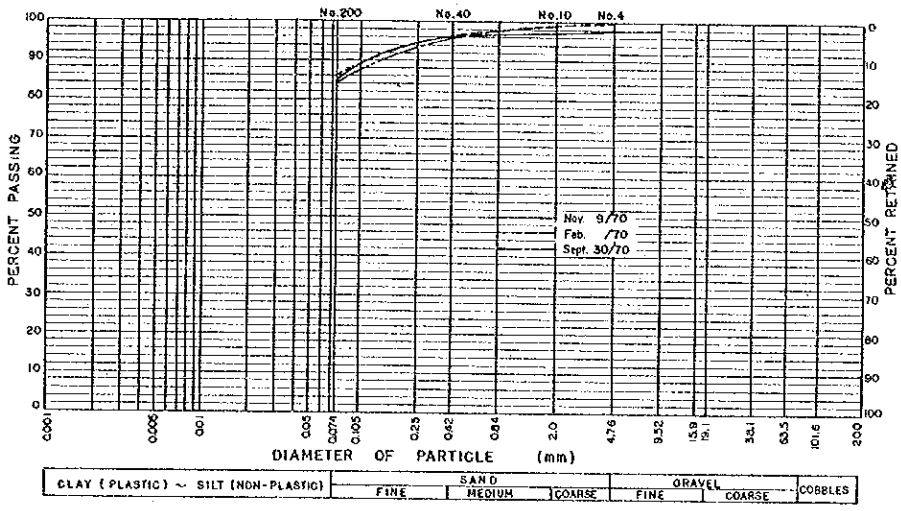
$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$: COEFFICIENT OF CURVATURE

CLAY (PLASTIC) ~ SILT (NON-PLASTIC)	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

SAMPLE		SOIL CLASSIFICATION		SPECIFIC GRAVITY		ATTERBERG LIMITS			
NUMBER	DEPTH (m)	UNIFIED SYSTEM	REVISED P.R. SYSTEM	Maximum dry unit weight (g/cm³)	Optimum water content (%)	LL	PL	PI	SL
TP-104 (Oct. 26/'70)	—	MH		H 1.14	H 46.3	67.0	52.6	14.4	—
TP-104 (Nov. 9/'70)	3.00	MH		H 1.22	H 41.9	61.0	45.9	15.1	—

P : PROCTOR
M : MODIFICADA
H : HAVARD

Gradation Analysis Curve TP201 (Sheet 5 of 23)



SAMPLE NO.	TP-201 Nov.9/70	TP-201 Feb. /71	TP-201 Sept.30/70
4.76 (%)	97.82	100	—
2.0 (%)	97.65	99.11	99.09
0.42 (%)	96.24	96.53	96.70
0.149 (%)	92.46	91.38	—
0.074 (%)	85.71	85.42	84.25
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

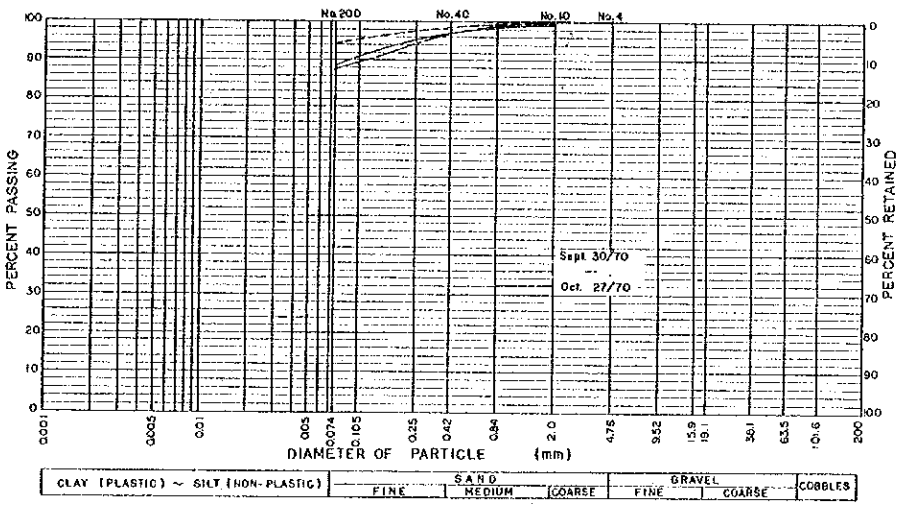
$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$: COEFFICIENT OF CURVATURE

SAMPLE NUMBER	SAMPLE DEPTH (m)	SOIL CLASSIFICATION UNIFIED SYSTEM	SOIL CLASSIFICATION REVISED P.R. SYSTEM	SPECIFIC GRAVITY Maximum dry unit weight (g/cm³)	SPECIFIC GRAVITY Optimum water content (%)	ATTERBERG LIMITS LL	PL	PI	SL
TP-201 (Nov. 9/70)	3.00	MH		H 1.30	H 38.1	58.3	39.9	18.4	—
TP-201 (Feb. /70)	3.00	ML		P H 1.30 1.31	P H 33.0 32.0	46.3	39.3	7.0	—
TP-201 (Sept. 30/70)	3.00	ML		H 1.42	H 26.9	48.0	30.0	10.0	—

P: PROCTOR
M: MODIFICADA
H: HAVARD

Gradation Analysis Curve TP202 (Sheet 6 of 23)



SAMPLE NO	TP-202 Sept.30/70	TP-202 —	TP-202 Oct.27/70
4.76 (%)	—	100	99.92
2.0 (%)	99.44	99.86	99.62
0.42 (%)	96.98	98.49	97.25
0.149 (%)	—	96.45	91.97
0.074 (%)	88.53	94.56	87.79
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

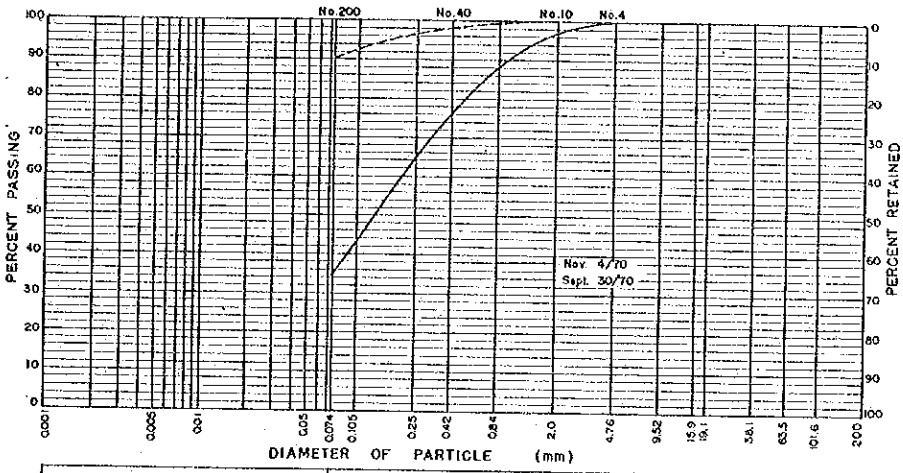
$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$: COEFFICIENT OF CURVATURE

SAMPLE NUMBER	SAMPLE DEPTH (m)	SOIL CLASSIFICATION UNIFIED SYSTEM	SOIL CLASSIFICATION REVISED P.R. SYSTEM	SPECIFIC GRAVITY Maximum dry unit weight (g/cm³)	SPECIFIC GRAVITY Optimum water content (%)	ATTERBERG LIMITS LL	PL	PI	SL
TP-202 (Sept 30/70)	3.00	ML		H 1.33	H 30.3	47.5	37.4	10.1	
TP-202 (—)	3.00	MH		P H 1.22 1.25	P H 39.0 44.0	78.8	64.5	14.3	
TP-202 (Oct. 27/70)	3.00	MH		—	—	50.0	37.4	12.6	

P: PROCTOR
M: MODIFICADA
H: HAVARD

Gradation Analysis Curve TP203 (Sheet 7 of 23)



SAMPLE NO.	TP-203 Nov. 4/70	TP-203 Sept. 30/70	
4.76 mm (%)	99.88	–	
2.0 mm (%)	97.20	99.96	
0.42 mm (%)	76.20	98.67	
0.149 mm (%)	50.23	–	
0.074 mm (%)	34.65	90.47	
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

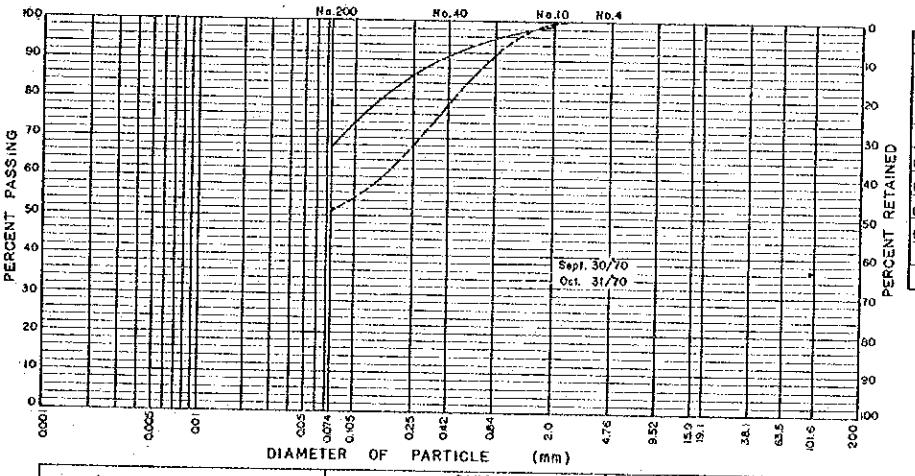
$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$: COEFFICIENT OF CURVATURE

CLAY (PLASTIC) ~ SILT (NON-PLASTIC)	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

SAMPLE		SOIL CLASSIFICATION		SPECIFIC GRAVITY		ATTERBERG LIMITS			
NUMBER	DEPTH (m)	UNIFIED SYSTEM	REVISED P.R. SYSTEM	Maximum dry unit weight (g/cm³)	Optimum water content (%)	LL	PL	PI	SL
TP-203 (Nov. 4/'70)	3.00	SM		–	–	–	–	–	–
TP-203 (Sept. 30/'70)	3.00	SM		–	–	–	–	–	–

Gradation Analysis Curve TP204 (Sheet 8 of 23)



SAMPLE NO.	TP-204 Sept. 30/70	TP-204 Oct. 31/70	
4.76 mm (%)	–	100	
2.0 mm (%)	98.66	99.98	
0.42 mm (%)	90.98	79.37	
0.149 mm (%)	–	59.25	
0.074 mm (%)	67.84	51.54	
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

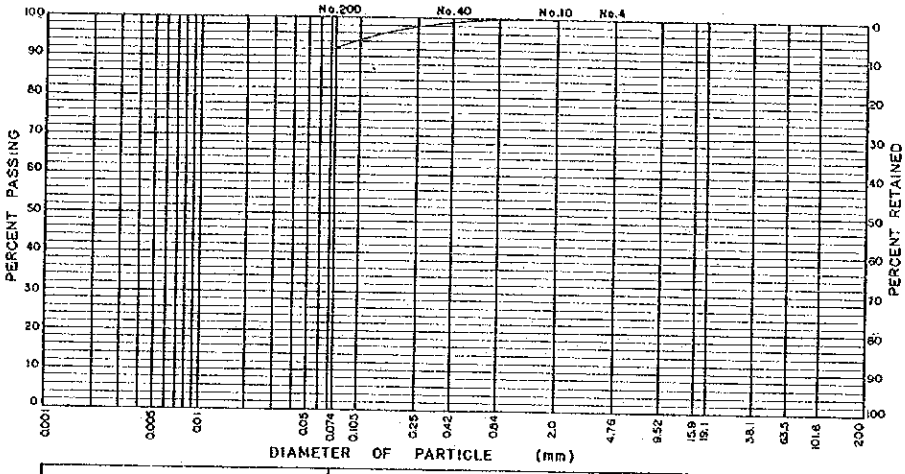
$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$: COEFFICIENT OF CURVATURE

CLAY (PLASTIC) ~ SILT (NON-PLASTIC)	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

SAMPLE		SOIL CLASSIFICATION		SPECIFIC GRAVITY		ATTERBERG LIMITS			
NUMBER	DEPTH (m)	UNIFIED SYSTEM	REVISED P.R. SYSTEM	Maximum dry unit weight (g/cm³)	Optimum water content (%)	LL	PL	PI	SL
TP-204 (Sept. 30/'70)	3.00	SM		–	–	–	–	–	–
TP-204 (Oct. 31/'70)	3.00	SMG		–	–	–	–	–	–

Gradation Analysis Curve DH-6, 6 to 7m deep (Sheet 9 of 23)



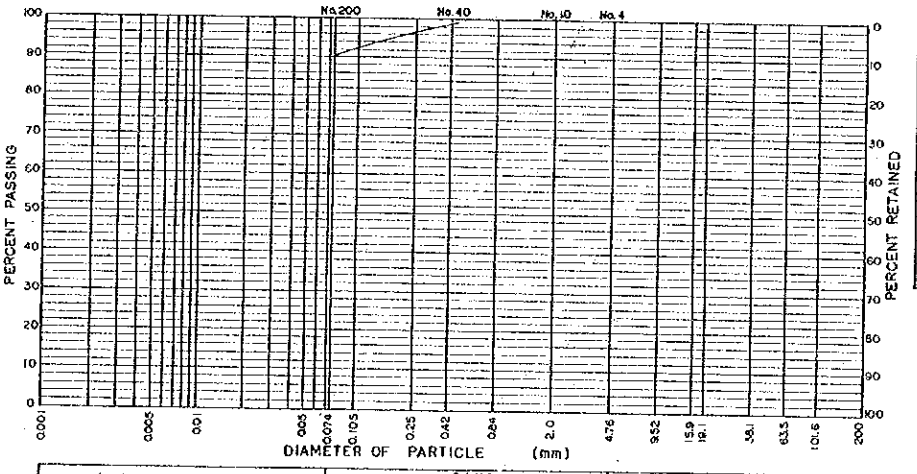
SAMPLE NO.	DH-6 Oct./70		
4.76 (%)	—		
2.0 (%)	99.90		
0.42 (%)	99.34		
0.149 (%)	96.82		
0.074 (%)	92.42		
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$: COEFFICIENT OF CURVATURE

SAMPLE		SOIL CLASSIFICATION		SPECIFIC GRAVITY		ATTERBERG LIMITS			
NUMBER	DEPTH (m)	UNIFIED SYSTEM	REVISED P.R. SYSTEM			LL	PL	PI	SL
DH-6(Oct./'70)	6.00 ~ 7.00	MH		—	—	66.5	51.6	14.9	—

Gradation Analysis Curve DH-6, 10 to 11m deep (Sheet 10 of 23)



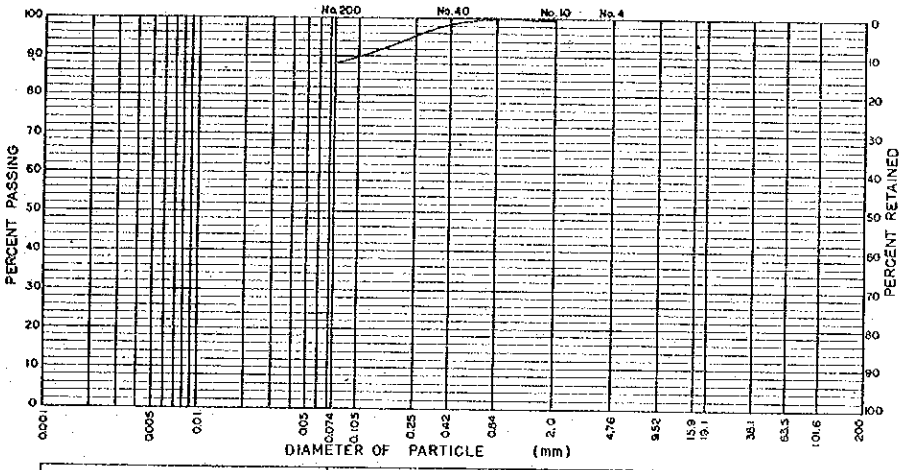
SAMPLE NO.	DH-6 Oct./70		
4.76 (%)	—		
2.0 (%)	—		
0.42 (%)	99.13		
0.149 (%)	94.33		
0.074 (%)	90.12		
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$: COEFFICIENT OF CURVATURE

SAMPLE		SOIL CLASSIFICATION		SPECIFIC GRAVITY		ATTERBERG LIMITS			
NUMBER	DEPTH (m)	UNIFIED SYSTEM	REVISED P.R. SYSTEM			LL	PL	PI	SL
DH-6(Oct./'70)	10.00~11.00	MH		—	—	56.5	44.3	12.2	—

Gradation Analysis Curve DH-6, 15 to 16m deep (Sheet 11 of 23)



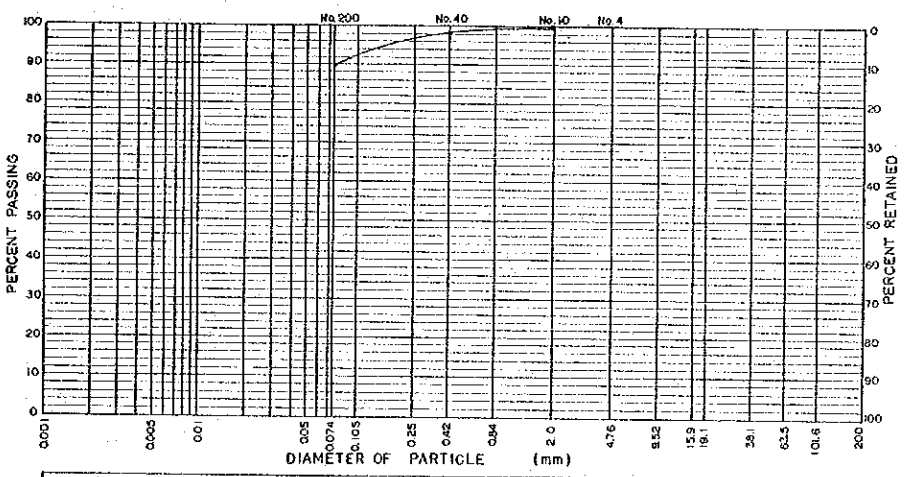
SAMPLE NO.	DH-6 Oct./70		
4.76 (%)	—		
2.0 (%)	99.86		
0.42 (%)	98.40		
0.149 (%)	92.68		
0.074 (%)	88.15		
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$: COEFFICIENT OF CURVATURE

SAMPLE		SOIL CLASSIFICATION		SPECIFIC GRAVITY		ATTERBERG LIMITS			
NUMBER	DEPTH (m)	UNIFIED SYSTEM	REVISED P.R. SYSTEM			LL	PL	PI	SL
DH-6 (Oct. /'70)	15.00~16.00	ML		—	—	42.5	32.8	9.7	—

Gradation Analysis Curve DH-7, 5 to 6m deep (Sheet 12 of 23)



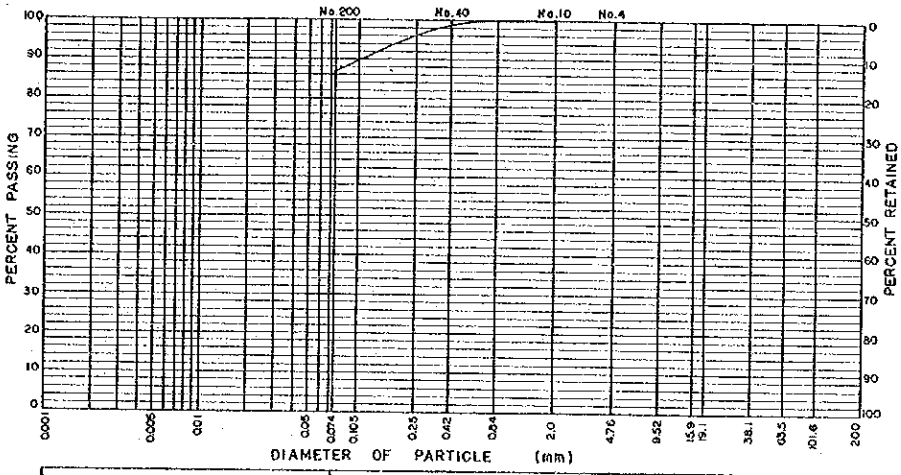
SAMPLE NO.	DH-7		
4.76 (%)	—		
2.0 (%)	99.95		
0.42 (%)	99.17		
0.149 (%)	94.84		
0.074 (%)	89.61		
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$: COEFFICIENT OF CURVATURE

SAMPLE		SOIL CLASSIFICATION		SPECIFIC GRAVITY		ATTERBERG LIMITS			
NUMBER	DEPTH (m)	UNIFIED SYSTEM	REVISED P.R. SYSTEM			LL	PL	PI	SL
DH-7	5.00~6.00	MH		—	—	62.0	44.4	17.6	—

Gradation Analysis Curve DH-7, 10 to 11m deep (Sheet 13 of 23)



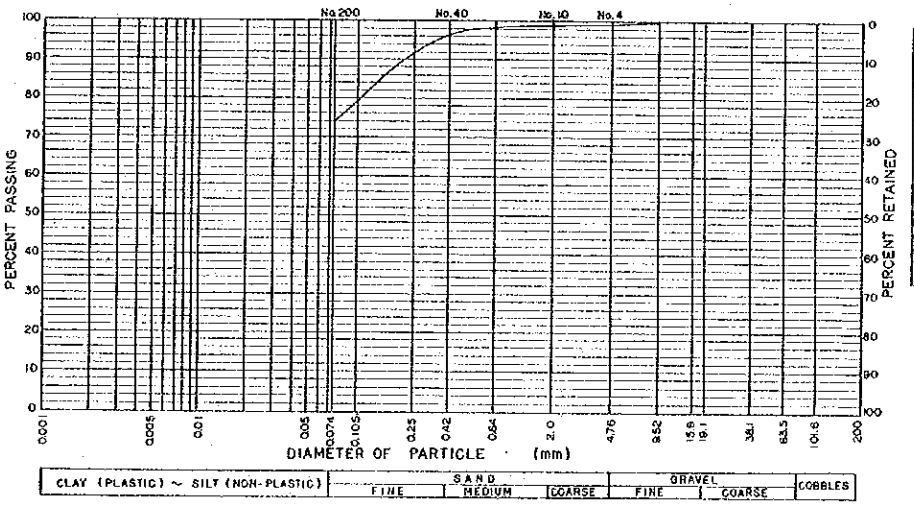
SAMPLE NO.	DH-7		
4.76 (%)	99.94		
2.0 (%)	99.87		
0.42 (%)	99.24		
0.149 (%)	93.30		
0.074 (%)	86.92		
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$: COEFFICIENT OF CURVATURE

SAMPLE		SOIL CLASSIFICATION		SPECIFIC GRAVITY		ATTERBERG LIMITS			
NUMBER	DEPTH (m)	UNIFIED SYSTEM	REVISED P.R. SYSTEM			LL	PL	PI	SL
DH-7	10.00~11.00	ML		—	—	47.5	31.5	16.0	—

Gradation Analysis Curve DH-7, 16 to 17m deep (Sheet 14 of 23)



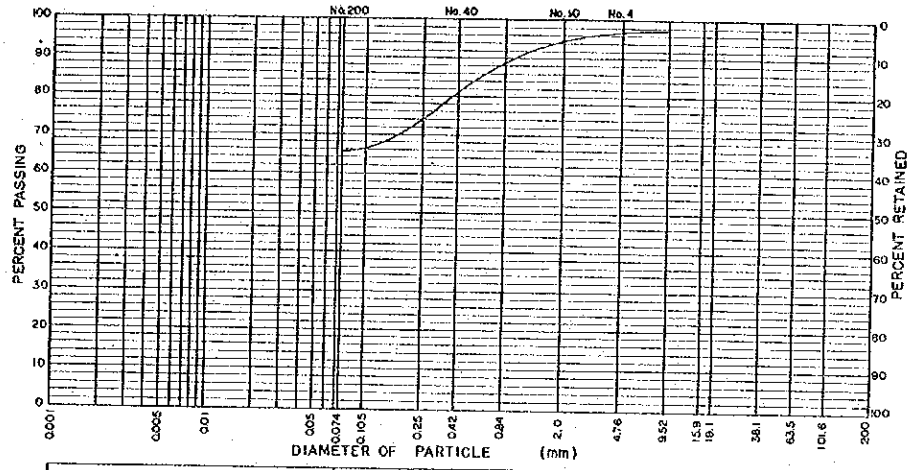
SAMPLE NO.	DH-7		
4.76 (%)	99.63		
2.0 (%)	99.17		
0.42 (%)	97.07		
0.149 (%)	85.87		
0.074 (%)	74.24		
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$: COEFFICIENT OF CURVATURE

SAMPLE		SOIL CLASSIFICATION		SPECIFIC GRAVITY		ATTERBERG LIMITS			
NUMBER	DEPTH (m)	UNIFIED SYSTEM	REVISED P.R. SYSTEM			LL	PL	PI	SL
DH-7	16.00~17.00	—		—	—	—	—	—	—

Gradation Analysis Curve DH-203 6 to 7m deep (Sheet 15 of 23)



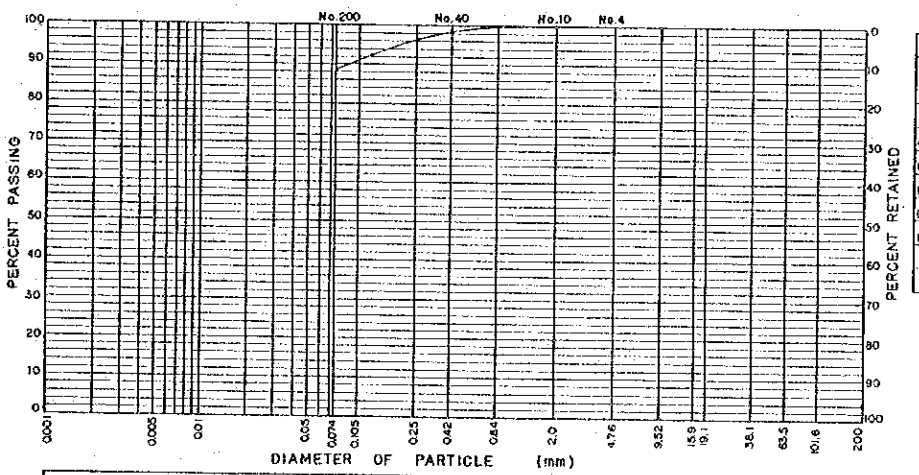
SAMPLE NO.	DH203 Nov.25/70		
4.76 mm (%)	97.31		
2.0 mm (%)	95.11		
0.42 mm (%)	81.39		
0.149 mm (%)	68.58		
0.074 mm (%)	65.86		
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$: COEFFICIENT OF CURVATURE

SAMPLE		SOIL CLASSIFICATION		SPECIFIC GRAVITY		ATTERBERG LIMITS			
NUMBER	DEPTH (m)	UNIFIED SYSTEM	REVISED P.R. SYSTEM			LL	PL	PI	SL
DH203(Nov.25/70)	6.00~7.00	—		—	—	—	—	—	—

Gradation Analysis Curve DH-2 5.6 to 6.0m deep (Sheet 16 of 23)



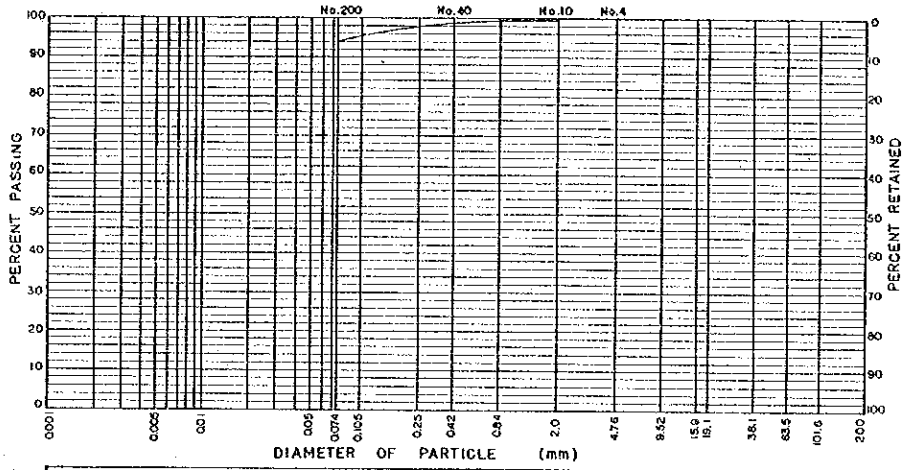
SAMPLE NO.	DH-2 Nov.25/70		
4.76 mm (%)	—		
2.0 mm (%)	99.92		
0.42 mm (%)	99.15		
0.149 mm (%)	93.97		
0.074 mm (%)	89.00		
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$: COEFFICIENT OF CURVATURE

SAMPLE		SOIL CLASSIFICATION		SPECIFIC GRAVITY		ATTERBERG LIMITS			
NUMBER	DEPTH (m)	UNIFIED SYSTEM	REVISED P.R. SYSTEM	Natural dry unit weight (g/cm³)	Natural water content (%)	LL	PL	PI	SL
DH-2(Nov.25/70)	5.60~6.00	MH		1.72	64.7	56.0	40.3	15.7	—

Gradation Analysis Curve DH-2 10 to 11m deep (Sheet 17 of 23)



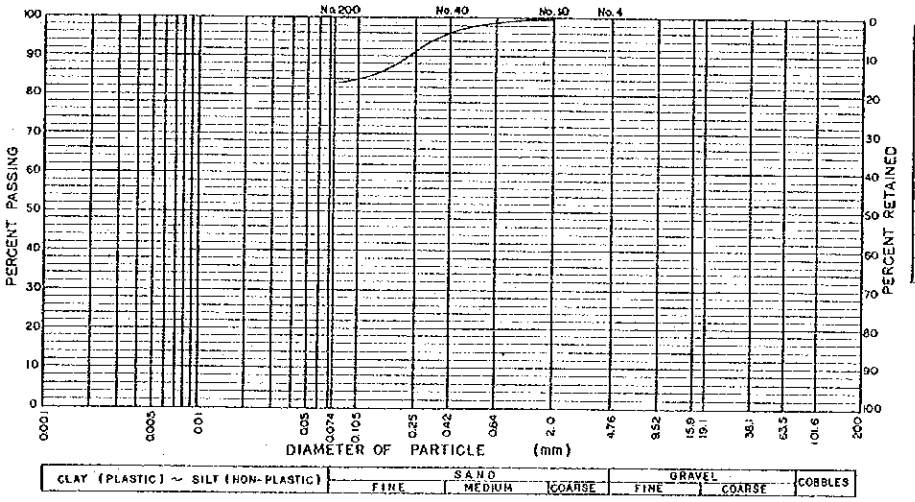
SAMPLE NO.	DH-2 Nov 25/70		
mm 4.76 (%)	—		
mm 2.0 (%)	99.97		
mm 0.42 (%)	99.10		
mm 0.149 (%)	96.20		
mm 0.074 (%)	94.25		
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$: COEFFICIENT OF CURVATURE

SAMPLE		SOIL CLASSIFICATION		SPECIFIC GRAVITY		ATTERBERG LIMITS			
NUMBER	DEPTH (m)	UNIFIED SYSTEM	REVISED P.R. SYSTEM	Natural dry unit weight (g/cm³)	Natural water content (%)	LL	PL	PI	SL
DH-2 (Nov 25/70)	10.00~11.00	MH		1.65	76.8	67.0	52.6	14.4	—

Gradation Analysis Curve DH-2 15 to 16m deep (Sheet 18 of 23)



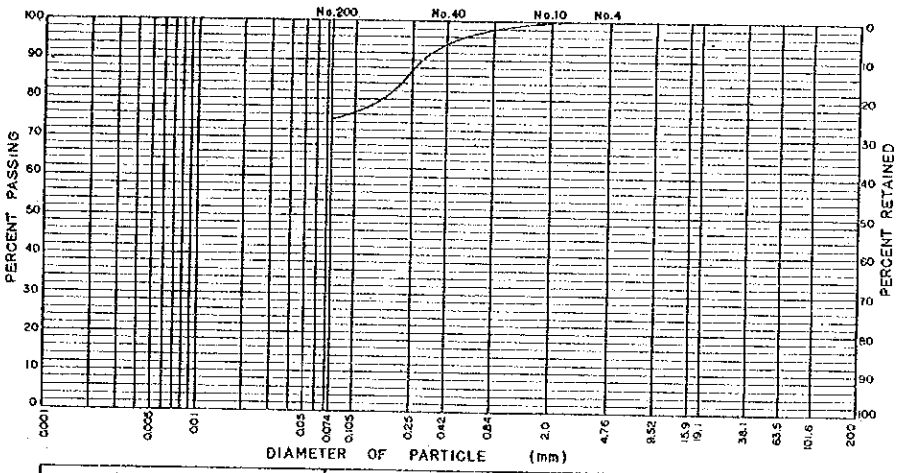
SAMPLE NO.	DH-2 Nov 25/70		
mm 4.76 (%)	100		
mm 2.0 (%)	99.98		
mm 0.42 (%)	96.31		
mm 0.149 (%)	86.00		
mm 0.074 (%)	82.80		
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$: COEFFICIENT OF CURVATURE

SAMPLE		SOIL CLASSIFICATION		SPECIFIC GRAVITY		ATTERBERG LIMITS			
NUMBER	DEPTH (m)	UNIFIED SYSTEM	REVISED P.R. SYSTEM	Natural dry unit weight (g/cm³)	Natural water content (%)	LL	PL	PI	SL
DH-2 (Nov 25/70)	15.00~16.00	ML		1.89	37.0	35.0	26.9	8.1	—

Gradation Analysis Curve DH-2 20 to 21m deep (Sheet 19 of 23)



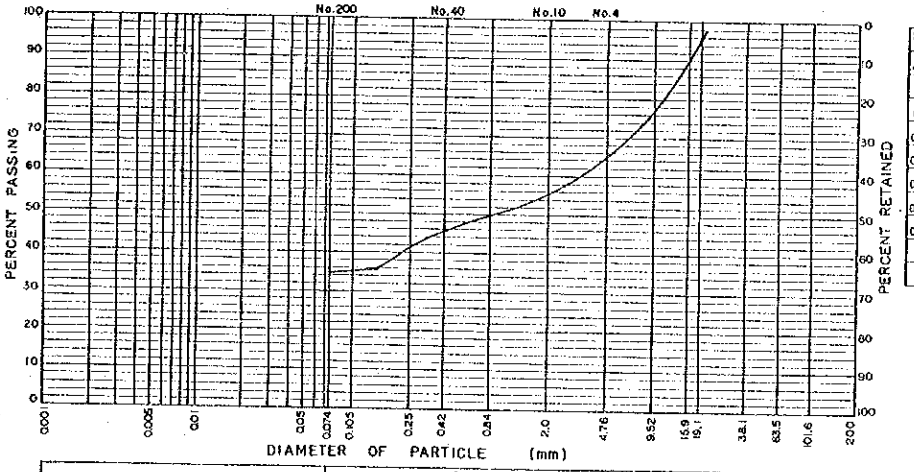
SAMPLE NO.	DH-2 Nov.25/70		
4.76 mm (%)	99.88		
2.0 mm (%)	99.66		
0.42 mm (%)	94.34		
0.149 mm (%)	80.08		
0.074 mm (%)	74.37		
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$: COEFFICIENT OF CURVATURE

SAMPLE		SOIL CLASSIFICATION		SPECIFIC GRAVITY		ATTERBERG LIMITS			
NUMBER	DEPTH (m)	UNIFIED SYSTEM	REVISED P.R.SYSTEM	Natural dry unit weight (g/cm³)	Natural water content (%)	LL	PL	PI	SL
DH-2(Nov. 25/70)	20.00~21.00	ML		1.85	38.1	32.8	28.8	4.0	—

Gradation Analysis Curve DDH-1, 20m deep (Sheet 20 to 23)



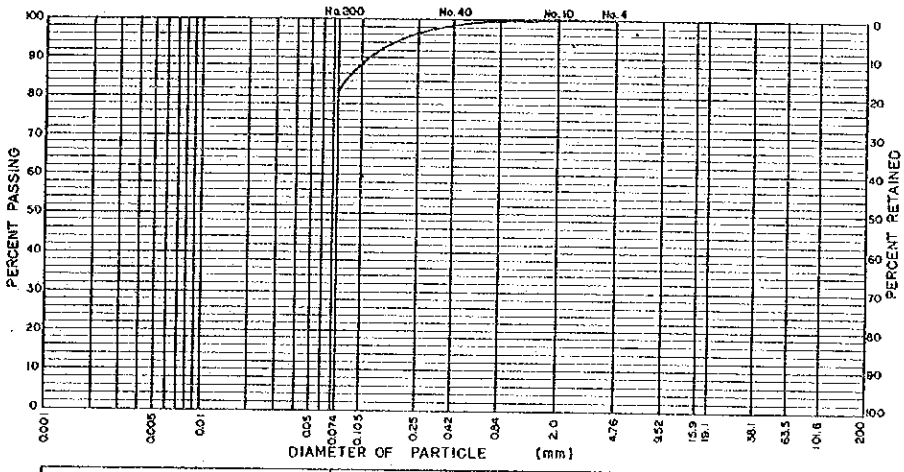
SAMPLE NO.	DDH-1 May.5/71		
4.76 mm (%)	64.76		
2.0 mm (%)	55.61		
0.42 mm (%)	45.83		
0.149 mm (%)	35.74		
0.074 mm (%)	34.98		
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$ COEFFICIENT OF CURVATURE

SAMPLE		SOIL CLASSIFICATION		SPECIFIC GRAVITY		ATTERBERG LIMITS			
NUMBER	DEPTH (m)	UNIFIED SYSTEM	REVISED P.R.SYSTEM			LL	PL	PI	SL
DDH-1 (May.5/71)	20.00	ML		—	—	38.5	38.0	0.5	—

Gradation Analysis Curve DDH-2, 5m deep (Sheet 21 of 23)



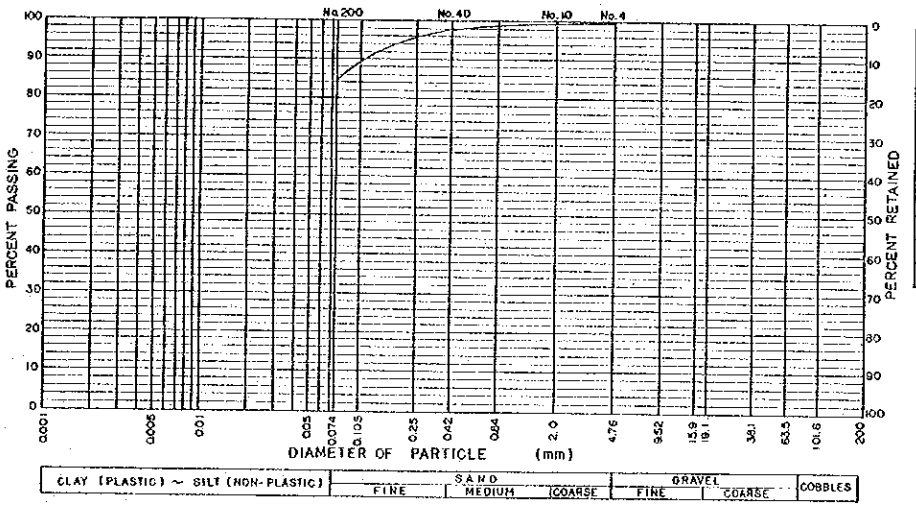
SAMPLE NO.	DDH-2 May.5/71		
mm 4.76 (%)	100		
mm 2.0 (%)	99.72		
mm 0.42 (%)	98.73		
mm 0.149 (%)	93.17		
mm 0.074 (%)	81.61		
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

$Cu = \frac{D60}{D10}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D30)^2}{(D60) \times (D10)}$ COEFFICIENT OF CURVATURE

SAMPLE		SOIL CLASSIFICATION		SPECIFIC GRAVITY		ATTERBERG LIMITS			
NUMBER	DEPTH (m)	UNIFIED SYSTEM	REVISED P.R. SYSTEM			LL	PL	PI	SL
DDH-2 (May.5/71)	5.00	MH		—	—	63.0	56.3	6.7	—

Gradation Analysis Curve DDH-2, 10m deep (Sheet 22 of 23)



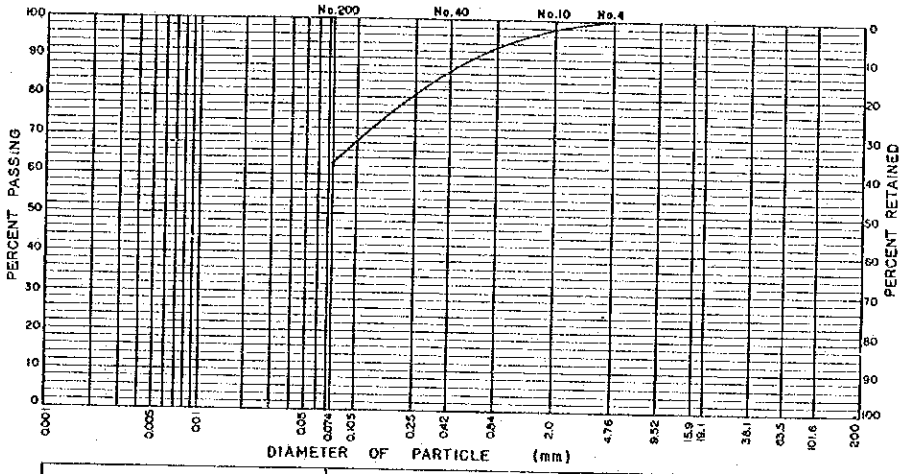
SAMPLE NO.	DDH-2 May.5/71		
mm 4.76 (%)	100		
mm 2.0 (%)	99.55		
mm 0.42 (%)	98.13		
mm 0.149 (%)	92.75		
mm 0.074 (%)	84.86		
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

$Cu = \frac{D60}{D10}$ COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D30)^2}{(D60) \times (D10)}$ COEFFICIENT OF CURVATURE

SAMPLE		SOIL CLASSIFICATION		SPECIFIC GRAVITY		ATTERBERG LIMITS			
NUMBER	DEPTH (m)	UNIFIED SYSTEM	REVISED P.R. SYSTEM			LL	PL	PI	SL
DDH-2 (May.5/71)	10.00	MH		—	—	58.0	50.6	7.4	—

Gradation Analysis Curve DDH-2, 20m deep (Sheet 23 of 23)



SAMPLE NO.	DDH-2 May 5/71		
4.76 mm (%)	99.97		
2.0 mm (%)	98.46		
0.42 mm (%)	87.01		
0.150 mm (%)	73.92		
0.074 mm (%)	63.44		
D60 (mm)			
D30 (mm)			
D10 (mm)			
Cu			
Cc			

$Cu = \frac{D_{60}}{D_{10}}$: COEFFICIENT OF UNIFORMITY

$Cc = \frac{(D_{30})^2}{(D_{60}) \times (D_{10})}$: COEFFICIENT OF CURVATURE

SAMPLE		SOIL CLASSIFICATION		SPECIFIC GRAVITY		ATTERBERG LIMITS			
NUMBER	DEPTH (m)	UNIFIED SYSTEM	REVISED P.R. SYSTEM			LL	PL	PI	SL
DDH-2 (May 5/71)	20.00	ML		—	—	58.0	50.3	7.7	—

IV-5-4 DIRECT SHEARING TEST

Remark ; Test was conducted by Universidad del Cauca responding to the request of CEDELCA

Direct Shearing Test (Sheet 1 of 3)

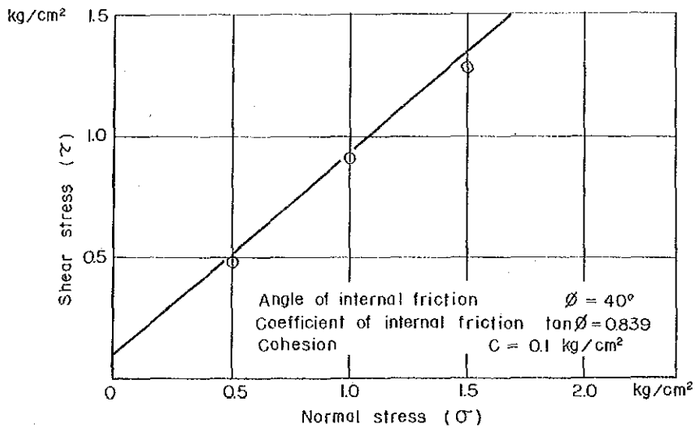
Locality of sample : TP-101 Depth ; — m Date. Oct. 26,'70 Type of test, C.R. (Qc)

No.	Area(cm²)	σ (kg/cm²)	τ (kg/cm²)
1	25	0.5	0.48
2	25	1.0	0.91
3	25	1.5	1.29

σ : Normal stress, τ : Shear stress

Note.

Natural water content : (%)	49.13	
Standard of test	Proctor	Harvard
Optimum water content (%)	—	—
Maximum dry density (g/cm³)	—	—



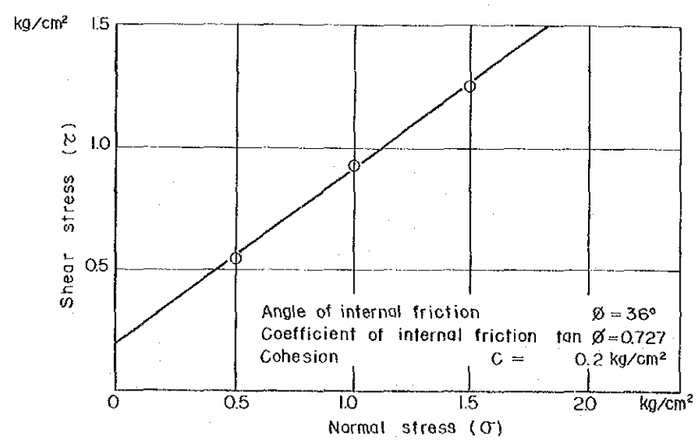
Locality of sample : TP - 102, Depth — m Date — Type of test —

No.	Area(cm²)	σ (kg/cm²)	τ (kg/cm²)
1	25	0.5	0.54
2	25	1.0	0.93
3	25	1.5	1.26

σ : Normal stress, τ : Shear stress

Note

Natural water content : (%)	48.0	
Standard of test	Proctor	Harvard
Optimum water content (%)	43.5	41.5
Maximum dry density (gr/cm³)	1.18	1.20



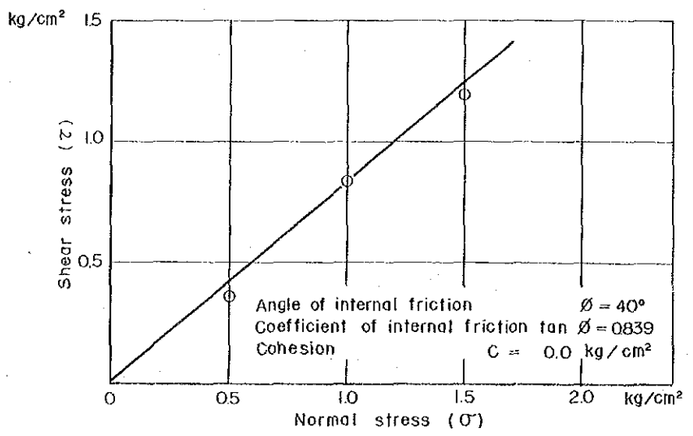
Locality of sample ; TP-102. Depth — m. Date. Nov. 7,'70 Type of test C.R. (Qc)

No.	Area(cm²)	σ (kg/cm²)	τ (kg/cm²)
1	25	0.5	0.36
2	25	1.0	0.83
3	25	1.5	1.19

σ : Normal stress, : Shear stress

Note.

Natural water content : (%)	57.2	
Standard of test	Proctor	Harvard
Optimum water content (%)	—	45.0
Maximum dry density (gr/cm³)	—	1.19



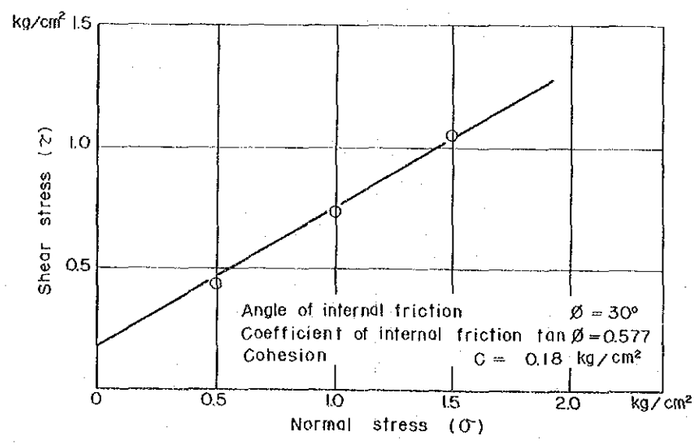
Locality of sample : TP-103. Depth — m Date. Oct. 28 '70 Type of test C.R. (Qc)

No.	Area(cm²)	σ (kg/cm²)	τ (kg/cm²)
1	25	0.5	0.44
2	25	1.0	0.74
3	25	1.5	1.05

σ : Normal stress : Shear stress

Note

Natural water content : (%)	102.0	
Standard of test	Proctor	Harvard
Optimum water content (%)	—	—
Maximum dry density (gr/cm³)	—	—



Direct Shearing Test (Sheet 2 of 3)

Remark ; Test was conducted by Universidad del Cauca responding to the request of CEDELCA.

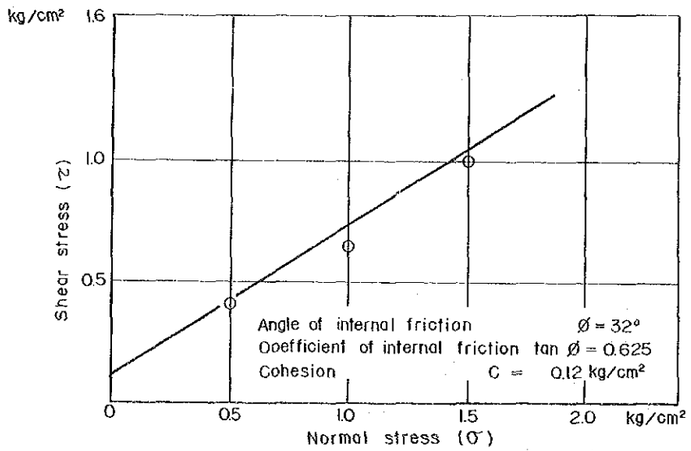
Locality of sample : TP-104 Depth ; — m Date ; Oct. 26,'70 Type of test. C.R. (Qc)

No.	Area (cm²)	σ (kg/cm²)	τ (kg/cm²)
1	25	0.5	0.41
2	25	1.0	0.64
3	25	1.5	1.00

σ : Normal stress , τ : Shear stress

Note.

Natural water content (%)	66.51	
Standard of test	Proctor	Harvard
Optimum water content (%)	—	46.3
Maximum dry density (g/cm³)	—	1.14



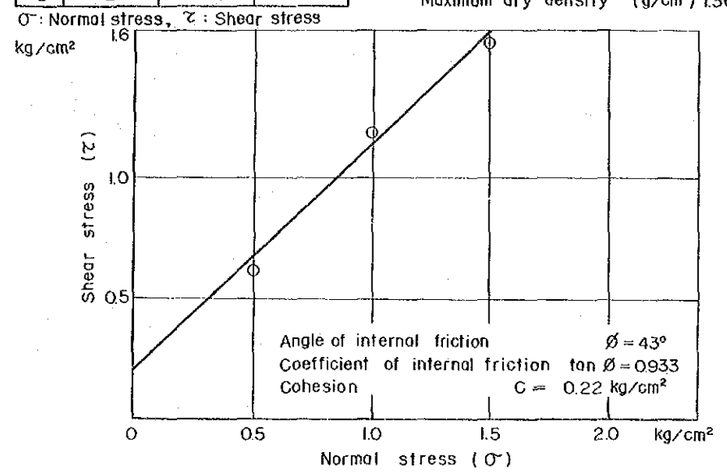
Locality of sample : TP-201 Depth ; 3.00m Date ; Feb. ,'71 Type of test –

No.	Area (cm²)	σ (kg/cm²)	τ (kg/cm²)
1	25	0.5	0.62
2	25	1.0	1.18
3	25	1.5	1.56

σ : Normal stress, τ : Shear stress

Note.

Natural water content (%)	47.3	
Standard of test	Proctor	Harvard
Optimum water content (%)	33.0	32.0
Maximum dry density (g/cm³)	1.30	1.31



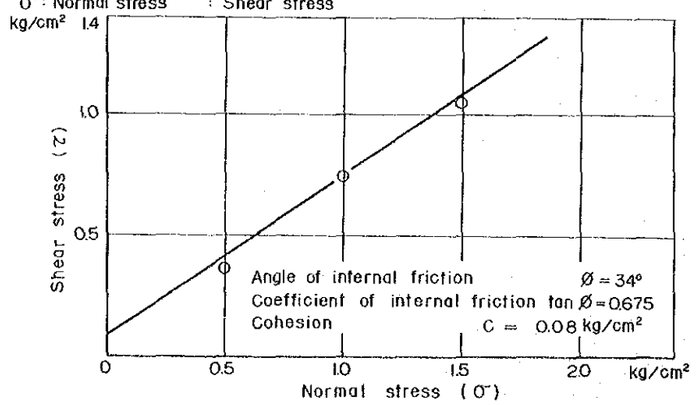
Locality of sample : TP-201 Depth ; 3.00m Date. Nov. 9,'70 Type of test , C.R. (Qc)

No.	Area (cm²)	σ (kg/cm²)	τ (kg/cm²)
1	25	0.5	0.37
2	25	1.0	0.75
3	25	1.5	1.05

σ : Normal stress : Shear stress

Note.

Natural water content (%)	42.9	
Standard of test	Proctor	Harvard
Optimum water content (%)	—	38.1
Maximum dry density (g/cm³)	—	1.30

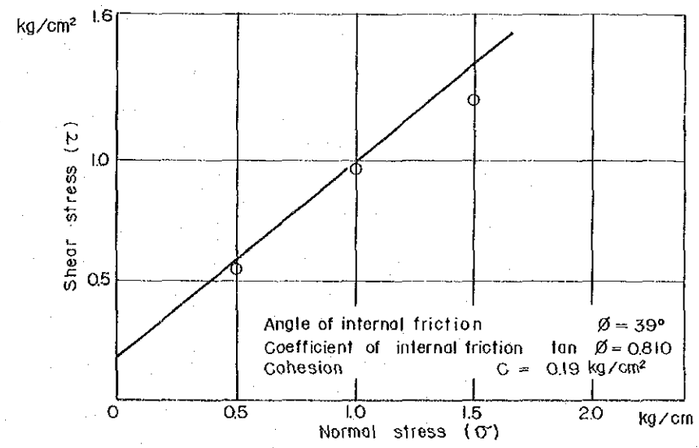


Locality of sample : TP-202 Depth, 3.00m. Date ; Type of test –

No.	Area (cm²)	σ (kg/cm²)	τ (kg/cm²)
1	25	0.5	0.55
2	25	1.0	0.97
3	25	1.5	1.25

Note.

Natural water content (%)	55.3	
Standard of test	Proctor	Harvard
Optimum water content (%)	39.0	44.0
Maximum dry density (g/cm³)	1.22	1.25



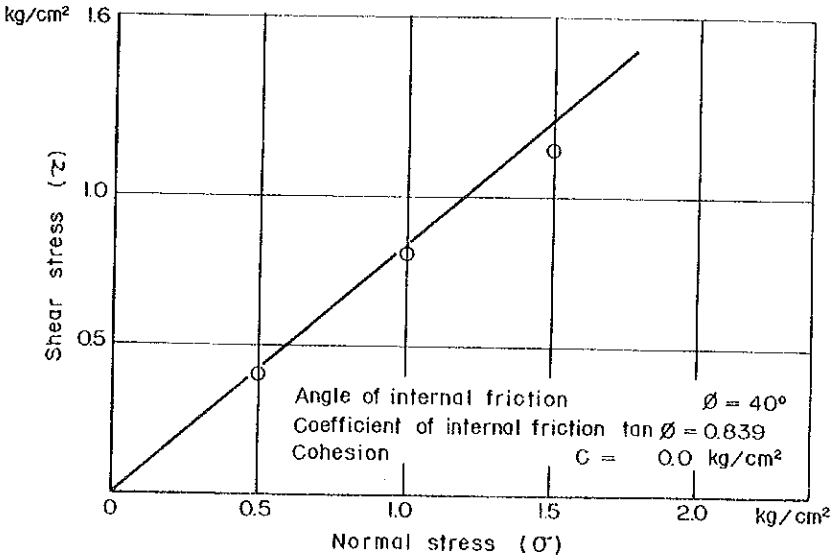
Direct Shearing Test (Sheet 3 of 3)

Locality of sample : TP-203 Depth ; 3.00m Date ; Nov. 4,'70 Type of test C.R. (Qc)

No.	Area (cm²)	σ (kg/cm²)	τ (kg/cm²)
1	25	0.5	0.40
2	25	1.0	0.81
3	25	1.5	1.16

Note.

Natural water content (%)	87.8	
Standard of test	Proctor	Harvard
Optimum water content (%)	—	—
Maximum dry density (g/cm³)	—	—

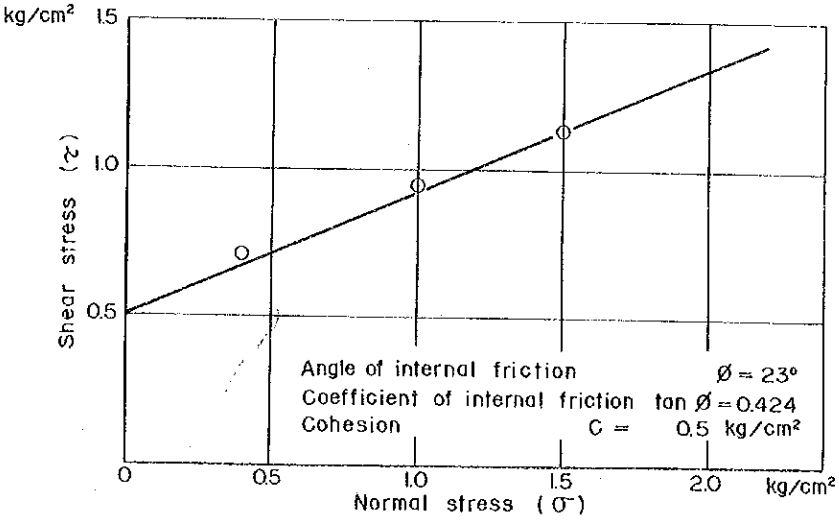


Locality of sample : TP-204 Depth ; 3.00m Date ; Oct. 31,'70 Type of test C.R. (Qc)

No.	Area (cm²)	σ (kg/cm²)	τ (kg/cm²)
1	25	0.5	0.71
2	25	1.0	0.95
3	25	1.5	1.13

Note.

Natural water content (%)	178.0	
Standard of test	Proctor	Harvard
Optimum water content (%)	—	—
Maximum dry density (g/cm³)	—	—



Remark ; Test was conducted by Universidad del Cauca responding to the request of CEDELCA

IV-5-5 TRIAXIAL SHEARING TEST

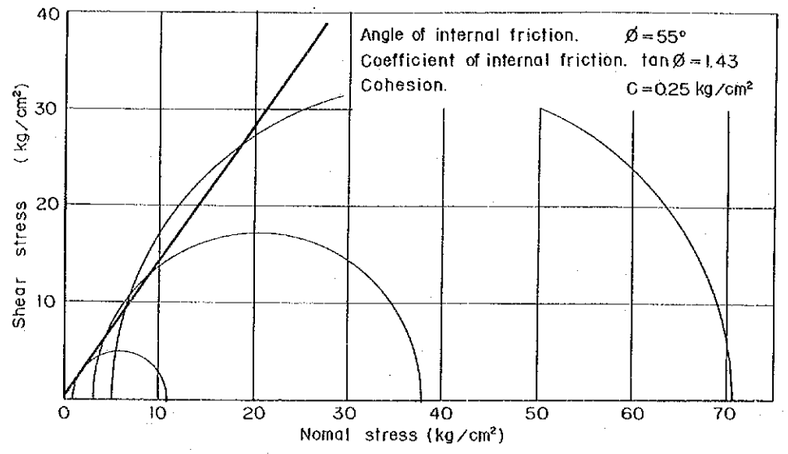
Triaxial Shearing Test (Sheet 1 of 3)

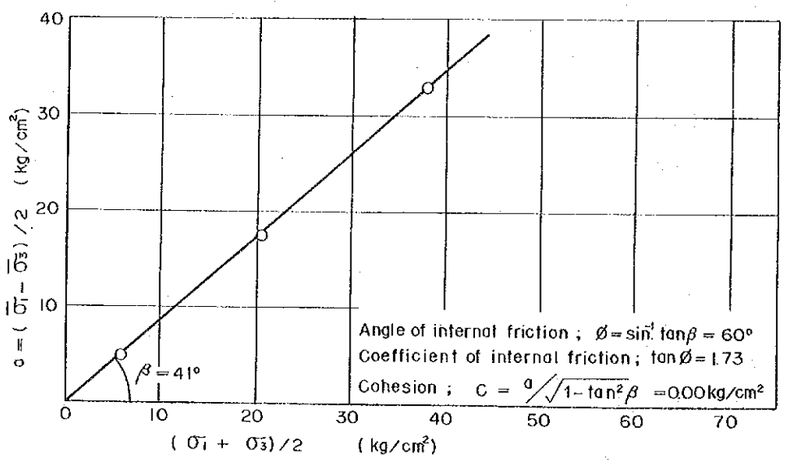
Remark ; Test was conducted by Universidad del Cauca responding to the request of CEDELCA

Locality of sample ; TP-102 Depth ; — m. Date —

No.	Principal stress σ_3 kg/cm²	Principal stress σ_1 kg/cm²	Pore pressure u kg/cm²
1	0.98	10.85	0.02
2	2.94	38.33	0.06
3	4.90	71.15	0.10

Type of test. —





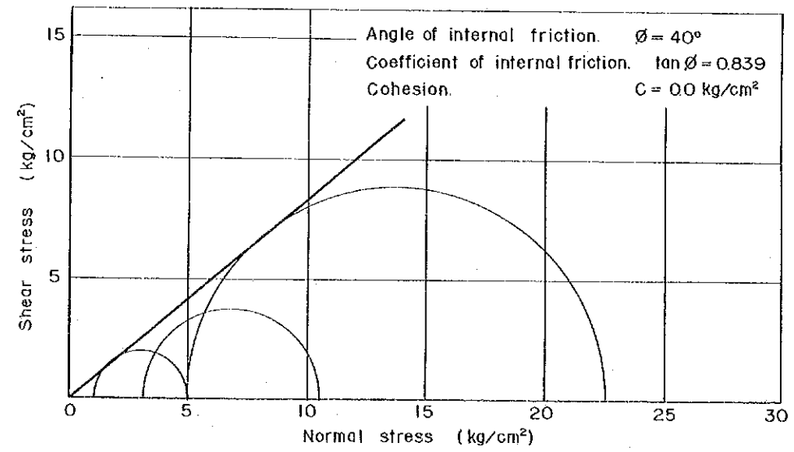
Note ;

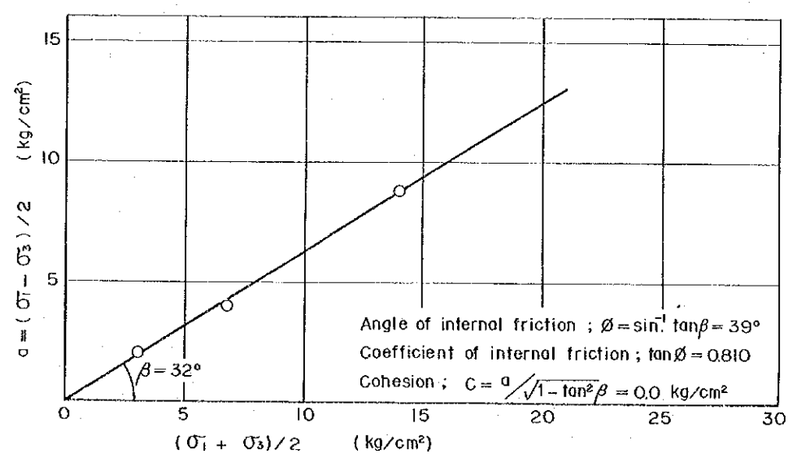
Natural water content (%)	48.0	
Standard of test	PROCTOR	HARVARD
Optimum water content (%)	43.5	41.5
Maximum dry density (g/cm³)	1.18	1.20

Locality of sample ; TP-102 Depth ; — m. Date ; Nov. 7 / '70

No.	Principal stress σ_3 kg/cm²	Principal stess σ_1 kg/cm²	Pore pressure u kg/cm²
1	0.98	4.90	0.020
2	2.96	10.71	0.045
3	4.94	22.63	0.058

Type of test. C.R. (Qc)





Note ;

Natural water content (%)	57.2	
Standard of test	PROCTOR	HARVARD
Optimum water content (%)	—	45.0
Maximum dry density (g/cm³)	—	1.19

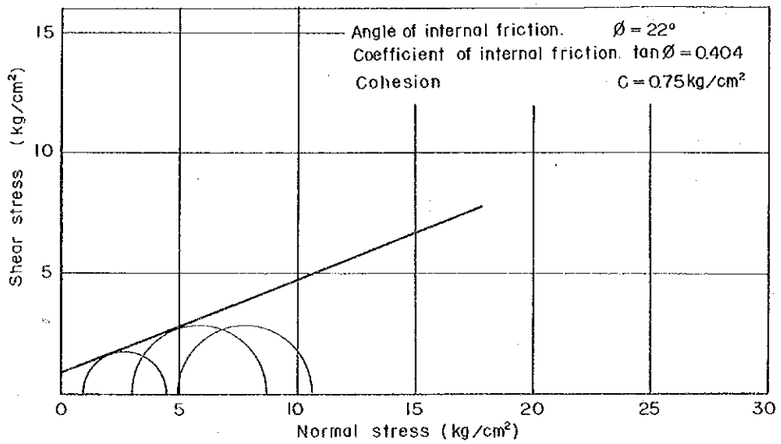
Triaxial Shearing Test (Sheet 2 of 3)

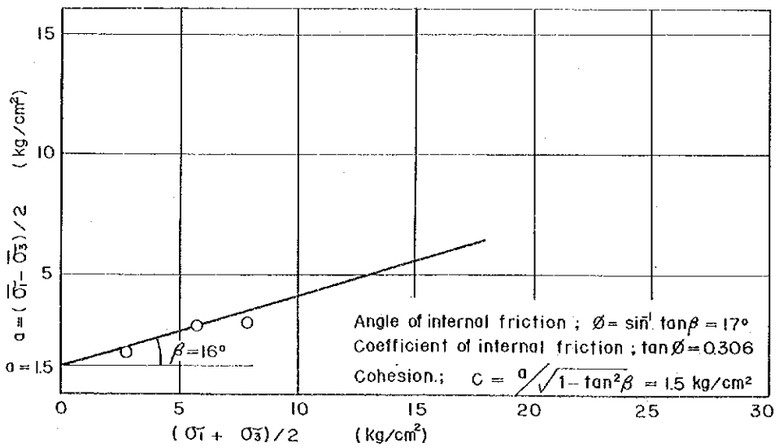
Remark ; Test wes conducted by Universidad del Cauca responding to the request of CEDELCA

Locality of sample ; TP-104 Depth ; — m. Date. Oct. 26/'70

No.	Principal stress $\bar{\sigma}_3$ kg/cm	Principal stress $\bar{\sigma}_1$ kg/cm²	Pore pressure u kg/cm²
1	0.97	4.47	0.035
2	2.98	8.68	0.020
3	4.95	10.75	0.055

Type of test. C.R. (Qc)





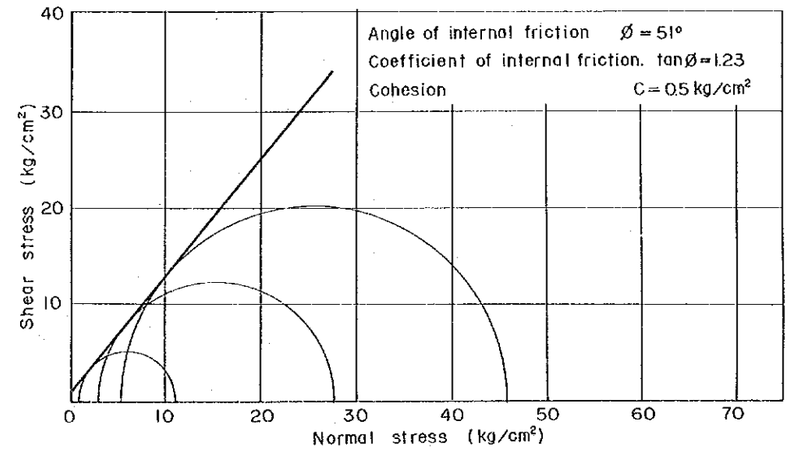
Note ;

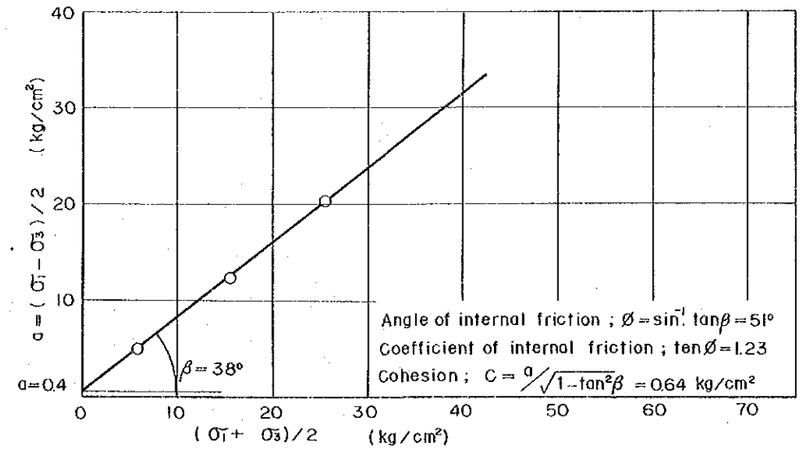
Natural water content (%)	66.51	
Standard of test	PROCTOR	HARVARD
Optimum water content (%)	—	46.3
Maximum dry density (g/cm³)	—	1.14

Locality of sample ; TP-201 Depth ; 3.00m. Date ; Nov. 9/'70

No.	Principal stress $\bar{\sigma}_3$ kg/cm²	Principal stress $\bar{\sigma}_1$ kg/cm²	Pore pressure u kg/cm²
1	0.99	10.99	0.012
2	2.97	27.79	0.022
3	4.99	45.88	0.015

Type of test. C.R. (Qc)





Note ;

Natural water content (%)	42.9	
Standard of test	PROCTOR	HARVARD
Optimum water content (%)	—	38.1
Maximum dry density (g/cm³)	—	1.30

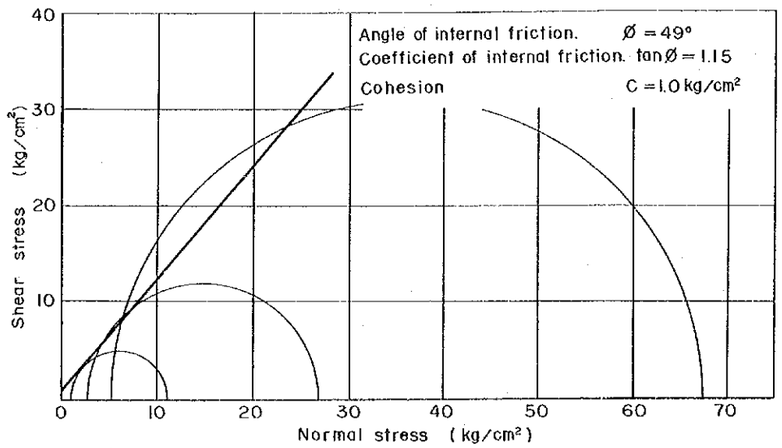
Triaxial Shearing Test (Sheet 3 of 3)

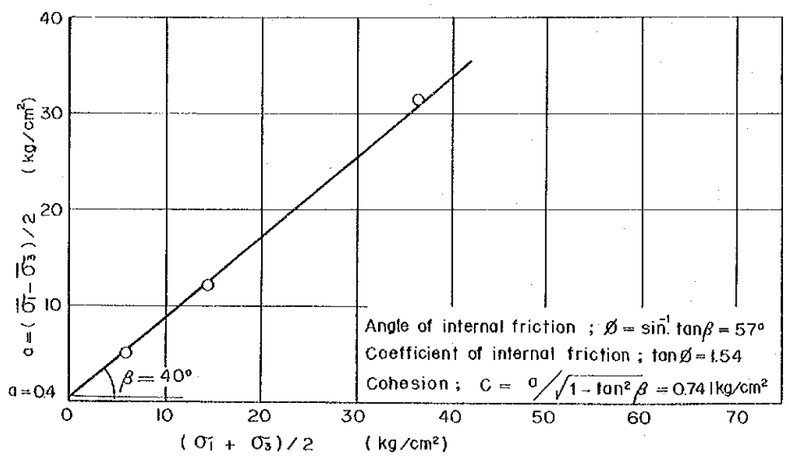
Remak ; Test was conducted by Universidad del Cauca responding to the request of CEDELCA

Locality of sample ; TP-201 Depth ; 3.00m. Date ; Fev. /'71

No.	Principal stress σ_3 kg/cm²	Principal stress σ_1 kg/cm	Pore pressure u kg/cm²
1	0.97	10.86	0.03
2	2.69	26.77	0.31
3	4.96	67.76	0.04

Type of test —





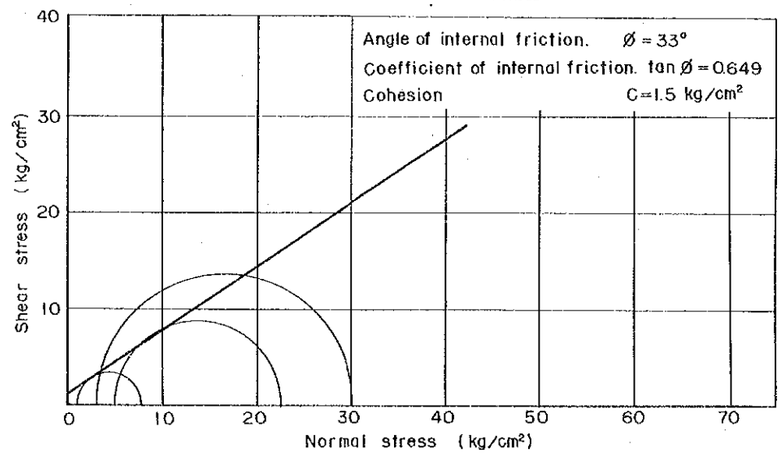
Note ;

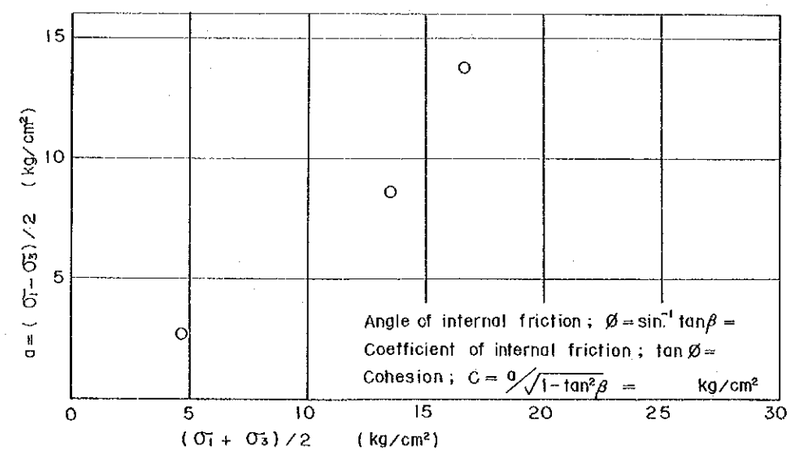
Natural water content (%)	47.3	
Standard of test	PROCTOR	HARVARD
Optimum water content (%)	33.0	32.0
Maximum dry density (g/cm³)	1.30	1.31

Locality of sample ; TP-202 Depth ; 3.00m. Date ;

No.	Principal stress σ_3 kg/cm²	Principal stress σ_1 kg/cm²	Pore pressure u kg/cm²
1	0.95	8.36	0.055
2	2.92	30.54	0.080
3	4.92	22.19	0.080

Type of test. —





Note ;

Natural water content (%)	55.3	
Standard of test	PROCTOR	HARVARD
Optimum water content (%)	39.0	44.0
Maximum dry density (g/cm³)	1.22	1.25

IV-6 ROCK MATERIAL

IV-6-1 PHOTOGRAPH OF ROCK SPECIMEN

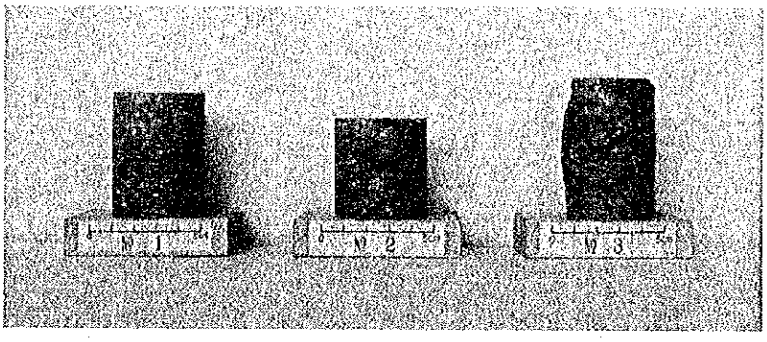
IV-6-2 TABLE OF ROCK TEST

IV-6-3 STRESS-STRAIN CURVES IN COMPRESSION STRENGTH TEST

IV-6-1 PHOTOGRAPH OF ROCK SPECIMEN

(Plate 1 of 2) PHOTOGRAPH OF ROCK SPECIMEN BEFORE THE ROCK TEST

NO. ····· SPECIMEN NUMBER



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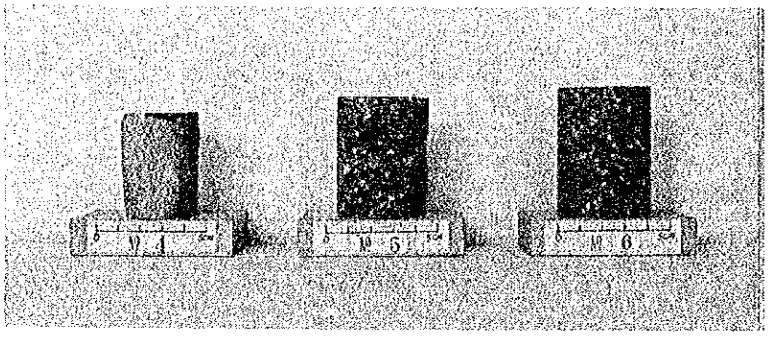

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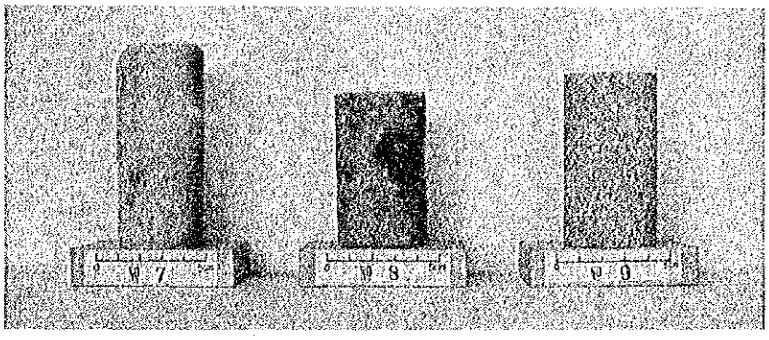

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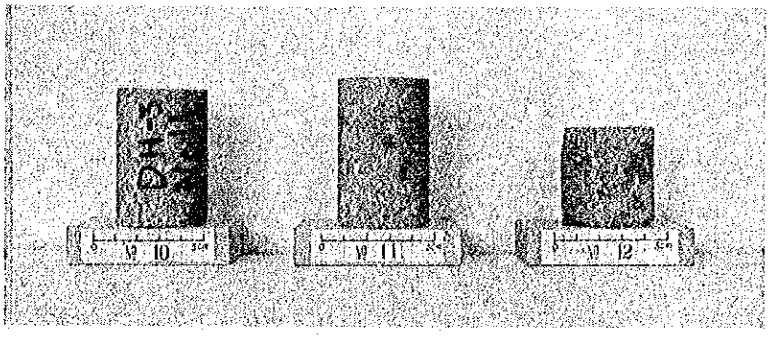
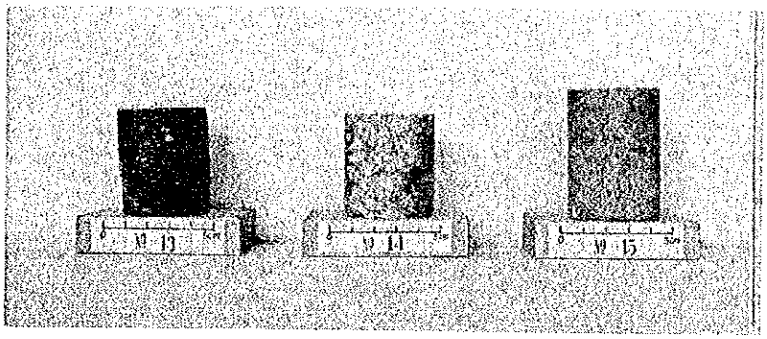


4

(Plate 2 of 2) PHOTOGRAPH OF ROCK SPECIMEN BEFORE THE ROCK TEST

NO. ····· SPECIMEN NUMBER



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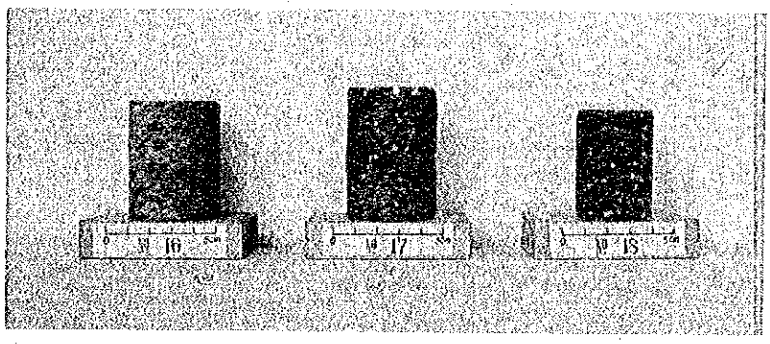

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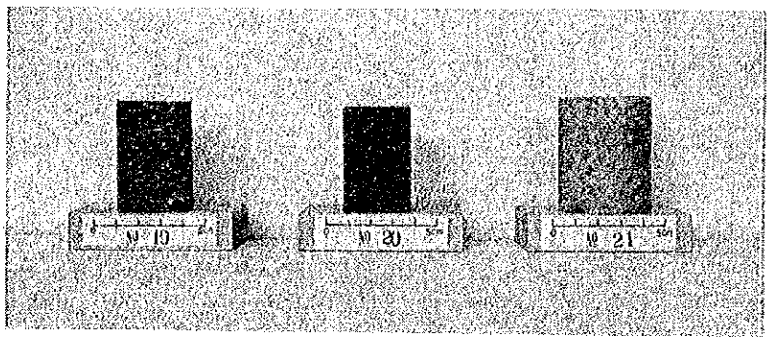


7

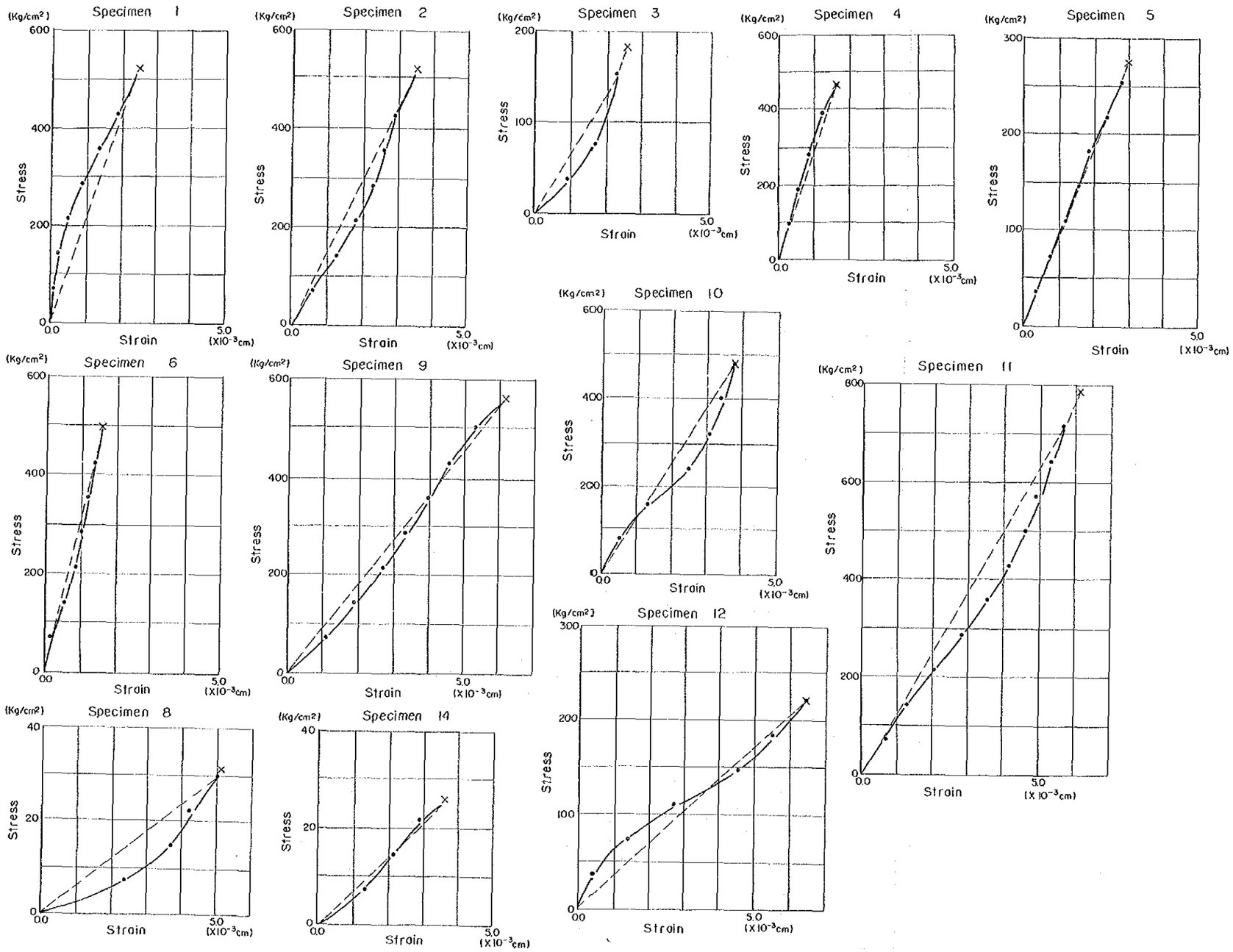
IV-6-2 TABLE OF ROCK TEST

Sample			Rock name	Length	Diameter	Area of cross section (cm^2)			Weight (g)				Specific gravity		Ratio of absorption (%)	Ultra sonic velocity (m/sec)				Poisson's ratio	
																P-wave		S-wave			
Specimen No.	Locality	Depth (m)		(cm)	(cm)	Upper	Bottom	Average	Natural	Dry	In water	Wet	Dry	Wet		Dry	Wet	Dry	Wet	Dry	Wet
1	DH- 1	38.00	Andesite	5.52	4.19	13.8	14.1	14.0	175.84	175.30	103.50	178.74	2.33	2.37	1.96	3410	3430	2100	2170	0.192	0.166
2	DH- 1	65.00	Andesite	4.36	4.20	14.0	14.1	14.1	140.68	140.33	83.02	143.02	2.34	2.38	1.92	3350	3600	2180	2190	0.136	0.206
3	DH- 1	83.00	Andesite	6.21	4.19	13.7	12.2	13.0	182.01	181.27	107.11	188.25	2.23	2.32	3.85	2770	2890	1670	1730	0.180	0.221
4	DH- 1	98.00	Andesite	4.63	4.19	10.1	11.3	10.7	106.38	106.05	60.73	110.50	2.13	2.22	4.20	3260	3480	2020	2060	0.186	0.230
5	DH- 1	105.00	Andesite	5.31	4.19	13.5	14.1	13.8	166.97	166.66	97.32	168.63	2.34	2.36	1.18	3880	4180	2380	2410	0.198	0.251
6	DH- 1	135.00	Andesite	5.72	4.20	14.0	14.2	14.1	187.05	185.94	108.96	187.76	2.36	2.38	0.98	2860	3030	1740	1820	0.204	0.218
7	DH- 1	150.00	Silty tuff	8.99	3.91	11.9	12.8	12.4	113.70	99.82	56.33	169.16	0.88	1.50	69.47	814	–	490	–	0.221	–
8	DH- 1	158.00	Tuff breccia	6.78	4.12	13.6	13.6	13.6	134.33	132.40	69.40	155.64	1.54	1.80	17.55	1600	1650	860	880	0.297	0.301
9	DH- 2	40.00	Andesite	7.61	4.18	14.0	14.0	14.0	235.70	235.10	139.80	243.00	2.28	2.36	3.36	2550	2800	1620	1710	0.159	0.203
10	DH- 3	15.00	Andesite	6.07	4.18	13.0	12.0	12.5	173.83	173.26	102.38	177.25	2.31	2.37	2.30	3490	3680	2090	2130	0.221	0.248
11	DH- 3	25.00	Andesite	6.53	4.19	14.1	13.9	14.0	208.00	207.00	122.64	211.50	2.33	2.38	2.17	3800	4110	2280	2420	0.221	0.235
12	DH- 4	10.00	River gravel	4.34	4.18	13.8	13.3	13.6	125.96	125.44	73.91	131.27	2.19	2.29	4.65	2080	2420	1250	1360	0.215	0.269
13	DH- 4	19.00	Tuff breccia	4.70	3.99	12.2	12.7	12.5	125.34	119.35	73.53	136.46	1.90	2.17	14.34	1640	1830	890	–	0.294	–
14	DH- 5	50.00	Weathered andesite	4.62	4.19	13.7	13.9	13.8	113.35	112.31	65.37	126.64	1.83	2.07	12.76	1230	1340	720	750	0.235	0.272
15	DH- 5	57.00	Andesite	5.80	4.19	14.0	13.8	13.9	173.75	172.87	102.61	181.65	2.19	2.30	5.08	2040	2220	1270	1310	0.180	0.233
16	DH-204	6.00	Weathered andesite	5.26	4.19	13.8	13.7	13.8	150.89	149.46	88.67	159.97	2.10	2.24	7.03	2050	2240	1180	1250	0.249	0.274
17	DH-204	12.00	Weathered andesite	5.81	4.18	13.7	13.5	13.6	169.75	169.20	98.32	175.68	2.19	2.27	3.83	2110	2370	1260	1310	0.221	0.280
18	Power House	–	Dacitic andesite	4.78	3.05x3.04	9.3	9.4	9.4	100.26	100.16	58.36	101.27	2.33	2.36	1.11	2100	2330	1190	1250	0.262	0.298
19	3-6-1 Rio Cauca	–	Andesite	4.81	3.05x3.05	9.6	9.4	9.5	103.21	102.77	60.23	104.23	2.34	2.37	1.42	4010	4040	2200	2100	0.329	0.315
20	La Titella	–	Meta Dolerite	4.54	3.05x3.03	9.7	9.5	9.6	123.36	123.08	81.76	123.45	2.95	2.96	0.30	5540	5670	3070	3100	0.280	0.287
21	DH- 5	57.00	Andesite	5.09	4.19	13.7	14.0	13.9	151.63	150.81	89.64	158.63	2.19	2.30	5.19	2140	2230	1330	1410	0.186	0.167

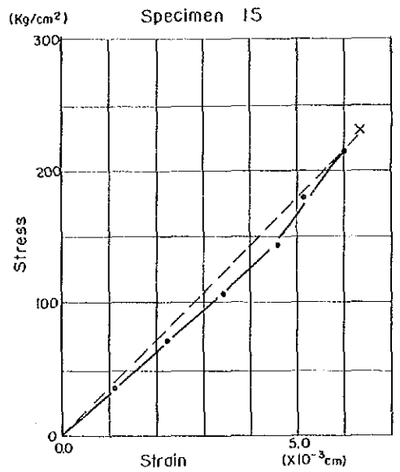
eight (g)			Specific gravity		Ratio of absorp-tion (%)	Ultra sonic velocity (m/sec)				Poisson's ratio		Compressive strength				Modulus of elasticity E (kg/cm^2)		Remarks
						P-wave		S-wave				Max. load (kg)	Max. strein (x10^{-3})	Strength (kg/cm^2)	Future of breaking	Static	Dynamic	
y	In water	Wet	Dry	Wet		Dry	Wet	Dry	Wet	Dry	Wet							
30	103.50	178.74	2.33	2.37	1.96	3410	3430	2100	2170	0.192	0.166	7300	2.50	521.4	Large pieces	2.11x10^5	2.60x10^5	
33	83.02	143.02	2.34	2.38	1.92	3350	3600	2180	2190	0.136	0.206	7300	3.50	517.7	Large pieces	1.48x10^5	2.75x10^5	
27	107.11	188.25	2.23	2.32	3.85	2770	2890	1670	1730	0.180	0.221	2400	2.55	184.6	Large pieces	6.52x10^4	1.70x10^5	
05	60.73	110.50	2.13	2.22	4.20	3260	3480	2020	2060	0.186	0.230	5000	1.65	467.3	Something into pieces	2.86x10^5	2.32x10^5	
66	97.32	168.63	2.34	2.36	1.18	3880	4180	2380	2410	0.198	0.251	3800	3.00	275.4	Large pieces	9.52x10^4	3.43x10^5	
94	108.96	187.76	2.36	2.38	0.98	2860	3030	1740	1820	0.204	0.218	7000	1.60	496.6	Large pieces	2.86x10^5	1.92x10^5	
82	56.33	169.16	0.88	1.50	69.47	814	–	490	–	0.221	–	–	–	–	Broken in water	–	(D) 5.14x10^3	
40	69.40	155.64	1.54	1.80	17.55	1600	1650	860	880	0.297	0.301	420	5.10	30.9	Large pieces	5.71x10^3	3.63x10^4	
10	139.80	243.00	2.28	2.36	3.36	2550	2800	1620	1710	0.159	0.203	7800	6.15	557.1	Small pieces	9.09x10^4	1.66x10^5	
26	102.38	177.25	2.31	2.37	2.30	3490	3680	2090	2130	0.221	0.248	6000	3.75	480.0	Small pieces	1.25x10^5	2.68x10^5	
00	122.64	211.50	2.33	2.38	2.17	3800	4110	2280	2420	0.221	0.235	11000	6.10	785.7	Something into pieces	1.25x10^5	3.44x10^5	
44	73.91	131.27	2.19	2.29	4.65	2080	2420	1250	1360	0.215	0.269	3000	6.40	220.6	Small pieces	3.39x10^4	1.07x10^5	
35	73.53	136.46	1.90	2.17	14.34	1640	1830	890	–	0.294	–	–	–	–	Broken after measure P wave	–	(D) 3.89x10^4	
11	65.37	126.64	1.83	2.07	12.76	1230	1340	720	750	0.235	0.272	350	3.60	25.4	Something into pieces	6.90x10^3	2.96x10^4	
37	102.61	181.65	2.19	2.30	5.08	2040	2220	1270	1310	0.180	0.233	3200	6.30	230.2	Large pieces	3.57x10^4	9.73x10^4	
6	88.67	159.97	2.10	2.24	7.03	2050	2240	1180	1250	0.249	0.274	2070	7.20	150.0	Small pieces	2.08x10^4	8.92x10^4	
0	98.32	175.68	2.19	2.27	3.83	2110	2370	1260	1310	0.221	0.280	2400	2.40	176.5	Small pieces	7.14x10^4	9.97x10^4	
6	58.36	101.27	2.33	2.36	1.11	2100	2330	1190	1250	0.262	0.298	1650	2.90	175.5	Small pieces	5.88x10^4	9.57x10^4	
7	60.23	104.23	2.34	2.37	1.42	4010	4040	2200	2100	0.329	0.315	5400	4.60	568.4	Small pieces	1.29x10^5	2.75x10^5	
8	81.76	123.45	2.95	2.96	0.30	5540	5670	3070	3100	0.280	0.287	13800	4.10	1437.5	Small pieces	3.64x10^5	7.32x10^5	
1	89.64	158.63	2.19	2.30	5.19	2140	2230	1330	1410	0.186	0.167	4400	11.50	316.5	Small pieces	2.78x10^4	1.07x10^5	

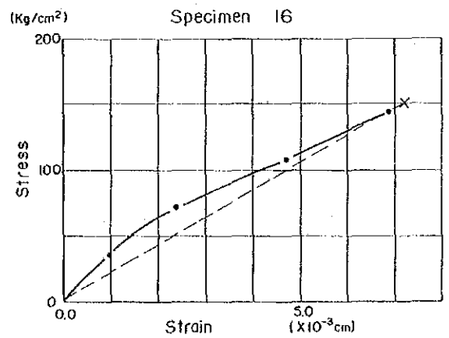
IV-6-3 STRESS-STRAIN CURVES IN COMPRESSION STRENGTH TEST

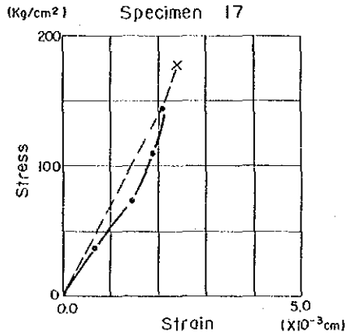
Stress-strain Curve in Unconfined Compression Test (Sheet 1 of 2)

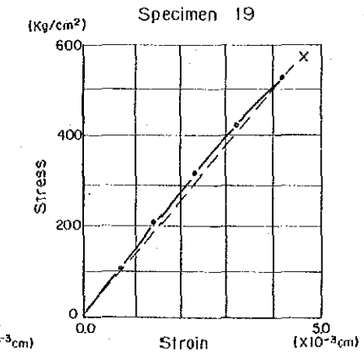


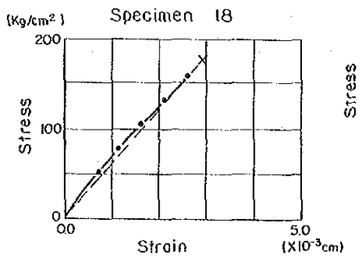
Stress-strain Curve in Unconfined Compression Test (Sheet 2 of 2)

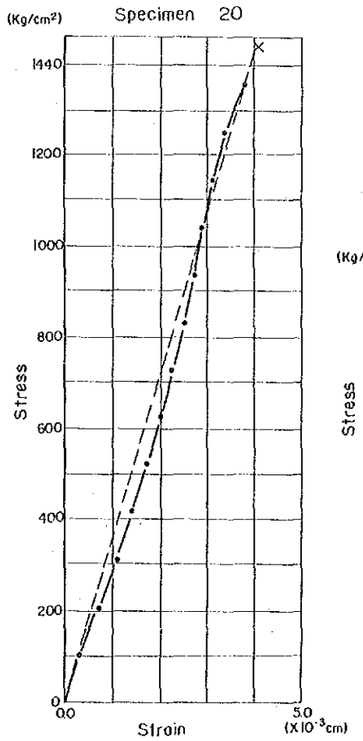


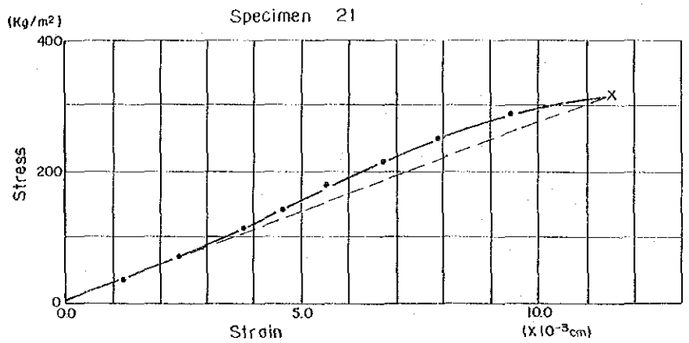










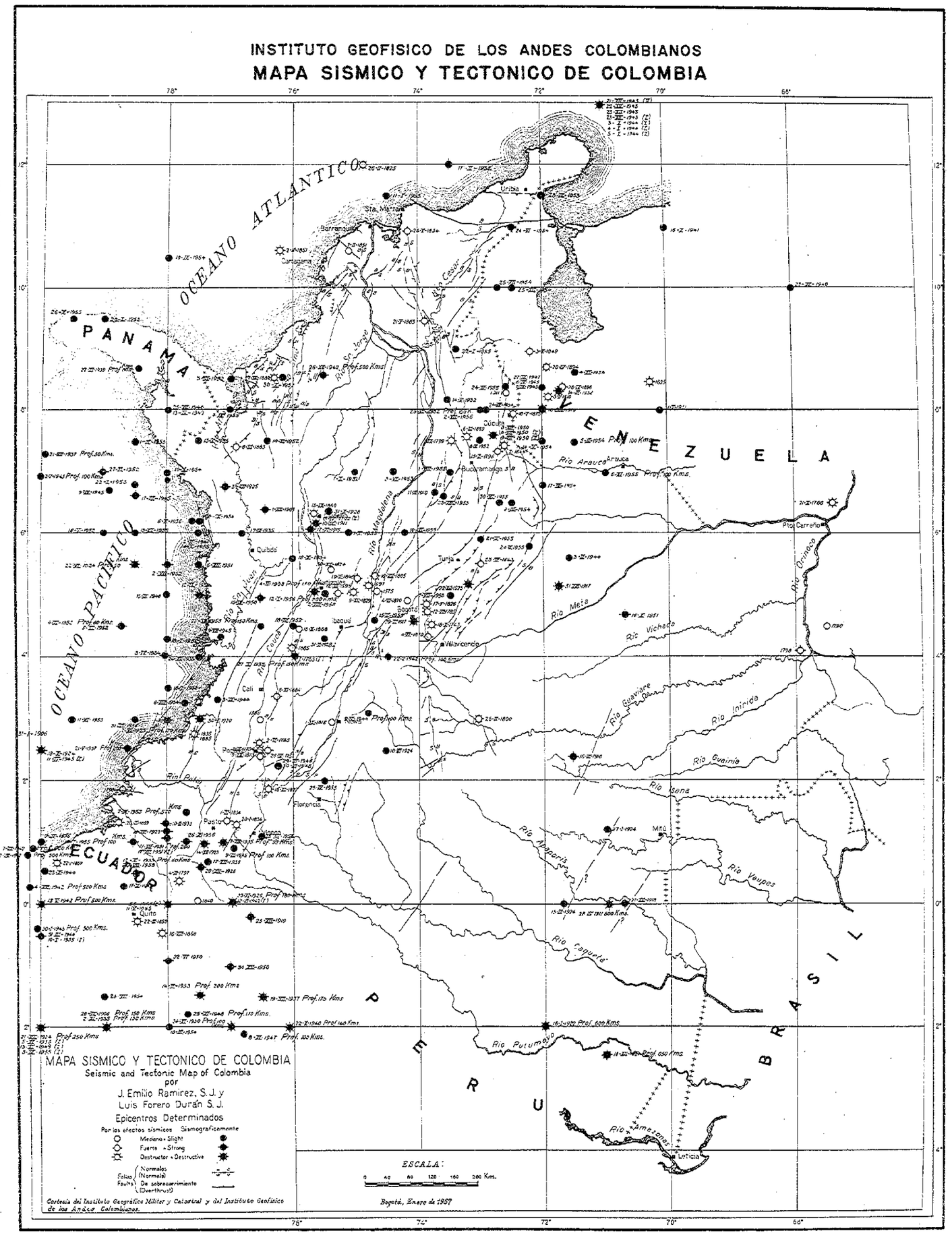


Summarized results of compressive strength and static modulus of elasticity.

Specimen		Compressive strength (kg/cm²)	Static modulus of elasticity (kg/cm²)	Remark
NO.	Locality			
1	DH-1, 38m deep	521.4	2.11×10^5	
2	DH-1, 65m deep	511.7	1.48×10^5	
3	DH-1, 83m deep	184.6	6.52×10^4	
4	DH-1, 98m deep	467.2	2.86×10^5	
5	DH-1, 105m deep	275.3	9.52×10^4	
6	DH-1, 135m deep	496.4	2.86×10^5	
7	DH-1, 150m deep	—	—	1/
8	DH-2, 158m deep	30.8	5.71×10^3	
9	DH-2, 40m deep	557.1	9.09×10^4	
10	DH-3, 15m deep	480.0	1.25×10^5	
11	DH-3, 25m deep	785.7	1.25×10^5	
12	DH-4, 10m deep	220.5	3.39×10^4	
13	DH-4, 19m deep	—	—	1/
14	DH-5, 50m deep	25.8	6.90×10^3	
15	DH-5, 57m deep	230.2	3.57×10^4	
16	DH-204, 6m deep	150.0	2.08×10^4	
17	DH-204, 12m deep	176.4	7.14×10^4	
18	Powerhouse site	175.5	5.88×10^4	
19	3-6-1 Rio Cauca	568.4	1.29×10^5	
20	La Titella	1,437.5	3.64×10^5	
21	DH-5, 57m deep	316.5	2.78×10^4	

1/ water-slaking

IV-7 EARTHQUAKE RECORDS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Río Meta
Río Vichada
Río Guaviare
Río Inírida
Río Guainía
Río Isana
Río Apaporis
Río Vaupés
Río Caquetá
Río Putumayo
Río Amazonas
Río Orinoco
Río Cesar
Río Magdalena
Río Cauca
Río Patía
Río San Jorge
Río San Juan
Río Cenepa
Río Cerreño
Barranquilla
Cartagena
Santa Marta
Uribia
Cúcuta
Arauca
Bucaramanga
Tunja
Bogotá
Villavicencio
Quibdó
Cali
Popayán
Pasto
Florencia
Mitú
Quito
Leticia
MAPA SISMICO Y TECTONICO DE COLOMBIA
Seismic and Tectonic Map of Colombia
por
J. Emilio Ramirez, S. J. y
Luis Forero Durán S. J.
Epicentros Determinados
Por los efectos sísmicos
Sismograficamente
Moderno = Slight
Fuerte = Strong
Destructor = Destructive
Fallas (Faults)
Normales (Normals)
De sobrecorrimiento (Overthrust)
ESCALA:
0 40 80 120 160 200 Kms.
Carteria del Instituto Geografico Militar y Catastral y del Instituto Geofisico de los Andes Colombianos.
Bogotá, Enero de 1957

TEMBLORES SENTIDOS EN COLOMBIA

Número de orden	Fecha: Año	Fecha: Día	Fecha: Mes	Intensidad triple escala	Profundidad focal en kilómetros	Epicentro: Coordenadas	Epicentro: Municipio	Hora de origen (tiempo de Bogotá): Horas	Minutos	Segundos
1	1566			I		76.5°O; 3.0°N	Santander, Cauca			
2	1575			II		74.5°O; 5.1°N	Guaduas, Cundinamarca			
3	1595	12	Marzo	II		75.4°O; 5.1°N	Manizales, Caldas	11		
4	1610	3	Febrero	III		71.9°O; 8.3°N	(Venezuela)			
5	1626			III		70.3°O; 8.5°N	(Venezuela)			
6	1643	23	Abril	II		73.0°O; 5.5°N	Pesca, Boyacá	20	30	
7	1644		Enero	III		72.5°O; 7.5°N	Herrán, Santander N.			
8	1697			III		74.8°O; 5.2°N	Honda, Tolima			
9	1736	2	Febrero	III		76.5°O; 2.5°N	Caldito, Cauca	14	30	
10	1736	2	Febrero	III		76.5°O; 2.5°N	Popayán, Cauca	9		
11	1743	18	Octubre	III		73.5°O; 4.5°N	Fómeque, Cundinamarca			
12	1751	25	Abril	II		76.4°O; 2.5°N	Puracé, Cauca			
13	1763		Enero	I		76.0°O; 4.0°N	Tuluá, Valle			
14	1766	21	Octubre	III		67.4°O; 6.5°N	(Venezuela)			
15	1785	12	Julio	III		73.5°O; 4.7°N	La Calera, Cundinamarca	7	45	
16	1790			I		67.5°O; 4.5°N	(Venezuela)			
17	1792	13	Abril	I		75.6°O; 6.2°N	Medellín, Antioquia			
18	1796	15	Febrero	II		72.2°O; 7.4°N	Pamplona, Santander N.			
19	1797	4	Febrero	III		77.5°O; 0.4°N	(Ecuador)			
20	1798			II		68.0°O; 4.1°N	Comisaría del Vichada			
21	1798			II		78.7°O; 1.9°N	(Océano Pacífico)			
22	1799		Septiembre	II		73.5°O; 7.5°N	Puerto Wilches, Santander			
23	1800	26	Febrero	III		73.0°O; 3.5°N	Intendencia del Meta			
24	1805	16	Julio	III		74.6°O; 5.3°N	Honda, Tolima			
25	1816	1	Septiembre	I		75.4°O; 3.0°N	Neiva, Huila	00		
26	1824	30	Diciembre	I		75.4°O; 5.4°N	Salamina, Caldas			
27	1825	26	Febrero	III		75.0°O; 12.0°N	(Océano Atlántico)	00		
28	1826	17	Mayo	III		73.9°O; 4.5°N	La Calera, Cundinamarca			
29	1827	16	Noviembre	III		76.4°O; 1.8°N	San Agustín, Huila	22	45	
30	1829	9	Diciembre	III		75.1°O; 5.1°N	Casablanca, Tolima	17	55	
								4	30	
31	1834	20	Enero	III		76.0°O; 1.3°N	El Tablón, Nariño			
32	1834	1	Marzo	II		77.1°O; 1.4°N	El Tablón, Nariño	8		
33	1834	24	Mayo	II		74.2°O; 11.0°N	Ciénaga, Magdalena			
34	1835			III		77.5°O; 2.5°N	Timbiquí, Cauca	2		
35	1840			I		75.5°O; 0.1°N	(Ecuador)	2		
36	1846	19	Febrero	II		75.0°O; 5.3°N	Marmetalis, Caldas			
37	1849	3	Mayo	II		72.2°O; 5.6°N	(Venezuela)	7		
38	1851	2	Febrero	III		76.3°O; 10.7°N	(Océano Pacífico)			
39	1851	7	Febrero	I		75.1°O; 10.6°N	Repelón, Atlántico			
40	1859	22	Enero	III		79.5°O; 0.7°N	(Ecuador)			
41	1859	22	Marzo	III		78.5°O; 0.3°S	(Ecuador)			
42	1868	10	Agosto	III		78.1°O; 0.5°S	(Ecuador)			
43	1868	15	Septiembre	III		75.6°O; 6.3°N	Bello, Antioquia	1	40	
44	1868	18	Octubre	I		75.9°O; 4.8°N	La Victoria, Valle			
45	1869	6	Marzo	III		73.3°O; 7.7°N	Cáchira, Santander N.			
46	1870	4	Junio	II		73.6°O; 4.3°N	Quetame, Cundinamarca	9	50	
47	1875	18	Mayo	III		72.5°O; 8.0°N	Cúcuta, Santander N.	11	15	
48	1878	9	Septiembre	II		76.5°O; 2.4°N	Popayán, Cauca			
49	1882	7	Septiembre	III		76.2°O; 8.5°N	Turbo, Antioquia	2	30	
50	1883	8	Marzo	III		76.9°O; 7.4°N	Riosucio, Chocó			
51	1883	21	Mayo	II		73.8°O; 9.5°N	Chimichagua, Magdalena			
52	1884	6	Noviembre	II		76.3°O; 3.3°N	La Florida, Valle			
53	1885			III		77.5°O; 2.8°N	Timbiquí, Cauca			
54	1894	20	Abril	III		71.0°O; 8.7°N	(Venezuela)			
55	1898	25	Abril	II		71.5°O; 8.4°N	(Venezuela)			
56	1903	1	Diciembre	II		75.4°O; 6.4°N	Urrao, Antioquia	3		
57	1906	31	Enero	III		81.0°O; 1.0°N	(Océano Pacífico)	10	36	
58	1906	28	Septiembre	III	150	79.0°O; 2.0°S	(Ecuador)	10	24	54
59	1911			I		72.5°O; 3.3°N	Puerto Villamizar, N. de S.			
60	1911	10	Abril	III		75.6°O; 6.2°N	Medellín, Antioquia			
61	1911	28	Abril	III	600	71.0°O; 0.0°	C. Amazonas			
62	1915	17	Junio	II		75.7°O; 6.1°N	Angelópolis, Antioquia	01	52	56
63	1917	29	Agosto	III		74.1°O; 4.5°N	Bogotá, Cundinamarca	11		
64	1917	31	Agosto	III		71.7°O; 5.2°N	Orocué, Boyacá	22	24	10
65	1918	11	Marzo	I		73.7°O; 6.7°N	Barrancabermeja, Santander	5	36	29
66	1918	16	Marzo	II		71.5°O; 2.4°N	C. Vaupés	11	25	00
67	1918	21	Diciembre	II		70.7°O; 0.0°	C. Amazonas	8	37	52
68	1919	10	Julio	III		72.0°O; 8.0°N	(Venezuela)	4	24	41
69	1919	23	Julio	II		76.7°O; 0.2°S	(Ecuador)	19	30	38
70	1920	30	Enero	III		77.5°O; 3.0°N	Micay, Cauca	23	44	00
								13	26	45
71	1921	18	Diciembre	III	650	71.0°O; 2.5°S	C. Vaupés	10	29	24
72	1922	16	Enero	III	600	72.0°O; 2.0°S	C. Vaupés	22	50	24
73	1923	14	Diciembre	III		77.5°O; 1.0°N	Funes, Nariño	5	31	18
74	1923	16	Diciembre	II		78.0°O; 1.2°N	Ricaurte, Nariño	2	38	40
75	1923	22	Diciembre	III		73.2°O; 5.2°N	Miraflores, Boyacá	9	56	00
76	1924	27	Enero	I		71.0°O; 1.2°N	C. Vaupés	22	43	34
77	1924	10	Marzo	I		74.5°O; 2.5°N	I. Meta	18	00	29
78	1924	15	Marzo	II		71.7°O; 0.0°	C. Amazonas	20	22	56
79	1924	22	Junio	III	60	78.5°O; 5.5°N	(Océano Pacífico)	17	29	08
80	1924	21	Julio	III	250	80.0°O; 2.0°S	(Ecuador)	23	04	18
81	1924	18	Octubre	III		80.0°O; 2.5°N	(Océano Pacífico)	18	05	27
82	1925	7	Junio	III	170	78.0°O; 3.0°N	(Océano Pacífico)	18	41	42
83	1925	23	Junio	III	180	77.0°O; 0.0°	(Ecuador)	11	46	58
84	1925	31	Julio	II		77.1°O; 6.8°N	La Isla, Chocó	3	40	20
85	1926	20	Diciembre	II		77.5°O; 0.6°N	(Ecuador)			
86	1928	31	Octubre	I		75.5°O; 6.3°N	Medellín, Antioquia	23	12	35
87	1930	24	Noviembre	III	100	77.0°O; 2.0°S	(Ecuador)	01	06	48
88	1931	1	Mayo	I		70.1°O; 8.0°N	(Venezuela)	17	36	36
89	1931	12	Septiembre	III		77.5°O; 3.0°N	(Océano Pacífico)	19	41	32
90	1932	17	Febrero	II		73.5°O; 12.0°N	(Mar Caribe)	11	06	57
91	1932	14	Marzo	III		71.7°O; 8.3°N	(Venezuela)	17	42	48
92	1932	14	Mayo	I		73.5°O; 8.2°N	Río de Oro, Magdalena	17		
93	1933	19	Febrero	II		76.0°O; 1.3°N	Ricaurte, Nariño			
94	1933	17	Mayo	II	60	78.5°O; 0.5°N	(Ecuador)	23	23	35
95	1933	4	Noviembre	I		71.5°O; 8.7°N	(Venezuela)	3	41	20
96	1933	5	Noviembre	I		80.0°O; 2.0°S	(Océano Pacífico)	7	11	56
97	1934	3	Abril	II		78.0°O; 4.0°N	(Océano Pacífico)	2	36	27
98	1934	6	Agosto	II		77.8°O; 3.4°N	(Océano Pacífico)	7	7	8
99	1935	7	Agosto	III	95	77.5°O; 1.0°N	Funes, Nariño	4	2	18
100	1935	17	Septiembre	I		76.8°O; 5.0°N	Beté, Chocó	23	58	00
101	1935	27	Octubre	III	150	76.0°O; 4.0°N	Pardo, Valle	17	5	5
102	1935	2	Noviembre	III	130	79.0°O; 2.0°S	(Ecuador)	16	5	40
103	1935	24	Diciembre	I		77.5°O; 4.0°N	(Océano Pacífico)	7	24	12
104	1936	17	Julio	I		77.4°O; 0.7°N	Potosí, Nariño	12	30	
105	1936	26	Octubre	II		77.8°O; 1.0°N	Guachucal, Nariño	20	45	
106	1937	21	Mayo	II	200	78.5°O; 2.5°N	(Océano Pacífico)	3	12	25
107	1937	21	Junio	I	60	80.0°O; 7.3°N	(Panamá)	10	12	2
108	1937	19	Julio	III	175	76.5°O; 1.5°S	(Ecuador)	14	35	14
109	1938	4	Febrero	III	130	76.7°O; 5.1°N	Manizales, Caldas	21	23	38
110	1939	27	Noviembre	I	80	78.5°O; 8.7°N	(Panamá)	21	9	56
111	1940	23	Junio	I		68.0°O; 10.0°N	(Venezuela)	13	59	33
112	1940	22	Octubre	III	140	76.0°O; 2.0°S	(Ecuador)	21	23	15
113	1941	2	Febrero	II		77.5°O; 6.0°N	(Océano Pacífico)	13	38	32
114	1941	16	Mayo	I		70.0°O; 11.0°N	(Venezuela)	8	7	21
115	1942	13	Mayo	III	500	80.0°O; 0.0°	(Ecuador)	21	13	22
116	1942	22	Mayo	II	130	74.5°O; 4.0°N	Cunday, Tolima	5	30	22
117	1942	12	Junio	I		77.0°O; 0.0°	(Ecuador)	5	21	44
118	1942	4	Julio	II	600	80.2°O; 0.3°N	(Ecuador)	20	53	6
119	1942	7	Julio	II	500	80.4°O; 0.9°N	(Ecuador)	7	32	42
120	1942	12	Julio	II	600	80.5°O; 0.8°N	(Ecuador)	0	5	17
121	1942	26	Diciembre	II	600?	75.5°O; 8.5°N	San Marcos, Bolívar	7	31	48
122	1943	30	Enero	I	600?	80.2°O; 0.3°S	(Ecuador)	0	33	51
123	1943	2	Mayo	I	100	80.1°O; 7.0°N	(Panamá)	12	18	12
124	1943	17	Mayo	I		78.7°O; 0.3°N	(Ecuador)	2	47	12
125	1943	21	Diciembre	II		71.0°O; 13.0°N	(Mar Caribe)	8	46	20
126	1943	22	Diciembre	III		71.0°O; 13.0°N	(Mar Caribe)	7	53	7
127	1943	23	Diciembre	III		71.0°O; 13.0°N	(Mar Caribe)	10	56	3
128	1943	23	Diciembre	I		71.0°O; 13.0°N	(Mar Caribe)	20	00	14
129	1944	3	Enero	I		71.0°O; 13.0°N	(Mar Caribe)	5	10	13
130	1944	4	Enero	I		71.0°O; 13.0°N	(Mar Caribe)	19	57	54
131	1944	6	Enero	I		71.0°O; 13.0°N	(Mar Caribe)	5	59	10
132	1944	3	Febrero	I		71.6°O; 5.6°N	Orocué, Boyacá	6	25	24
133	1944	31	Marzo	II		80.0°O; 0.5°S	(Ecuador)	15	35	4
134	1944	9	Mayo	I	100	74.8°O; 3.1°N	Baraya, Huila	9	29	49
135	1944	3	Septiembre	I		77.2°O; 3.3°N	San Antonio, Valle	16	29	36
136	1944	23	Octubre	III		80.0°O; 0.8°N	(Ecuador)	18	40	5
137	1944	23	Octubre	I		80.0°O; 0.5°N	(Ecuador)	19	27	42
138	1945	17	Marzo	II		78.5°O; 6.0°N	(Océano Pacífico)	18	57	54
139	1945	6	Abril	I		72.0°O; 8.4°N	(Venezuela)	13	30	50
140	1945	7	Abril	I		72.0°O; 8.4°N	(Venezuela)	5	25	23
141	1945	11	Abril	I		80.0°O; 2.5°N	(Océano Pacífico)	19	21	7
142	1945	9	Julio	I		78.0°O; 6.7°N	(Océano Pacífico)	6	56	44
143	1945	3	Julio	I	100	76.9°O; 1.0°N	C. Putumayo	11	42	3
144	1946	29	Marzo	I		76.3°O; 2.3°N	Volcán Puracé	2	17	28
145	1946	29	Marzo	I		76.3°O; 2.3°N	Volcán Puracé	15	7	1
146	1946	29	Marzo	I		76.3°O; 2.3°N	Volcán Puracé	19	2	18
147	1946	30	Marzo	I		76.3°O; 2.3°N	Volcán Puracé	12	22	31
148	1946	16	Septiembre	I		78.0°O; 5.0°N	(Océano Pacífico)	00	21	22
149	1947	27	Septiembre	I		72.0°O; 8.4°N	(Venezuela)	17	12	39
150	1947	8	Noviembre	I	100	76.8°O; 2.1°S	(Ecuador)	00	24	19
151	1948	25	Junio	I	170	77.7°O; 1.8°S	(Ecuador)	4	19	13
152	1948	25	Julio	I		78.0°O; 8.0°N	(Panamá)	22	37	42
153	1949	13	Septiembre	I		78.0°O; 8.0°N	(Panamá)	11	16	42
154	1949	13	Noviembre	I		80.0°O; 2.0°S	(Ecuador)	21	10	2
155	1950	10	Abril	II		76.5°O; 5.0°N	Condoto, Chocó	11	48	38
156	1950	22	Junio	II		78.0°O; 1.0°S	(Ecuador)	15	43	00
157	1950	8	Julio	III		72.8°O; 7.6°N	Arboledas, Santander N.	21	35	31
158	1950	8	Julio	I		72.8°O; 7.6°N	Arboledas, Santander N.	22	28	59
159	1950	9	Julio	II		72.8°O; 7.6°N	Arboledas, Santander N.	7	34	15
160	1950	30	Diciembre	II		77.0°O; 1.0°S	(Ecuador)	3	2	20
161	1951	17	Julio	II	200	78.0°O; 1.0°N	Cumbal, Nariño	2	34	17
162	1951	17	Julio	I		78.0°O; 1.0°N	Cumbal, Nariño	4	19	17
163	1951	7	Octubre	I		75.0°O; 7.0°N	Amalfi, Antioquia	1	00	30
164	1951	15	Octubre	II		70.7°O; 4.9°N	S. José de Ocune, Vichada	21	38	26
165	1951	6	Diciembre	I		77.5°O; 5.5°N	(Océano Pacífico)	9	29	18
166	1952	13	Enero	I		73.0°O; 3.5°N	(Océano Pacífico)	17	53	17
167	1952	14	Febrero	I		76.4°O; 7.5°N	Pavarandocito, Antioquia	16	2	26
168	1952	18	Marzo	I		76.0°O; 4.5°N	La Victoria, Valle	15	27	18
169	1952	8	Mayo	I		73.0°O; 7.5°N	Matanza, Santander	3	11	3
170	1952	16	Mayo	I		79.0°O; 6.0°N	(Océano Pacífico)	15	45	40
171	1952	3	Junio	I		77.0°O; 8.5°N	(Mar Caribe)	7	24	12
172	1952	4	Junio	II	60	78.7°O; 4.5°N	(Océano Pacífico)	16	30	58
173	1952	5	Junio	II		78.7°O; 4.5°N	(Océano Pacífico)	00	56	45
174	1952	29	Junio	I	150	73.0°O; 8.0°N	Bucaramico, Sant. N.	4	56	36
175	1952	2	Julio	II		78.0°O; 5.5°N	(Océano Pacífico)	10	52	27
176	1952	30	Octubre	I		76.3°O; 8.7°N	Montería, Córdoba	8	13	7
177	1952	27	Noviembre	II		79.0°O; 7.0°N	(Océano Pacífico)	20	12	56
178	1953	20	Enero	I		79.0°O; 9.5°N	(Panamá)	4	43	9
179	1953	14	Febrero	III	200	77.5°O; 1.5°S	(Ecuador)	17	10	29
180	1953	1	Abril	I		78.5°O; 7.0°N	(Océano Pacífico)	17	37	51
181	1953	7	Abril	I	570	77.7°O; 1.5°N	Los Andes, Nariño	5	23	13
182	1953	3	Junio	I		74.4°O; 7.0°N	Remedios, Antioquia	7	3	26
183	1953	11	Junio	I		79.5°O; 3.0°N	(Océano Pacífico)	9	36	00
184	1953	7	Julio	I		73.5°O; 5.0°N	Manta, Cundinamarca	22	26	50
185	1953	21	Agosto	I	150	76.5°O; 4.5°N	Versalles, Valle	11	45	57
186	1953	23	Agosto	I		73.5°O; 6.0°N	San Vicente, Santander	23	37	36
187	1953	28	Septiembre	I		72.0°O; 11.5°N	(Venezuela)	23	39	46
188	1953	7	Octubre	I		75.1°O; 6.0°N	Cocorná, Antioquia	2	26	45
189	1953	23	Diciembre	I		76.5°O; 1.0°N	Urcusique, Putumayo	4	45	23
190	1954	5	Febrero	I	100	71.5°O; 7.5°N	(Venezuela)	8	8	53
191	1954	9	Marzo	I		72.5°O; 6.5°N	El Espino, Boyacá	14	39	42
192	1954	10	Abril	I		78.0°O; 2.0°S	(Ecuador)	9	9	7
193	1954	10	Abril	I		78.0°O; 10.5°N	(Mar Caribe)	10	15	46
194	1954	24	Abril	I		72.0°O; 8.0°N	Villa Caro, Sant. N.	22	57	15
195	1954	14	Mayo	I		72.0°O; 7.5°N	(Venezuela)	13	34	37
196	1954	24	Junio	I		72.5°O; 11.0°N	Maicao, Guajira	10	37	3
197	1954	25	Julio	I		72.5°O; 10.0°N	(Venezuela)	5	40	46
198	1954	25	Julio	I		72.7°O; 10.0°N	(Venezuela)	5	00	15
199	1954	26	Julio	I		79.0°O; 1.5°S	(Ecuador)	14	9	00
200	1954	8	Septiembre	I		77.5°O; 6.2°N	Mutis, Chocó	23	50	14
201	1954	17	Septiembre	I		72.0°O; 6.8°N	Arauquita, Arauca	14	1	52
202	1954	10	Octubre	I		78.0°O; 7.0°N	(Océano Pacífico)	18	21	40
203	1954	16	Octubre	I		76.0°O; 5.5°N	Andes, Antioquia	14	49	29
204	1955	5	Enero	I		78.0°O; 0.0°	(Ecuador)	10	35	3
205	1955	10	Enero	I		80.0°O; 0.5°S	(Ecuador)	4	38	43
206	1955	11	Enero	I		74.5°O; 11.5°N	(Mar Caribe)	16	11	10
207	1955	19	Enero	II	100	73.5°O; 1.0°N	(Ecuador)	10	33	7
208	1955	22	Enero	I		78.5°O; 6.8°N	(Océano Pacífico)	11	18	53
209	1955	22	Enero	I		73.4°O; 9.0°N	Carmen, Santander N.	15	44	9
210	1955	8	Abril	I		80.0°O; 2.0°S	(Ecuador)	8	11	30
211	1955	24	Abril	I		72.6°O; 8.4°N	Puerto Villamizar, Sant. N.	16	7	45
212	1955	25	Abril	I		75.5°O; 2.0°N	Andalucía, Huila	5	25	21
213	1955	11	Mayo	III		78.0°O; 0.0°	(Ecuador)	6	4	00
214	1955	13	Mayo	I		77.5°O; 7.5°N	Juradó, Chocó	16	55	47
215	1955	15	Mayo	I		74.7°O; 4.8°N	Jerusalén, Cundinamarca	20	2	12
216	1955	21	Mayo	I		72.9°O; 5.9°N	Sta. Rosa de Viterbo, Boy.	5	43	40
217	1955	26	Mayo	I		79.5°O; 9.5°N	(Panamá)	1	11	16
218	1955	10	Junio	I		74.2°O; 6.0°N	Puente Nacional, Boyacá	19	31	32
219	1955	13	Junio	I		78.5°O; 0.0°N	(Océano Pacífico)	22	42	50
220	1955	30	Junio	I		72.7°O; 6.5°N	Capitanejo, Santander	14	8	51
221	1955	20	Julio	II		78.5°O; 0.5°N	(Ecuador)	16	00	43
222	1955	1	Agosto	I		73.5°O; 7.0°N	San Vicente, Santander	23	00	30
223	1955	7	Septiembre	I		77.0°O; 8.0°N	Santafé, Chocó	22	21	25
224	1955	14	Octubre	I		77.5°O; 6.0°N	(Océano Pacífico)	23	31	16
225	1955	24	Octubre	I		72.2°O; 5.8°N	Támara, Casanare	10	6	51
226	1955	6	Noviembre	I	100	71.0°O; 7.0°N	Arauca, Arauca	18	57	10
227	1956	12	Enero	I	200	75.6°O; 5.0°N	Villa María, Caldas	2	45	27
228	1956	18	Enero	I		78.0°O; 4.3°N	(Océano Pacífico)	22	52	3
229	1956	6	Febrero	I		77.6°O; 6.2°N	(Océano Pacífico)	21	3	25
230	1956	9	Marzo	I		80.0°O; 1.0°N	(Ecuador)	12	31	7
231	1956	31	Marzo	I		78.5°O; 3.0°N	(Océano Pacífico)	3	19	17
232	1956	2	Julio	I		73.0°O; 8.0°N	Villa Caro, Santander N.	5	31	30
233	1956	2	Agosto	I		75.5°O; 5.0°N	Villa María, Caldas	7	11	20