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EVALUATION OF RESPONSE SPECTRA DERIVED FROM LOCAL ACCELEROGRAPHIC REGISTERS (VENEZUELA CASE)

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ABSTRACT

The evaluation of important seismic occurrances in different regions have pointed out the influence of the conditions that local soil has, based on the experimented ground movement and the damage observed in the structures that have founded on it. This influence has been incorporated in the differents design codes through the normalized spectra response.

The paper's objective was to evaluate the response spectra derived from local accelerographic records obteined by the national accelerographic network since 1981, due to 22 earthquakes, (a total of 108 real accelerographic records) from different ground conditions.

The response spectra of the earthquakes mentioned before were compared with the response spectra of the Venezuelan code for antiseismic buildings.

KEYWORDS

Response spectra; site efects; building codes; accelerographic registers; statistical processing; venezuelan earthquake.

INTRODUCTION

The Venezuelan Code for Antiseismic Buildings - COVENIN 1756-87 - , presents three curves corresponding to representative spectral forms for different soil conditions, such selection was based on statistical studies of spectral forms derived from a total of 108 real accelerographic records with maximum accelerations with 0.50*g as a maximum limit , obtained from diverse geological conditions that belong to different regions of the West Coast of the United States and Japan.

In the present work has been a comparison among the Normalized Acceleration Elastic Response Spectra with 5% of damping, obtained in different regions from Venezuela and registered by the local acelerographic net from 1981 to 1994 plotted in natural scale.

In 1981 The National Accelerographic Network began to work, and now it counts with 70 accelerographic stations (31 in the Western, 14 in the East and 25 in the Central Region) representing the venezuelan faults main system. This has permitted to record 22 earthquakes (12 in the West,7 in the East and 3 in the Center of the country) obtaining a total of 108 real accelerographic records, from different ground conditions.

To generate the response spectra, it was necessary to process previously the accelerographic records. That process takes into account the following steps:
- Automatic record digitation (most of the recording equipment is analog).
- To obtain the corrected record (a specialized commercial software was used).

Once this phase is completed, and on the ground of spectral forms' statistical study associated with the local accelerographic recorders family, it is determined the representative forms for different ground conditions, which were compared with those that appear in our design code for antiseismic buildings (1), setting the following conclusions:

- It was justified a corner period increment in S1 (*) soil type.
- It was justified to establish a new type of normative spectra for soils S3 (**).
- The data base of local seismicity demonstrated that the use of normative spectra obtained from foreign seismic activity is totally admissable.

(*) S1 :Rock or dense soil, with a rock base with no more than 50 meters deepness. Shear velocity upper than 300 meters per second

S2 : Medium dense soil. Shear velocity between 250 to 450 meters per second

(**)S3 :A little density granular soil, or soft consistency cohesive soil, having more than 10 meters thickness. Shear velocity less than 250 meters per second

METHODOLOGY

Once gathered all the acelerographic records recolected from1981 to1994, they were processed as follows:

Digitalization of the Records
Base Line Correction
Integration of the Records
Spectrum of the Record
Normalization of the Spectrum.

Then, it was proceeded to classify the records according to the type of the soil: S1, S2, S3, or S3 distant Earthquakes, depending on where the stations were at the moment of the earthquake. Moreover, it was taking into account the geological information that was available for that moment and the particular spectrum information.

In addition, the stations were classified depending on the type of the soil and the region where the station was situated:

Western region: It is mainly composed of the states that cross the Bocono fault;
Central region:It is mainly constituted by the states that cross the San Sebastian fault,
Eastern region: That has the states that cross the Pilar fault.

After classifying the type of soil all the Spectra, it was elaborated a seismic data base as the main tool for the accomplished comparisons.

All the Spectra, that were obtained from S1 soils, were taken to create the attenuation laws for the diferent zones of the country using local acelerographics records.

The Follow tables and figures show the distribution of the acelerographics records:

Table 1.

	DISTRIBUTION	**OF THE**	**RECORDS**	
	(According to the	type of Soil)		
	Western	**Central**	**Eastern**	**TOTAL**
S1	33	12	8	**53**
S2	13	4	16	**33**
S3	14	-	2	**16**
S3(distant earthquake)	6	-	-	**6**
TOTAL	**66**	**16**	**26**	**108**

Table 2.

	DISTRIBUTION	**OF THE**	**RECORDS**
	(By	Regions)	
	Number of Earthquakes	**Number of Records**	**Number of Analyzed Components**
Western	12	33	66
Central	3	10	16
Eastern	7	13	26
TOTAL	**22**	**56**	**108**

LIMITATIONS

- Poor data base for the statistic analysis of the Spectra.
- Most of records are characterized by having low accelerations and as well as a high content of high frequencies, which are not representative of all desired frequencies diversity.

CONCLUSIONS

- It was justified a corner period increment in S1 (*) soil type.
- It was justified to establish a new kind of normative spectra for soils S3 (**).
- The data base of local seismicity demonstrated that the use of normative spectra obtained from foreign seismic activity is totally admissable.

(*) Rock or dense soil, with a rock base with no more than 50 meters deepness.
(**)A little density granular soil, or soft consistency cohesive soil, having more than 10 meters thickness.

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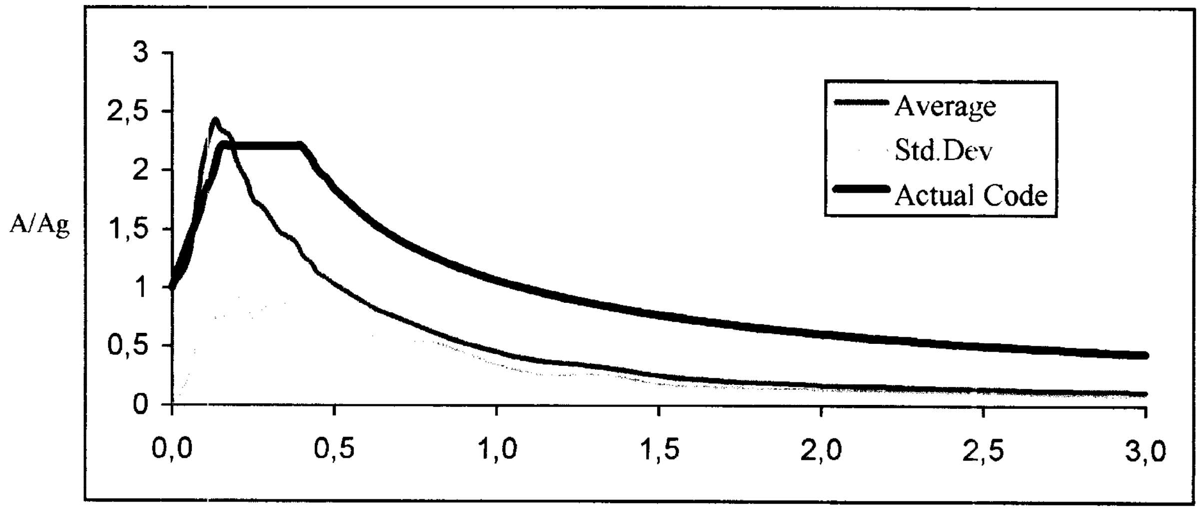


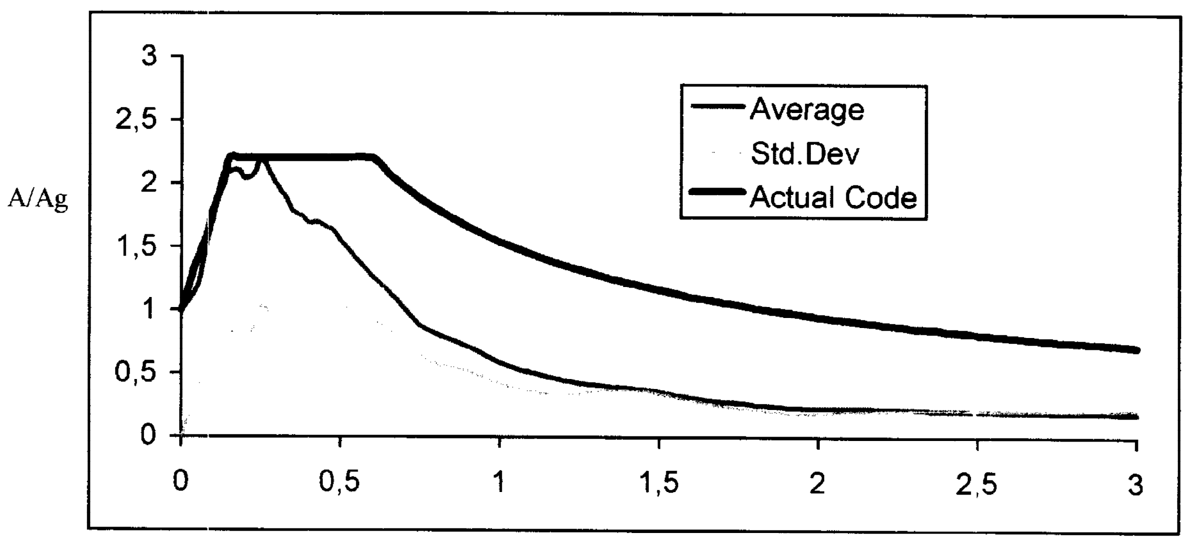
Period (secs)

Fig. 1

Soil profile S1

Response spectra average vs Normative spectrum

Where A/Ag is Acceleration/Ground Acceleration



Period (secs)

Fig. 2

Soil profile S2

Response spectra average vs.

Normative spectrum

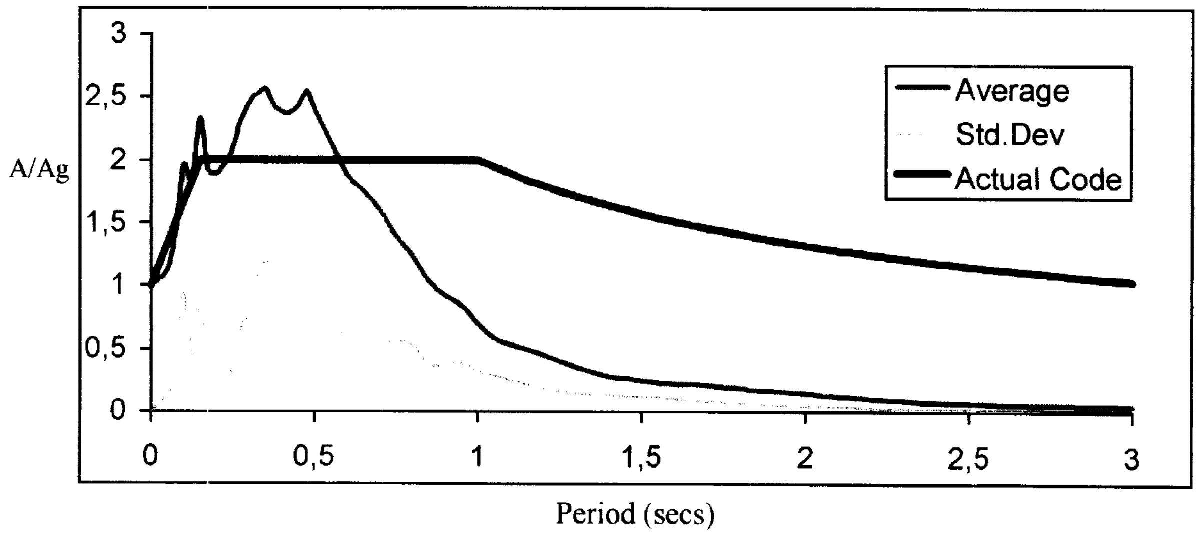


Fig. 3
Soil profile S3
Response spectra average vs.
Normative spectrum

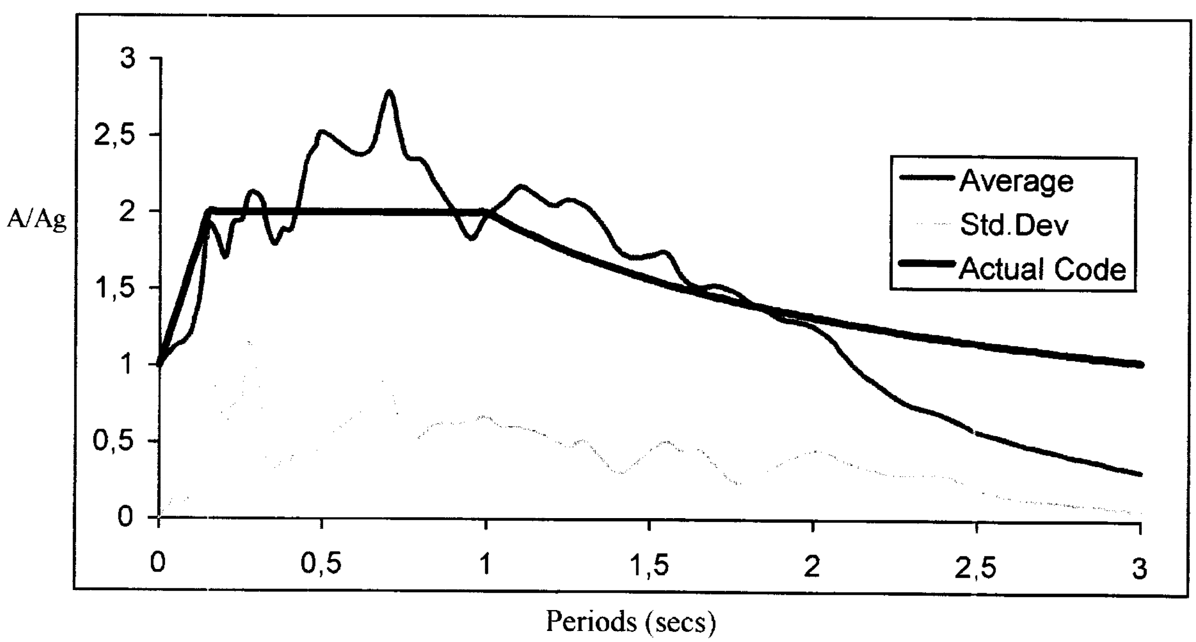


Fig. 4
Soil profile S3 (distant Earthquakes)
Response spectra average vs.
Normative spectrum

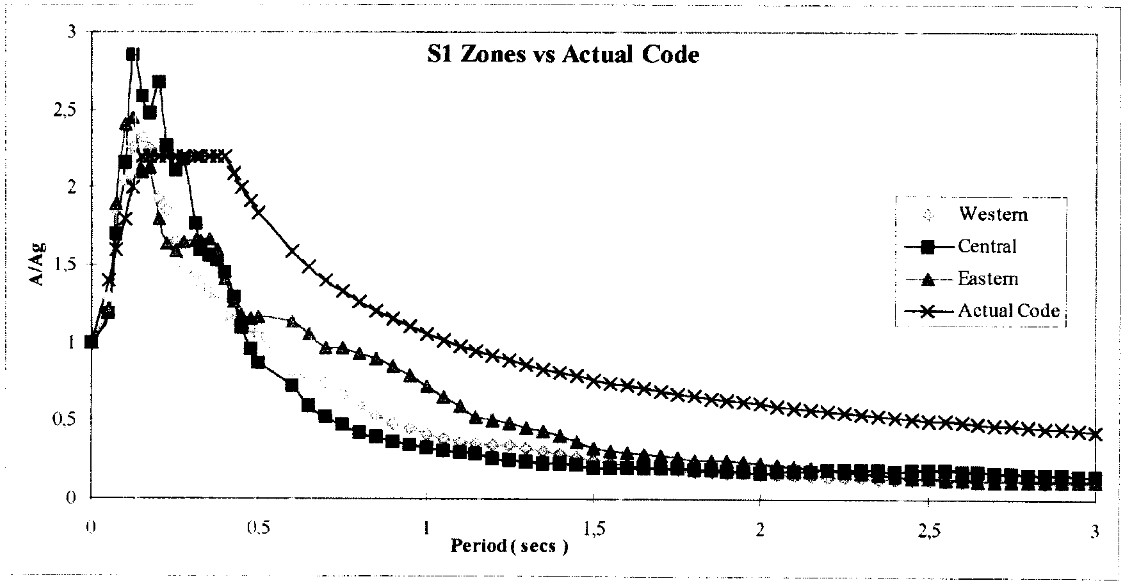


Fig. 5
Soil profile S1
Response spectra for differents zones vs. Normative spectrum

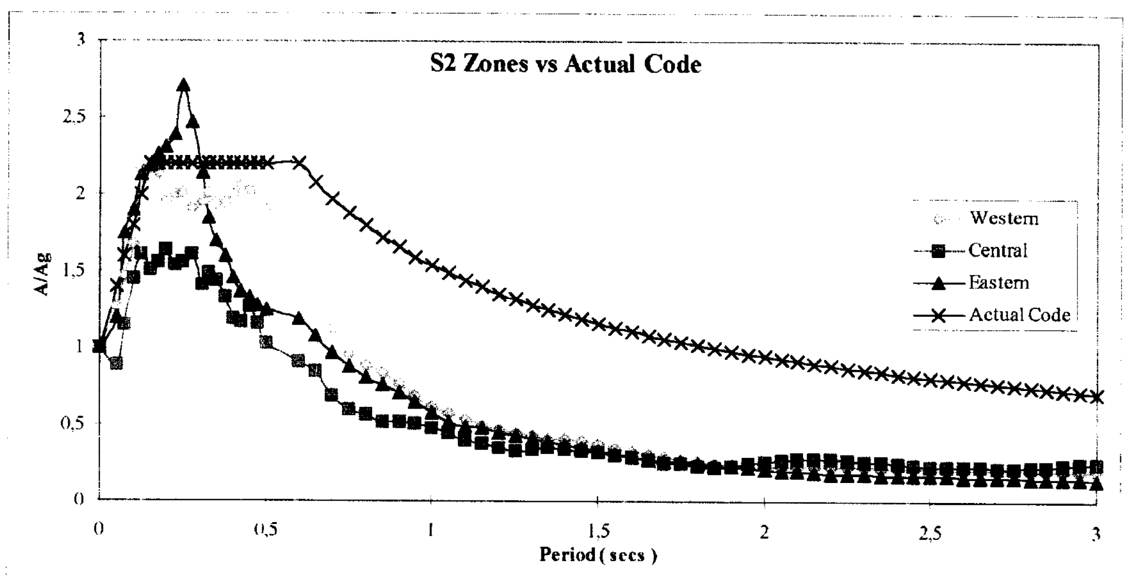


Fig. 6
Soil profile S2
Response spectra for differents zones vs. Normative spectrum

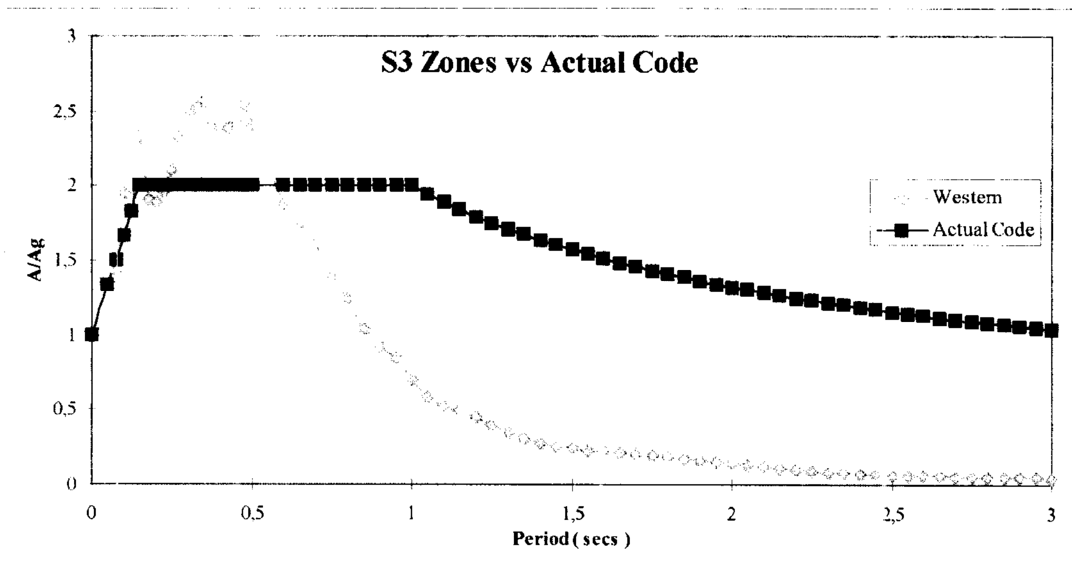


Fig. 7
Soil profile S3
Response spectra for differents zones vs. Normative spectrum

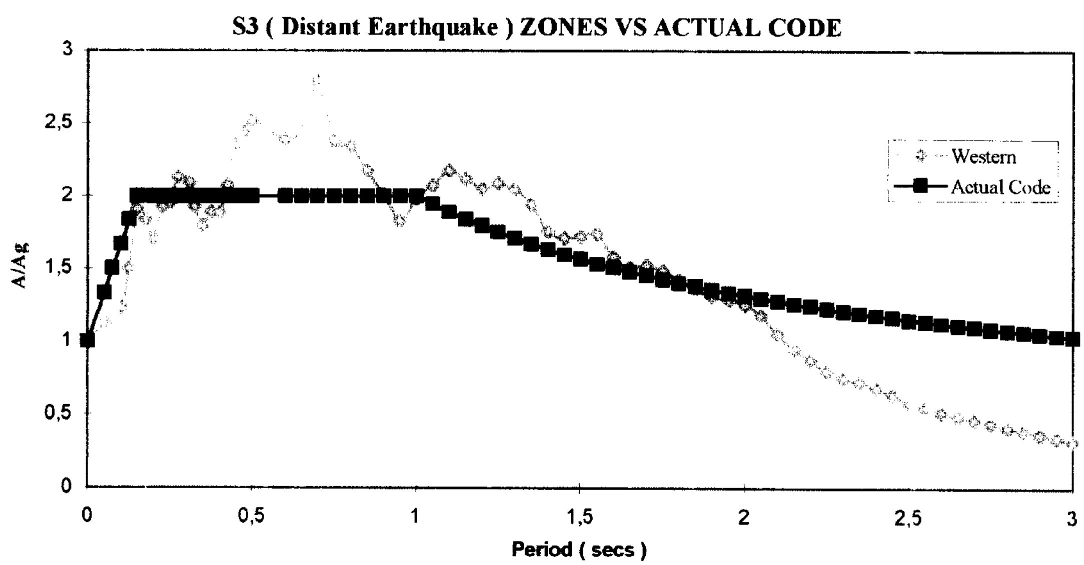


Fig. 8
Soil profile S3
Response spectra for differents zones vs. Normative spectrum