2019 SEMANA DE LA INGENIERÍA

CONECTADOS CON EL FUTURO

TRANSICIÓN ENERGÉTICA
HACIA UN MUNDO SUSTENTABLE

FACULTAD DE INGENIERIA
Universidad de Buenos Aires

CAI

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FACULTAD DE INGENIERIA Universidad de Buenos Aires

CAI

VITELMO BERTERO

(1923-2016)

Ingeniero Civil – Universidad Nacional del Litoral (1940-1947)
PhD – MIT (1953-1957)
Profesor Emerito – UC Berkeley (1958-2016)

El inolvidable 'Premio Nobel' de la Ingeniería Argentina

VITELMO BERTERO

VITELMO BERTERO
(1923-2016)

- **Reconocimiento mundial del Prof. Bertero**
- **Reconocimiento de sus colegas y estudiantes**
- **Why?**
  - **Cómo era ser estudiante de Vitelmo?**
  - **Cómo trabajaba Vitelmo?**
  - **Porqué el 'premio nobel' de la ingeniería argentina?**

VITELMO BERTERO

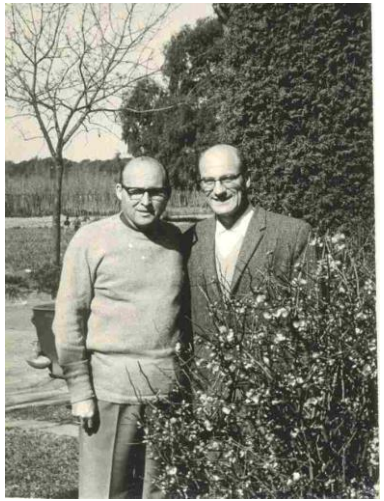
VITELMO BERTERO
(1923-2016)

- **Reconocimiento mundial del Prof. Bertero**

VITELMO BERTERO

Premios

1965 Award for research, Instituto Universitario di Achitectura de Venezia, **Italy**.
1971 Elected to the Academy of Science of **Argentina**.
1974 Tai Krishna Award, India Society of Earthquake Technology, **India**.
1976 Shared Raymond C. Reese Award, American Concrete Institute- **USA**
1979 Honorary Professor, University of Guayaquil, **Ecuador**.
1987 Bicentennial Certificate of Distinction and Medal, University of Los Andes, Merida, **Venezuela**.
1987 Moissief Award, American Society of Civil Engineers - USA
1989 Shared J. James R. Croes Medal, **American Society of Civil Engineers** - USA
1989 Arthur R. Anderson Award, **American Concrete Institute** - USA
1989 Gold Medal from "Consejo Superior de Investigaciones Científicas," Madrid, **Spain**.
1990 T.R. Higgins Lectureship Award, **American Institute of Steel Construction** -USA
1991 Honorary Professor of the University of Buenos Aires, Argentina.
1991 Nathan M. Newmark Medal, American Society of Civil Engineers - USA
1991 The Berkeley Citation, highest honor bestowed by the University of California - USA
1992 Honorary Professor, Universidad Tecnologíca Nacional, Facultad Regional de Mendoza, Argentina.
1994 Asociación de Ingeniería Sísmica de **Costa Rica**
1995 Housner Medal from the Earthquake Engineering Research Institute (EERI) – USA
2006 Asociación de Ingeniería Sísmica de **República Dominicana**
2010 Honoris Causa por los 100 años de la UNAM, **Mexico**
2010 Rose School Award – Eucentre, Italy



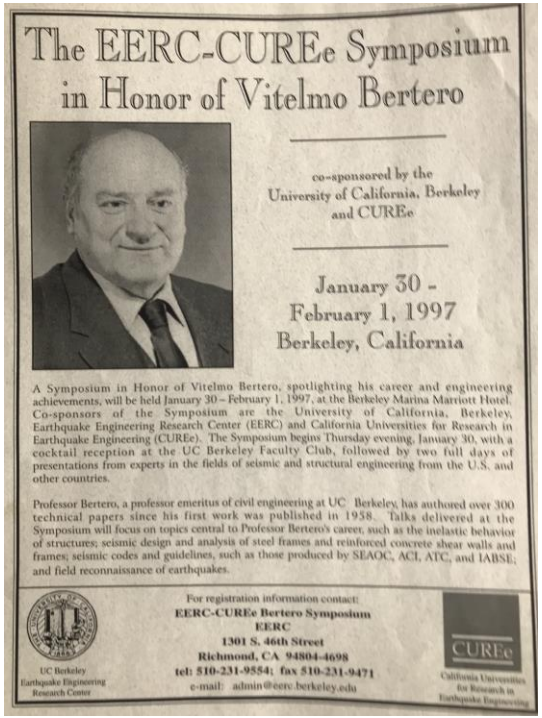
Vargas Llosa

Vit

“Man of the Year” – Engineering News Record (1990)

Sismo de Loma Prieta – 17 de octubre 1989 – Oakland (California) a la salida del Bay Bridge entre SF-Oakland

Symposium in Honor of Vitelmo Bertero – EERC -CUREe (1997)



The EERC-CUREe Symposium in Honor of Vitelmo Bertero

co-sponsored by the University of California, Berkeley and CUREe

January 30 - February 1, 1997
Berkeley, California

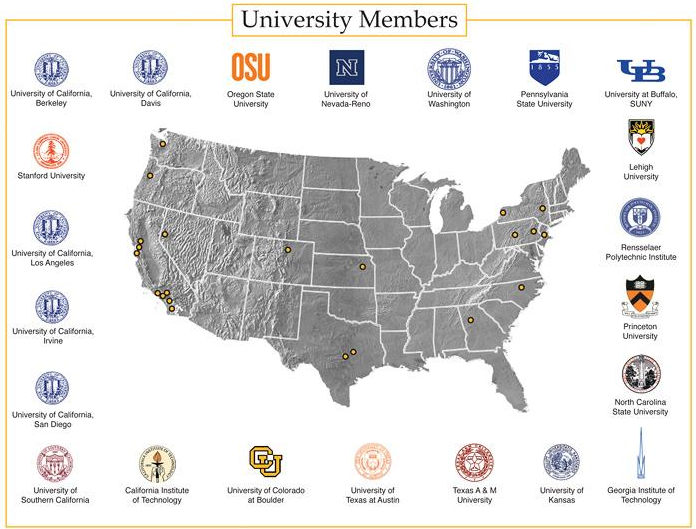
A Symposium in Honor of Vitelmo Bertero, spotlighting his career and engineering achievements, will be held January 30 – February 1, 1997, at the Berkeley Marina Marriott Hotel. Co-sponsors of the Symposium are the University of California, Berkeley, Earthquake Engineering Research Center (EERC) and California Universities for Research in Earthquake Engineering (CUREe). The Symposium begins Thursday evening, January 30, with a cocktail reception at the UC Berkeley Faculty Club, followed by two full days of presentations from experts in the fields of seismic and structural engineering from the U.S. and other countries.

Professor Bertero, a professor emeritus of civil engineering at UC Berkeley, has authored over 300 technical papers since his first work was published in 1958. Talks delivered at the Symposium will focus on topics central to Professor Bertero's career, such as the inelastic behavior of structures; seismic design and analysis of steel frames and reinforced concrete shear walls and frames; seismic codes and guidelines, such as those produced by SEAOC, ACI, ATC, and IABSE; and field reconnaissance of earthquakes.

For registration information contact:
EERC-CUREe Bertero Symposium
EERC
1301 S. 46th Street
Richmond, CA 94804-4698
tel: 510-231-9554; fax 510-231-9471
e-mail: admin@eerc.berkeley.edu

UC Berkeley Earthquake Engineering Research Center

CUREe
California Universities for Research in Earthquake Engineering



EERC "Earthquake Engineering Research Center" – CUREe "Consortium of Universities for Research in Earthquake Engineering"

Top Seismic Engineers of the 20th Century – ATC (2006)

Applied Technology Council

Awards Dinner

ATC

Media Sponsor

Engineering News Record

ENR

Westin St. Francis Hotel
San Francisco, California
April 17, 2006

SPECIAL ADVERTISING SECTION

APPLIED TECHNOLOGY COUNCIL AWARDS

TOP U.S. SEISMIC ENGINEERS OF THE 20th CENTURY

PIONEERING. VISIONARY. INGENIOUS.

These are just a few of the adjectives that aptly describe the extraordinary field of honorees in this salute to U.S. seismic engineers of the last century. The ATC is proud to honor the following individuals for exceptional service and contributions in mitigating the effects of natural and other disasters on the built environment.

One of the most notable was John Ripley Freeman. At the age of 70, Freeman shifted his considerable expertise from hydraulic engineering to earthquake engineering after seeing the devastation caused by the 6.3 earthquake in Santa Barbara, CA, in 1925.

Until his death in 1933, Freeman emphasized to the engineering community, academia, and the public the possibilities of earthquake engineering. In 1932, he was principally responsible for the development and installation of the first strong motion accelerographs that were used to monitor structural behavior on many buildings during the March 10, 1933 Long Beach earthquake. In this regard, many consider him the founding father of the strong ground motion program in the United States.

Here is a list of the other recipients of the ATC Top U.S. Seismic Engineering Awards of the 20th Century:

JOHN A. BLUME

The 1925 Santa Barbara earthquake inspired 16-year-old Blume to study earthquake engineering. By 1974, he established the John A. Blume Earthquake Engineering Center at Stanford University, a center devoted to the advancement of earthquake engineering. He used the latest analysis and design methodologies in his practice.

HENRY J. DEGENKOLB

Degenkolb was a powerful advocate of high-quality seismic design starting from the 1930s through the 1980s. He is noted for early and prolonged contributions to building code development, as well as his advocacy of research and earthquake reconnaissance as a means to learn more about structural behaviors.

GEORGE HOUSNER

Inspired by observations of the 1933 Long Beach Earthquake, Housner undertook doctoral study on the response of structures to recorded earthquake ground motion, which led to the introduction of response spectrum methods in earthquake engineering. This was but the beginning of a long career of making continual, creative contributions on both the technical and public policy fronts of earthquake risk mitigation.

RAY W. CLOUGH

Clough, the co-developer of the Finite Element Method in the 1950s, pioneered the use of finite element analysis to predict the effects of earthquakes on structures from tall buildings to dams. Clough was also a pioneer in the development of structural dynamic models for earthquake engineering applications. A brilliant analyst, Clough emphasized experimental verification through field testing and creative early uses of the earthquake simulator.

JOSEPH PENZIEN

Penzien was one of the early researchers to recognize the importance of probabilistic methods in earthquake engineering. Motivated by witnessing damage to freeway overpasses during the 1971 San Fernando Earthquake, Penzien initiated a major research program that led to advanced analysis procedures and design criteria for highway bridges. He was the primary force behind the creation of the Earthquake Engineering Research Center at UC Berkeley.

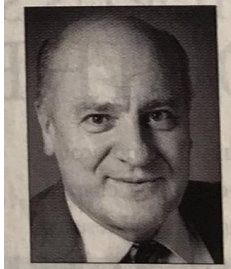
VITELMO BERTERO

Bertero challenged industry to perform earthquake studies beginning in the 1970s. He is considered an expert in the seismic design and construction of steel and reinforced concrete structures. Bertero pursued and promoted a holistic approach to earthquake engineering, balancing analytical, experimental and post-earthquake field investigations to improve earthquake-resistant design.

EGOR POPOV

For over 50 years, Popov focused his energy on designing earthquake-resistant structures, and improving seismic code provisions, particularly for reinforced concrete and steel. Popov's other contributions included his extraordinary efforts to expand research and education of earthquake engineering at the UC, Berkeley.

VITELMO BERTERO



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Honoris Causa por los 100 años de la UNAM a los más destacados individuos en cada area del conocimiento (2010)

Pobreza y falta de cultura sísmica,

factores de riesgo para la construcción:

Vitelmo Victorio Bertero

La inspección adecuada y exhaustiva en la construcción por parte de especialistas es una obligación en Estados vulnerables, tanto en el diseño como en el detallado de los refuerzos, que implican una mayor participación del gobierno.

En la conferencia magistral Reflexiones sobre los Grandes Sismos, ofrecida el pasado día 21, apuntó que en un comparativo entre los temblores ocurridos en Haití y Chile, la falta de cultura y los tipos de edificaciones fueron factores que influyeron en una mayor pérdida de vidas, que en Haití sumaron más de 300 mil, mientras que en Chile la cifra fue de 565.

La pobreza sigue como el elemento más alto de vulnerabilidad en países en desarrollo, donde es necesaria la resiliencia y sustentabilidad, explicó el especialista asesor de gobiernos.

Se requiere mayor instrucción y vinculación entre las instituciones educativas que forman a los constructores, y más participación de las autoridades en el terreno de protección civil, indicó en la Torre de Ingeniería de la UNAM.

Foto: Marco Mijares.

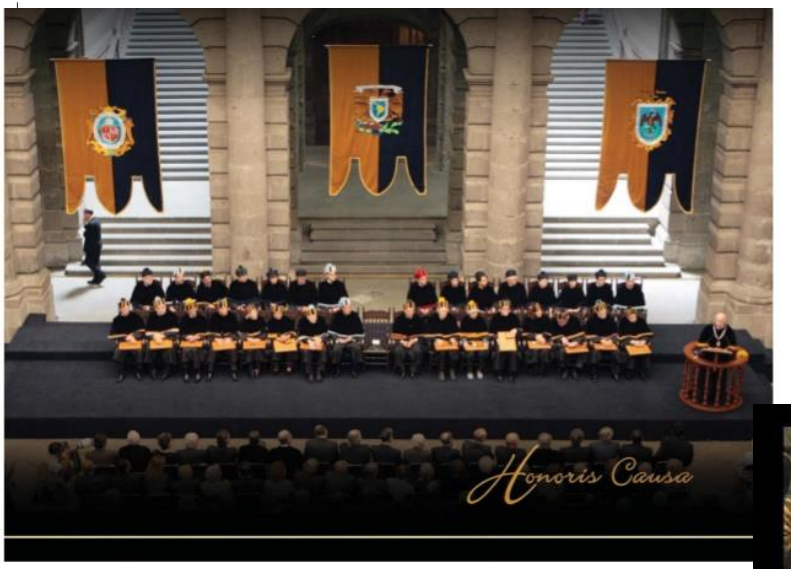
La falta de cultura sísmica en países como Haití, aunada a la pobreza, fueron factores que detonaron mayor número de muertes en esa isla caribeña, en comparación con el terremoto en Chile, en 2010, señaló Vitelmo Victorio Bertero Risso.

En la semana del Centenario de la Universidad Nacional, Bertero Risso, quien recibió el Doctorado *Honoris Causa* por la UNAM, dijo que ante la problemática de la ingeniería del ramo, los muros de resistencia son factores primordiales frente a los impactos ocasionados por temblores, explosiones y maremotos, así como los materiales costosos, un inconveniente en varias naciones latinoamericanas.

En el país, la problemática radica en que las plantas bajas son débiles en edificios altos, y se requieren vigas y columnas de tal espesor, que representan costos elevados.

El destacado ingeniero civil de origen argentino, quien participó activamente en proyectos de investigación y formación de especialistas a raíz de los sismos de México en 1985, se refirió también al costo de las construcciones modernas con alto contenido de vidrio, que es otro gran factor de riesgo.

Edición del Centenario Gaceta 41



Vargas Llosa

Vit

VITELMO BERTERO
(1923-2016)

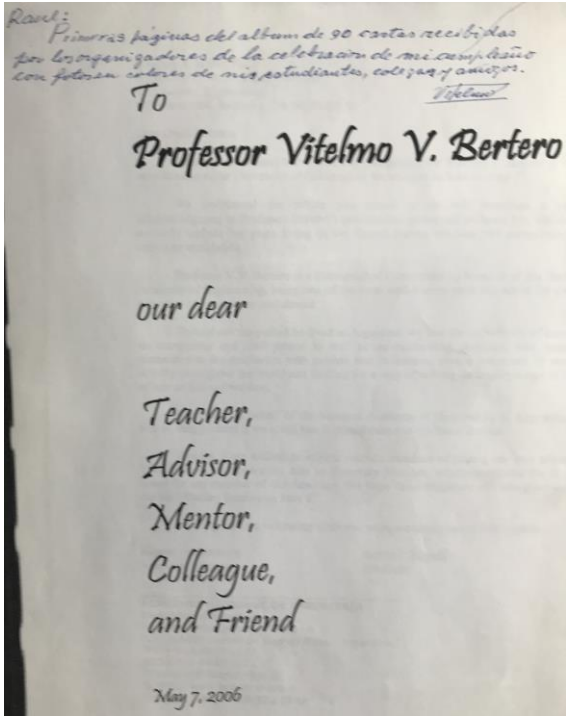
- **Reconocimiento de sus colegas y estudiantes**

VITELMO BERTERO

EERC - Richmond

Biblioteca del EERC

Homenaje por los 83 años de Vit Bertero – Mayo 2006 - Berkeley



Raul:
Primeras páginas del album de 90 cartas recibidas por los organizadores de la celebración de mi cumpleaños con fotos en colores de mis estudiantes, colegas y amigos.
Vitelmo

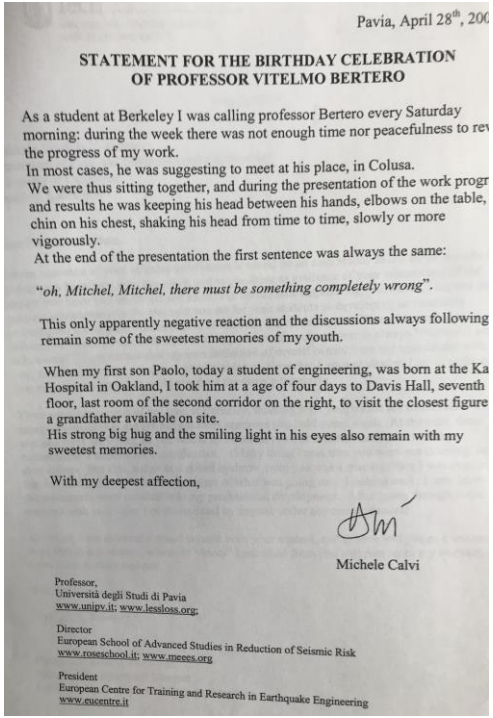
To

Professor Vitelmo V. Bertero

our dear

Teacher,
Advisor,
Mentor,
Colleague,
and Friend

May 7, 2006



Pavia, April 28th, 200

STATEMENT FOR THE BIRTHDAY CELEBRATION OF PROFESSOR VITELMO BERTERO

As a student at Berkeley I was calling professor Bertero every Saturday morning: during the week there was not enough time nor peacefulness to rev the progress of my work.
In most cases, he was suggesting to meet at his place, in Colusa.
We were thus sitting together, and during the presentation of the work progr and results he was keeping his head between his hands, elbows on the table, chin on his chest, shaking his head from time to time, slowly or more vigorously.
At the end of the presentation the first sentence was always the same:

"*oh, Mitchel, Mitchel, there must be something completely wrong*".

This only apparently negative reaction and the discussions always following remain some of the sweetest memories of my youth.

When my first son Paolo, today a student of engineering, was born at the Ka Hospital in Oakland, I took him at a age of four days to Davis Hall, seventh floor, last room of the second corridor on the right, to visit the closest figure a grandfather available on site.
His strong big hug and the smiling light in his eyes also remain with my sweetest memories.

With my deepest affection,

Michele Calvi

Professor,
Università degli Studi di Pavia
www.unipv.it; www.lessloss.org;

Director
European School of Advanced Studies in Reduction of Seismic Risk
www.roseschool.it; www.meees.org

President
European Centre for Training and Research in Earthquake Engineering
www.eucentre.it

VITELMO BERTERO
(1923-2016)

- **Why?**
- **Cómo era ser estudiante de Vitelmo?**

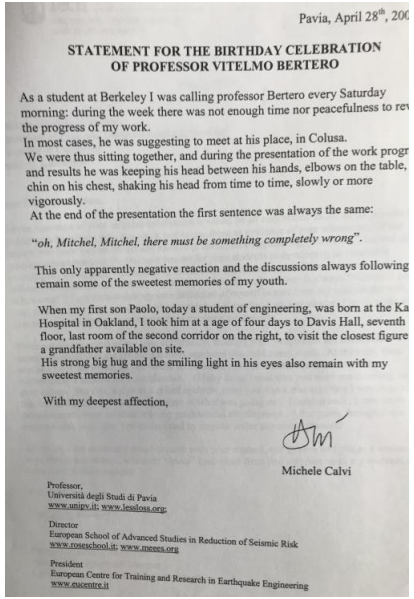
VITELMO BERTERO

Homenaje por los 83 años de Vit Bertero – Mayo 2006 – 90 cartas de profesores de todo el mundo

- Michele Calvi (Profesor Universidad de Pavia – Director European School of Advanced Studies in Reduction of Seismic Risk – Presidente European Centre for Training and Research in EE

- "Como estudiante en Berkeley me reunía con Profesor Bertero cada sábado a la mañana: durante la semana no había tiempo para revisar el progreso de mi trabajo. En la mayoría de los casos èl sugería reunirnos en su casa de Colusa. Nos sentábamos juntos y durante la presentación de mi trabajo y sus resultados, Bertero mantenía su cabeza entre sus manos, inclinado sobre la mesa, moviendo su cabeza cada tanto, lenta o más vigorosamente hacia cada lado. Al final de la presentación la primer frase era siempre la misma:

  Oh, Mitchel, Mitchel, there must be something completely wrong…



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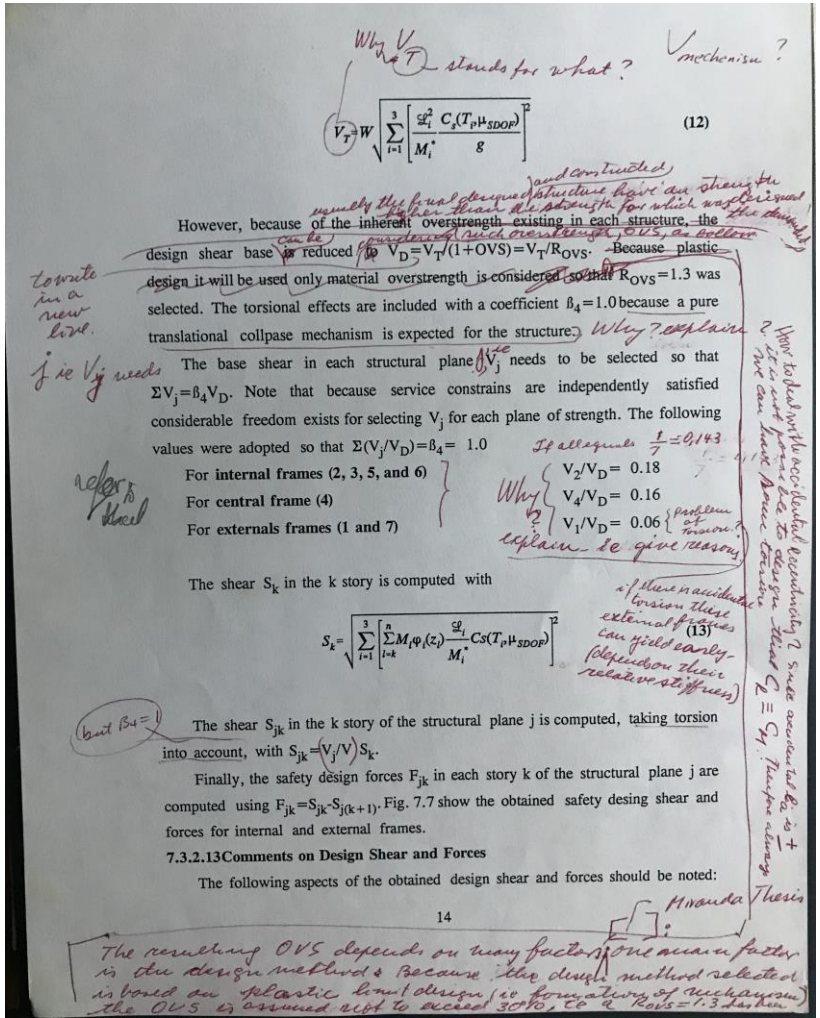
President
European Centre for Training and Research in Earthquake Engineering
www.eucentre.it

Hacer la tesis con Vitelmo

Casa de Vitelmo – Colusa Av. Berkeley



Why V_T stands for what? $V_{mechanism}$?

$$V_T = W\sqrt{\sum_{i=1}^{3}\left[\frac{\xi_i^2}{M_i^*}\frac{C_s(T_p,\mu_{SDOF})}{g}\right]^2} \qquad (12)$$

However, because of the inherent overstrength existing in each structure, the design shear base is reduced to $V_D = V_T/(1+OVS) = V_T/R_{OVS}$. Because plastic design it will be used only material overstrength is considered so that $R_{OVS} = 1.3$ was selected. The torsional effects are included with a coefficient $\beta_4 = 1.0$ because a pure translational collpase mechanism is expected for the structure.

The base shear in each structural plane V_j needs to be selected so that $\Sigma V_j = \beta_4 V_D$. Note that because service constrains are independently satisfied considerable freedom exists for selecting V_j for each plane of strength. The following values were adopted so that $\Sigma(V_j/V_D) = \beta_4 = 1.0$

For **internal frames (2, 3, 5, and 6)** $V_2/V_D = 0.18$

For **central frame (4)** $V_4/V_D = 0.16$

For **externals frames (1 and 7)** $V_1/V_D = 0.06$

The shear S_k in the k story is computed with

$$S_k = \sqrt{\sum_{i=1}^{3}\left[\sum_{l=k}^{n} M_l \varphi_i(z_l)\frac{\xi_i}{M_i^*} C_s(T_p,\mu_{SDOF})\right]^2} \qquad (13)$$

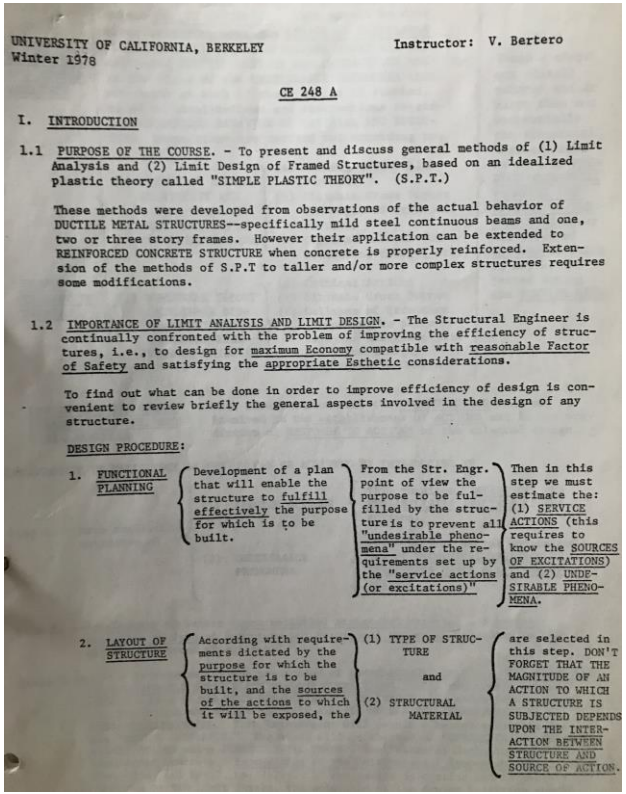
The shear S_{jk} in the k story of the structural plane j is computed, taking torsion into account, with $S_{jk} = (V_j/V)S_k$.

Finally, the safety design forces F_{jk} in each story k of the structural plane j are computed using $F_{jk} = S_{jk} - S_{j(k+1)}$. Fig. 7.7 show the obtained safety desing shear and forces for internal and external frames.

7.3.2.13 Comments on Design Shear and Forces

The following aspects of the obtained design shear and forces should be noted:

Estudiar con Vitelmo



UNIVERSITY OF CALIFORNIA, BERKELEY
Winter 1978

Instructor: V. Bertero

CE 248 A

I. INTRODUCTION

1.1 PURPOSE OF THE COURSE. - To present and discuss general methods of (1) Limit Analysis and (2) Limit Design of Framed Structures, based on an idealized plastic theory called "SIMPLE PLASTIC THEORY". (S.P.T.)

These methods were developed from observations of the actual behavior of DUCTILE METAL STRUCTURES--specifically mild steel continuous beams and one, two or three story frames. However their application can be extended to REINFORCED CONCRETE STRUCTURE when concrete is properly reinforced. Extension of the methods of S.P.T to taller and/or more complex structures requires some modifications.

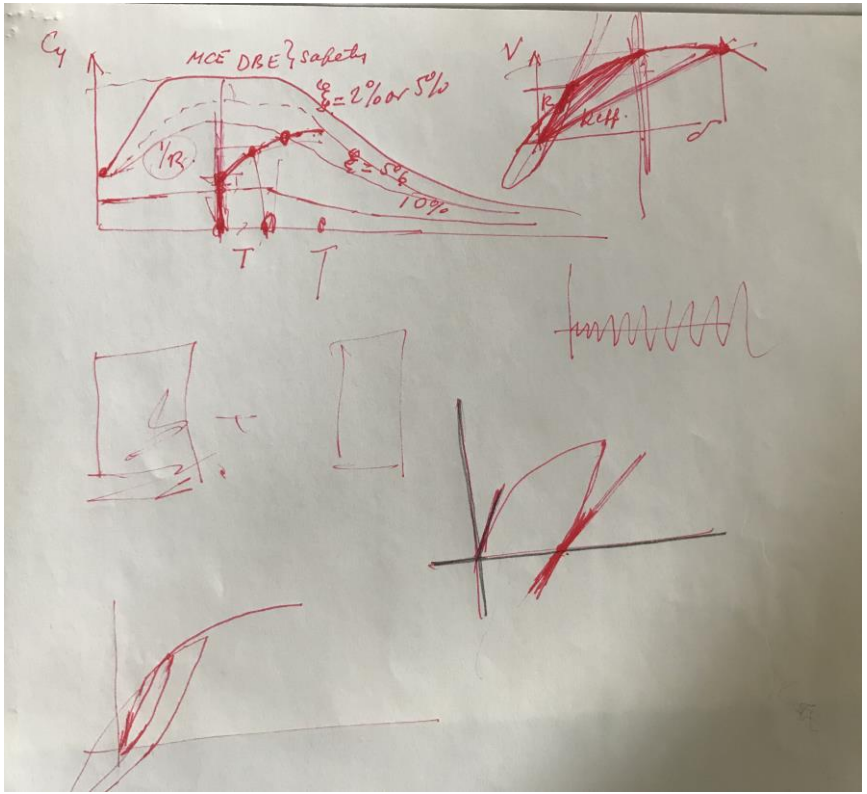
1.2 IMPORTANCE OF LIMIT ANALYSIS AND LIMIT DESIGN. - The Structural Engineer is continually confronted with the problem of improving the efficiency of structures, i.e., to design for maximum Economy compatible with reasonable Factor of Safety and satisfying the appropriate Esthetic considerations.

To find out what can be done in order to improve efficiency of design is convenient to review briefly the general aspects involved in the design of any structure.

DESIGN PROCEDURE:

1. FUNCTIONAL PLANNING — Development of a plan that will enable the structure to fulfill effectively the purpose for which is to be built. — From the Str. Engr. point of view the purpose to be fulfilled by the structure is to prevent all "undesirable phenomena" under the requirements set up by the "service actions (or excitations)" — Then in this step we must estimate the: (1) SERVICE ACTIONS (this requires to know the SOURCES OF EXCITATIONS) and (2) UNDESIRABLE PHENOMENA.

2. LAYOUT OF STRUCTURE — According with requirements dictated by the purpose for which the structure is to be built, and the sources of the actions to which it will be exposed, the (1) TYPE OF STRUCTURE and (2) STRUCTURAL MATERIAL are selected in this step. DON'T FORGET THAT THE MAGNITUDE OF AN ACTION TO WHICH A STRUCTURE IS SUBJECTED DEPENDS UPON THE INTERACTION BETWEEN STRUCTURE AND SOURCE OF ACTION.



VITELMO BERTERO
(1923-2016)

- **Why?**
- **Cómo trabajaba Vitelmo?**

VITELMO BERTERO

Nieto de inmigrantes piamonteses, hijo de agricultores de Esperanza (Santa Fe), primera generación profesional

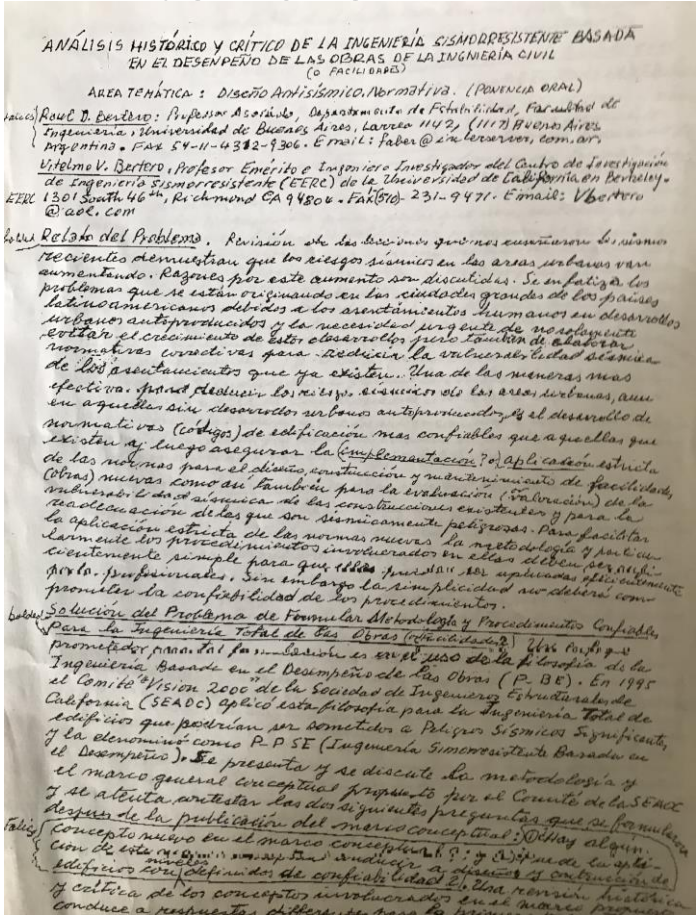
Su vida en Argentina corresponde a la primera mitad del siglo XX
Sus estudios interrumpidos por la tension Brasil –Argentina por la 2 WW
Su Desarrollo académico en argentina afectado por los bajos sueldos y los conflictos universitarios del primer peronismo

Talento, pasión, investigación aplicada, integración de una amplia gama de contenidos ingenieriles y TRABAJO DURO

2006

2011

Talento, pasión, investigación aplicada, integración de una amplia gama de contenidos ingenieriles y TRABAJO DURO



ANÁLISIS HISTÓRICO Y CRÍTICO DE LA INGENIERÍA SISMORRESISTENTE BASADA EN EL DESEMPEÑO DE LAS OBRAS DE LA INGNIERÍA CIVIL (O FACILIDADES)

AREA TEMÁTICA: DISEÑO ANTISÍSMICO, NORMATIVA. (PONENCIA ORAL)

Autores: Raul D. Bertero: Profesor Asociado, Departamento de Estabilidad, Facultad de Ingeniería, Universidad de Buenos Aires, Larrea 1142, (1117) Buenos Aires Argentina. FAX 54-11-4382-9306. E mail: faber@ar.lerservice.com.ar;

Vitelmo V. Bertero, Profesor Emérito e Ingeniero Investigador del Centro de Investigación de Ingeniería Sismorresistente (EERC) de la Universidad de California en Berkeley. EERC 1301 South 46th, Richmond CA 94804. FAX (510) 231-9471. E mail: VBertero@aol.com

Resumen: Relato del Problema. Revisión de los sismos que nos enseñaron los sismos recientes demuestran que los riesgos sísmicos en las áreas urbanas van aumentando. Razones por este aumento son discutidas. Se enfatiza los problemas que se están originando en las ciudades grandes de los países latinoamericanos debidos a los asentamientos humanos en desarrollos urbanos autoproducidos y la necesidad urgente de no solamente evitar el crecimiento de estos desarrollos, pero también de elaborar normativas correctivas para reducir la vulnerabilidad sísmica de los asentamientos que ya existen. Una de las maneras mas efectiva para reducir los riesgos sísmicos no las áreas urbanas, aun en aquellas sin desarrollos urbanos autoproducidos es el desarrollo de normativas (códigos) de edificación mas confiables que aquellas que existen y luego asegurar la implementación? o aplicación estricta de las normas para el diseño, construcción y mantenimiento de facilidades (obras) nuevas como así también para la evaluación (valoración) de la vulnerabilidad sísmica de las construcciones existentes y para la readecuación de las que son sísmicamente peligrosas. Para facilitar la aplicación estricta de las normas nuevas la metodología y procedimientos involucrados en ellas deben ser suficientemente simple para que sean aplicadas eficientemente por los profesionales. Sin embargo la simplicidad no debería comprometer la confiabilidad de los procedimientos.

Solución del Problema de Formular Metodología y Procedimientos Confiables para la Ingeniería Total de las Obras (Facilidades) Obras Porque prometedor para el fut... Desde es en el uso de la filosofía de la Ingeniería Basada en el Desempeño de las Obras (P-BE). En 1995 el Comité "Vision 2000" de la Sociedad de Ingenieros Estructurales de California (SEAOC) aplicó esta filosofía para la Ingeniería Total de edificios que podrían ser sometidos a Peligros Sísmicos Significantes y la denominó como P-PSE (Ingeniería Sismorresistente Basada en el Desempeño). Se presenta y se discute la metodología y el marco general conceptual propuesto por el Comité de la SEAOC y se atienta aclarar las dos siguientes preguntas que se formularon después de la publicación del marco conceptual: 1) Hay algún concepto nuevo en el marco conceptual? 2) Que de los conceptos con los que se está trabajando, a nivel de edificios son definidos de confiabilidad? Una revisión histórica y crítica de los conceptos involucrados en el marco conceptual conduce a respuestas diferentes para la pregunta

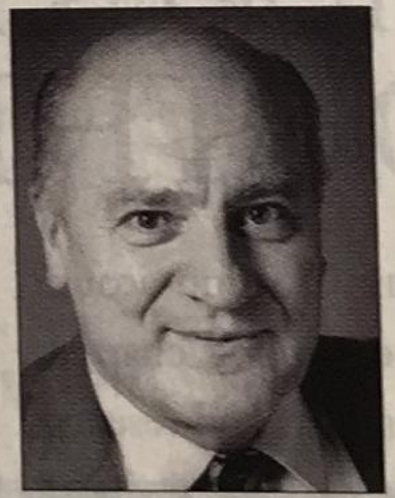
VITELMO BERTERO
(1923-2016)

- **Why?**
- **Porqué el premio nobel de la ingeniería argentina?**

VITELMO BERTERO

Top Seismic Engineers of the 20th Century – ATC (2006)

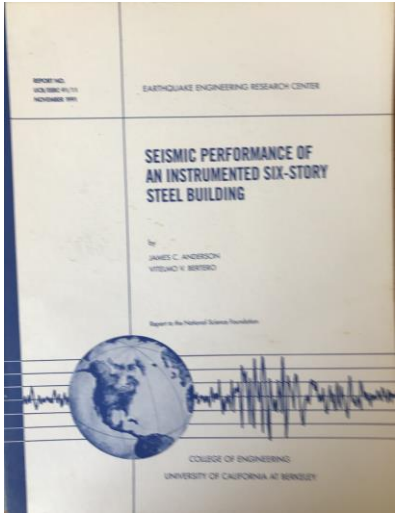
VITELMO BERTERO

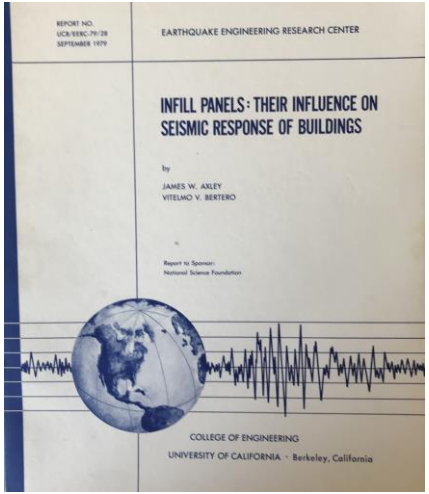


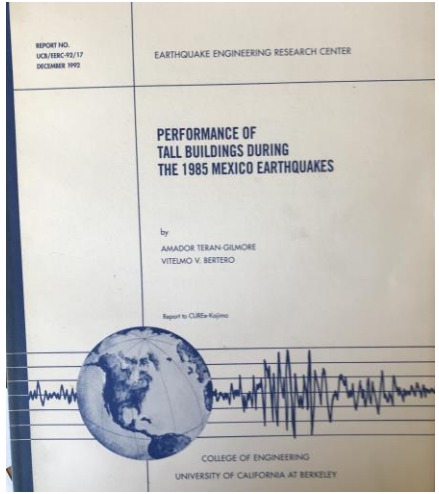
Bertero challenged industry to perform earthquake studies beginning in the 1970s. He is considered an expert in the seismic design and construction of steel and reinforced concrete structures. Bertero pursued and promoted a holistic approach to earthquake engineering, balancing analytical, experimental and post-earthquake field investigations to improve earthquake-resistant design.

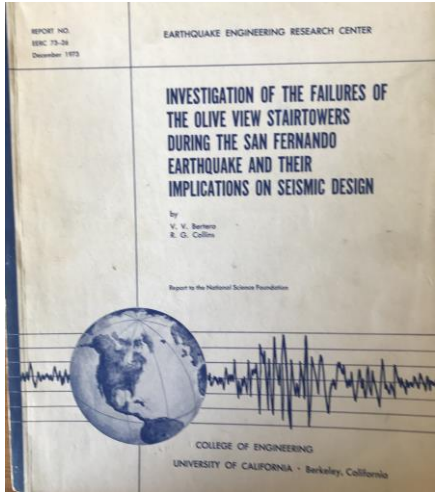
Investigación aplicada – Del lab a la realidad

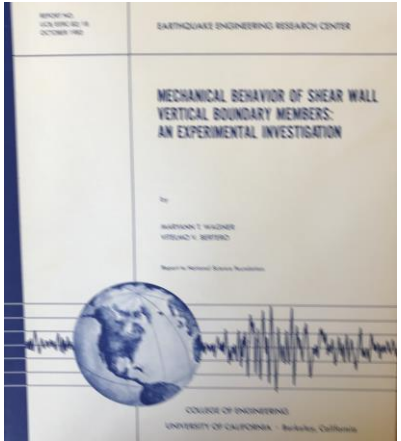
Del comportamiento de las estructuras y edificios reales

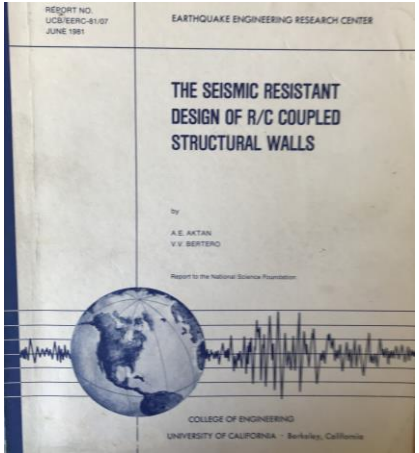


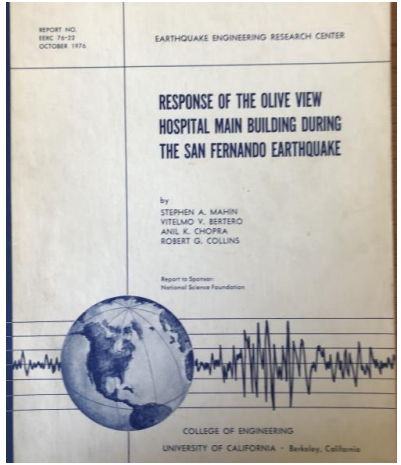


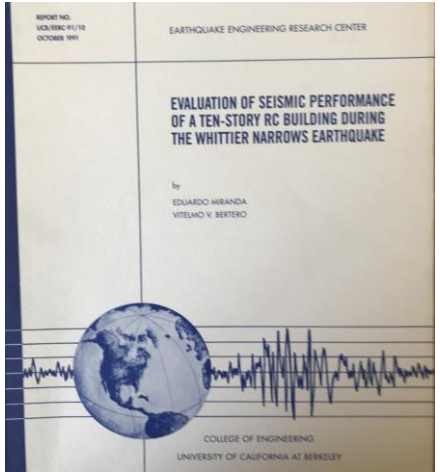




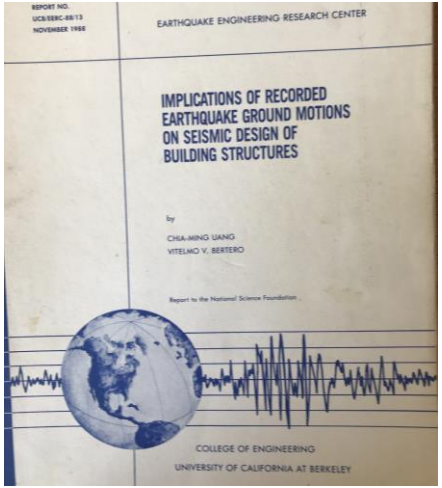


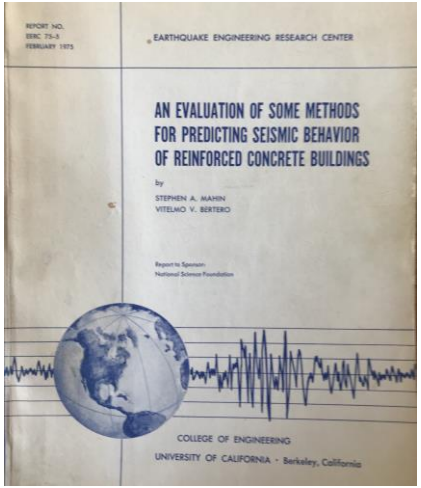


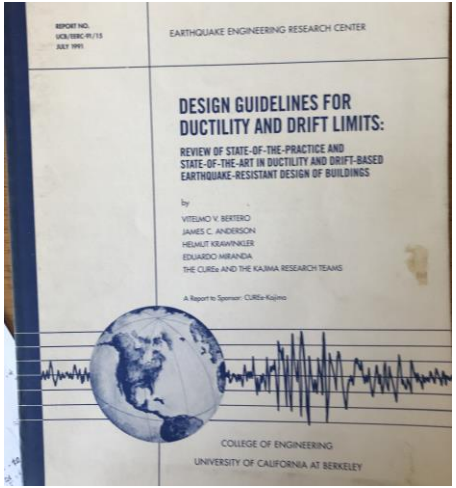


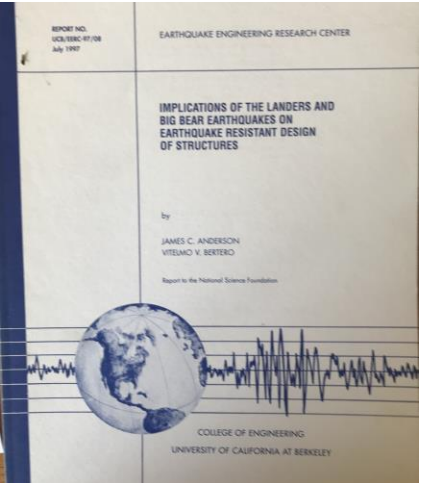


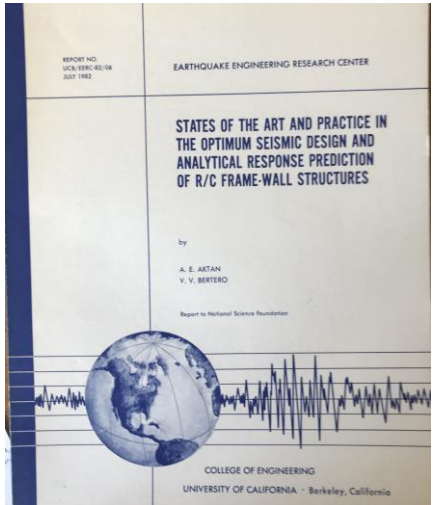
A las recomendaciones para el diseño y construcción



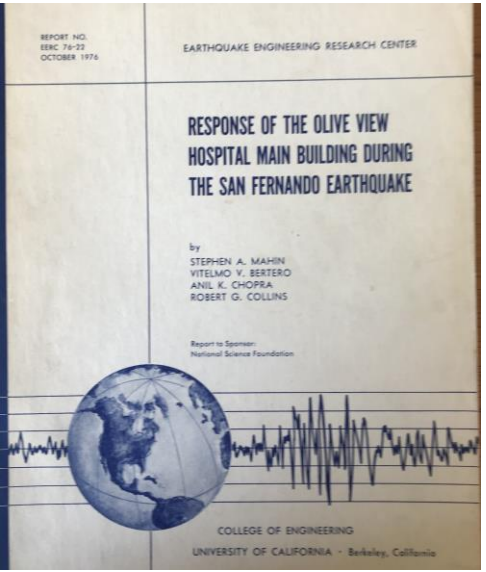








Sismo de San Fernando de 1971 – Olive View Hospital


REPORT NO.
EERC 76-22
OCTOBER 1976

EARTHQUAKE ENGINEERING RESEARCH CENTER

RESPONSE OF THE OLIVE VIEW HOSPITAL MAIN BUILDING DURING THE SAN FERNANDO EARTHQUAKE

by
STEPHEN A. MAHIN
VITELMO V. BERTERO
ANIL K. CHOPRA
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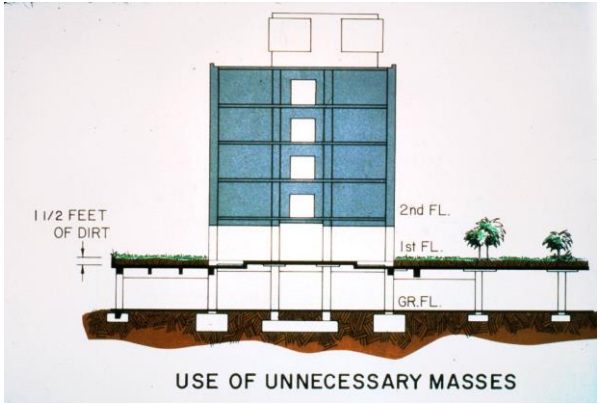
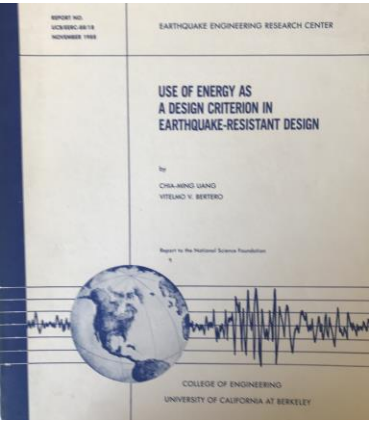


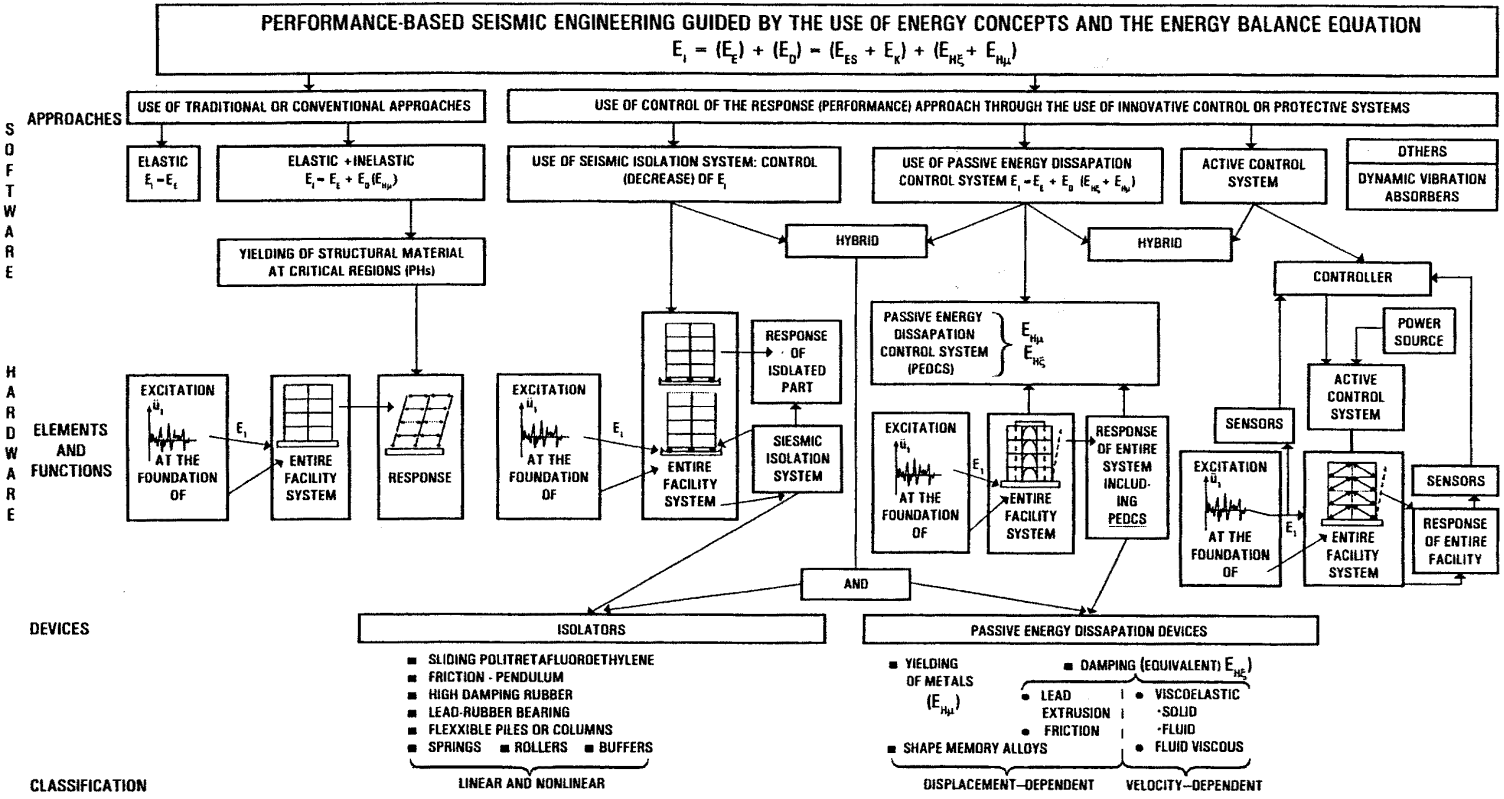
Metodos innovadores de diseño sìsmico



$$E_I = E_E + E_D$$

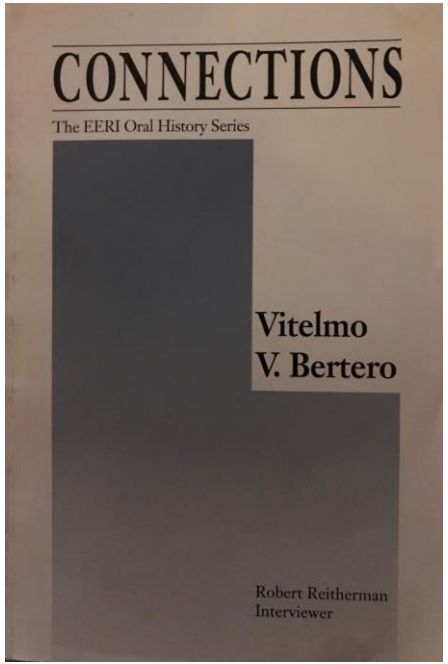
$$E_I = \overbrace{E_K + E_S}^{} + \overbrace{E_{H\zeta} + E_{H\mu}}^{}$$

$$DEMANDS \leqslant SUPPLIES$$

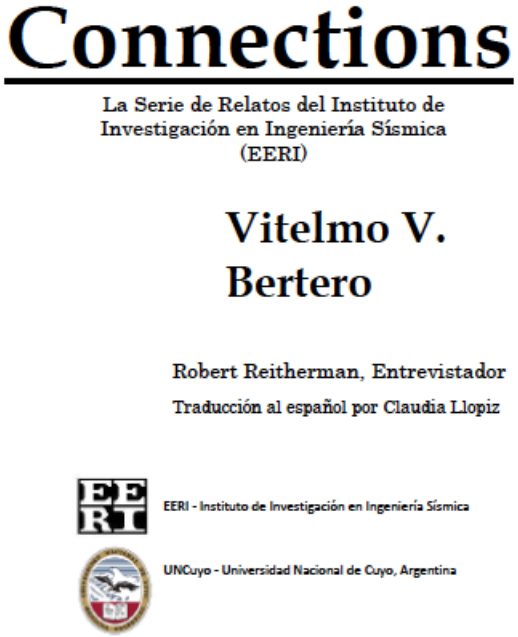


Flow chart of the approaches for performance-based earthquake-resistant design.

Connections – Vitelmo V. Bertero



2008 (EERI)



2019 (EERI - UNCuyo)

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VITELMO BERTERO

GRACIAS!

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