**INTERNACIONAL CONFERENCE - SATREPS PROJECT** 

JAPAN PERU COOPERATION FOR EARTHQUAKE AND TSUNAMI DISASTER RISK REDUCTION

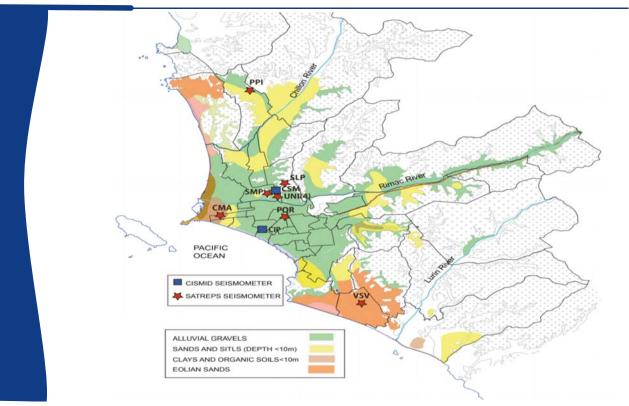
# COMPARISON OF DIRECT AND INDIRECT GEOPHYSICAL METHODS TO OBTAIN SOIL PROFILES FOR LIMA CITY

Zenón Aguilar Bardales, Dr. Eng. Diana Calderón Cahuana, Dr. Eng.



#### STRONG GROUND MOTION NETWORK CISMID – FIC - UNI

CENTRO PERUANO JAPONÉS DE INVESTIGACIONI SÍSMICAS Y MITIGACIÓN DE DESASTRES - CISMII





### GROUND MOTION RECORDS FROM 2012 EARTHQUAKES

1	Fecha	Hora Loc Epicentro	Profundio	Magnitud	Intensidad	СМА	СМГ	PPI	POB	SMP	IUMI	IINI2	IINI3	IIINI4	VSV
2	30/12/2012	08:32:49 19 Km al E de Puerto Supe		4.3 ML	Il Puerto Supe	X	ОК	X	X			X			X
3	28/12/2012	20:57:40 40 Km al E de Huaral		4.3 ML	II-III Huaral	ок	OK	ок		OK	OK	X	OK		ок
4	22/12/2012	01:43:39 10 Km al SO de Chilca		4.2 ML	Il Chilca. Lima	ОК	ОК	ОК			OK	X			OK
5	10/12/2012	06:25:24 13 Km al SO de Ancon		4.3 ML	III Ancon II Chosica	ОК	ок	ок		OK	ок	X			OK
6	04/12/2012	20:33:00 5 Km al NE de Lima		3.5 ML	II Lima	X	ОК	X		X		X			X
7	04/12/2012	19:23:35 45 Km al NO de Cerro de Pasco		4.4 ML	No Sentido	X	OK	X		X		X			X
8	27/11/2012	22:09:49 92 Km al NO de Yurimaguas		5 ML	II III Yurimaguas	X	X	ОК		X		ОК			ОК
9	27/11/2012	04:19:59 11 Km al SE de Barranca		4.4 ML	III Barranca; III-II Huacho; II Lima	X	ок	ОК							ок
10	26/11/2012	20:50:56 60 Km al SE de Lima		3.9 ML	II Lima	X	X	X	X	X	X	X			ок
11	20/11/2012	00:20:27 62 Km al O de Ancon		4.1 ML	Il Lima Ancon	X	ОК	ОК	X			ОК	OK		OK
12	20/11/2012	00:11:14 24 Km al S de Lima		3.8 ML	II Lima	X	X	X	X	X	X	ок			ок
13	15/11/2012	19:21:55 41 Km al SO de San Vicente de C		4.8 ML	III San Vicente de Cañete, Chincha Alta; II-III Lunahuana; II Lima, Ica	X	ОК	ОК				ОК			ОК
14	13/11/2012	00:48:58 70 Km al SE de Lima		4 ML	II Lima	X	X	X	X	X	X	X	X	X	OK
15	12/11/2012	22:03:47 63 Km al SE de Lima		3.9 ML	II Lima	X	X	X	X	X	X	X	X		ОК
16	10/11/2012	09:57:48 45 Km al E de Aguautia		6 ML	IV-V Aquautía	ок	ок	ок		ОК				X	ок
17	10/11/2012	01:57:44 57 Km al SE de Lima		3.9 ML	II Lima	X	X	X	X	X	X	OK			OK
18	05/11/2012	03:08:11 58 Km al SE de Lima		3.9 ML	II Lima	X	x	X		X	X	X			ОК
19	04/11/2012	15:29:38 22 Km al SE de Chincha Alta		4 ML	II Chincha	X	X	X		X	X	X			OK
20	03/11/2012	20:52:12 38 Km al N de Yauyos		4.7 ML	III-IV Yauyos: III Lima	ОК	x	ОК			X				OK
21	31/10/2012	20:53:31 47 Km al E de Matucana		4.2 ML	Il Matucana	OK	X	ОК			X	OK			OK
22	31/10/2012	20:37:26 III Matucana		4.5 ML	III Matucana	ОК	X				X	OK	OK		OK
23	30/10/2012	14:44:54 57 Km al SE de Lima		4.3 ML	III Lima	X	X	ОК			X	ок			OK
24	30/10/2012	08:35:46 60 Km al S de Lima		3.9 ML	II Lima	X	X	OK					OK		OK
25	30/10/2012	02:48:53 58 Km al S de Lima		3.9 ML	ILLima	X	X			ОК	X	ОК			OK
26	22/10/2012	21:26:58 12 Km al SE de Lima		3.8 ML	ILima	X	X	OK		OK	X	OK			OK
27	14/10/2012	11:50:29 51 Km al O de Callao		3.7 ML	ILima	ОК	X	OK			X	OK			OK
28	08/10/2012	21:32:26 41 Km al S de Pisco		4.5 ML	III Pisco II Ica	X	X	X		X		OK			OK
29	03/10/2012	17:48:54 74 Km al SO de Ica		4.8 ML	III Ica Pisco	ОК	X	ОК	X	ОК	X	OK			OK
30	27/09/2012	23:39:01 10 Km al O de Matucana		4.4 ML	III Matucana, Chosica, San Mateo, Ricardo Palma; III-II Lima	X	×	ОК		OK	X	ок	ок		ок
31	25/09/2012	01:50:45 37 Km al SO de Lima		3.9 ML	Il Lima	X	X	X	OK	OK	X	OK			OK
32	23/09/2012	03:47:19 39 Km al O de San Vicente de Ca		4.4 ML	III-II San Vicente de Cañete	ок	×			ОК	X	ОК	ОК		OK
33	19/09/2012	00:21:55 34 Km al O de San Vicente de Ca		4 ML	II-III Cañete	OK	X	OK		OK	X	OK			OK
34	18/09/2012	14:42:26 18 Km al SO de Callao		3.8 ML	II Lima	X	x	OK			X	OK	OK		OK
35	15/09/2012	06:27:50 62 Km al SO de Lima		4 ML	ILLima	X	X				X	OK			OK
36	15/09/2012	05:39:00 102 Km al O de Tacna		4.3 ML	II Tacha	X	X	X			X	X			OK
37	15/09/2012	00:14:27 85 Km al E de Mancoraa		4 ML	Il Mancora	ок	X	X			X	X			X
38	09/09/2012	20:35:55 61 Km al S de Lima		3.9 ML	Il Chilca, Lima	X	X	X					OK		OK
39	09/09/2012	19:04:03 9 Km al SE de Matucana		3.7 ML	II.Matucana	X	X	X		X	X	OK	X		X
40	01/09/2012	22:34:59 23 Km al O de Chincha Alta		4.2 ML	III Chincha II San Vicente de Cañete Pisco	OK	x	X		X	X		OK		OK
41	29/08/2012	22:01:23 25 Km al NE de Aguautía		4.8 ML	Il Aguaytia, Tingo Maria, Pucalipa	V	1 V	ок ОК		X	X	OK			OK
42	25/08/2012	11:06:37 43 Km al SO de Lima		3.9 ML	Il Lima	x	X	X		x	X	OK			OK
43	24/08/2012	02:22:12 16 Km al O de Ancón		3.9 ML	II Ancon	x	1 <u>2</u>	x	X	x	X	OK			OK
44	11/08/2012	04:35:47 40 Km al S de Huacho		4.3 ML	III Huacho; III-II Lima	OK	x	ОК		о ок	X				OK
45	08/08/2012	03:35:17 41 Km al SE de Tingo María		4.3 ML	No Sentido	X	<u><u></u></u>	X	X	X	X	OK	V.	X	OK
46	07/08/2012	21:53:02 86 Km al S de Lima		3.9 ML	ILima	x	10	ÔK			X	OK	ÔK		OK
 40	07/08/2012	05:30:59 83 Km al SO de San Vicente de C		5.4 ML	II-III San Vicente de Cañete: II Ica, Lima	ОК	<del>0</del>	OK		о ок	x	OK			OK
 48	06/08/2012	21:02:50 32 Km al NO de Tingo María		4.9 ML	II-III Tingo María; II Huanuco	OK	0	OK	X		x				OK
48	06/08/2012	21:02:50 32 Km al NO de Tingo Maria 02:23:38 14 Km al NO de Pisco		4.3 ML	II-III Tingo Maria; II Huanuco III-II Pisco: II Chincha Alta. Tambo de Mora	X	X	OK						OK	
43	06/08/2012		JOKI	4.3 MIL	inhi misco; il Grinoha Alta, Tambo de Miora	<u> </u>	<u> </u>		<u> </u>	UK	ń.	OK	UK	UK	

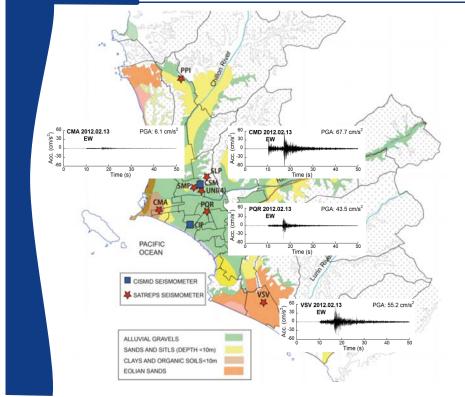


# GROUND MOTION RECORDS FROM 2012 EARTHQUAKES

51	03/08/2012	08:46:49 68 Km al SE de Lima	56 Km	3.8 ML	II Lima	X	X	ок	x	X	X	пк	ок	x	ок
52	02/08/2012	04:38:14 47 Km al SE de Pucalipa	150 km	6.4 ML	IV-V Pucalipa; III-IV Huanuco; III Trujillo; II Lima	ок	X			ок		OK	OK		
53	01/08/2012	08:02:15 36 Km al SO de Callao	46 Km	3.7 ML	Il Lima	OK	X			OK		OK	OK		
54	29/07/2012	12:35:49 7 Km al N de Callao	58 Km	4.5 ML	III Lima Callao II Huacho Huaral	OK	X			ОК		OK	OK		
55	28/07/2012	21:07:38 50 Km al SO de Callao	38 Km	3.7 ML	II Lima	X	X	ОК		OK		OK		ОК	
56	16/07/2012	12:21:06 39 Km al SE de Lima	40 Km	3.8 ML	II Lima	X	X	X	X		X	ок	OK		
57	14/07/2012	03:09:02 22 Km al S de Matucana	15 Km	3.9 ML	Il Matucana, Ricardo Palma, Lima	X	X	ок			X	X			ОК
58	09/07/2012	05:02:52 59 Km al SO de Huarmeu	50 Km	4.4 ML	No Sentido	X	X	ОК			X	X		X	X
59	06/07/2012	17:59:45 2 Km al SE de Matucana	24 Km	4.1 ML	II-III Lima, Matucana	X	X	OK			X	X		X	X
60	06/07/2012	13:59:06 7 Km al SE de Matucana	22 Km	4 ML	II Lima. Matucana	X	X	ОК			X	X		X	X
61	04/07/2012	11:01:37 8 Km al S de Lima	54 Km	3.8 ML	II Lima	X	X	X	X		X	X		X	X
62	02/07/2012	18:31:30 121 Km al SO de Ica	33 Km	5.6 ML	IV Ica III Palpa II Lima	X	X	ок	X	X	X	X	X	X	
63	28/06/2012	06:18:59 57 Km al O de Callao	44 Km	4.2 ML	Il Lima Callao	OK	X	OK			X	X		x	o
64	27/06/2012	07:41:07 21 Km al E de San Vicente de Cai		4.2 ML	II III San Vicente de Ca ete	X	X		OK		X	X		X	0
65	26/06/2012	16:17:14 22 Km al N de Pisco	48 Km	4.3 ML	III Pisco Chincha	X	X	OK	X		X	X		X	X
66	21/06/2012	17:17:10 38 Km al N de Lima	96 km	4.7 ML	III Lima Huacho Matucana	ÖK	ОК		ок		X	X			O
67	08/06/2012	07:54:17 76 Km al S de Callao	40 Km	4.3 ML	III Lima	X	OK	X	OK		X	X		X	0
68	31/05/2012	01:35:54 30 Km al S de Huacho	46 Km	4 ML	Il Huacho Huaral Lima	X	OK	X	X		X	X		X	
69	28/05/2012	11:46:41 54 Km al N de San Vicente de Ca		3.9 ML	ILlima	X	OK	X	X		X	OK		X	lõ
70	27/05/2012	00:21:30 15 Km al O de Pisco	44 Km	4.5 ML	II-III pisco	X	OK	x	1X	X	x	OK		ок	
70	23/05/2012	18:01:53 31 Km al SO de Huacho	73 Km	4.3 ML	II-III Lima	X	OK	x	1x	X	OK	OK			
72	23/05/2012	09:36:40_130 Km al S de Nasca	40 Km	4.6 ML	III Yauca Acari II Chala	1 x	X	X	x	X	X	X		OK	X
73	16/05/2012					×	OK	X	ÔK	X	OK	OK		OK	
74		22:45:27 32 Km al SO de Matucana	100 km	4.2 ML	II Lima, Chosica	X	OK	X	X	X	OK	OK		OK	
75	14/05/2012	19:45:49 19 Km al S de San Vicente de Cai		4 ML	Il Cerro Azul (Dpto Lima)	×	X	ОК		X	X	X			X
	12/05/2012	16:39:22 58 Km al SO de Huacho	45 Km	4.0 ML	II Huacho II-III Pisco	X	OK			X	X	X			X
76	06/05/2012	08:13:30 20 Km al SE de Pisco	62 Km	4.3 ML		OK	OK		OK		OK	OK	OK		
77	06/05/2012	07:40:57 11 Km al S de Pisco	67 Km	5.5 ML	III-IV Ica; III San Vicente de Cañete; II-III Lima		OK	X							
78	05/05/2012	19:10:15 69 Km al SO de Huarmey	52 Km	4.5 ML	II-III Huarmey	X		OK	X	X	OK OK	Х		OK	X
79	22/04/2012	18:45:55 19 Km al SE de Ambo	120 km	4.7 ML	Il Huanuco, Ambo, Panao		OK							ок	
80	17/04/2012	07:26:32 66 Km al SE de Nasca	71 Km	4.5 ML	III Acari II Nazca Coracora Caraveli chala	×	OK	OK OK		X	X	X		X	X
81	14/04/2012	02:11:10 46 Km al NO de Barranca	61 Km	4.5 ML	III Huarmey II Casma		X	X						X	
82	25/03/2012	18:00:56 87 Km al SO de Callao	48 km	5 ML	II Lima	X	X	X	X		ОК	ок		OK	X
83	23/03/2012	23:23:32 28 Km al NE de Trujillo	47 km	4 ML	ll Trujilo					X	X	X		OK	
84	19/03/2012	21:36:25 32 Km al NE de San Vicente de C		4.2 ML	II Lunahuana	×	X	X	X	X	X	ОК		ОК	X
85	19/03/2012	18:21:45 36 Km al NO de Callao	45 km	4 ML	ll Huacho, Lima, Callao	×	X	X		X	OK	OK		OK	X
86	15/03/2012	08:21:30 11 Km al O de Chincha Alta	64 Km	4.4 ML	III Tambo de Mora II Chincha Pisco	×	X	ОК		X	ОК	ОК		ОК	X
87	14/03/2012	05:52:34 5 Km al NE de Ambo	108 Km	4.4 ML	Il Huanuco	×	X	OK	X	X	ок	ок		ок	
88	12/03/2012	01:34:57_20 Km al SO de Ica	70 km	5.4 ML	III Ica	×	X		ок	X	X	X		X	X
89	11/03/2012	03:20:36 53 Km al S de Callao	52 km	3.8 ML	II Lima	×	X	ОК		X	х	х		х	
90	08/03/2012	21:35:09 68 Km al N de Rioja	46 km	4.5 ML	ll Nueva Cajamarca	X	Х	Х	ОК	Х	х	Х		х	X
91	08/03/2012	12:42:59 54 Km al SO de Barranca	63 Km	4.3 ML	Il Supe	ОК	Х	ОК	х		х	х		х	0
92	06/03/2012	22:52:03 28 Km al S de Callao	49 Km	3.7 ML	II Lima	ОК	Х				х	Х		х	0
93	29/02/2012	03:50:15 59 Km al NO de San Vicente de 0		4.3 ML	ll Mala Lima	OK	OK	Х	х		х	Х		х	0
94	18/02/2012	21:19:23 12 Km al NO de Callao	47 km	4 ML	ll Callao	ОК	Х		ОК		х	ОК	ОК		
95	13/02/2012	23:42:20 42 Km al S de Lima	42 km	4.8 ML	IV Lima	OK	ОК	ОК			ок	ОК			
96	10/02/2012	23:27:17 34 Km al O de San Vicente de Ca		4.8 ML	Il Cañete	ОК	ОК	Х	Х		ОК	ОК	OK	х	0
97	30/01/2012	00:10:58 47 km al SO de Cañete	54 km	6.3ML	V Ica, IV-V Pisco, IV Chincha, III Lima	×	ОК	Х	OK			ОК		х	0
98	22/01/2012	21:31:13 63 km al O del Callo	37 km 👘	4.4ML	ll Lima	×	ОК	Х	ОК		х	Х		х	O
99	19/01/2012	15:58:34 61 Km al Sur de Callao	48 km	3.9 ML	I Lima	OK	IOK	OK	IOK	IOK	OF.	X	OK	х	0

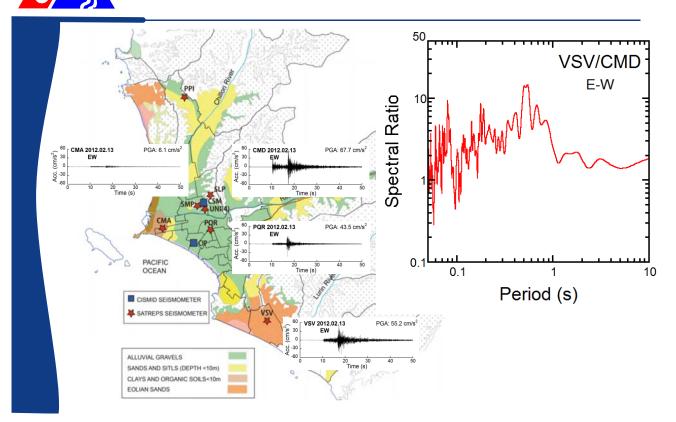


# GROUND MOTION RECORDS FROM 2012/02/13 EARTHQUAKE



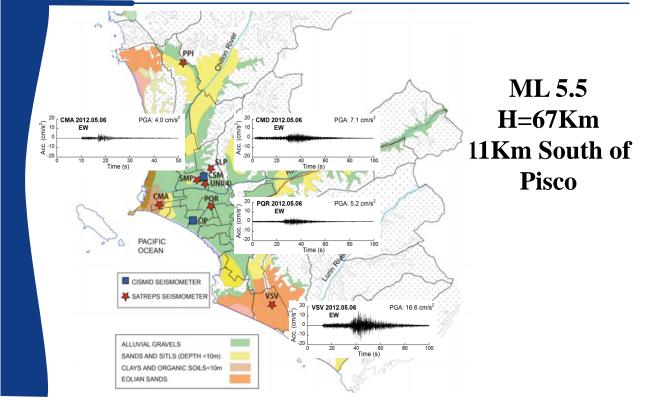
# ML 4.8 H=42Km 42 Km South of Lima



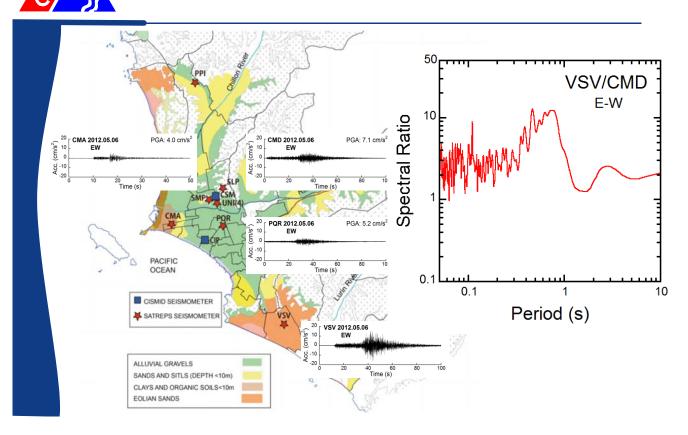




# GROUND MOTION RECORDS FROM 2012/05/06 EARTHQUAKE



# GROUND MOTION RECORDS FROM 2012/05/06 EARTHQUAKE



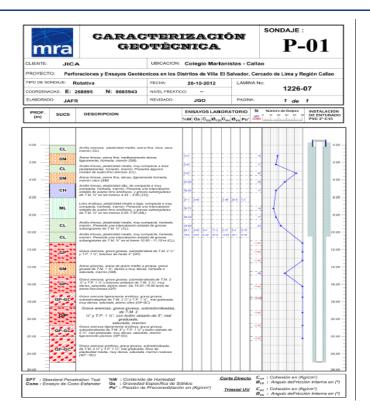


# DIAMOND BOREHOLE AT CMA STATION - CALLAO





# **BOREHOLE LOGGING CMA STATION - CALLAO**





# DIAMOND BOREHOLE AT PQR STATION - LIMA





03 CA IA 04 Prof - 11 00 \_ 15 00



### **BOREHOLE LOGGING PQR STATION - LIMA**

LIENTE:	JICA		UBICACION	E Parque de	Las A	quas - 4	Cercado	de Lima		
ROYECTO:		iones y Ensayos Geo				-			legión C	allao
PO DE SONDAJ			FECHA:	02-11-201		LAMIN				
OORDENADAS:	E: 278	602 N: 8664785	NIVEL FREAT	100:				1226-	09	
LABORADO:	JAFR		REVISADO:	JGO		PAGINA	le .	1 de	1	
PROF. SU	cs	DESCRIPCION		ENSAYOS L				oro de Galipes 20 30 40 3		LACIO
(m) 00				SW Gs C <sub>00</sub>	Ø <sub>CD</sub> C <sub>au</sub>	Ø <sub>ve</sub> Po'	ىلىسا 🏎	20 30 40 5	PVC 3	°C15
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-		no igerorere de pososo, posos. ny osmpacia Asmeda mandri I tredordeada de 7.84.1	Contere preva							
1.00 G	iP Ga	на анновка, рача режка: зайне	dandeades: T.M. 2 %*							- 1
- 22	S 22	no arecusa, provo pruesa, asbre .P. 21, arene de grano medio, Abr ny dense (GP).	onda marrin, abroar							
2.00										21
3.00	81									31
100										-
5.00										51
e.oe 6	2 2	na arentest, preve gruese, sobre (P. 1197) arena de grano mesilo, r mo a égenerente marcin. Contes	dendesels, do T.M. 3" tray decas, historica,							61
	1	mo a ilgenerarite marries. Contie 7.14. 81. (GP).	te baloons aldados							
7.00				8.8 2.74	0.55	<i>a</i> 33				2.1
8.00										0.0
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		wa arecesa, preve praese, sobre	dandhaidh an T.M. 🖛							
1.00 G	1 <b>P</b>	P. 1157, arena de grano medio, n no a igenerente caarón. Coste 7.14.5°, (GP).	noy dense, Alimeda, no bolonez aldadoz							71.1
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2.00										121
	<b>P</b>	eco precoza, grovo granos, subre (P. 1.57) anoso de grano crealo, n mo ligaramento mantin. Contiene 19.	dandeades de T.M. 2° ouy decisio, húmedia, i belones: de trasty 8°							
4.00	10	ŋ.								14.5
0.14										761



# DIAMOND BOREHOLE AT VSV STATION – VILLA EL SALVADOR







Fato 52: SONDEO P.02 CA IA 06 Prof - 37 00 - 44 05 m

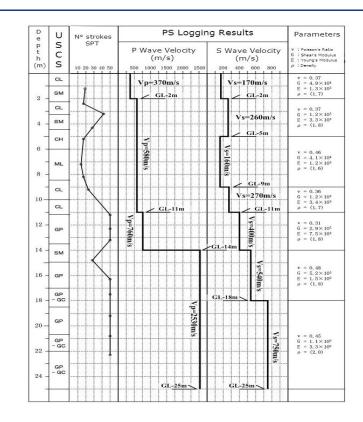


#### BOREHOLE LOGGING VSV STATION

m	nra	GARAG GEC		izacić Nica	ÌN		-02
LIENTE:	JIC	•	UBICACION	Comisaria Villa	El Salvado	r	
ROYEC1	TO: Perfe	raciones y Ensayos Geotéc	nicos en los l	Distritos de Villa El S	alvador, Ce	rcado de Lima y	Región Callao
PO DE SI	ONDALE: R	otativa	FECHA:	26-10-2012	LAMINA N		
DORDEN	ADAS: E: 2	289163 N: 8649199	NIVEL FREAT	100:		1226	5-08
LABORAC	DO: JAFF	2	REVISADO:	JGO	PAGINA:	1 de	1
PROF. (m)	SUCS	DESCRIPCION		ENSAYOS LABOR		Múmero de Galpes 8 78 20 30 49 9	
	SM	de porticulas de minerar de nierra (SM).		201			
LOP	5 <b>8</b>	Jennie andog, werze kod, medialostene bierweit, mieror chim, medialostene de notecar de biero (3P-586) Anna mal grottlado, anna lína, muy de mierrón clero (3P).		992			8.0
	SP	Anana mal predicada, arena lina: muy de exarcia clario. Presencia de iseñes de sos concestración de innos entre 12.06 12.0 18.40 exote un Ambr de anana arcilicos	NG De 16.30 a	30212231== 20:			12.00
	SP-SM	Annra mal graduado ligaramento limous denas, Aureda, ouarder claro. Preasona limous (SP-SM).	, anana fina, muy Autos do anoca	2000			20.07
.00	SP-SM	Annen mel gredisede ligeramento lincos dense, Nomeda, marrón claro, Presente lincoso (SP-534).	anana fina, muy Autoa do anoca				24.01
	SP	Anvar mai produado igenerarante Ancao densa, Acimeda, manter ctaro, Prosenta Innote (SP):	, anima fina, muy Jantos an anna	985 :		•	32.01
.00	SP-SM	Anna mal gradiada liperamento Amosa denas, Alameda, mante claro (SP-568, Anno mal gradiado, anera fina, may de mante alombo (SP).		285			36.01
		downe med provinselite, armore lines more de	man foirmoith	247 (248 (246 (247 ) = 1		•	40.00
	SP	marrian picintes, presentais de lamita co concentración de úmos entre 48.50-86.0		2000		1	
2.00	SP SP	Anna mal prediado, anan fine, may de mantin claro (SP). Anvre cral prediado, anvre fine, cray de mentin olaro (SP).		200			A2.03
PT : Ste ono : En	endard Penes 188yo de Con	nation Teat NW : Contenido o Estandar Gs : Gravelad Po" : Presión de	Espec/fica de S	lólidice .	diamini ULL C	. : Cohesión en	icción Interna en (*)



# PS WELL LOGGING RESULTS CMA STATION



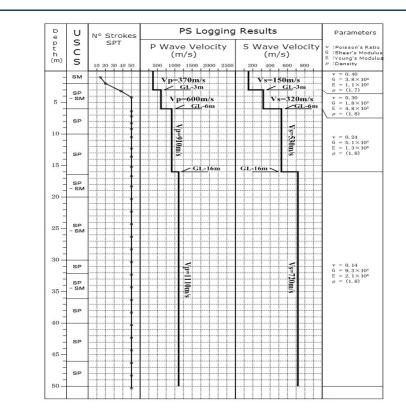


### PS WELL LOGGING RESULTS PQR STATION

D e	U	N° Strokes	PS Logging	Results	Parameters
p t h (m)	S C S	SPT	P Wave Velocity (m/s)	S Wave Velocity (m/s)	ν : Poisson's Ratio G :Shear's Modulus Ε : Young's Modulu ρ : Density
	CL		<b>x</b> 220 (	Vs=180m/s	$\nu = 0, 27$ G = 5, 5×10 <sup>4</sup>
2 -	GP		Vp=320m/s 	GL-2m	$\begin{array}{rcl} G &=& 5,  5 \times 10^{4} \\ E &=& 1,  4 \times 10^{5} \\ \rho &=& (1,  7) \end{array}$
- 4 -	e 9	•	Vp=740m/s	Vs=340m/s	$ \begin{array}{l} \nu \ = \ 0, \ 37 \\ G \ = \ 2, \ 1 \times 10^{5} \\ E \ = \ 5, \ 7 \times 10^{3} \\ \rho \ = \ (1, \ 8) \end{array} $
-			GL-5m	GL-5m	
6 -	GP	•	Vp=970m/s	Vs=5	v = 0.22 G = 6.1×10 <sup>5</sup>
8 -			GL-9m	s=580m/s GL-9m	$E = 1.5 \times 10^8$ $\rho = (1.8)$
10 -					
1			Vp=		v = 0.25
12 -			/p=1\$20m/s	<u>s=880m/s</u>	$G = 1.4 \times 10^{6}$ $E = 3.5 \times 10^{6}$ $\rho = (1.8)$
- 14 -	GP	Î.	s/	Is	
			GL-15m	GL-15m	

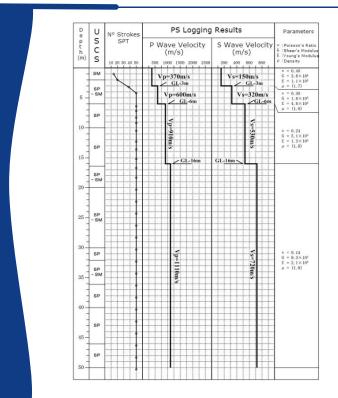


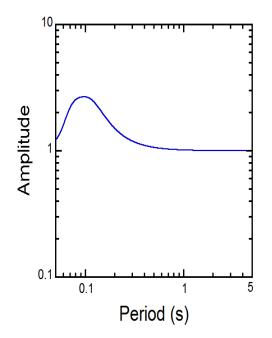
# PS WELL LOGGING RESULTS VSV STATION



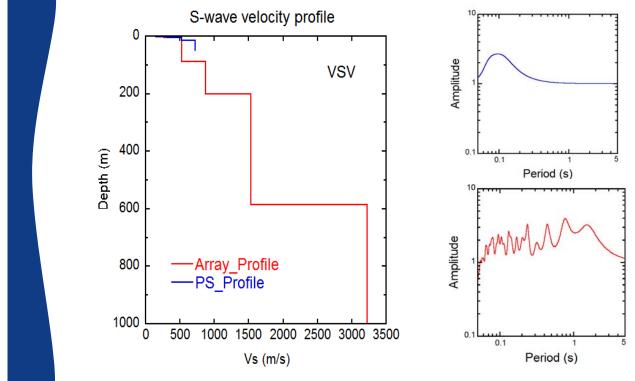


#### TRANSFER FUNCTION USING PS LOGGING DATA AT VSV STATION

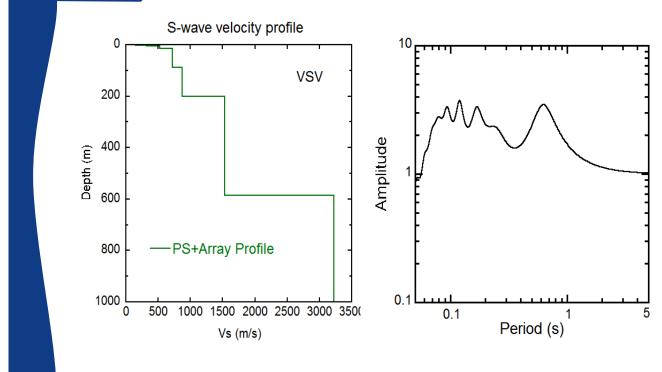






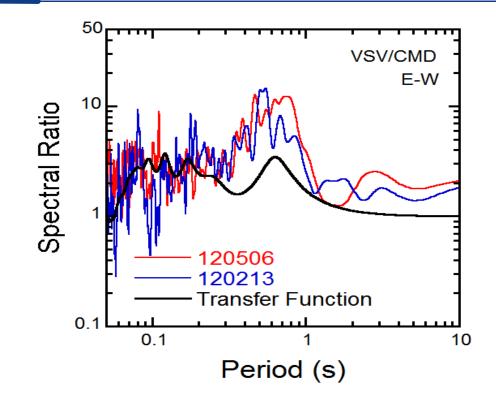






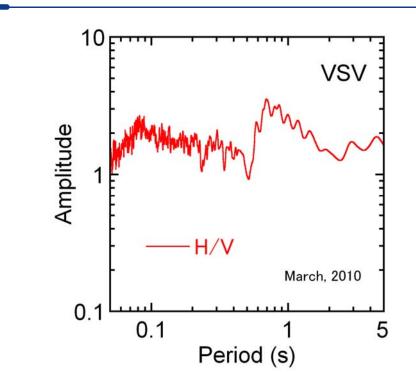


#### COMPARISON OF TRANSFER FUNCTIONS OF THE Vs PROFILE AND SPECTRAL RATIO FROM SEISMIC RECORDS





#### MICROTREMOR H/V SPECTRAL RATIO VSV STATION





# **THANK YOU**

