



Enhancement of Earthquake and Tsunami Disaster Mitigation Technology in Peru

PROGRESS OF THE PROJECT – 2013

G1 GROUP

(Seismic Motion and Geotechnical / SMGT Group)



Centro Peruano Japonés de Investigaciones
Sísmicas y Mitigación de Desastres
UNIVERSIDAD NACIONAL DE INGENIERÍA



ACTIVITIES DEVELOPED IN THE YEAR 2013

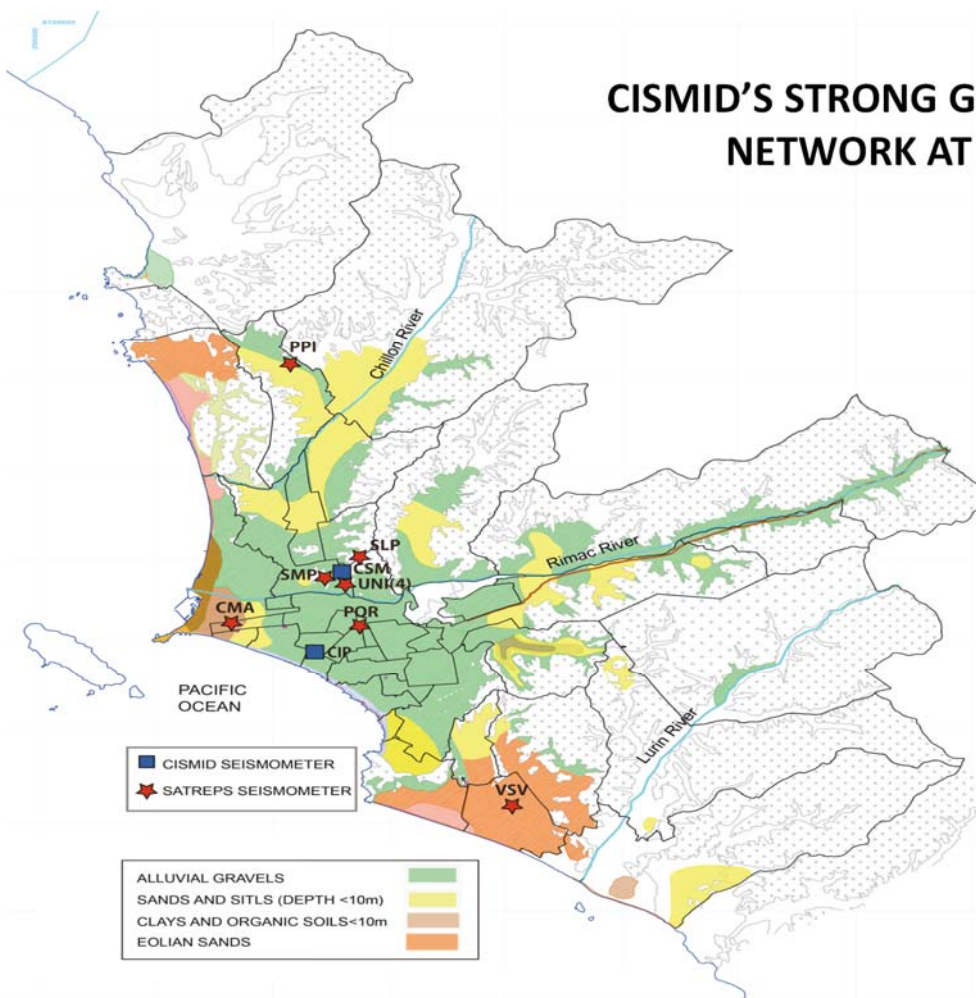
- SEISMIC MONITORING BY THE CISMID GROUND MOTION NETWORK AT LIMA CITY
 - GROUND RESPONSE ANALYSIS FOR LIMA CITY
 - GROUND MOTION ACCELEROGRAPH INSTALATION IN TACNA CITY
 - GROUND RESPONSE ANALYSIS FOR TACNA CITY
 - UPDATING OF THE GROUND MOTION NETWORK MONITORING CENTER
 - ADVICE TO SENCICO FOR IMPROVEMENT OF THE PERUVIAN SEISMIC CODE
-



SEISMIC MONITORING BY THE CISMID GROUND MOTION NETWORK AT LIMA CITY



CISMID'S STRONG GROUND MOTION NETWORK AT LIMA CITY

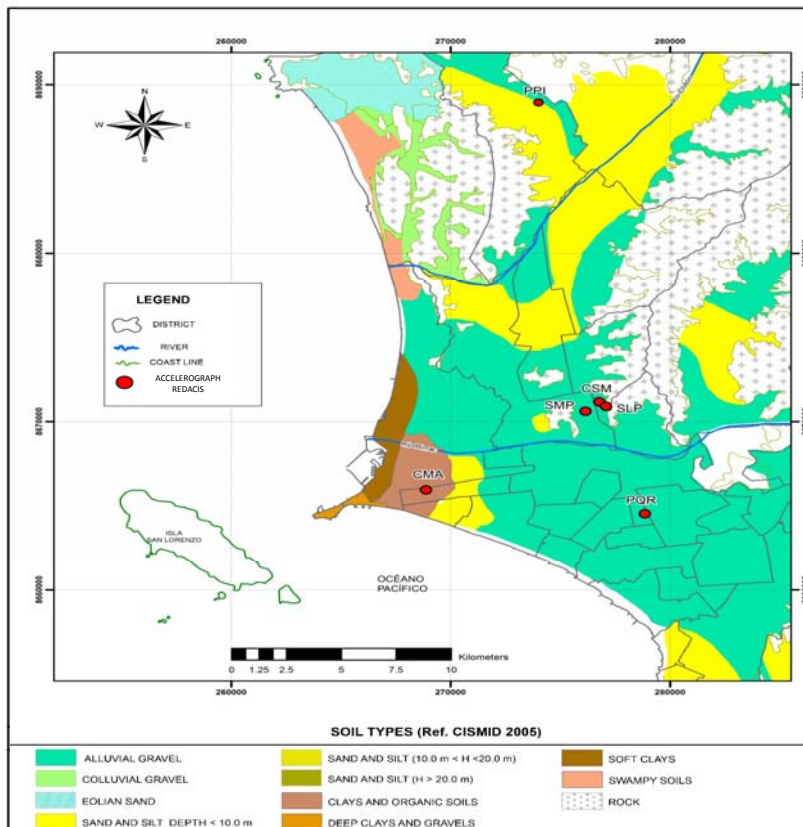


EARTHQUAKES RECORDED FROM 2013 TO 2014

Fecha	Hora Local	Epicentro	Profundidad	Magnitud	Intensidad	latitud	longitud	CMA	PPI	PQR	SLP	SMP	UNI1	UNI2	UNI3	UNI4	VES	CSM
18/02/2014	18:35:51	90 Km al SO de Ica	44 Km	5.6 ML	a Tinguíña, Pisco,	14.56	76.13	OK	OK	OK	OK	OK	X	X	X	X	X	OK
20/01/2014	00:27:00	31 Km al NE de Chilca	91 Km	4.1 ML	II Chilca	12.25	76.63	X	OK	OK	OK	X	X	X	X	X	X	
02/01/2014	17:27:43	90 Km al O de Huacho	25 Km	4.1 ML	No Sentido	11.19	78.42	X	OK	X	OK	OK	X	X	OK	X	X	
25/11/2013	15:06:00	N-NO de San Vicente d	59 km	5.8 ML	dad de Lima y la	12.77	76.48	X	OK	OK	OK	X	X	X	X	X	X	OK
14/11/2013	02:50:32	46 Km al N de Pucallpa	157 Km	4.4 ML	No Sentido	7.96	74.53	X	X	X	X	X	X	X	OK	X	X	OK
13/11/2013	05:29:57	19 Km al S de Chosica	87 Km	3.6 ML	II La Molina	12.1	76.67	X	X	X	OK	X	X	X	OK	X	X	OK
29/10/2013	18:43:23	33 Km al S de Lima	55 Km	3.8 ML	II Lima	12.33	76.95	X	OK	X	OK	OK	X	X	OK	X	X	OK
27/10/2013	14:37:01	71 Km al SO de Chilca	31 Km	4 ML	No Sentido	12.78	77.32	X	X	X	OK	X	X	X	X	X	X	
27/10/2013	00:28:24	49 Km al S de Maca	49 Km	4.2 ML;	II Maca	16.08	71.73	X	OK	X	OK	X	X	X	OK	X	X	
20/10/2013	19:14:11	2 Km al E de Chincha Alt	71 Km	4.3 ML	II Chincha Alta	13.46	75.94	X	OK	X	X	X	X	X	X	X	X	
19/10/2013	20:16:17	48 Km al N de Ancon	55 km	3.8 ML	II Ancon	11.325	77.1441	X	OK	X	OK	OK	X	X	X	X	X	OK
18/10/2013	04:47:54	20 Km al N de Chilca	60 Km	3.8 ML	II Chilca	12.34	76.8	OK	OK	OK	OK	OK	X	X	OK	X	X	OK
18/10/2013	02:32:30	49 Km al O de Chilca	11 Km	4.2 ML	II Chilca, Lima	12.59	77.17	X	OK	OK	OK	OK	X	X	OK	X	X	OK
17/10/2013	05:51:01	29 Km al S de Callao	45 Km	3.9 ML	II Callao Lima	12.31	77.23	OK	OK	OK	OK	OK	X	X	OK	X	X	OK
16/10/2013	11:47:12	n al NE de Punta de Bor	46 Km	4.1 ML	Punta de Bombc	17.07	71.7	X	OK	X	X	X	X	X	X	X	X	
11/10/2013	11:49:43	16 Km al S de Ancon	56 km	3.8 ML	II Lima	11.903	77.1394	OK	OK	OK	OK	OK	X	X	OK	X	X	OK
11/10/2013	00:09:09	69 Km al E de Tumbes	62 Km	4 ML	No Sentido	3.44	79.85	X	X	X	X	OK	X	X	X	X	X	
09/10/2013	21:15:40	70 Km al O de Huarney	45 Km	4.5 ML	II Huarney	9.88	78.75	X	OK	X	X	X	X	X	X	X	X	
25/09/2013	11:42:39	78 Km al S de Lomas	37 Km	6.9 ML	Arequipa, Ica; III	16.26	74.98	X	X	OK	OK	X	X	X	OK	X	X	OK
23/09/2013	19:18:40	13 Km al NO de Chilca	59 Km	4 ML	II Lima	12.46	76.85	X	X	OK	OK	OK	X	X	OK	X	X	OK
17/09/2013	23:41:40	al NE de San Martin de l	100 Km	4 ML	No sentido	10.97	74.12	X	OK	X	X	X	X	X	X	X	X	
02/09/2013	03:12:31	20 Km al O de Jauja	40 Km	4.3 ML	II Jauja	11.76	75.67	X	OK	X	X	X	X	X	X	X	X	OK
29/08/2013	06:47:40	13 Km al E de Lima	45 Km	3.8 ML	II Lima	12.01	76.92	X	X	X	OK	X	X	X	OK	X	X	



CURRENT LOCATION OF SEISMIC STATIONS



Two stations were moved to Tacna City



LARGEST MAGNITUDE EARTHQUAKE RECORDS

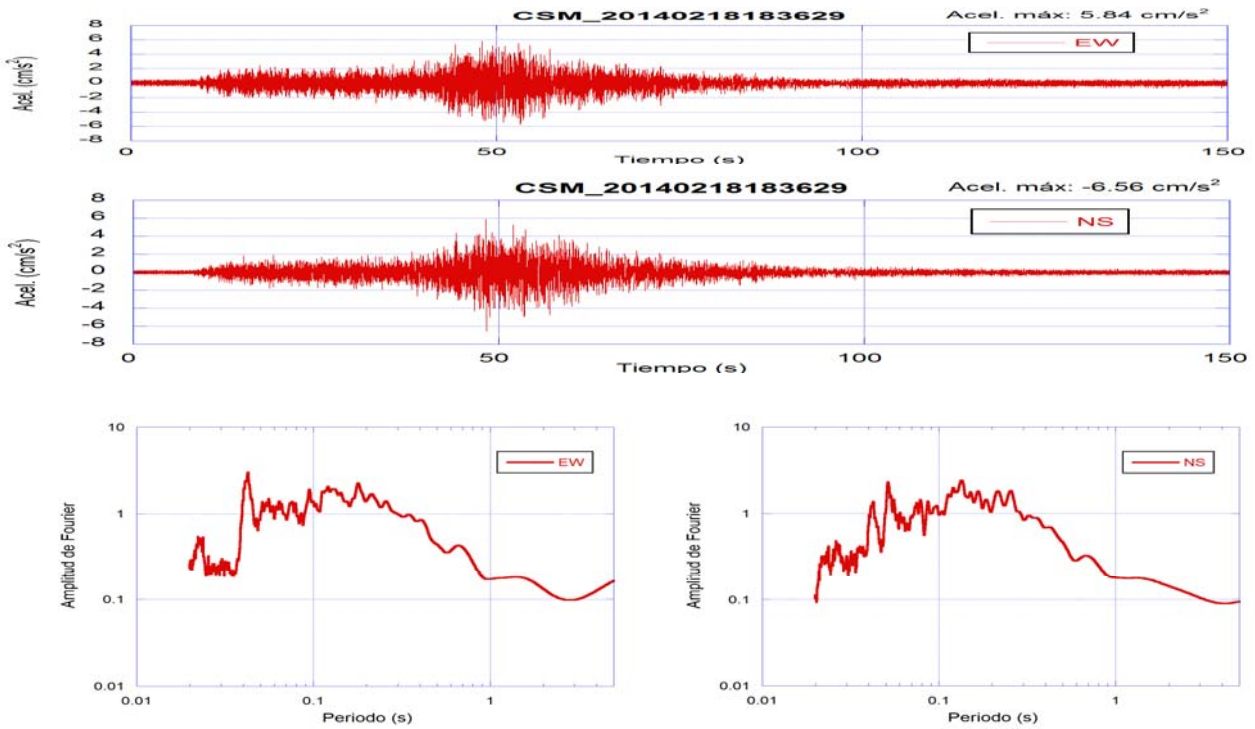
Fecha	18/02/2014	25/11/2013	14/11/2013	09/10/2013	25/09/2013
Hora Local	18:35:51	15:06:00	02:50:32	21:15:40	11:42:39
Epicentro	90 Km al SO de Ica	36 km al N-NO de San Vicente de Cañete	46 Km al N de Pucallpa	70 Km al O de Huarney	78 Km al S de Lomas
Profundidad	44 Km	59 km	157 Km	45 Km	37 Km
Magnitud	5.6 ML	5.8 ML	4.4 ML	4.5 ML	6.9 ML
Intensidad	IV Ica, La Tinguiña, Pisco, III Lima	V (MM) entre la ciudad de Lima y la localidad de Cañete	No Sentido	II Huarney	V-VI Acari, Caraveli; IV Arequipa, Ica; III Huancavelica; II Cusco
latitud	14.56	12.77	7.96	9.88	16.26
longitud	76.13	76.48	74.53	78.75	74.98
CMA	OK	X	X	X	X
PPI	OK	OK	X	OK	X
PQR	OK	OK	X	X	OK
SLP	OK	OK	X	X	OK
SMP	OK	X	X	X	X
UNI1	X	X	X	X	X
UNI2	X	X	X	X	X
UNI3	X	X	OK	X	OK
UNI4	X	X	X	X	X
VES	X	OK	OK	X	OK
CSM	OK	X	X	X	X



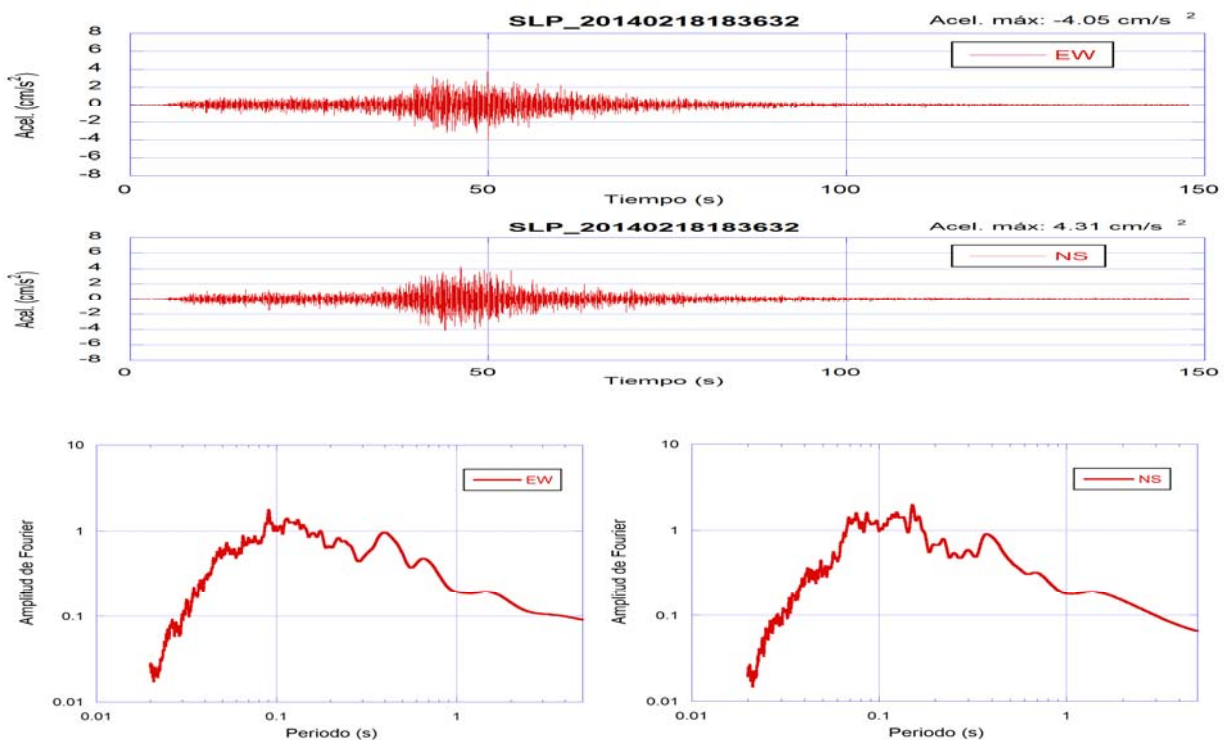
FEBRUARY 18, 2014 M5.6 EARTHQUAKE



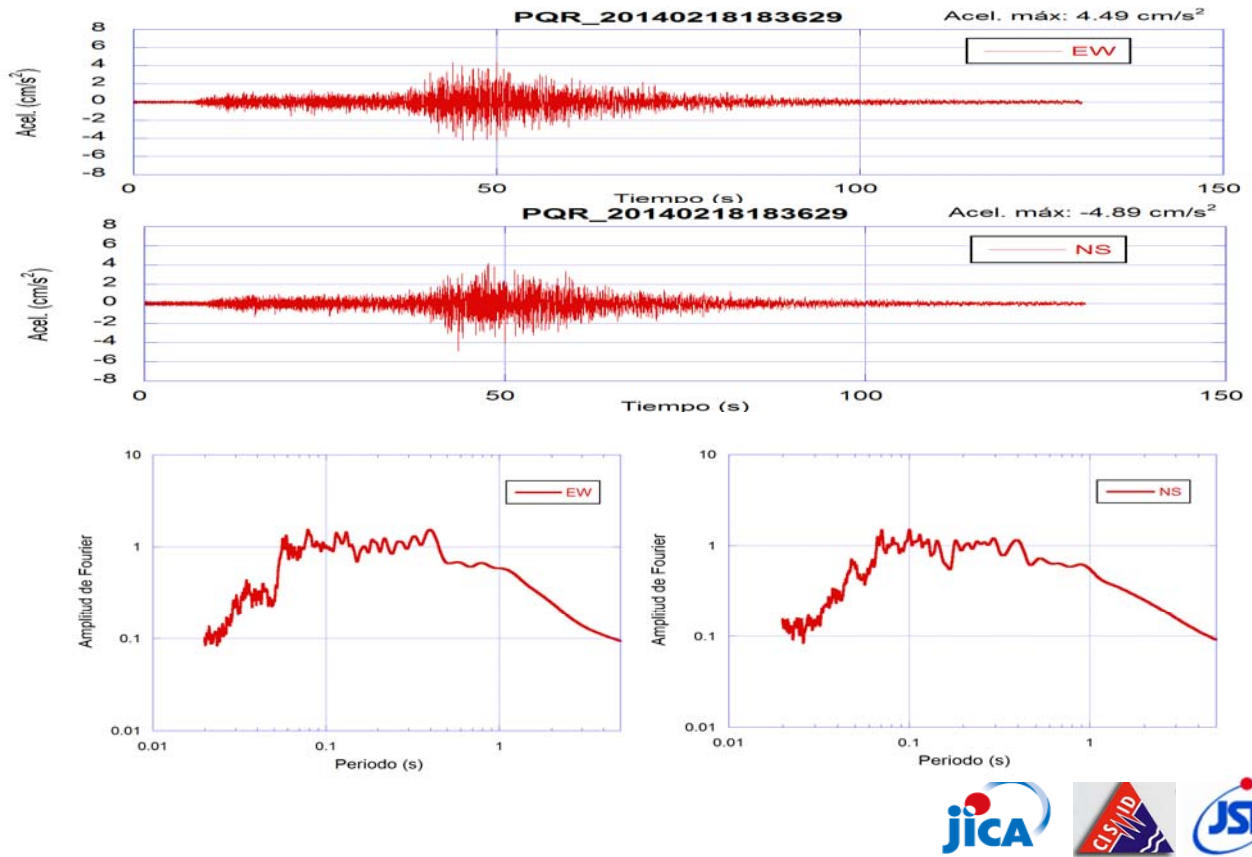
CSM STATION: ACCELERATION TIME HISTORY AND FOURIER SPECTRA



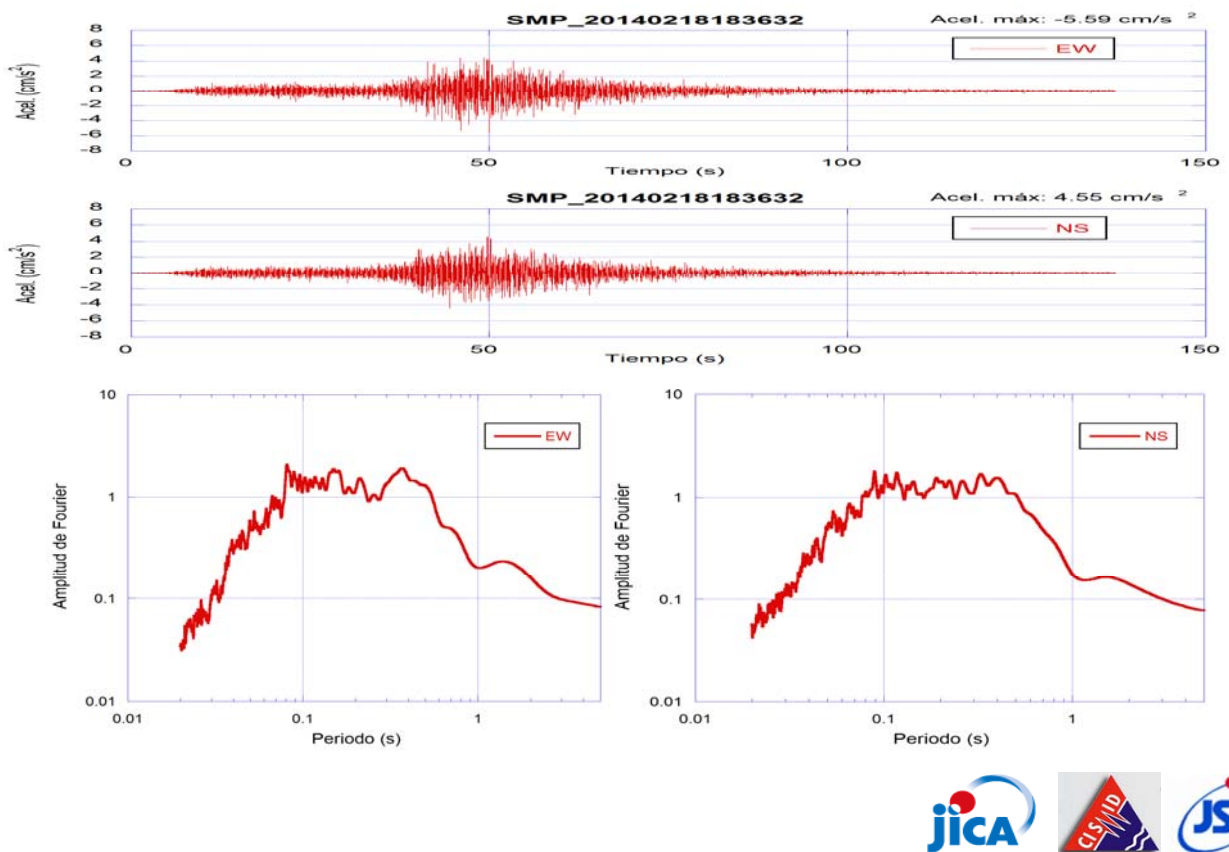
SLP STATION: ACCELERATION TIME HISTORY AND FOURIER SPECTRA



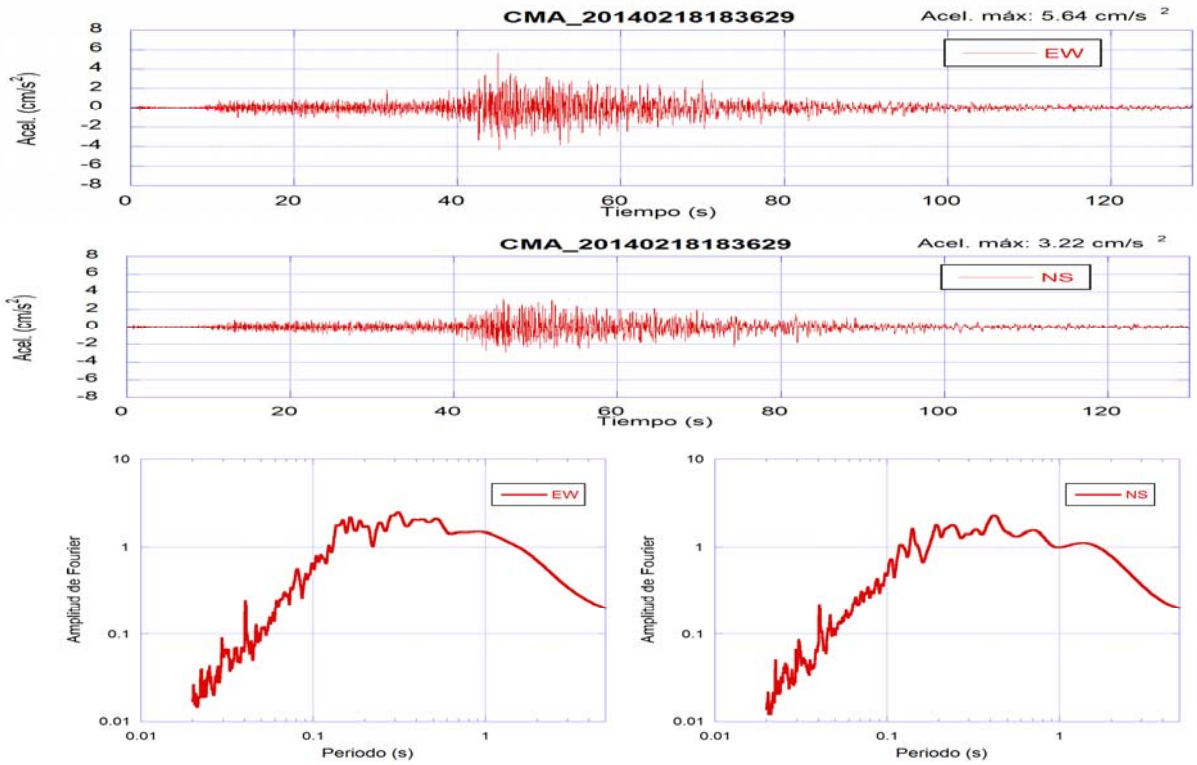
PQR STATION: ACCELERATION TIME HISTORY AND FOURIER SPECTRA



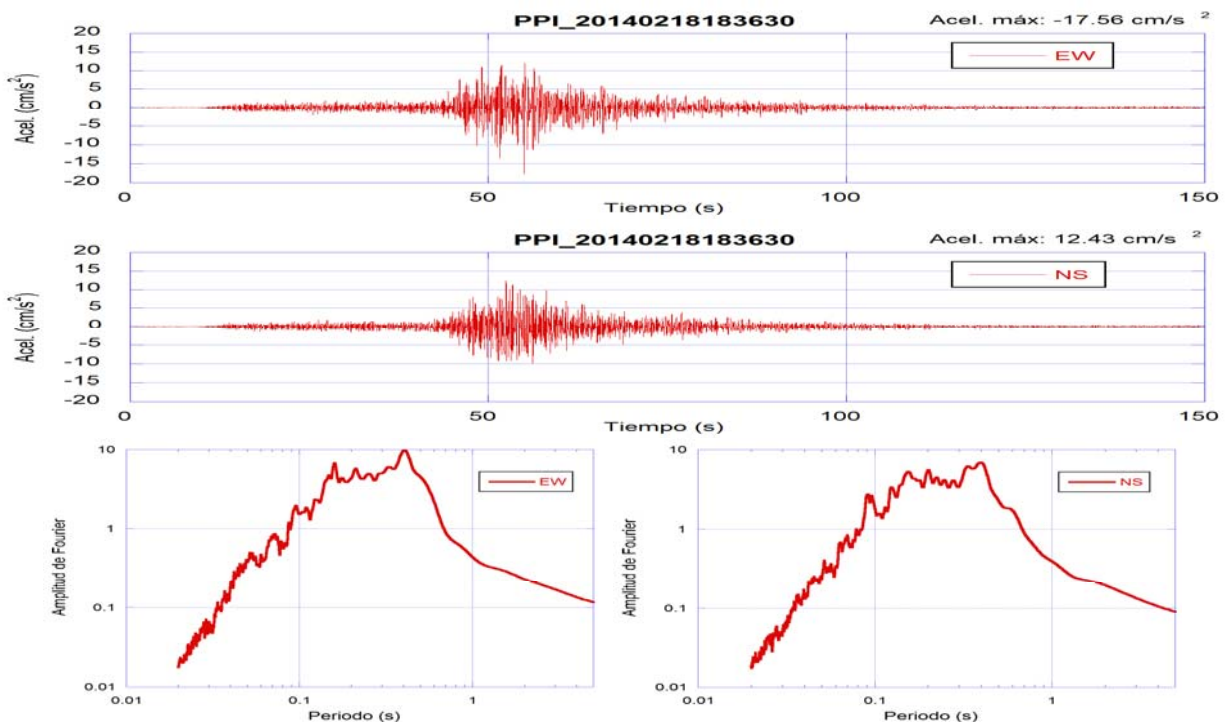
SMP STATION: ACCELERATION TIME HISTORY AND FOURIER SPECTRA



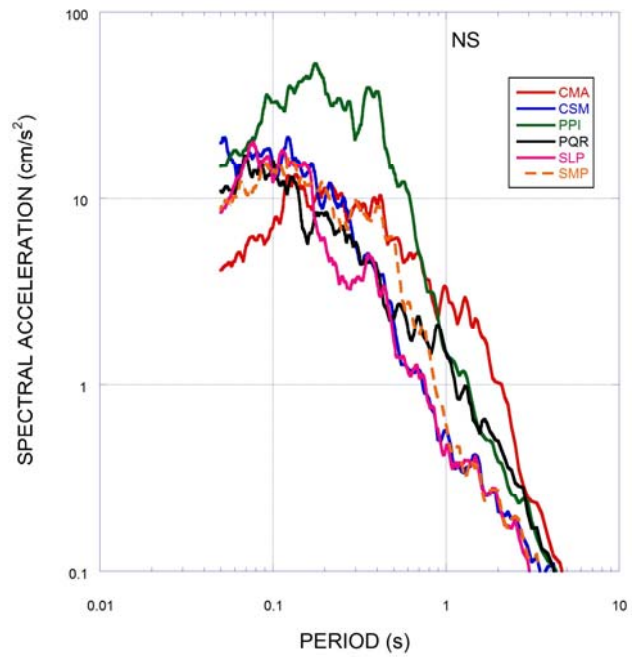
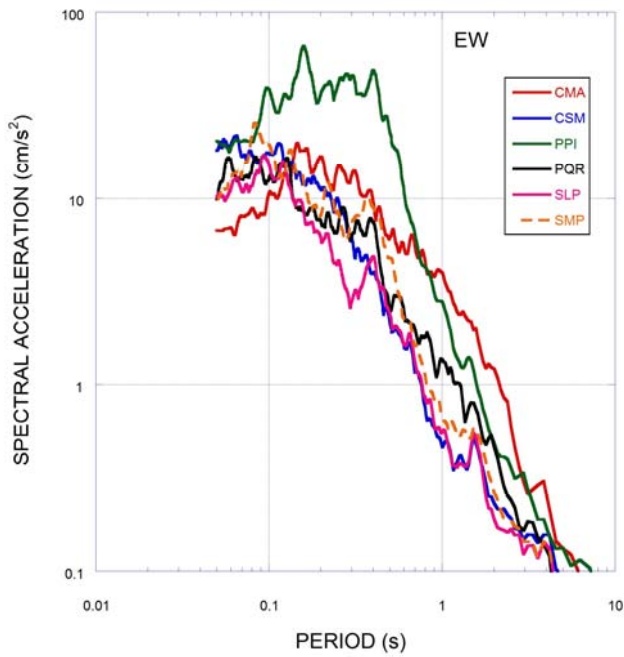
CMA STATION: ACCELERATION TIME HISTORY AND FOURIER SPECTRA



PPI STATION: ACCELERATION TIME HISTORY AND FOURIER SPECTRA

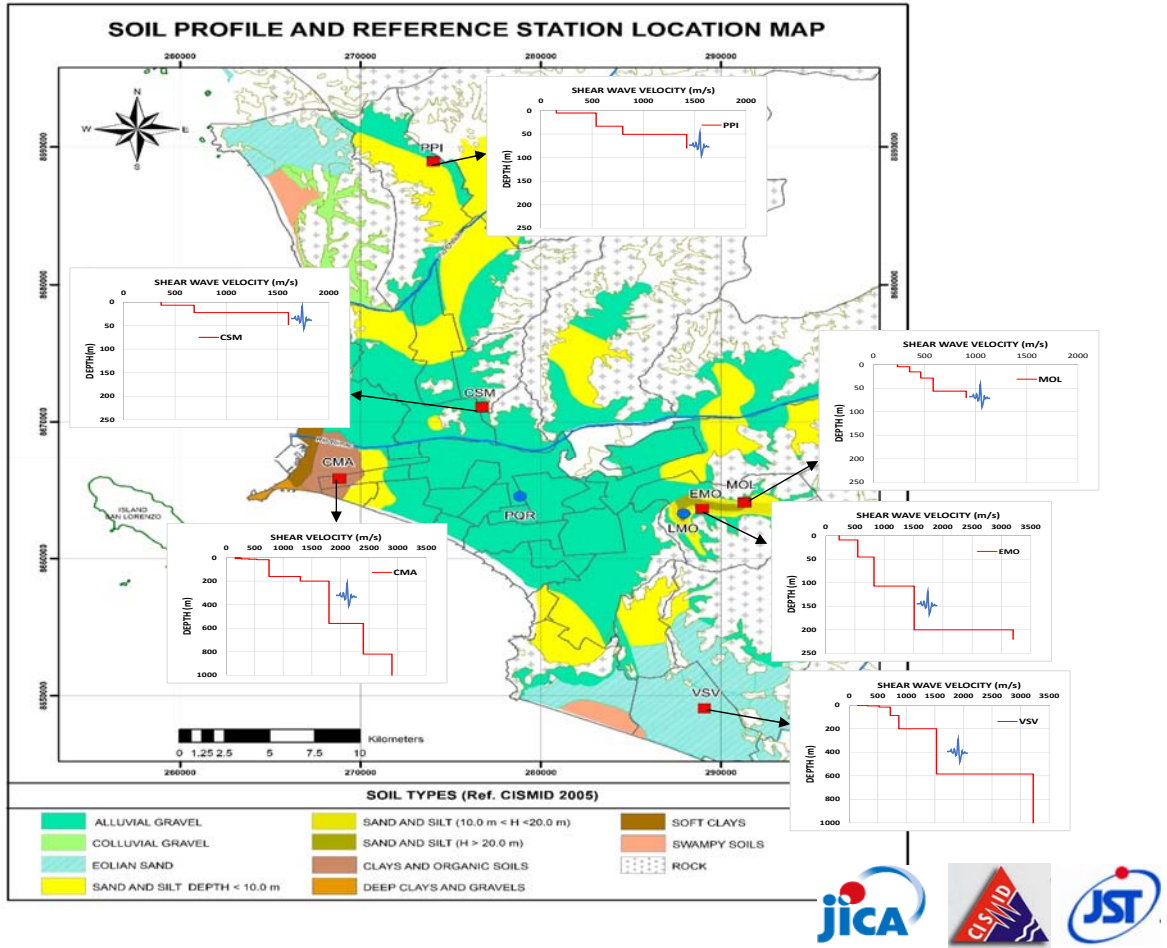


RESPONSE SPECTRA FROM THE FEBRUARY 18, 2014 M 5.6 ICA EARTHQUAKE

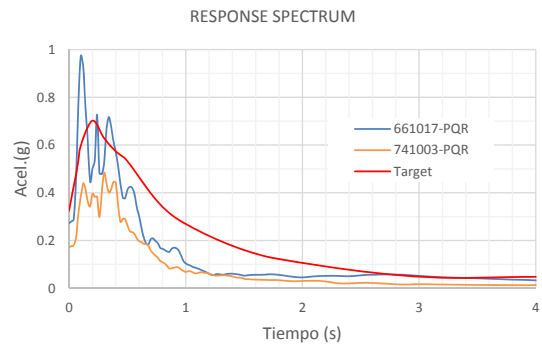
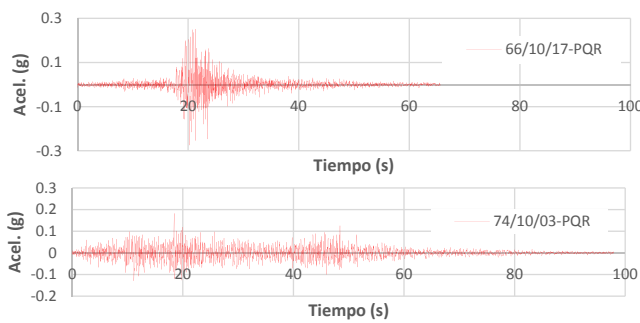


GROUND RESPONSE ANALYSIS FOR LIMA CITY

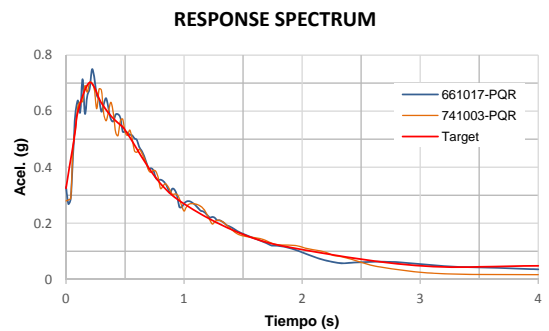
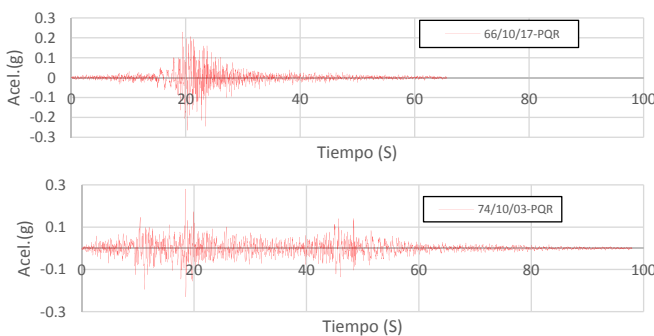




SPECTRAL MATCHING ANALYSIS FOR THE 1966-10-17 AND THE 1974-10-03 LIMA EARTHQUAKES AT PQR STATION – LIMA CITY



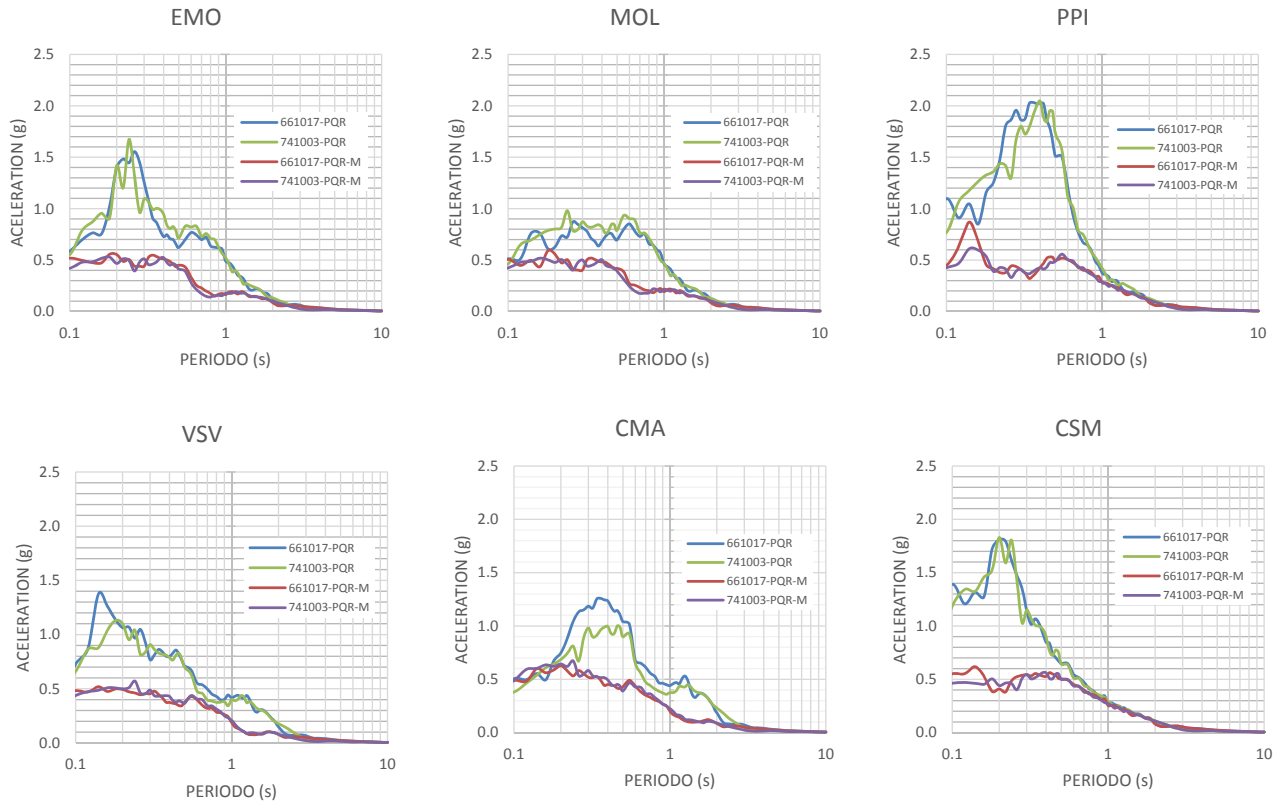
INPUT EARTHQUAKE AND TARGET SPECTRA AT ROCK LEVEL



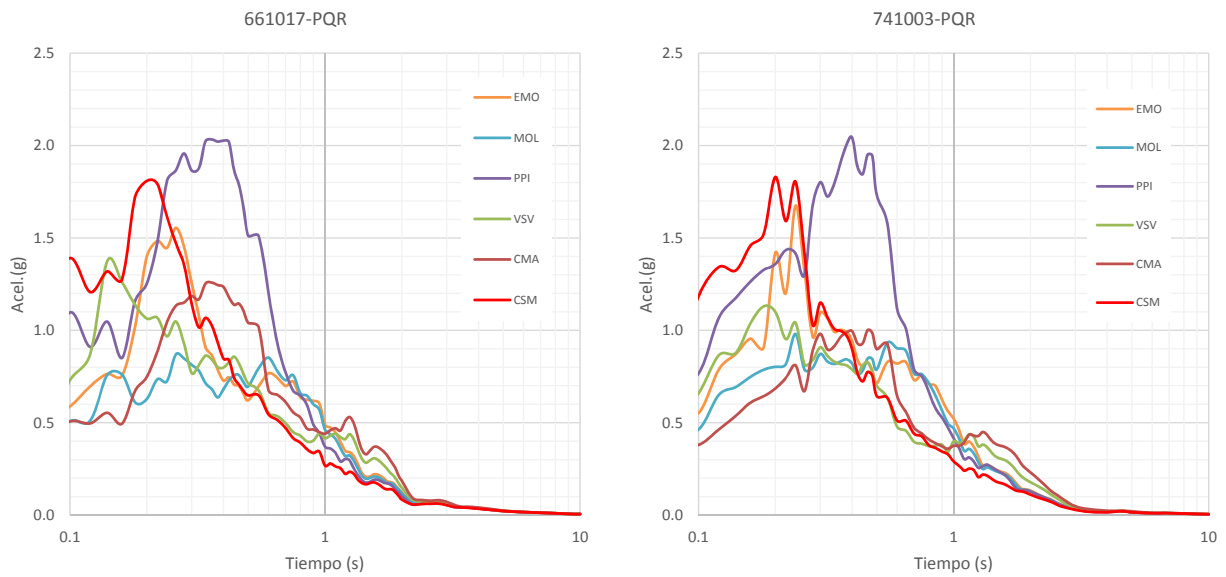
OUTPUT EARTHQUAKE AND MATCHED SPECTRA AT ROCK LEVEL



RESPONSE SPECTRA ON THE GROUND SURFACE IN LIMA CITY



RESPONSE SPECTRA ON THE GROUND SURFACE IN LIMA CITY



GROUND MOTION ACCELEROGRAPH INSTALATION IN TACNA CITY



ACCELEROGRAPH INSTALLATION AT UPT STATION - TACNA CITY

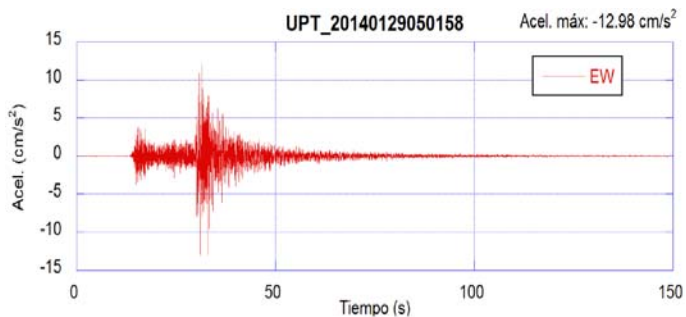
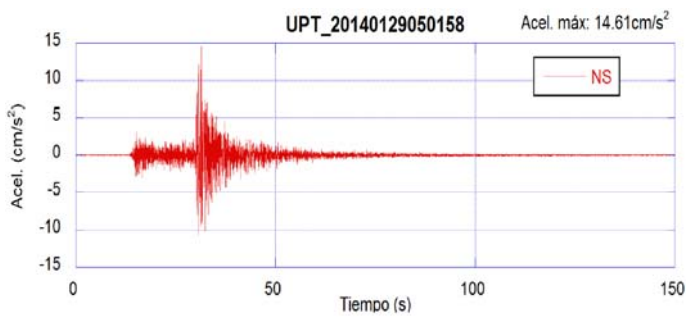


ACCELEROGRAPH INSTALLATION AT UNJBG STATION – TACNA CITY

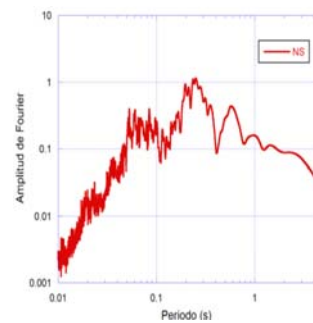
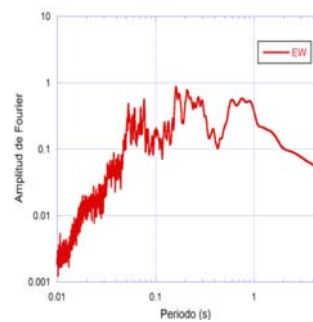


RECORD OF THE JANUARY 29, 2014 M 5.4 TACNA EARTHQUAKE AT UPT STATION – TACNA CITY

ACCELEROGRAM



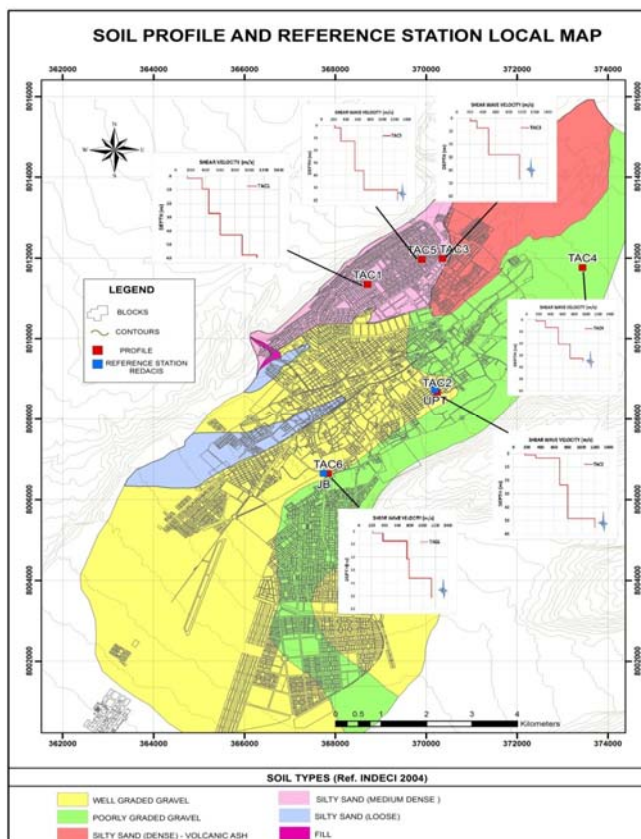
FOURIER SPECTRUM



GROUND RESPONSE ANALYSIS FOR TACNA CITY



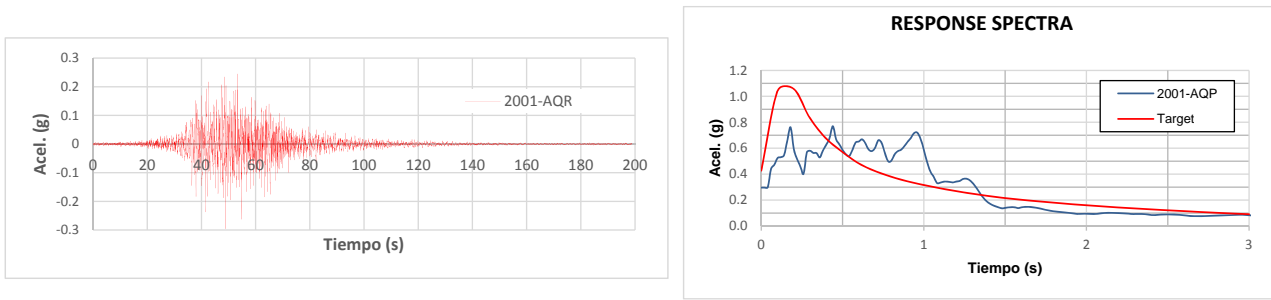
GROUND RESPONSE ANALYSIS FOR TACNA CITY



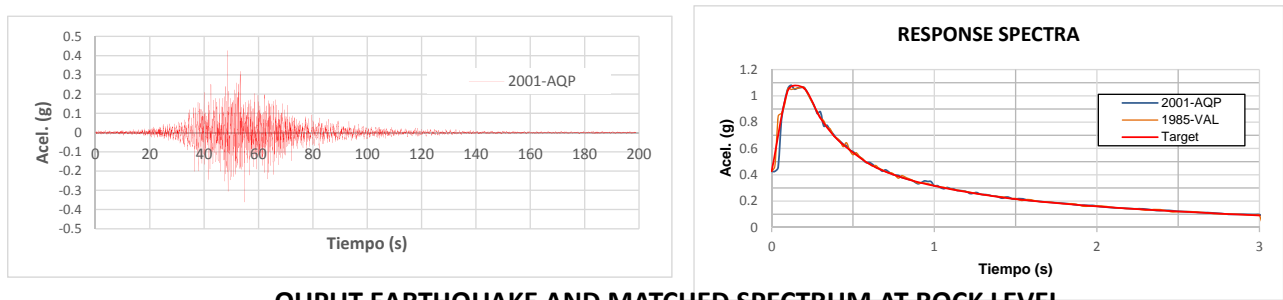
PROFILES	DISTRICT
TAC1, TAC3, TAC5	CIUDAD NUEVA
TAC6	TACNA
TAC2, TAC4	POCOLLAY



SPECTRAL MATCHING ANALYSIS FOR THE 2001 AREQUIPA Mw 8.4 EARTHQUAKE AT UNJBG STATION – TACNA CITY



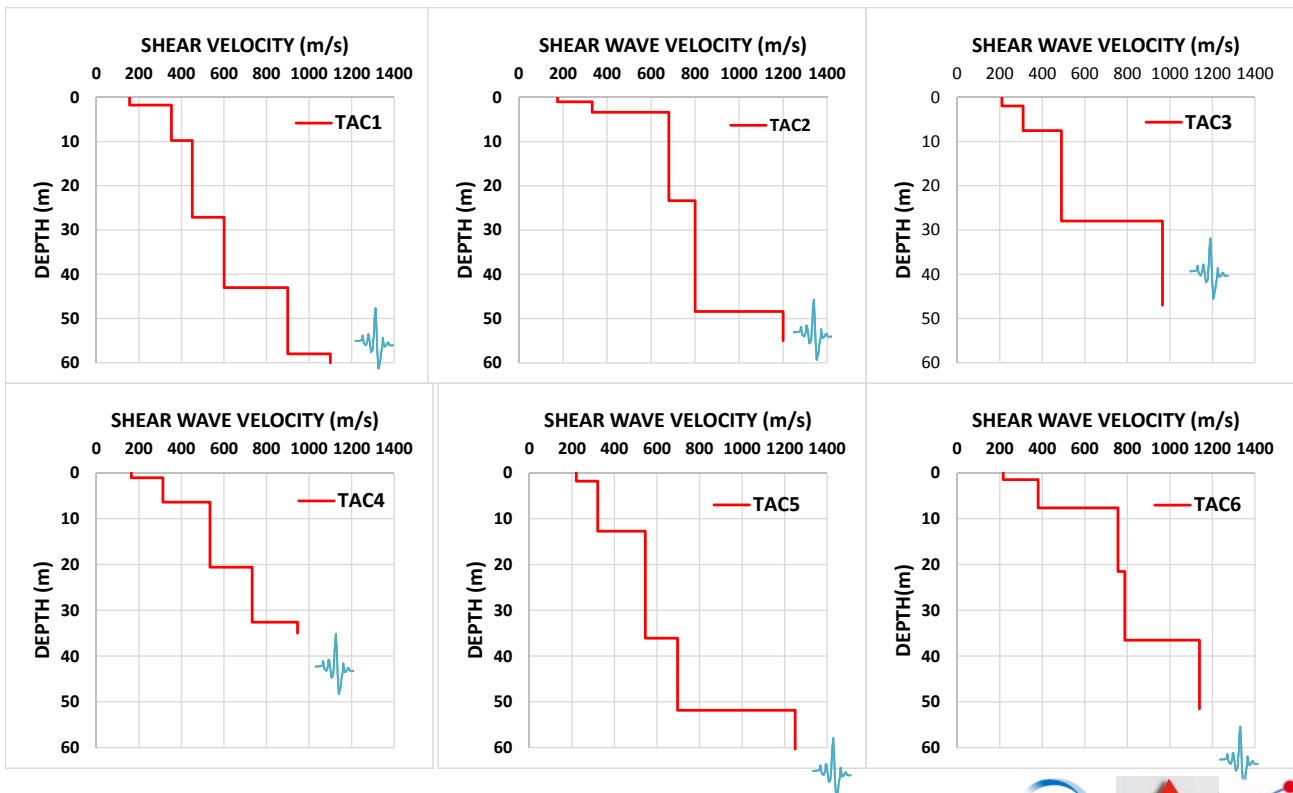
INPUT EARTHQUAKE AND TARGET SPECTRUM AT ROCK LEVEL



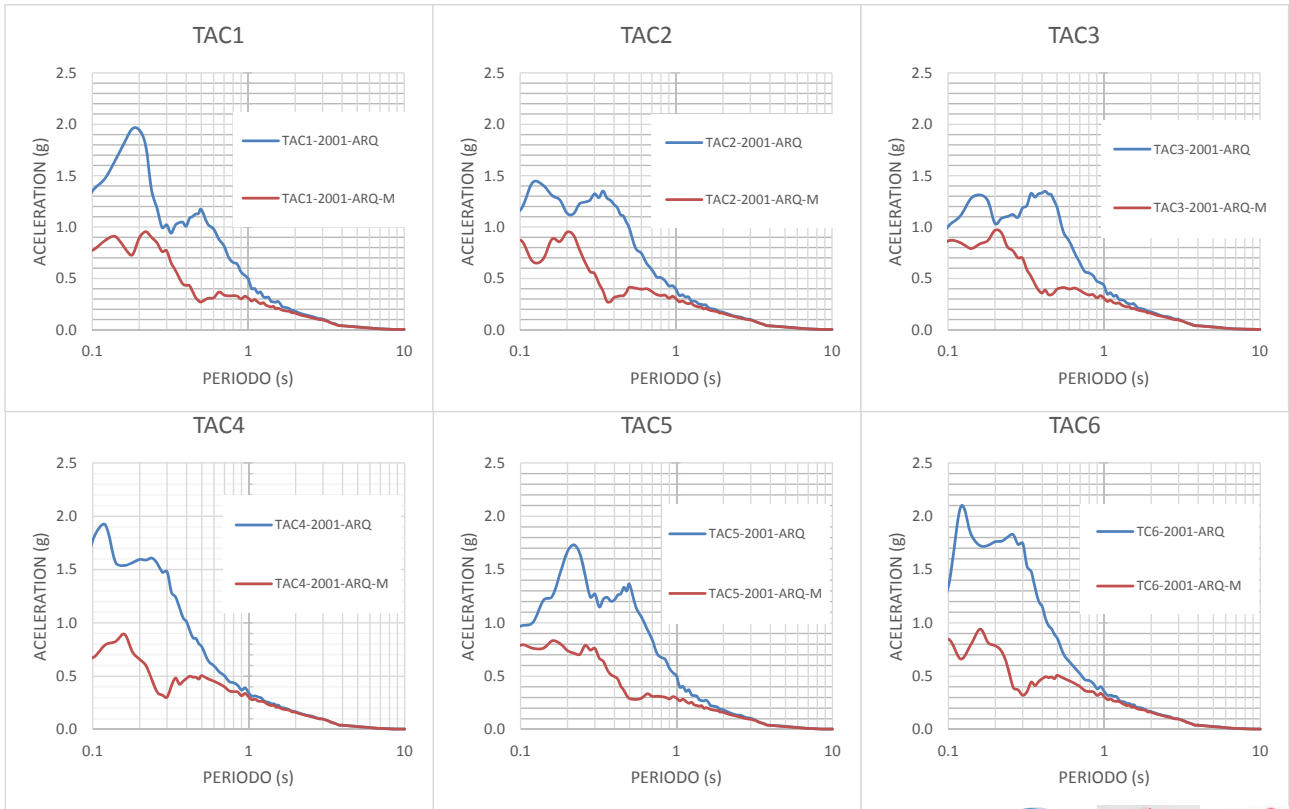
OUTPUT EARTHQUAKE AND MATCHED SPECTRUM AT ROCK LEVEL



S WAVE PROFILES AT TACNA CITY



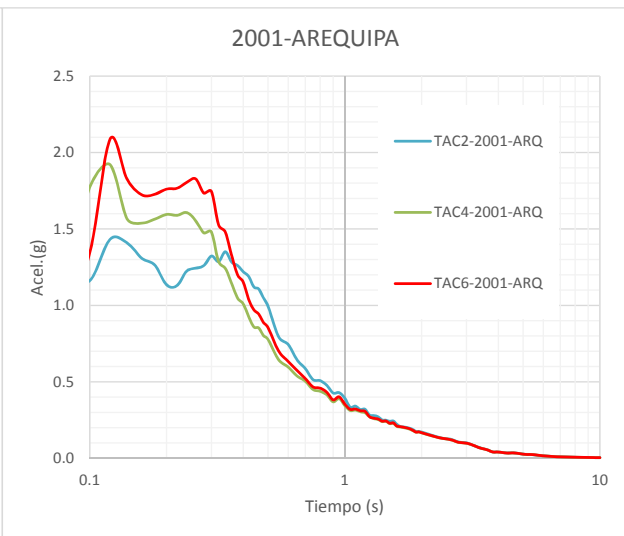
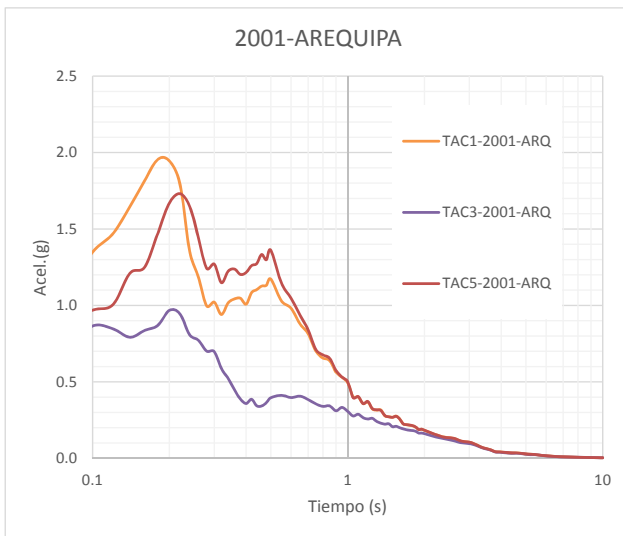
RESPONSE SPECTRA ON THE GROUND SURFACE IN TACNA CITY



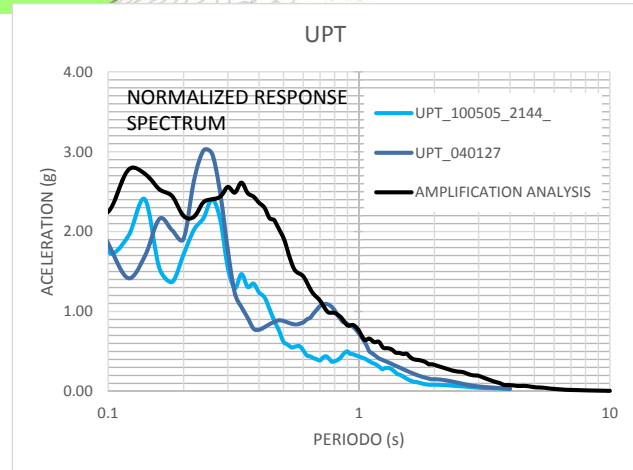
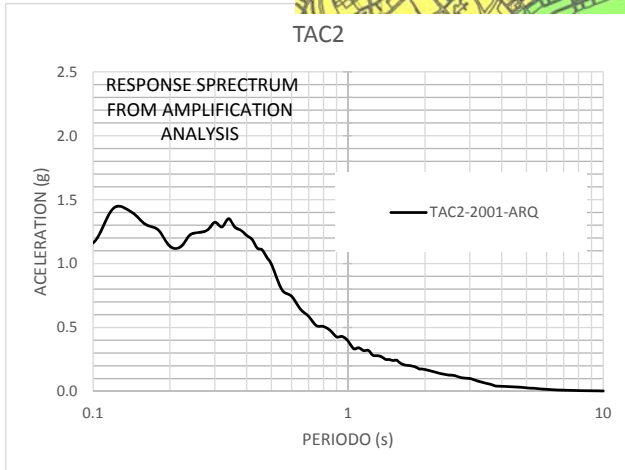
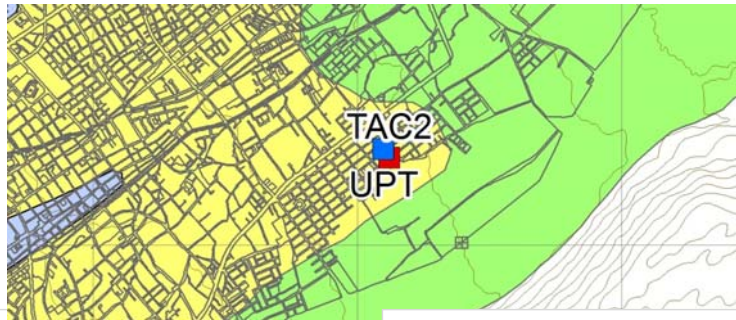
RESPONSE SPECTRA ON THE SURFACE GROUND

CIUDAD NUEVA DISTRICT (SAND)

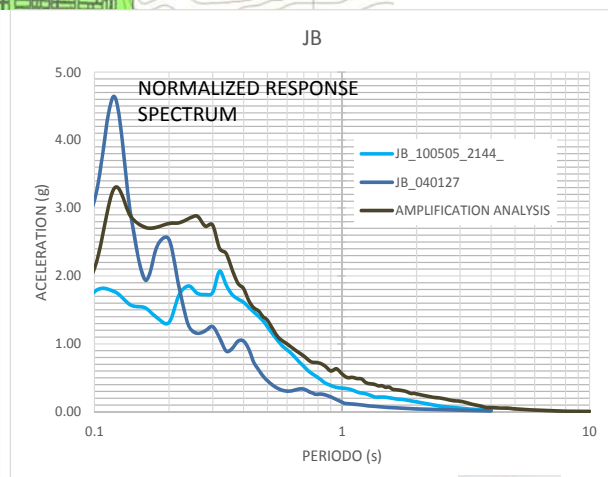
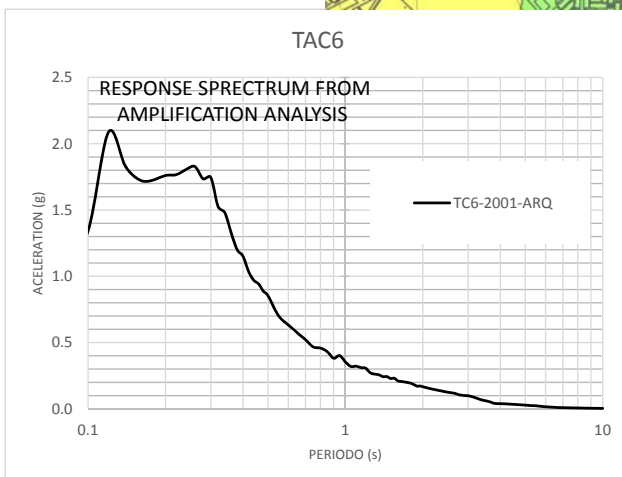
POCOLLAY AND TACNA DISTRICT (GRAVEL)



COMPARISON BETWEEN RESPONSE SPECTRUM FROM OBSERVED EARTHQUAKES AND SPECTRUM ESTIMATED FROM AMPLIFICATION ANALYSIS



COMPARISON BETWEEN RESPONSE SPECTRUM FROM OBSERVED EARTHQUAKES AND SPECTRUM ESTIMATED FROM AMPLIFICATION ANALYSIS AT TAC 6



UPDATING OF THE GROUND MOTION NETWORK MONITORING CENTER



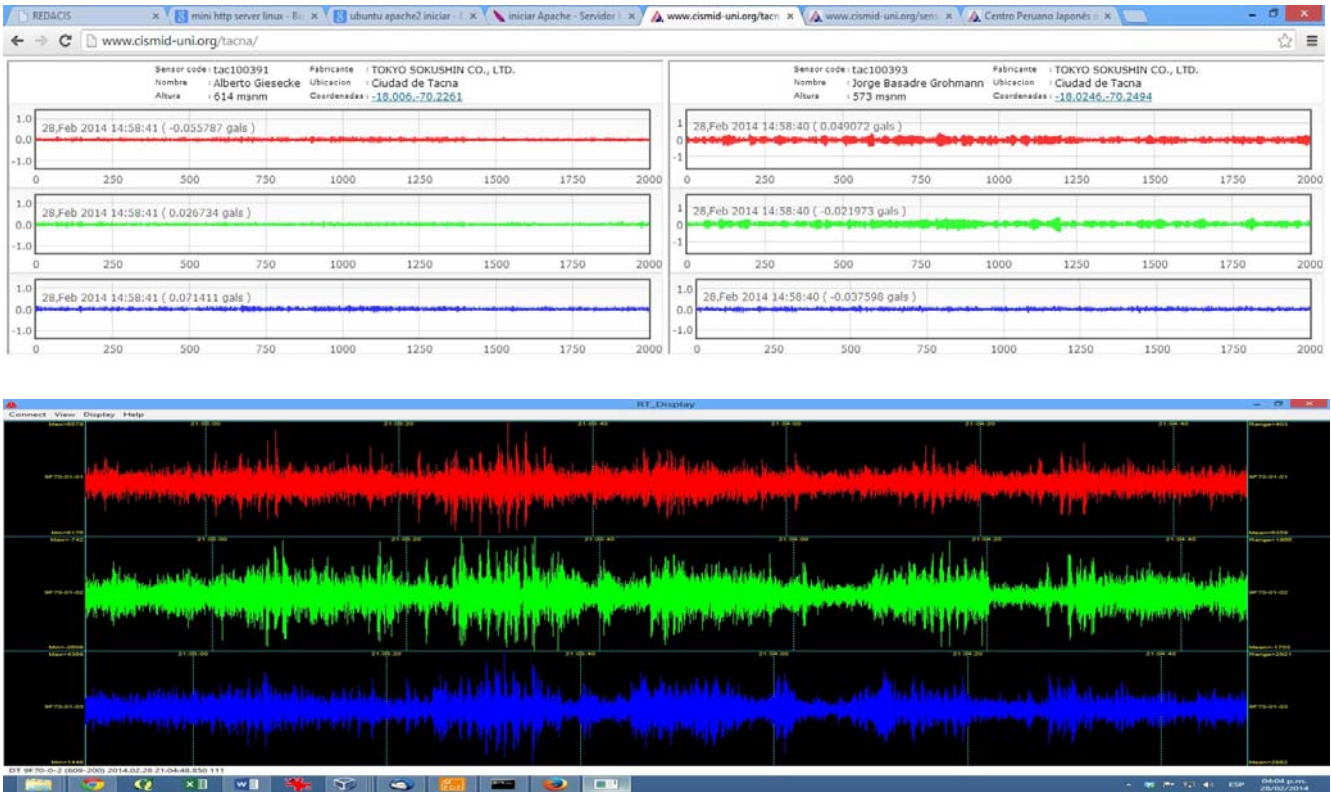
IMPLEMENTATION OF A NEW REDACIS' WEP PAGE

The screenshot shows a web browser window displaying the CISMID website. The page features a header with the organization's name and logo, a navigation menu, and a search bar. The main content area displays a news article titled "Informe del sismo del 18 de febrero de 2014". The article includes a table of seismic data and a map showing the epicenter location. The table data is as follows:

Tabla 1. Datos sísmicos (Fuente: IGP).	
Hora local (UTC-5)	18:35:52
hora UTC 0:	23:40:02
Latitud (°)	-14.84
Longitud (°)	-76.24
Profundidad (km)	26.0
Magnitud (M _s)	6.3
Lugares de referencia	86 km al SO de Ica

The map, labeled "Figure 1. Ubicación del epicentro (Google earth)", shows the epicenter location in the southern part of Peru. The article text states: "El 18 de febrero de 2014 a las 18:35:52 UTC-5 (hora local), ocurrió un sismo a 86 km al SO de Ica (Fuente: IGP). Las características sísmicas del evento se resumen en la Tabla 1 y la ubicación del epicentro se muestra en la Figura 1." The page also includes social media sharing options and a "Conectar" button for social networks.

REAL TIME MONITORING OF GROUND MOTION ACCELEROGRAPHS



ACCESS TO REDACIS' SEISMIC DATA BASE

Centro Peruano Japonés de Investigaciones Sísmicas y Mitigación de Desastres
 UNIVERSIDAD NACIONAL DE INGENIERÍA

Inicio Proyectos Nosotros CISMID Publicaciones Videos Buscar

Lunes, 24 Febrero 2014 10:10

Informe del sismo del 18 de febrero de 2014

Written by Webmaster

Hora local (UTC-5)	18:35:52
hora UTC-0	23:35:02
Latitud (°)	-14.84
Longitud (°)	-76.24
Profundidad (km)	26.0
Magnitud (M _L)	6.3
Lugares de referencia	86 km al SO de Ica

Figure 1. Ubicación del epicentro (Google earth).

El 18 de febrero de 2014 a las 18:35:52 UTC-5 (hora local), ocurrió un sismo a 86 km al SO de Ica (Fuente: IGP). Las características sísmicas del evento se resumen en la Tabla 1 y la ubicación del epicentro se muestra en la Figura 1.

Published in Noticias



ACCESS TO REDACIS' SEISMIC DATA BASE

Sensores

- Alberto Gesecke
- CDL CIP
- César Vizcarra
- Characato
- Chen Chen
- CIP-10a
- Ciudad Nueva
- DRI
- GRM
- Jorge Alva Hurtado
- Jorge Basadre
- La Molina
- Moyobamba
- UFSA
- UNISG

N	Codigo	Fecha	Hora	Prof.	Mag.	Long.	Lat.	Plot	Archivo
0	TAC002	2003-11-02	02:30:00	117	4.4	-71.203	-17.100		TAC002-201209231140.am
1	TAC002	2002-11-28	01:02:00	117	4.3	-69.763	-18.590		TAC002-200211280102.am
2	TAC002	2002-11-27	22:57:00	75	4.4	-69.683	-18.180		TAC002-200211272257.am

Records from 1 to 3 of 3

Mapa de ubicación

Overlays

- Sismos
- Capa de selecciones
- Ubicación del sensor
- Capa de Sensores

Base Layer

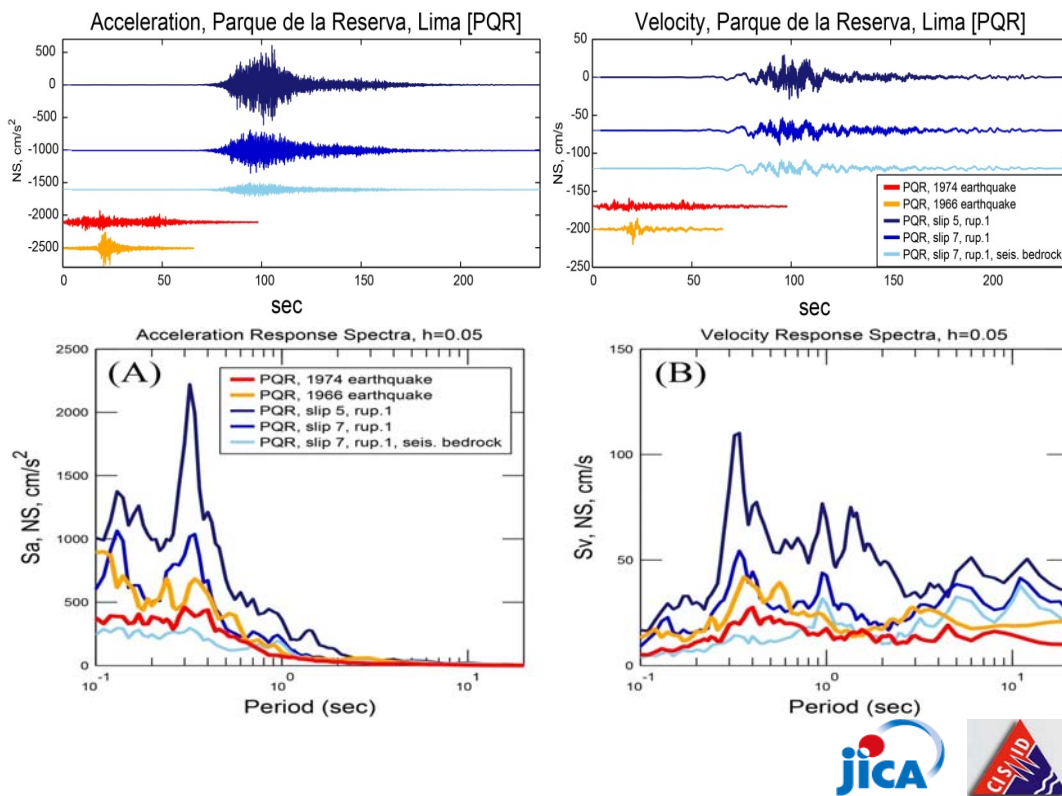
- OpenStreetMap
- Google Streets
- Google Satellite



ADVICE TO SENCICO FOR IMPROVEMENT OF THE PERUVIAN SEISMIC CODE



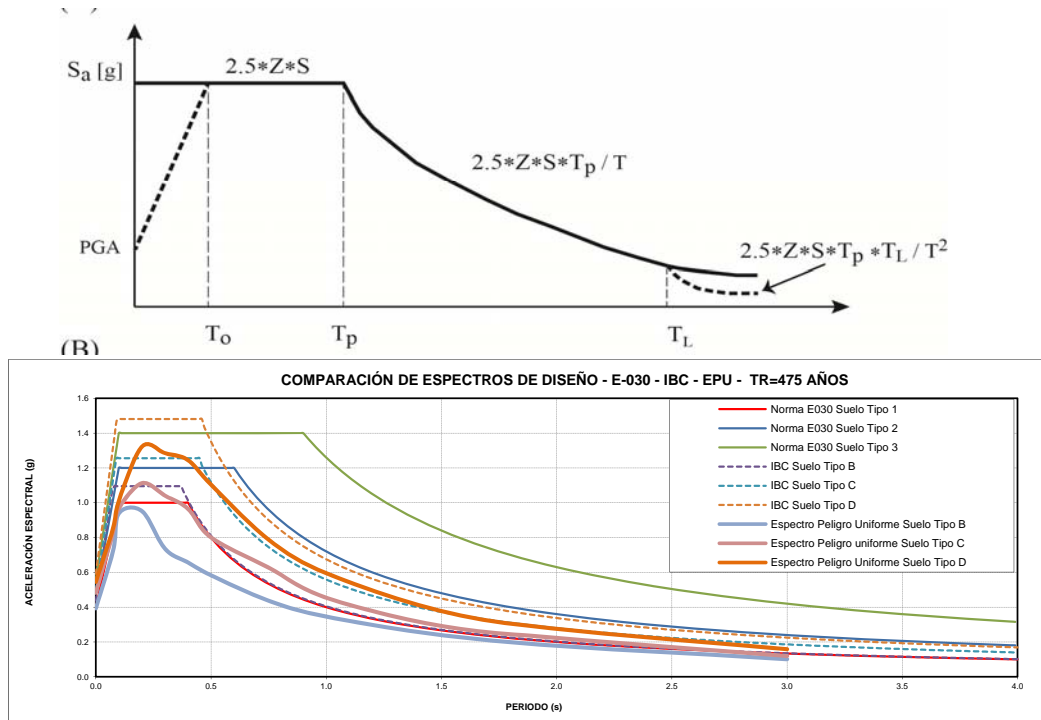
SYNTHETIC GROUND MOTION ACCELOGRAMS FOR LIMA CITY (PULIDO ET AL, 20013)



REQUIREMENTS FROM SENCICO

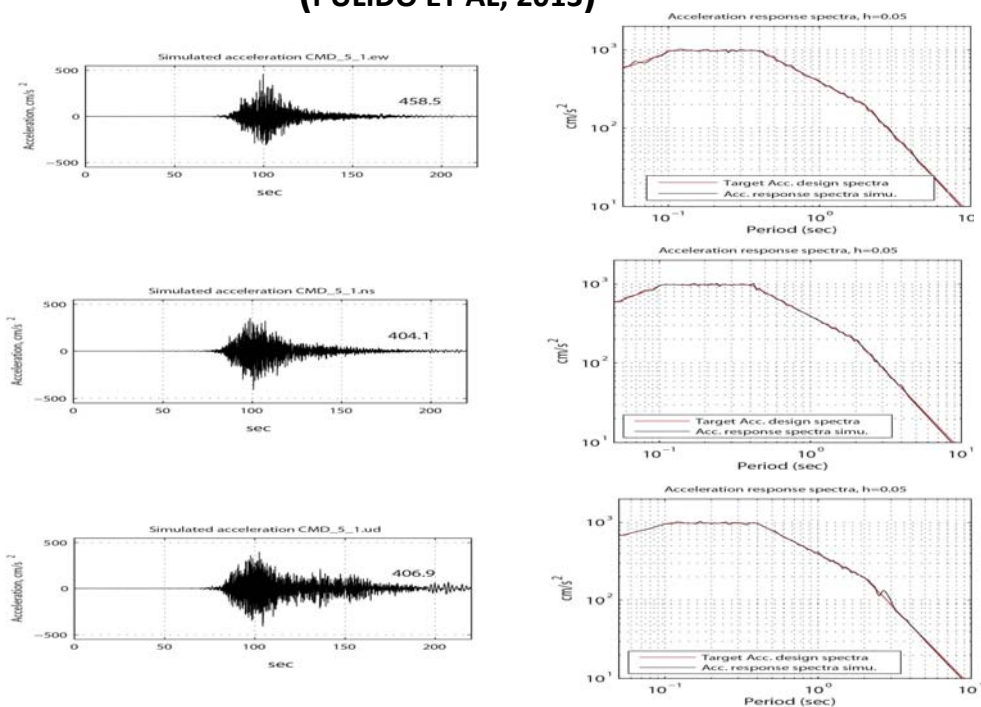
- DEVELOPMENT OF A SET OF 20 ACCELOGRAMS TO FIT THE SPECIFICATION OF PERUVIAN SEISMIC CODE FOR THE SEISMIC ZONE 3 (HIGHEST SEISMIC ZONE)
- EARTHQUAKE RECORDS SHOULD BE REPRESENTATIVE FOR EACH ONE OF THE THREE TYPE OF SOIL SPECIFIED BY THE PERUVIAN SEISMIC CODE

TARGET RESPONSE SPECTRA FOR SEISMIC ZONE 3 IN PERU

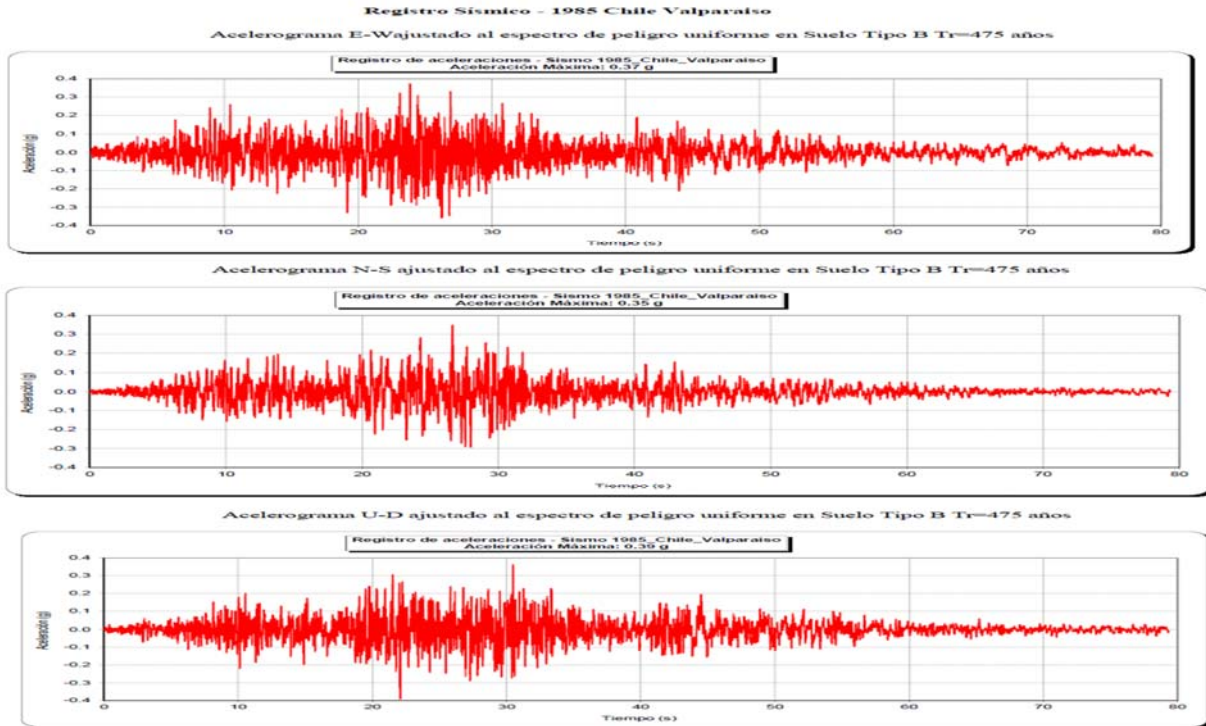


SYNTHETIC GROUND MOTION ACCELEROGRAMS FOR LIMA CITY MATCHED TO THE PERUVIAN SEISMIC CODE DESIGN SPECTRA

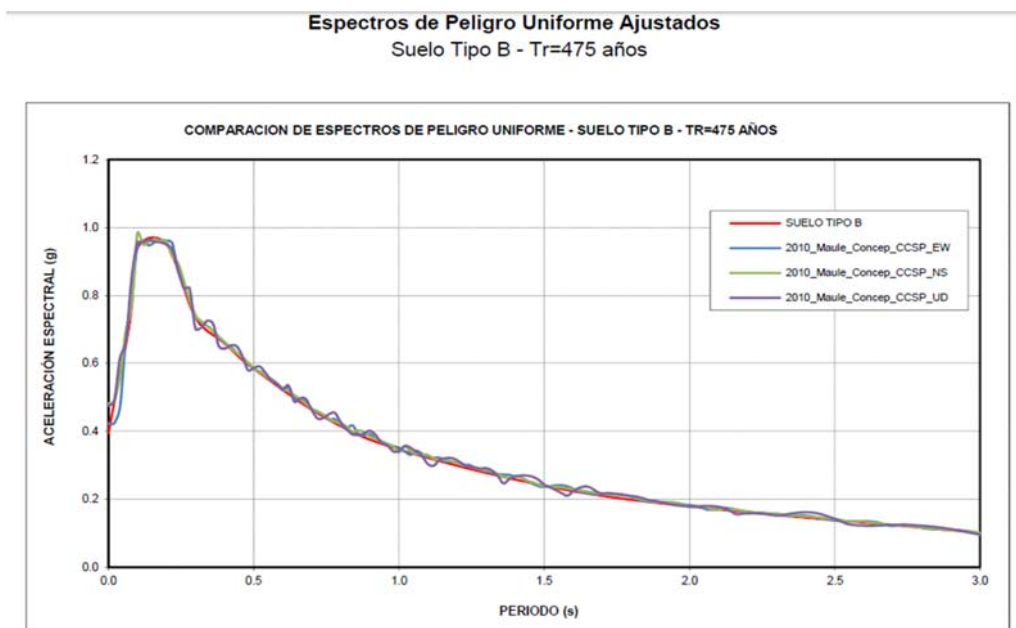
(PULIDO ET AL, 2013)



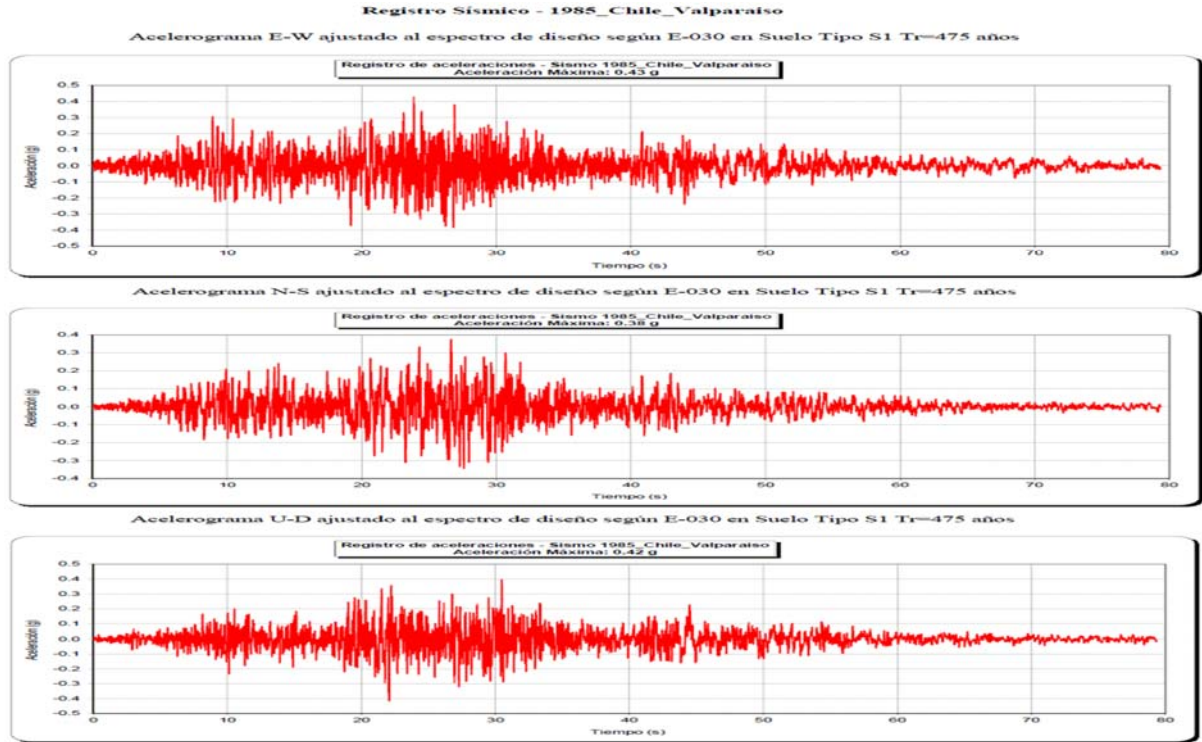
1985 VALPARAISO – CHILE EARTHQUAKE MATCHED TO UNIFORM HAZARD SPECTRA



SPECTRAL MATCHING TO THE UNIFORM HAZARD SPECTRUM (475 RETURN PERIOD EVENT)

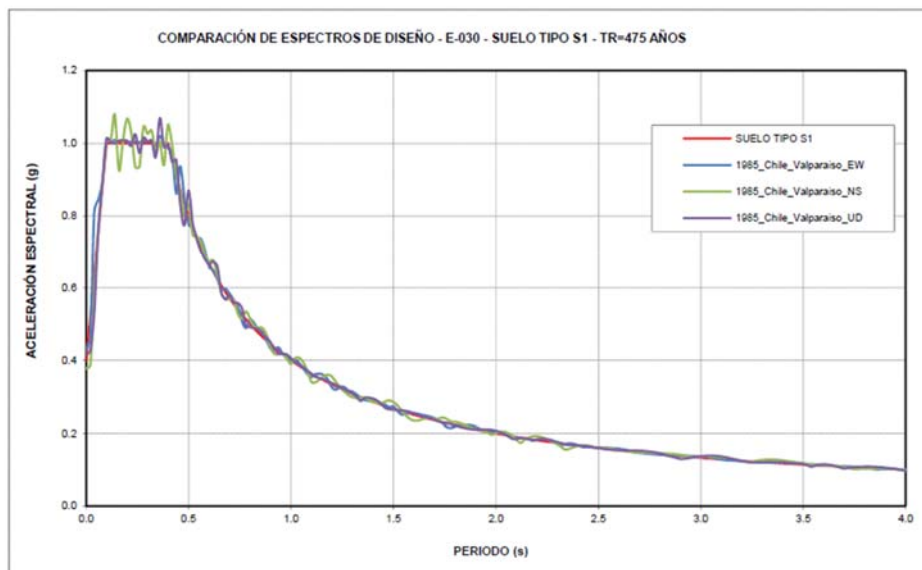


1985 VALPARAISO – CHILE EARTHQUAKE MATCHED TO PERUVIAN SEISMIC CODE DESIGN SPECTRA

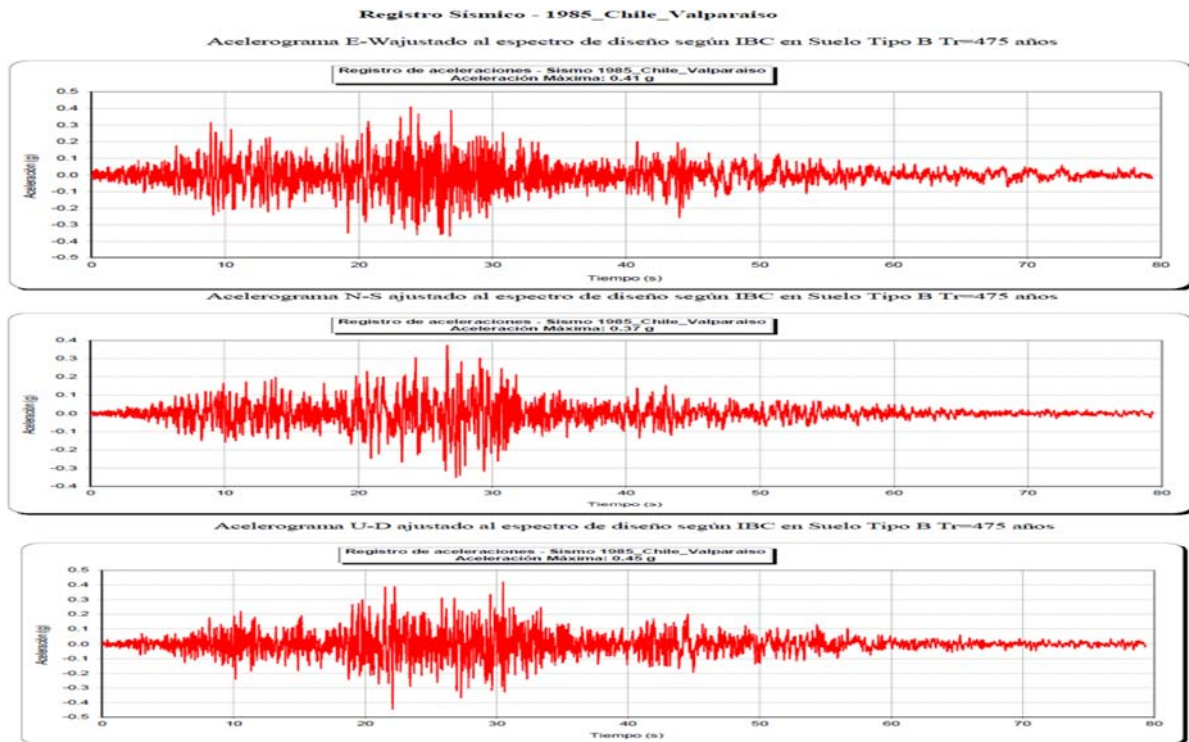


SPECTRAL MATCHING TO THE PERUVIAN SEISMIC CODE DESIGN SPECTRA

Espectros de Diseño según Norma E-030 - Ajustados
Suelo Tipo S1 - Tr=475 años

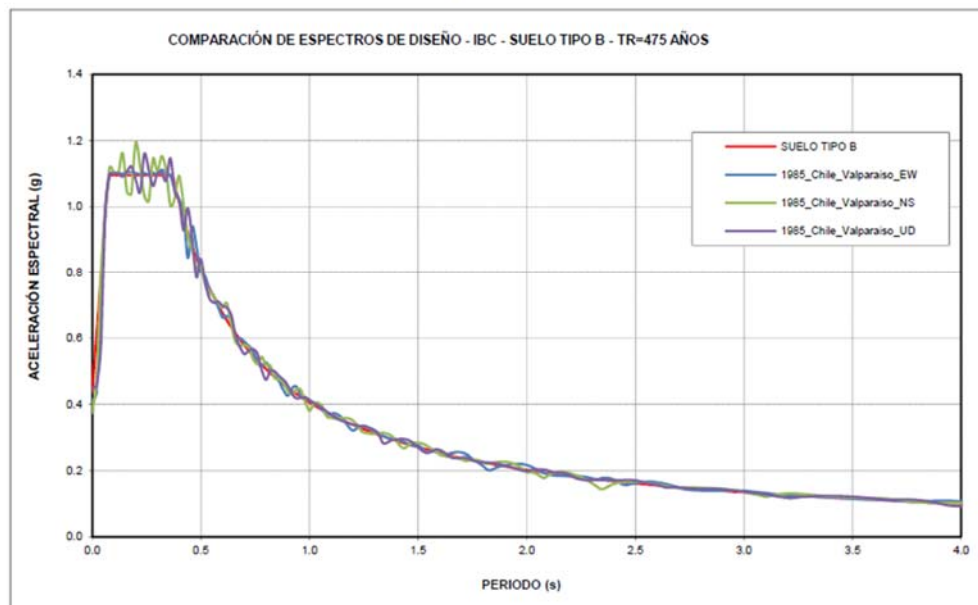


1985 VALPARAISO – CHILE EARTHQUAKE MATCHED TO THE INTERNATIONAL BUILDING CODE DESIGN SPECTRA



SPECTRAL MATCHING TO THE INTERNATIONAL BUILDING CODE DESIGN SPECTRA

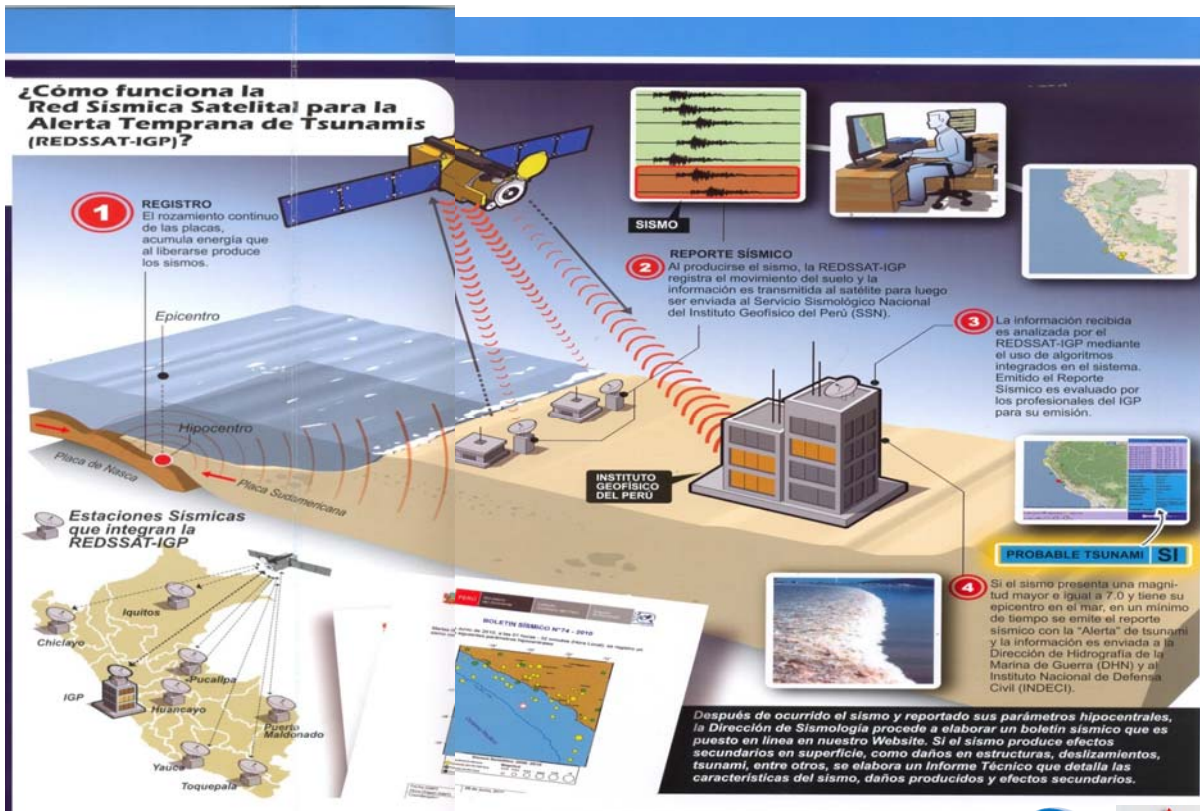
Espectros de Diseño según código IBC - Ajustados
Suelo Tipo B - Tr=475 años



IMPLEMENTATION OF THE SATELITAL NETWORK REDSSAT - IGP



IMPLEMENTACION DE LA REDSSAT - IGP



REDSSAT - IGP

Integrada por 21 estaciones
Sísmicas Satelitales

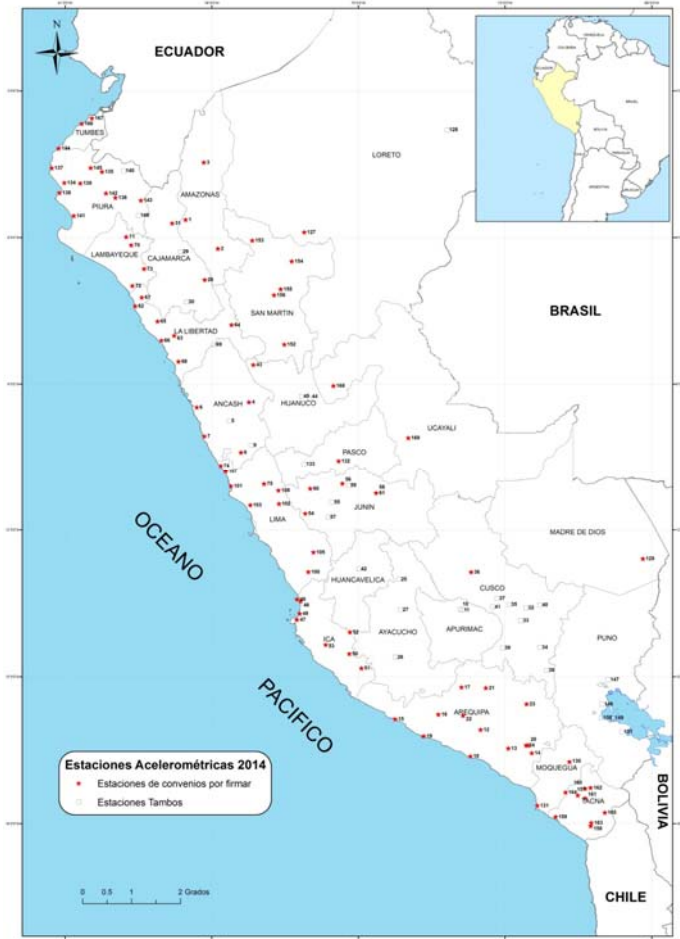
Centro Principal de Procesamiento y
Análisis de la información: Oficina de
Mayorazgo

Centro Alterno: Observatorio de Huayao -
Huancayo



ENHANCEMENT OF THE NATIONAL ACCELEROMETER NETWORK - IGP





169 ACELEROMETROS

- 1.- Ley de atenuacion de la aceleracion
Norma Sismorresistente
- 2.- Mapa de aceleraciones instrumentales
- 3.- proyectos de investigacion



Lima Metropolitana

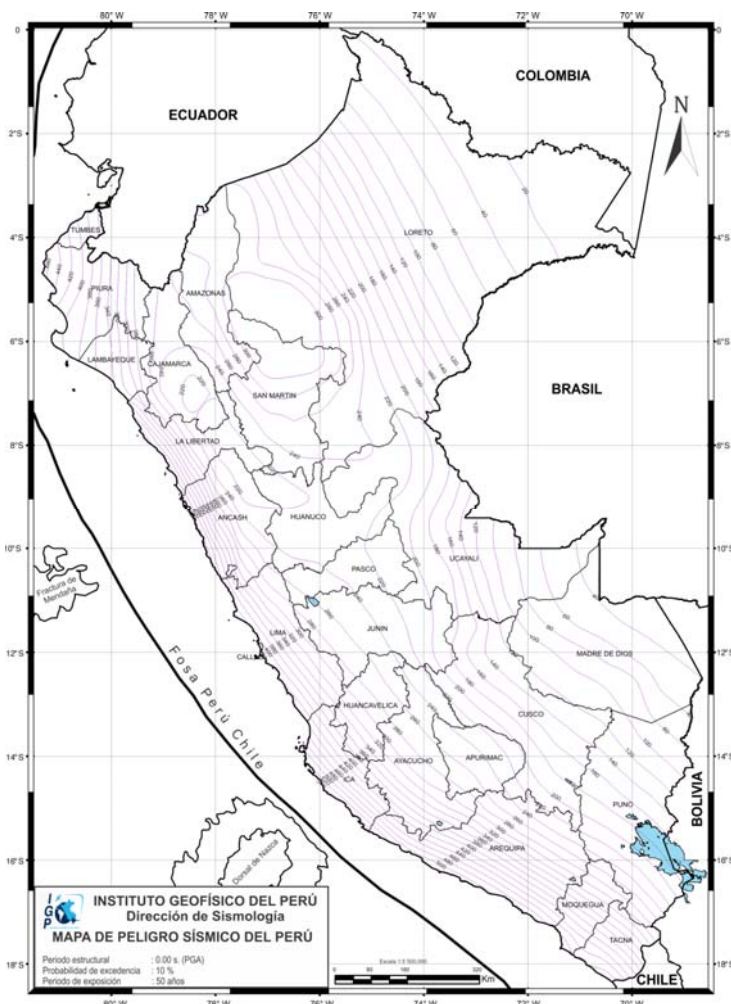
43 acelerometros (1 x distrito)

Mapa de intensidades acelerometricas



SEISMIC HAZARD ASSESSMENT FOR PERU

IGP – WB Project



Catálogo Sísmico: 1960 -2012

Propuesta de Fuentes Sismogénicas

Uso de ecuación de atenuación de Young et al (1997) y Sadigh et al (1997)

Uso de algoritmo CRISIS-2007

Asesoramiento técnico: Dr. Mario Ordaz



ENHANCEMENT OF CISMID STRONG GROUND MOTION ACCELEROGRAPH NETWORK - REDACIS - IN LIMA CITY

- 23 NEW ACCELEROGRAPHS WILL BE INSTALLED IN LIMA CITY
 - A REAL TIME MONITORING CENTER WILL BE IMPLEMENTED
 - CONSTRUCTION OF SOURCE MODEL AND STRONG MOTION SIMULATION FOR TACNA CITY
 - CALCULATION OF GROUND MOTION INCLUDING SITE RESPONSE AT 6 LOCATIONS IN TACNA CITY.
 - A NEW SLOPE MODEL FOR LIMA CITY WILL BE DEVELOPED
-

