



Association régie par la loi
du 1.07.1901

Comité Français de Mécanique des Sols
et de Géotechnique



Voyage en liquéfaction...

Etienne Flavigny

Liquéfaction of Loose Sand Fills in 1989 Loma Prieta Earthquake, California : Comparison with Large Scale and Centrifuge Tests

Ricardo Dobry, RPI, USA

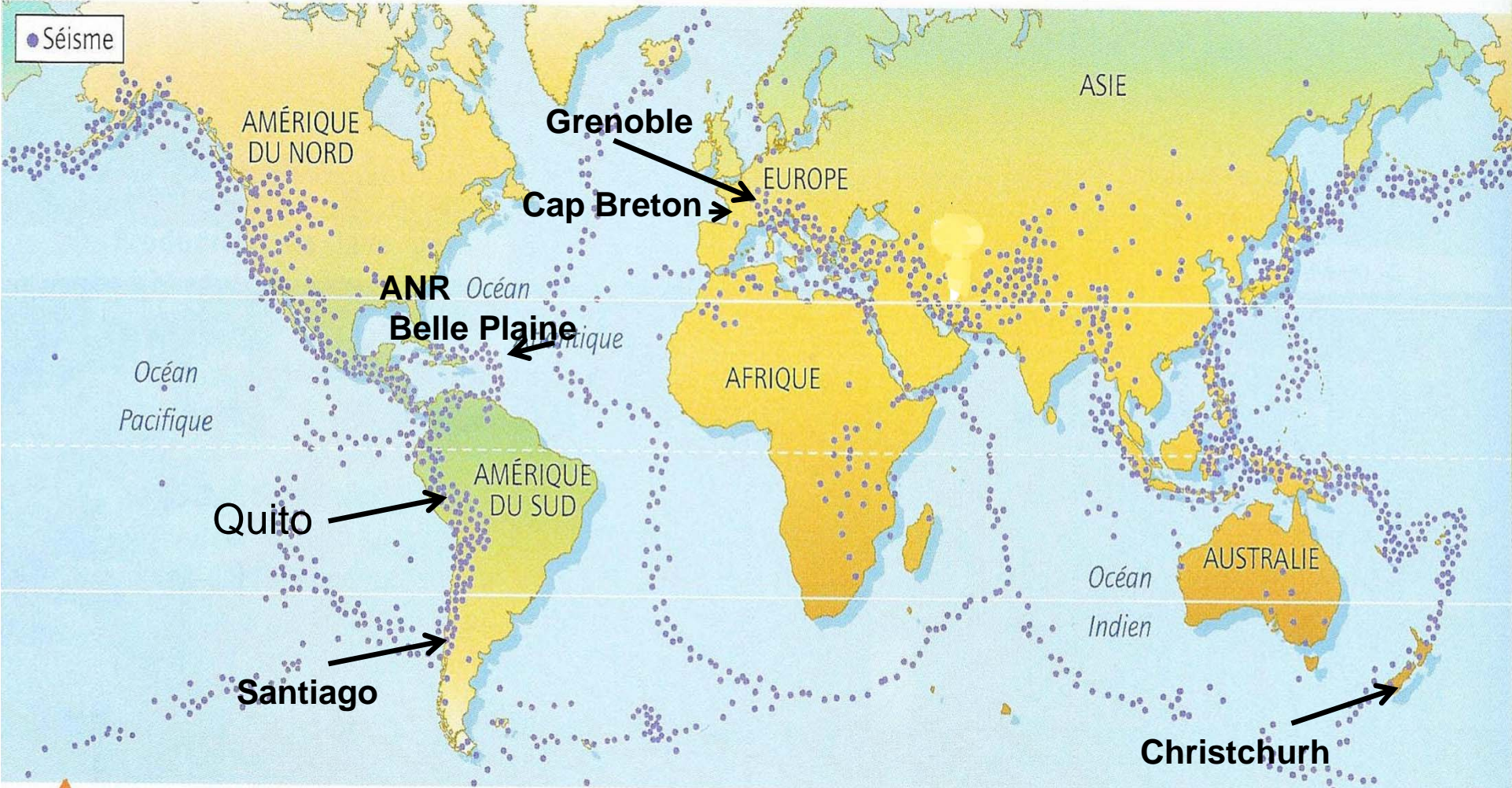


« *Sols et fondations sous sollicitations statiques, cycliques et dynamiques* »

Journée Technique du 27 Janvier 2015

Hommage au Professeur Pierre FORAY

Voyage dans le monde



Voyage dans le temps

Janvier 86
1^{er} colloque AFPS

COMPORTEMENT MECANIQUE DES SABLES SUR CHEMINS NON DRAINÉS
ET LIQUEFACTION
Etienne FLAVIGNY(*), Pierre FORAY(**)

Dec 88
Programme Piézocone

PIEZOCONE et LIQUEFACTION
des
SABLES

ESSAIS SUR SITES LIQUEFIÉS EN NOUVELLE ZÉLANDE
ESSAIS EN CHAMBRE DE CALIBRATION A L'I.M.G.

rapport des travaux effectués dans le cadre du
Programme National de Recherche M.R.E.S "Piezocone"

Pierre FORAY
Jean-luc PAUTRE | INSTITUT de MECANIQUE de GRENOBLE

Colloque AFPS, Paris 91

Action Internationale : Prédiction du Potentiel de Liquéfaction des Sables à l'aide du Piézocône

Pierre FORAY, Maître de Conférences, Institut de Mécanique de
Grenoble
John BERRILL, Professeur, Université de Canterbury (Nouvelle-
Zélande)
Jean CANOU, Chercheur, CERMES/ENPC

Voyage dans le temps et les projets

Thèse Bouguerra 1997

Prévision du potentiel de liquéfaction des sites sableux
à l'aide d'appareillages in-situ

Rapport PARN 2006

Rapport pour le Pôle grenoblois d'études et prévention des risques
naturels : compte rendu des travaux du programme de recherche 2005



CHARACTERISATION DU COMPORTEMENT NON LINEAIRE
DE LA COUCHE LACUSTRE DANS LA CUVETTE
GRENOBLOISE

Pierre FORAY¹
Safwan LABANIEH
Jane JERRAM

Fluid-soil-structure interaction in liquefaction around a cyclically moving
cylinder Projet LIMAS 2004

Liquéfaction des sols
et essais in situ

Recherches en cours
Lien avec la pratique

Exposé CFMS 5.5.2005

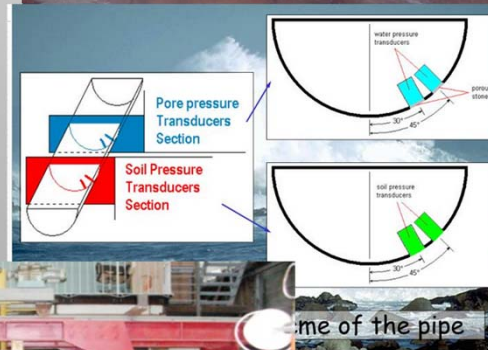
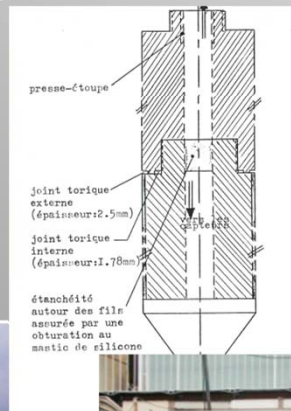
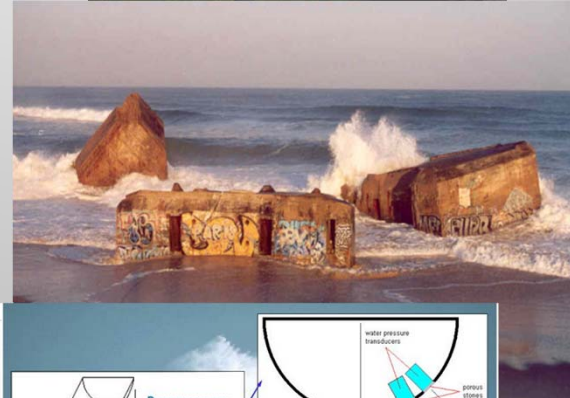
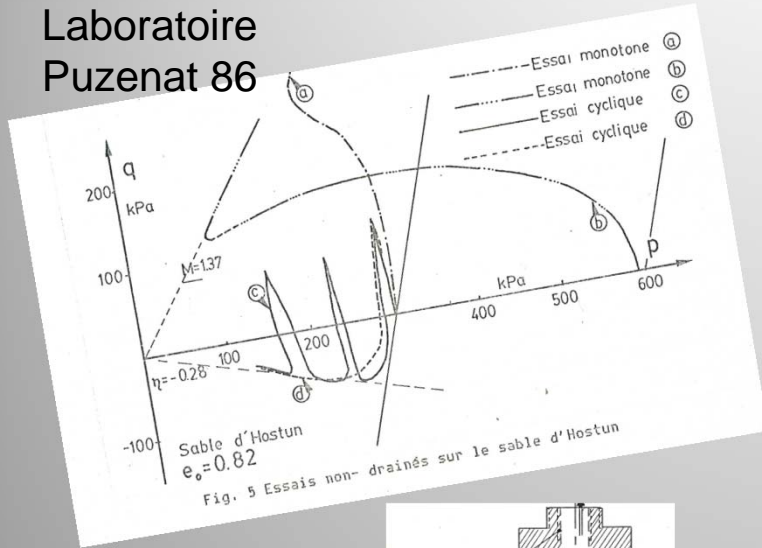
SEISMIC LIQUEFACTION PREDICTION AND NON
LINEAR
RESPONSE IN SOILS :
APPLICATION TO THE GRENOBLE BASIN REGION
† Jane JERRAM
2008



ANR BellePlaine

Voyages dans les moyens d'études

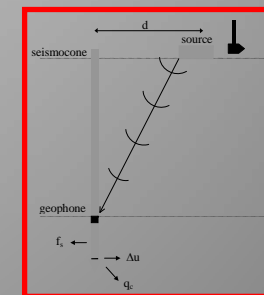
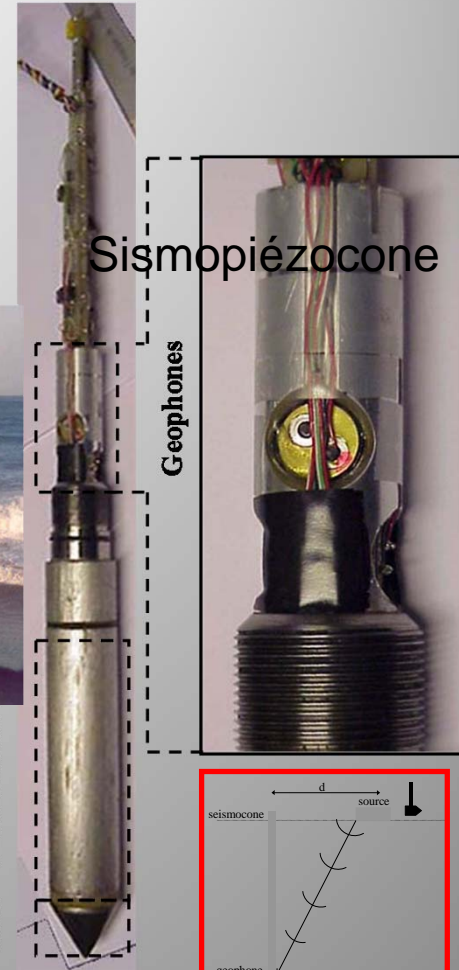
Laboratoire
Puzenat 86



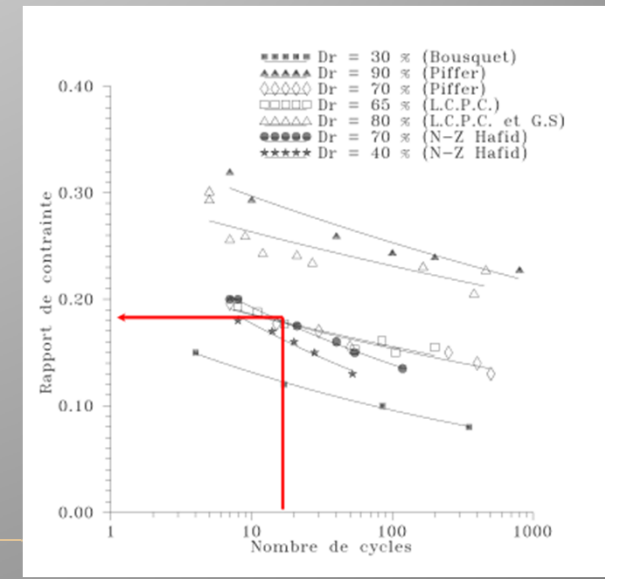
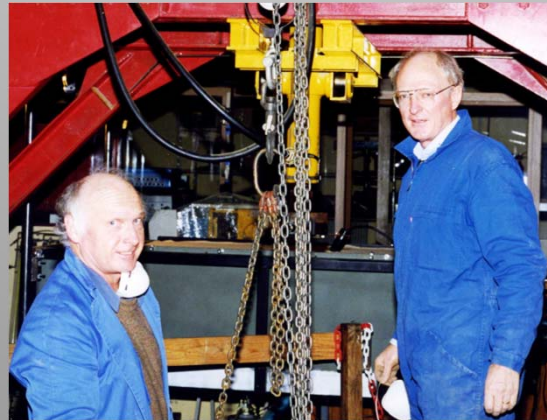
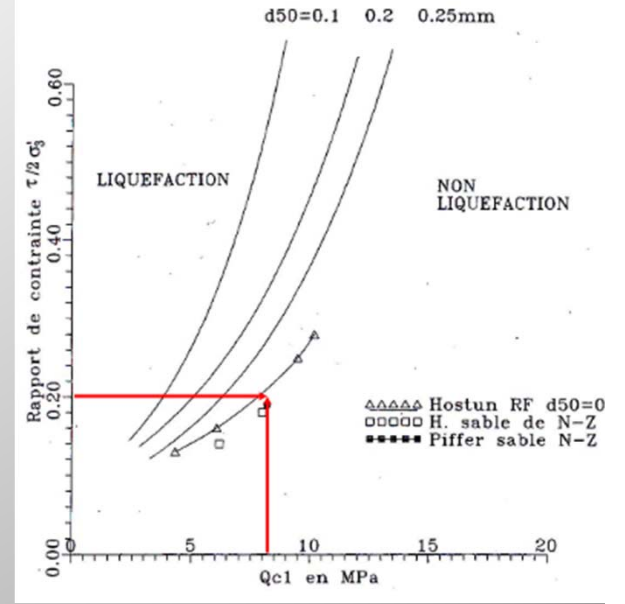
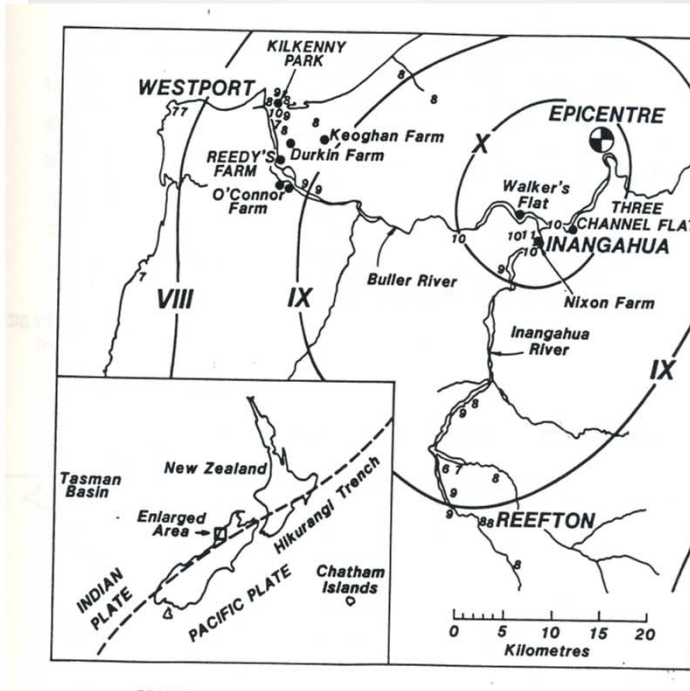
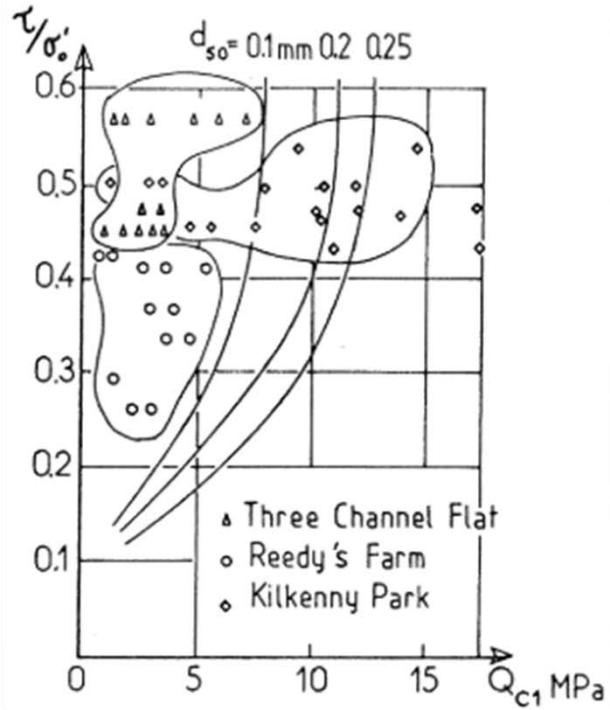
Piézocone Parez



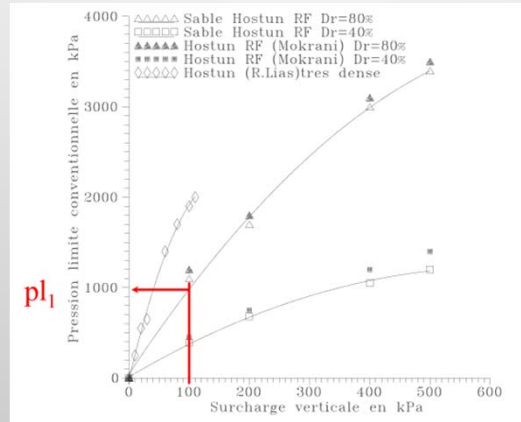
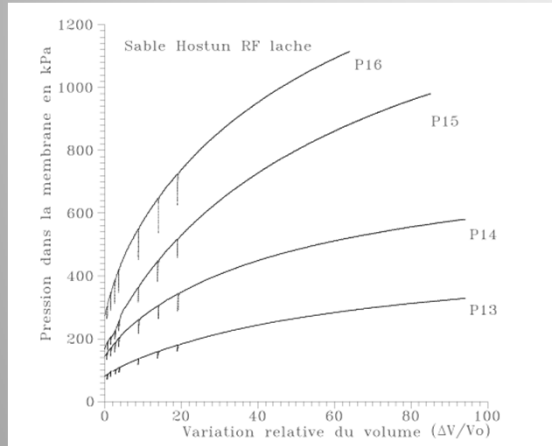
Collaboration S



Voyage dans des résultats

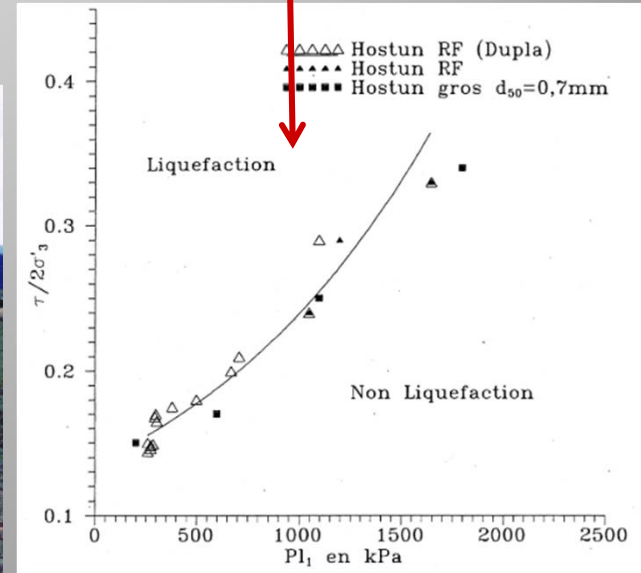
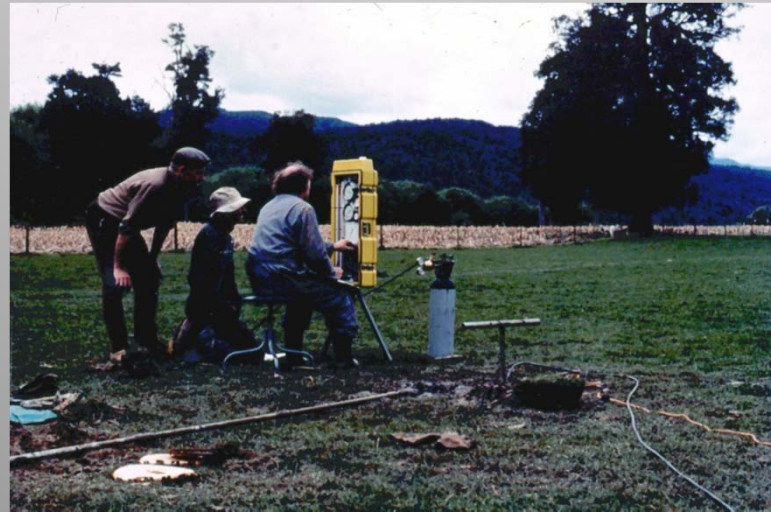


Voyage dans les résultats



Et la pressiométrie aussi

Essais sur sites ayant liquéfié



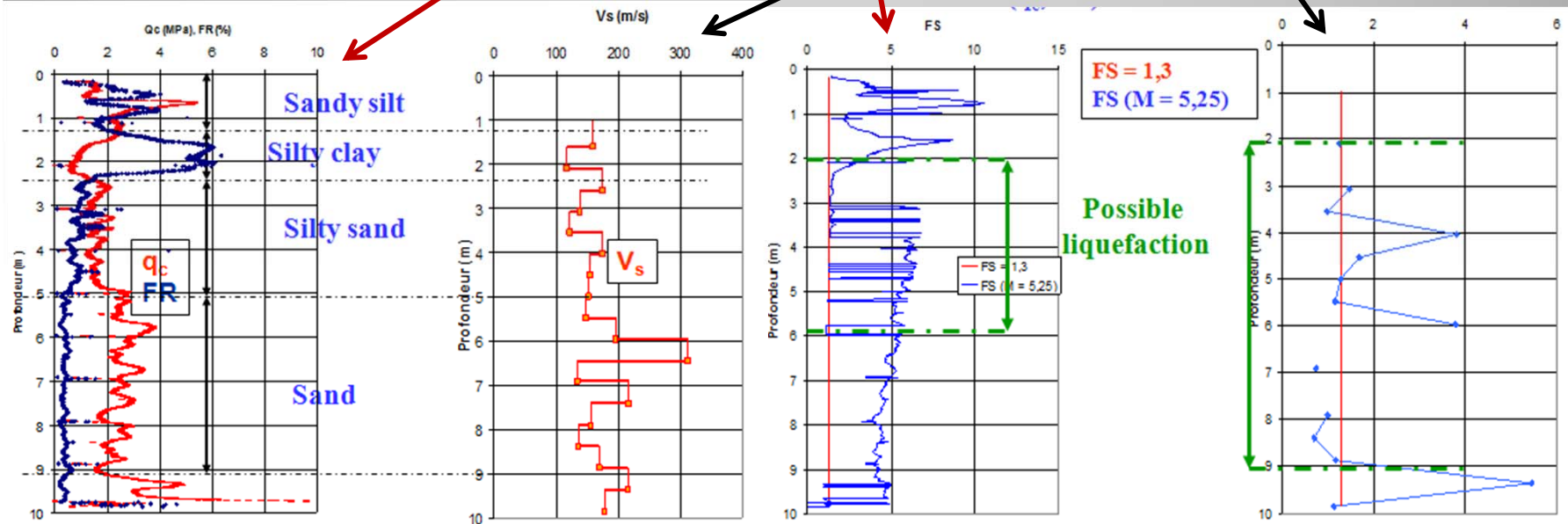
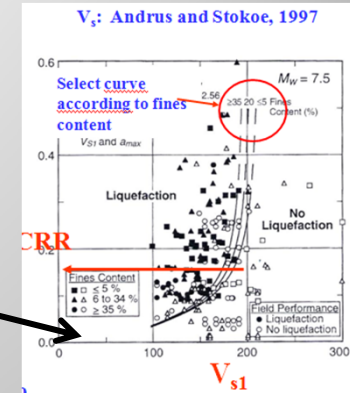
Abaque de Seed

Voyage dans les résultats



Robertson

Andrus et Stokoe



Liquefaction of Loose Sand Fills in 1989 Loma Prieta Earthquake, California : Comparison with Large Scale and Centrifuge Tests

Ricardo Dobry, RPI, USA

(in collaboration with T. Abdoun, S. Thevanayagam, H. El-Ganainy
and V. Mercado)

Pierre Foray Memorial Day

Paris, January 27, 2015

San Francisco Bay Area of California



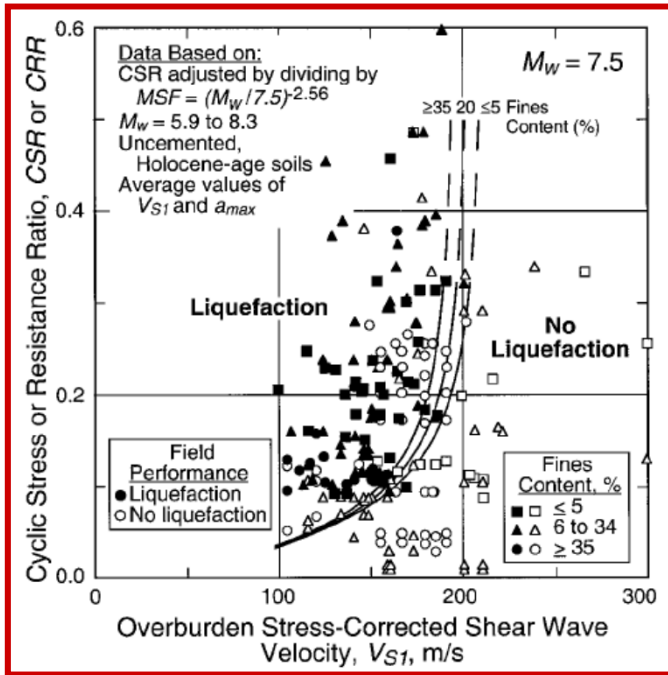
Liquefaction San Francisco in 1989 (USGS, 1989)



Focus and Objectives of Paper

- **Focus:** Loose clean and silty sand fills in and around San Francisco that liquefied in 1989 Loma Prieta earthquake
- **Tools:**
 - Andrus and Stokoe V_s field liquefaction chart
 - Large scale (1g) liquefaction tests
 - Centrifuge liquefaction tests
- **Objectives:**
 - Integrate centrifuge-large scale testing with field case histories
 - Validate centrifuge testing as credible tool toward improved methods for liquefaction evaluation and mitigation of sandy fills

Field Liquefaction Chart, Large Scale Tests, Centrifuge Tests



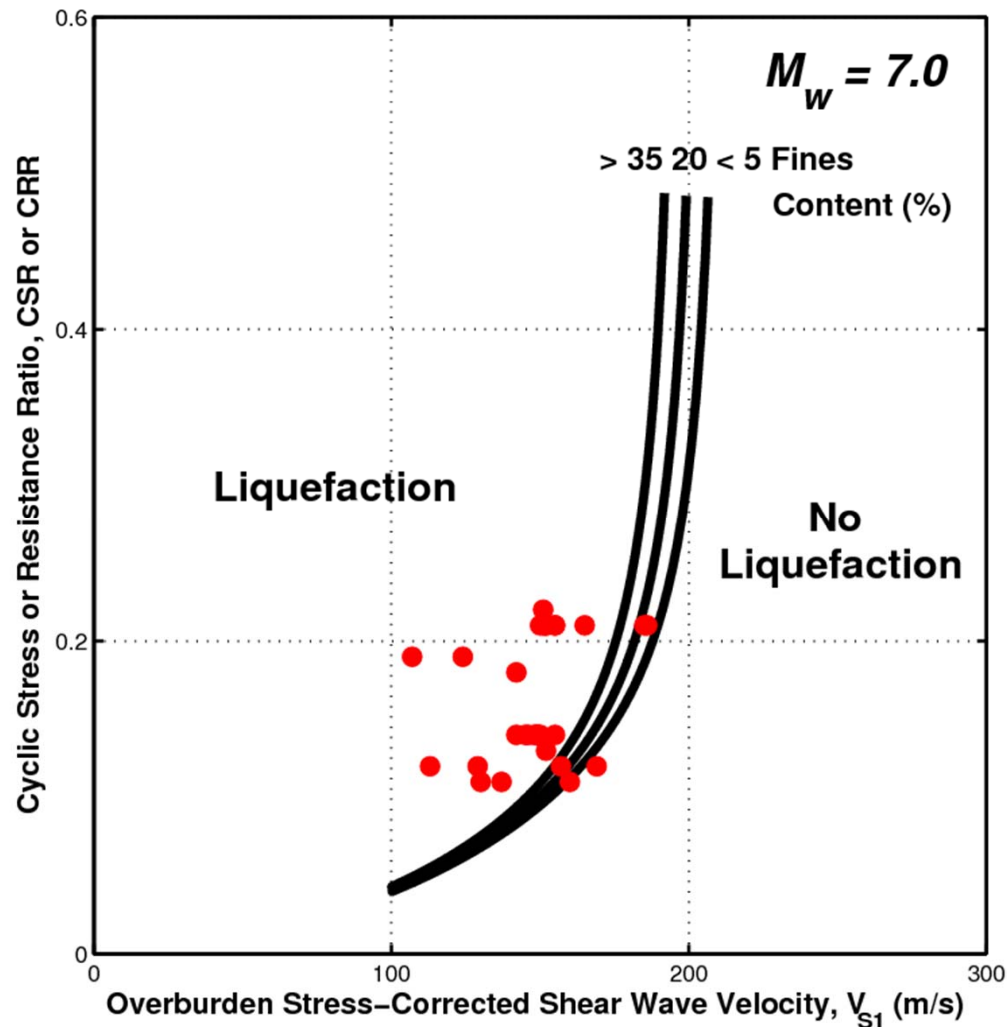
V_s Liquefaction Chart
 (Andrus and Stokoe,
 2000)

Centrifuge Liquefaction
 Tests (RPI)

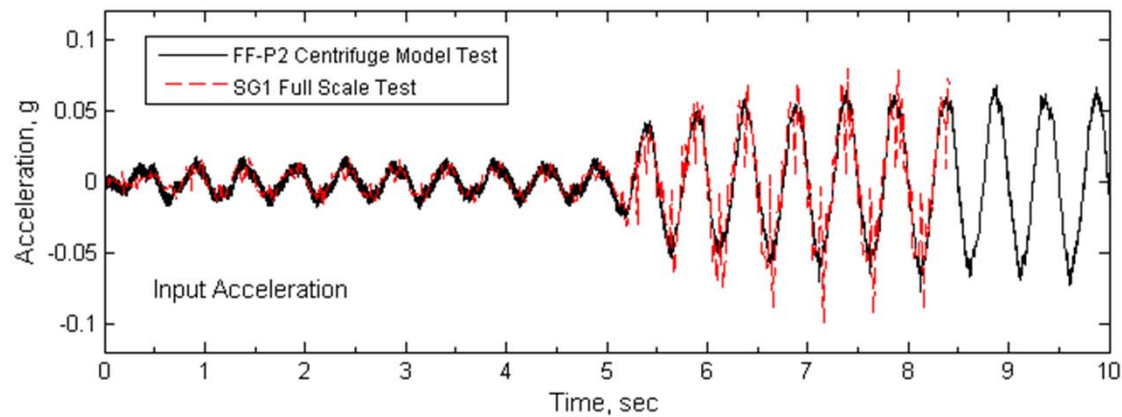
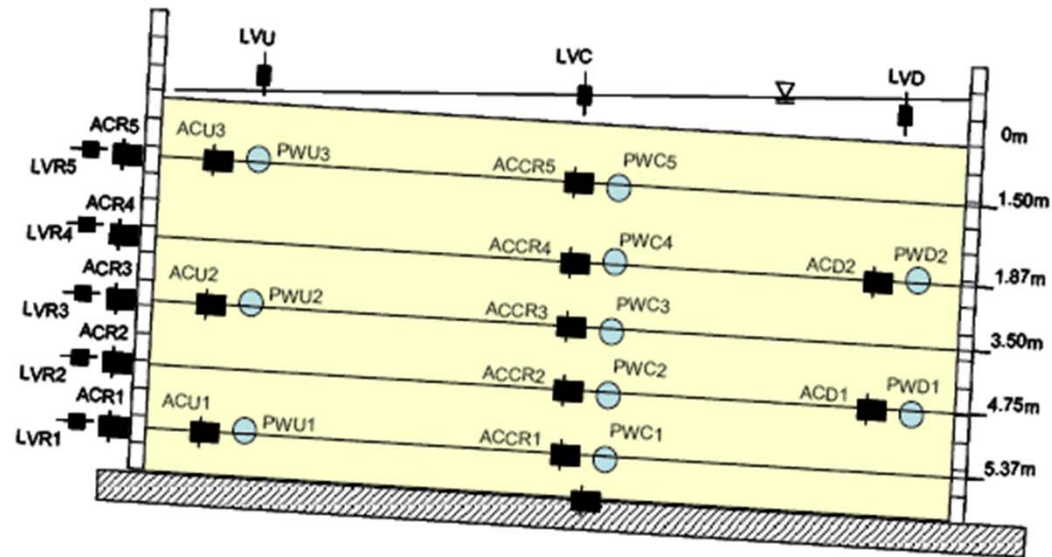


Large Scale Liquefaction
 Tests (U. Buffalo)

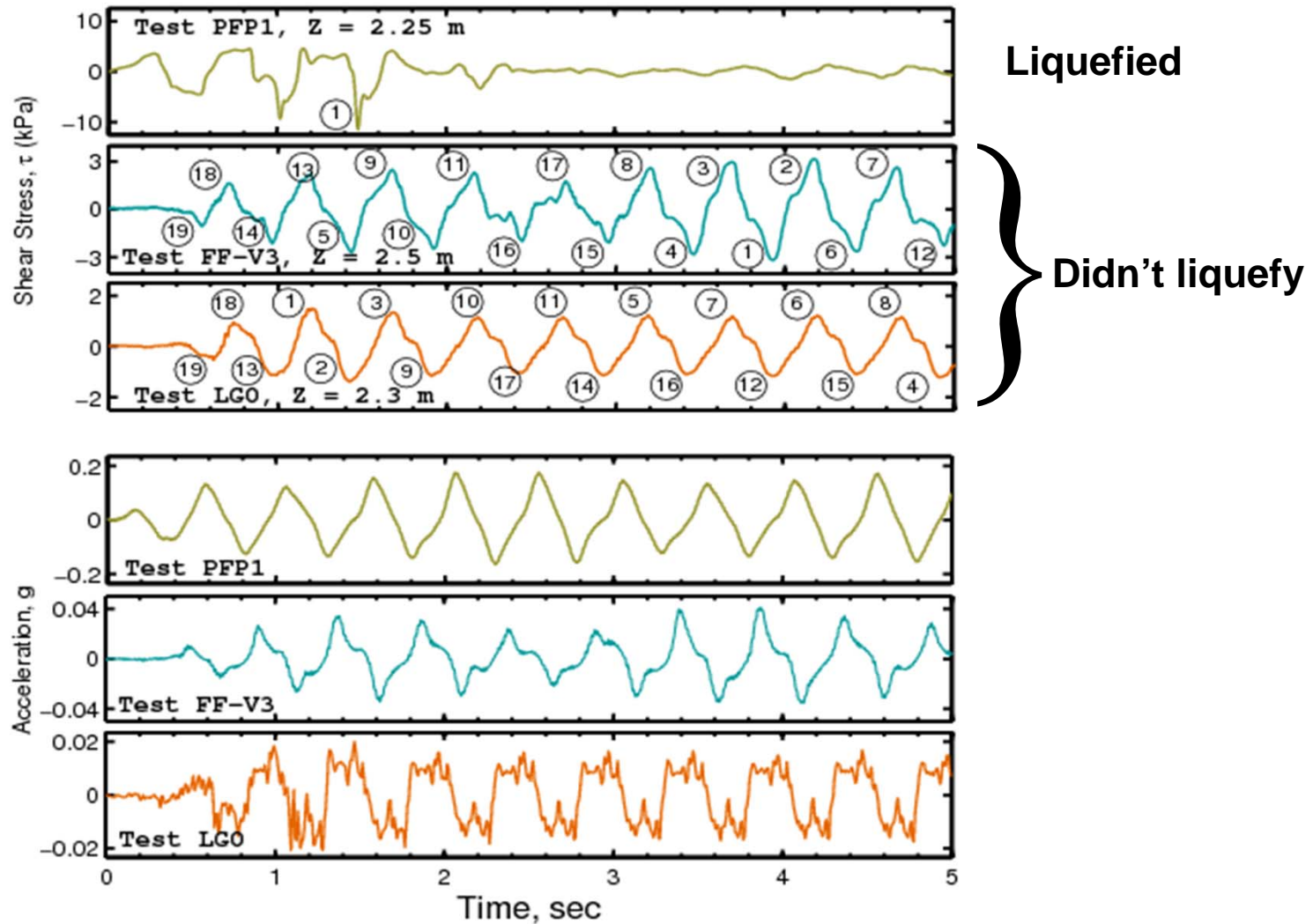
Case Histories of Loose Fills That Liquefied in Loma Prieta Earthquake



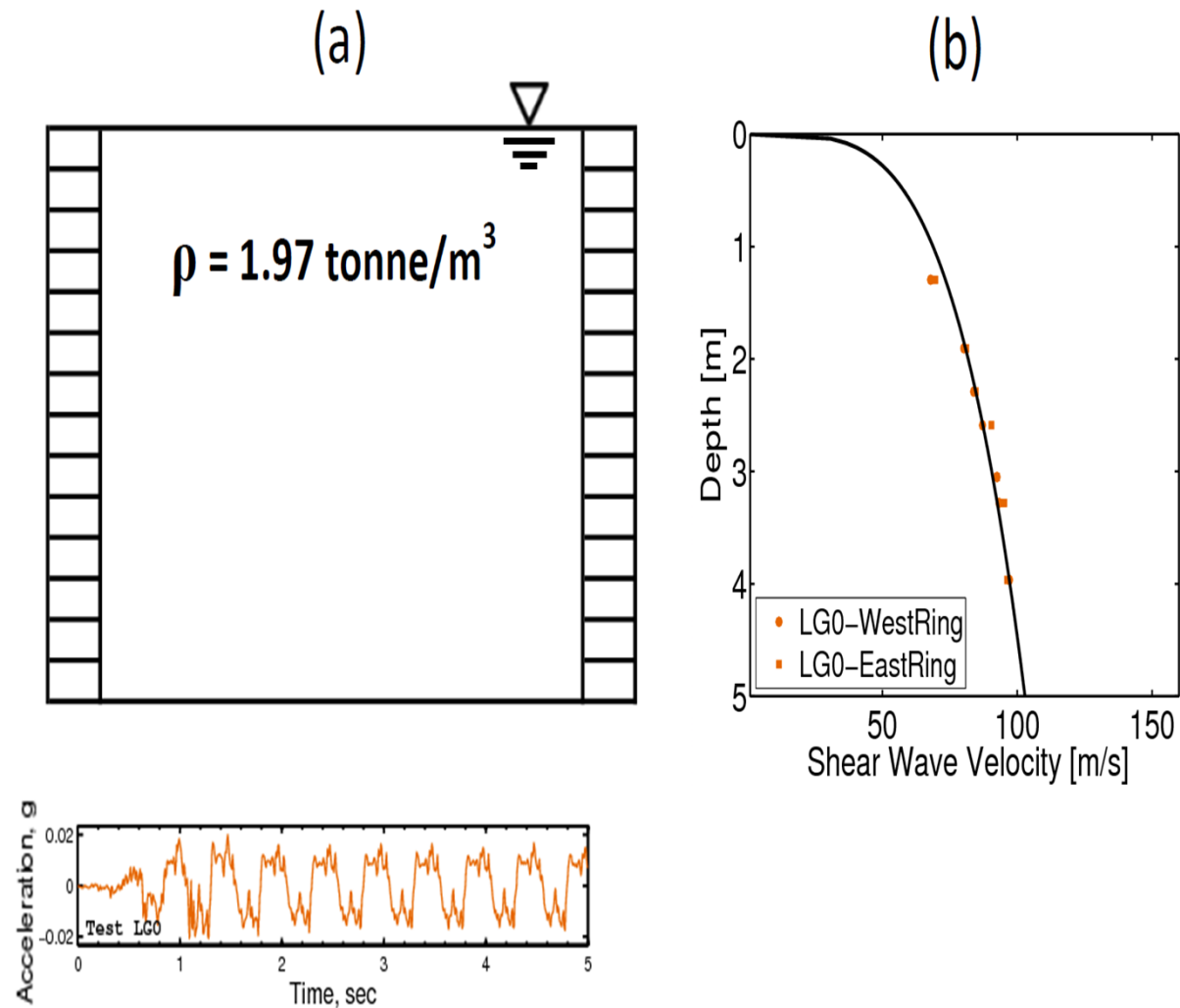
Centrifuge Liquefaction Tests



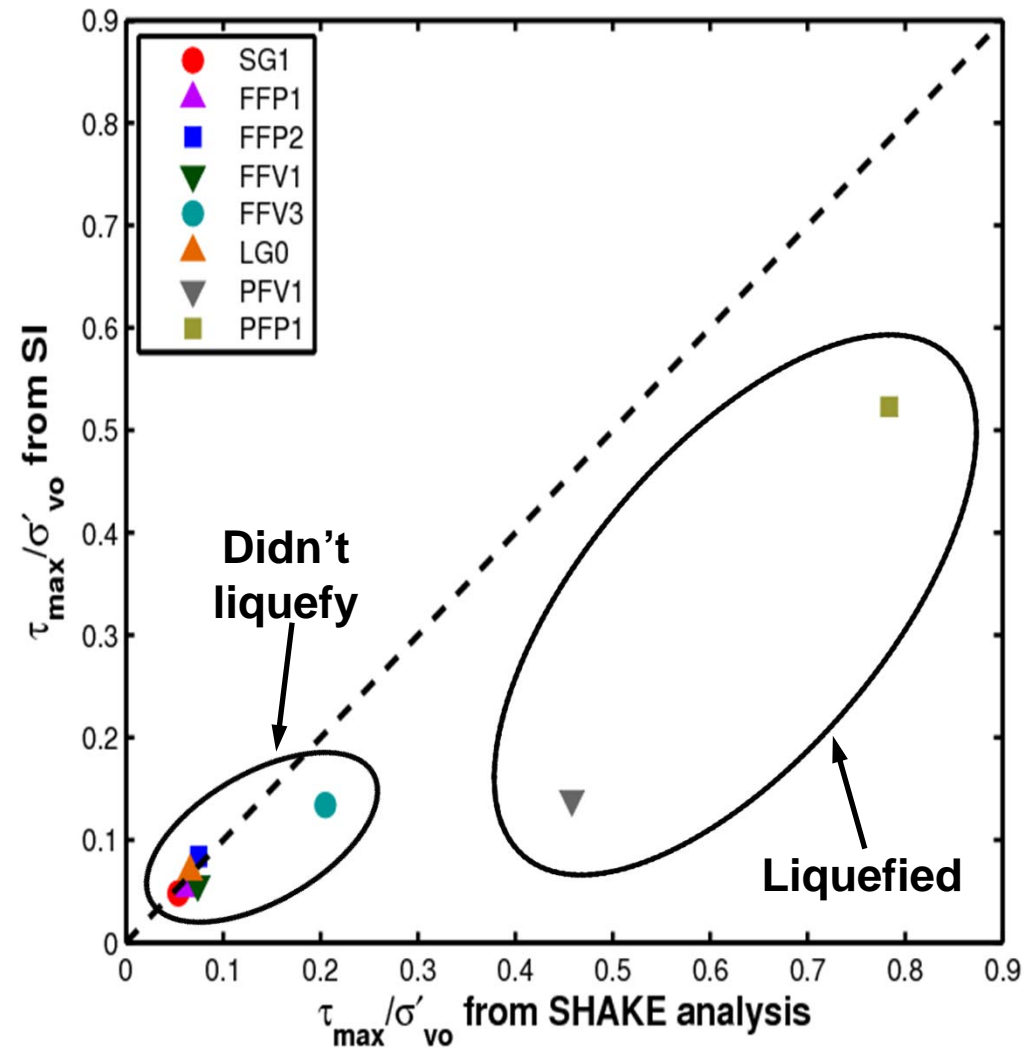
Cyclic Shear Stresses for Tests That Did and Did Not Liquefy



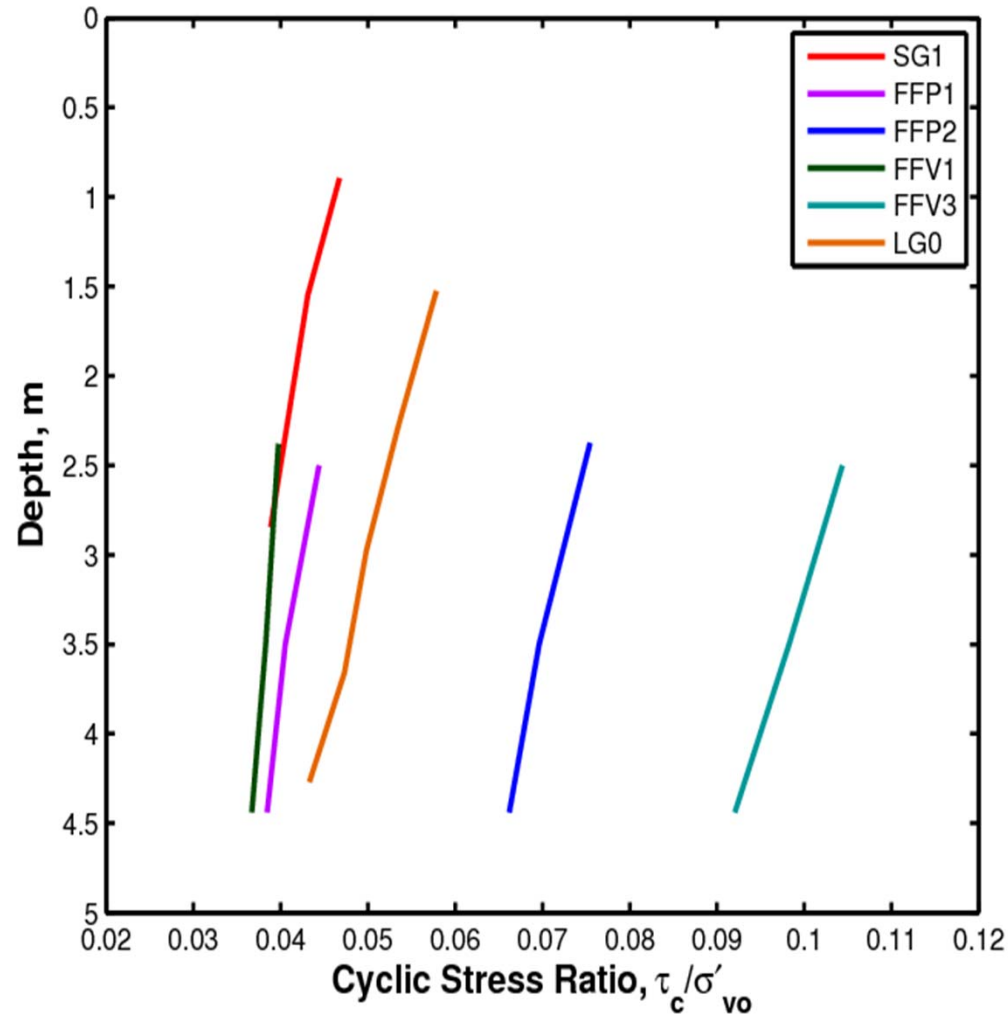
SHAKE Site Response Analysis of Large Scale Test LG-0



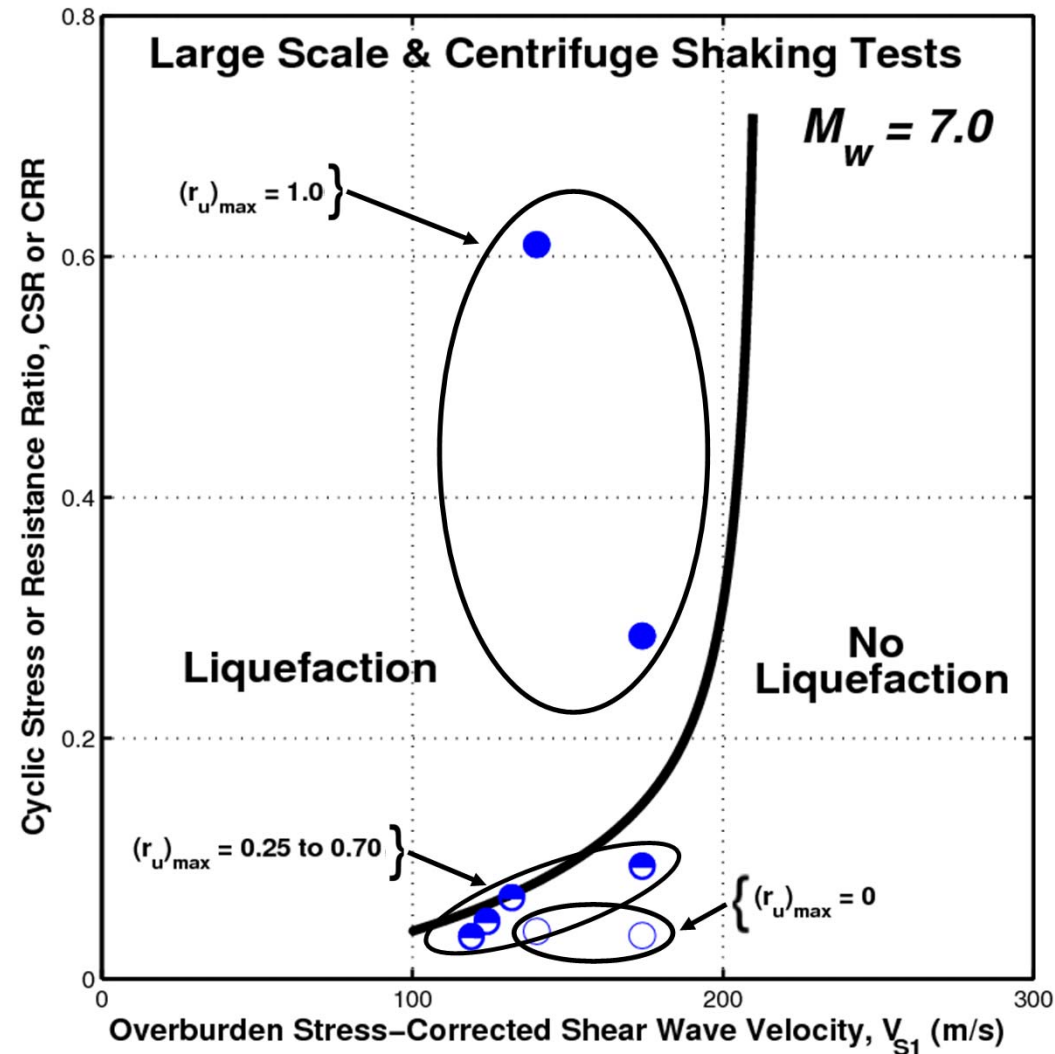
Maximum Shear Stress Ratios at Mid-Depth: SHAKE vs. System Identification (all tests)



Cyclic Stress Ratios for Six Tests That Did Not Liquefy (from SI)



Large Scale / Centrifuge Test Results and Field Liquefaction Chart



Conclusions

- Good integration between centrifuge and large scale tests when V_s is used as main parameter
- Good agreement between centrifuge / large scale testing and field liquefaction response of loose fills in 1989 Loma Prieta earthquake when using V_s
- No difference found in lab or field liquefaction triggering response between clean and silty sands up to about 30% nonplastic fines content
- Centrifuge and large scale testing have been validated and can be used with confidence in future studies to evaluate and mitigate liquefaction of loose sandy fills

Merci pour votre attention
et
Merci Pierre
pour toutes ces années