

# PEER – Development of Next Generation Liquefaction (NGL) Database for Liquefaction-Induced Lateral Spread

## Research Team

- University of Utah,
- University of Washington
- Brigham Young University,
- Oregon State University
- Others?



# PEER – Next Generation Lateral Spread Database

## Transportation Pooled Fund Study Contributors

- U of U Transportation Center – Mountain Plains Consortium (MPC)
- CalTrans
- UDOT
- WSDOT
- ADOT?
- Others?

# Solicitation Details

The screenshot shows a web browser window with the URL [www.pooledfund.org/Details/Solicitation/1405](http://www.pooledfund.org/Details/Solicitation/1405). The page header features the TPF logo and the text 'TRANSPORTATION POOLED FUND PROGRAM'. A navigation menu includes links for Home, About TPF, How to Participate, Open Solicitations, Search, Forms, Success Stories, Related Links, and Email Alerts. The main content area is titled 'Solicitation Detail View' and describes the 'Development of Next Generation Liquefaction (NGL) Database for Liquefaction-Induced Lateral Spread'. A 'Tools' sidebar on the right contains links for Contacts, FAQs, and Glossary. The 'General Information' section lists the following details:

<b>Solicitation Number:</b> 1405	<b>Status:</b> Solicitation posted	<b>Date Posted:</b> Jul 21, 2015
<b>Last Updated:</b> Oct 6, 2015	<b>Solicitation Expires:</b> Jul 21, 2016	<b>Partners:</b> UT
<b>Lead Agency:</b> Utah Department of Transportation		

The 'Contact Information' section provides the following details:

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The 'Financial Summary' section is currently empty.

<http://www.pooledfund.org/Details/Solicitation/1405>

## Overall Research Objectives

- ❑ Improve the methodologies used to estimate the amount of permanent ground displacement associated with liquefaction-induced lateral spread
  - ❑ Update, validate and improve current empirical, semi-empirical, analytical and numerical methods using a peer-reviewed, community database of well-documented case histories of liquefaction-induced lateral spread.
  - ❑ Coordinate efforts with NGL triggering database

# Phases

- (1) Database development and collection (Funded)
- (2) Gathering additional subsurface and topographical data (Unfunded)
- (3) Predictive model development (Unfunded)

## Phase I Objectives

Phase I: (1) develop peer-reviewed and consistent methods for data documentation and archiving,

(2) develop quality assurance protocols for assessing and documenting data quality

(3) develop methods/protocols to quantify uncertainties associated with the collected data

(4) populate the database with well-documented case histories of liquefaction-induced lateral spread

(5) disseminate this database for general use using web-based software tools.

# Tasks

## Description of Tasks:

- (1) Procurement of software and kickoff meeting
- (2) Development of database protocols and quality assurance procedures
- (3) Structuring of database
- (4) Draft and review progress report pertaining to Tasks 1 and 2
- (5) Selection of case histories to populate dataset.

Possible case histories: 1906 San Francisco, California; 1964 Alaska; 1964 Niigata, Japan; 1971 San Fernando, California; 1979 Imperial Valley, California; 1983 Nihonkai-Chu, Japan; 1983 Borah Peak, Idaho; 1987 Superstition Hills, California; 1989 Loma Prieta, California; 1999 Kocaeli, Turkey; 1999 Chi-Chi, Taiwan; 2004 Northridge, California; 2005 Kobe, Japan; 2010 Chile; 2011 Tohoku, Japan; 2011 Christchurch New Zealand.

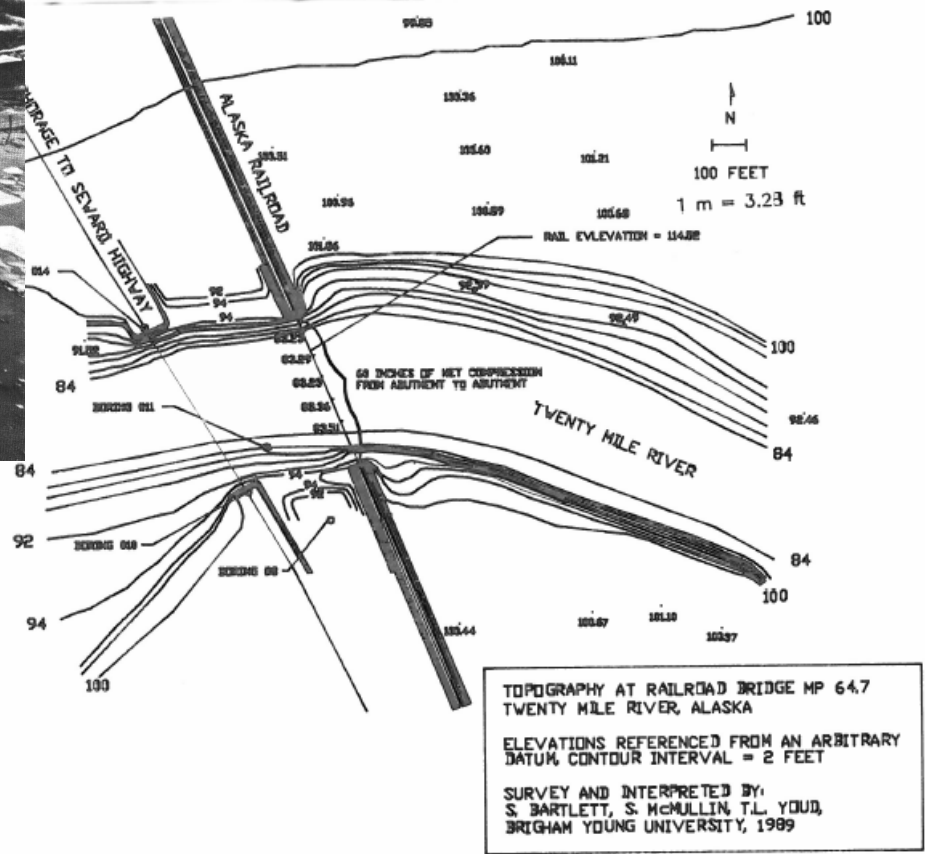
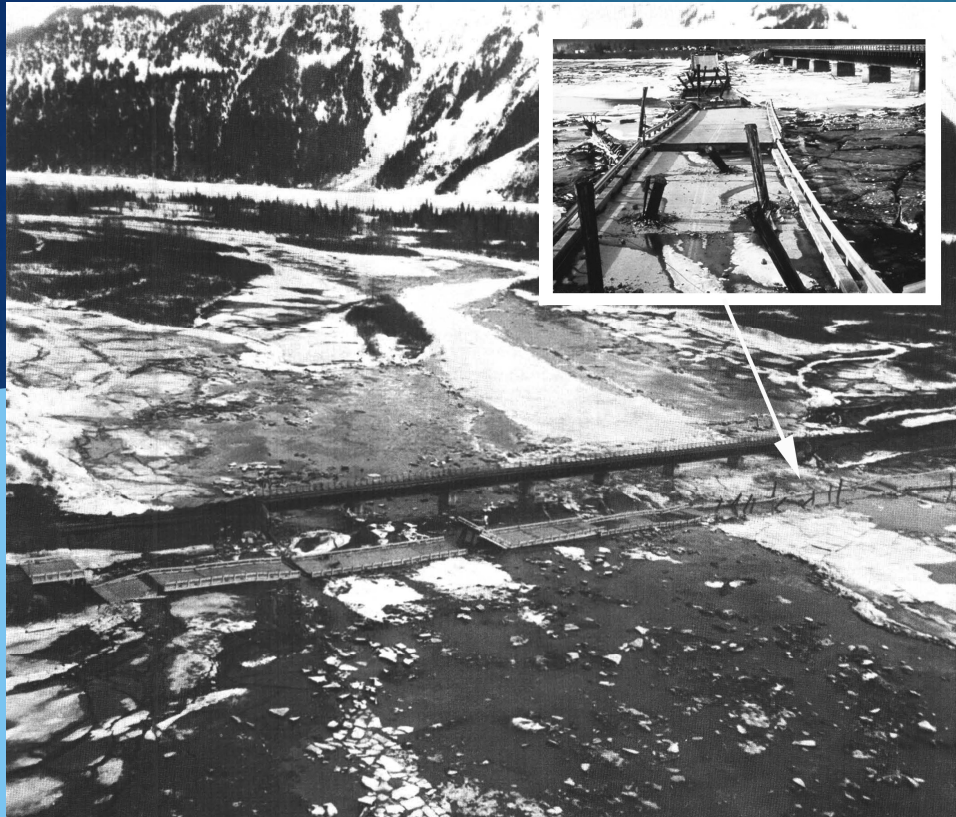
- (6) Population of database and review of data
- (7) Draft technical report
- (8) Final technical report

# Data Types

- Displacement Estimates
  - Point Estimates
  - Vector Displacement Maps
  - Crack Maps
- Subsurface Information
  - Interpretive soil profiles (graphs)
  - Borehole data (electronic & graphs)
    - Soil type
    - Layering
    - SPT N values
    - Grain size
  - CPT logs
  - Vs measurements
- Other Information
  - Surficial geology maps
  - Topographical maps
  - Aerial photography
  - Reports



# Photos and Topographical Maps



1964 Alaska  
Earthquake

# Aerial Photography and Satellite Imagery

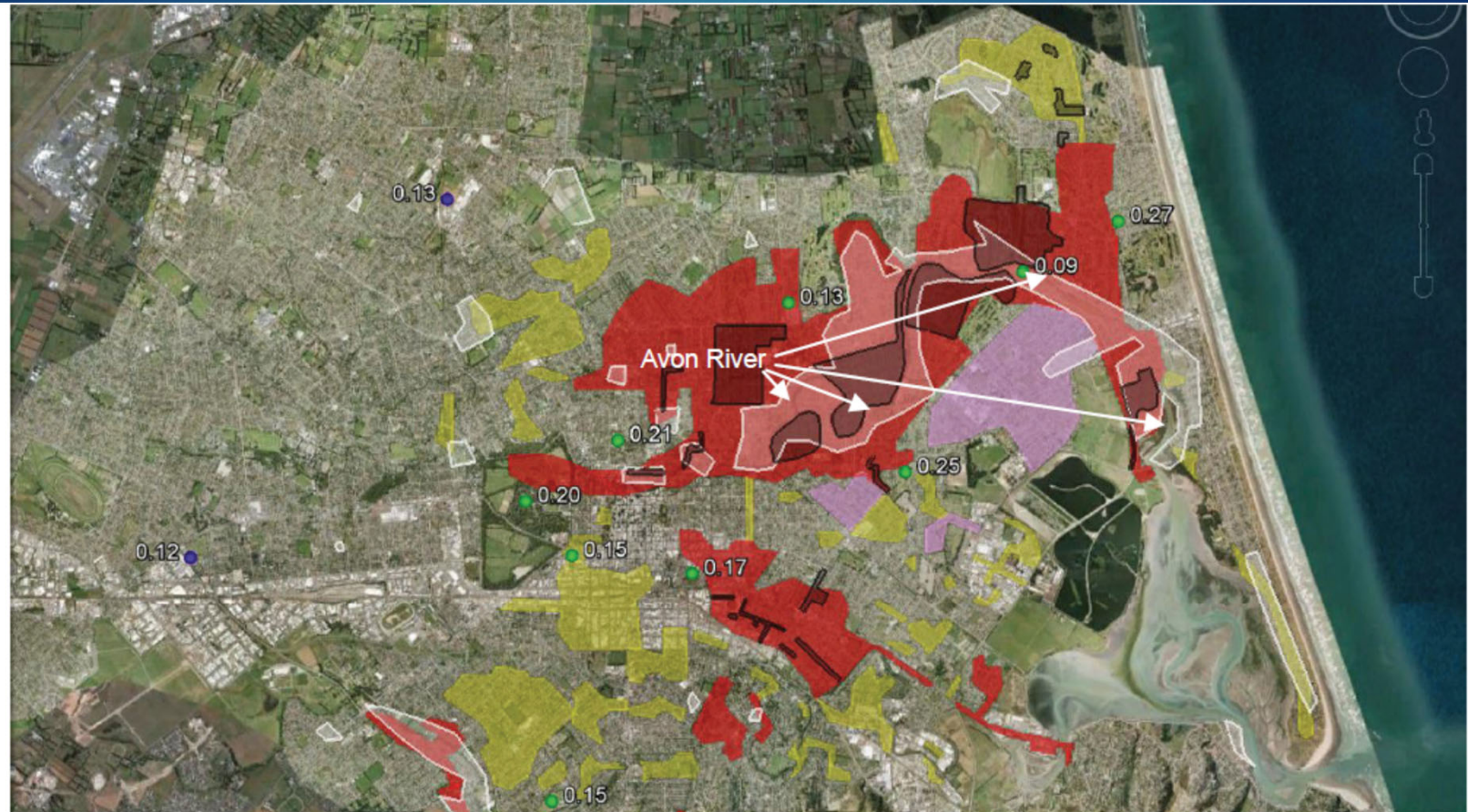
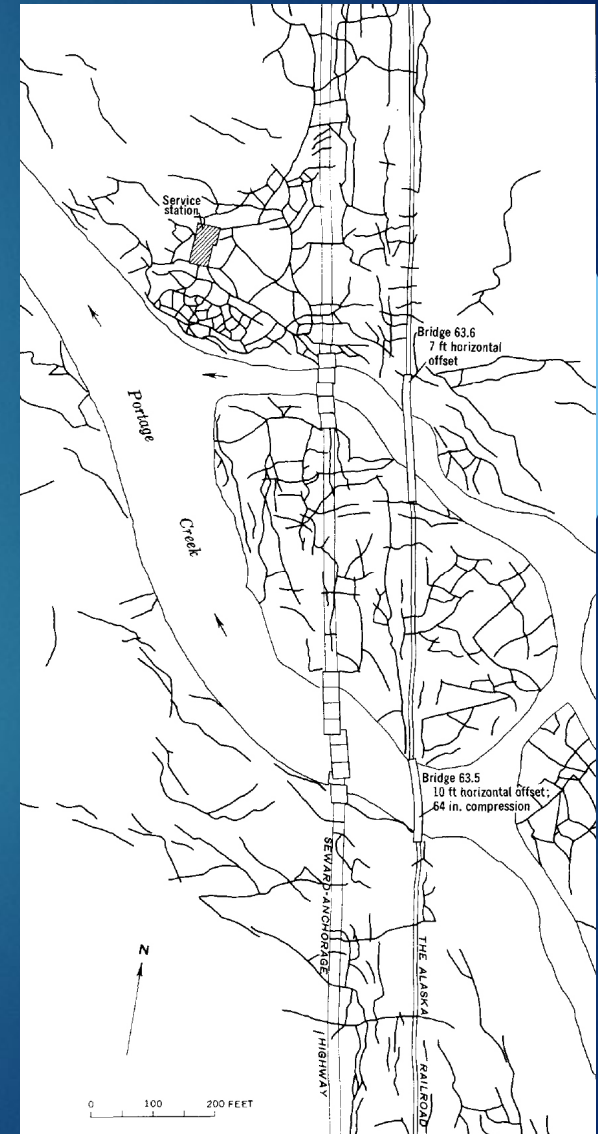
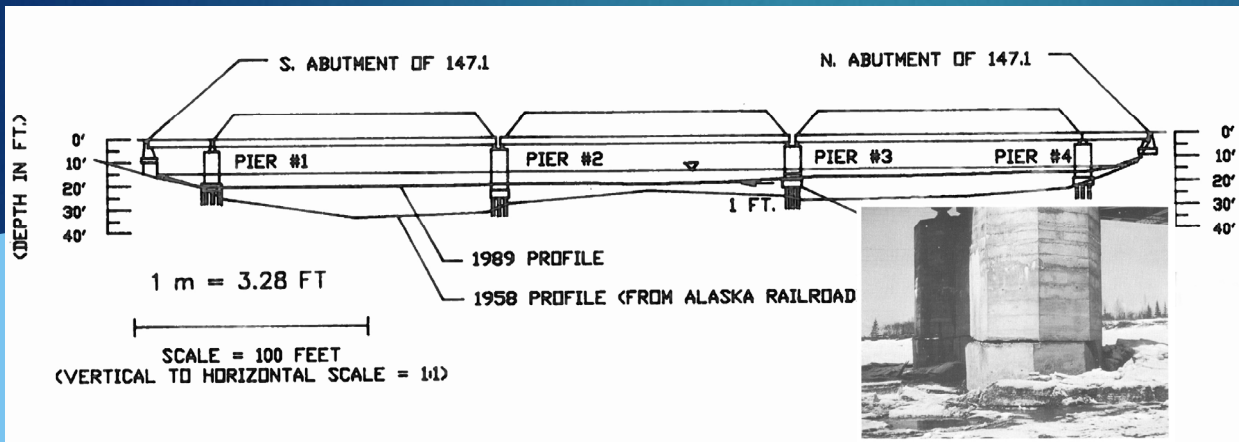


Fig. 4 Liquefaction maps indicating areas of observed liquefaction in the 4 September 2010 (white

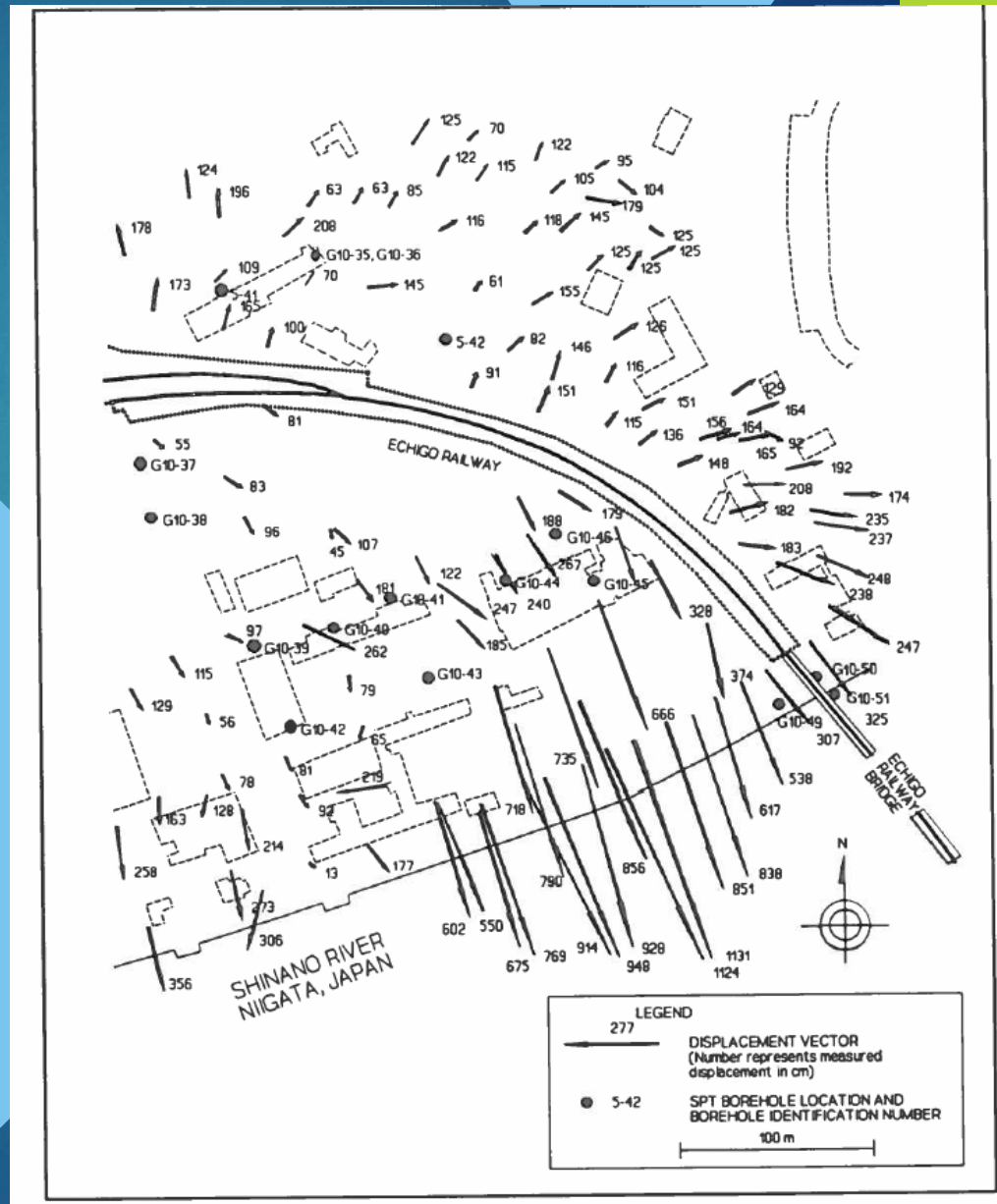
2010 Christ Church Earthquake

# Interpretive Plots and Maps



# Vector Displacement Maps

1964 Niigata, Japan  
Earthquake



# Lateral Spread Displacement Profiles

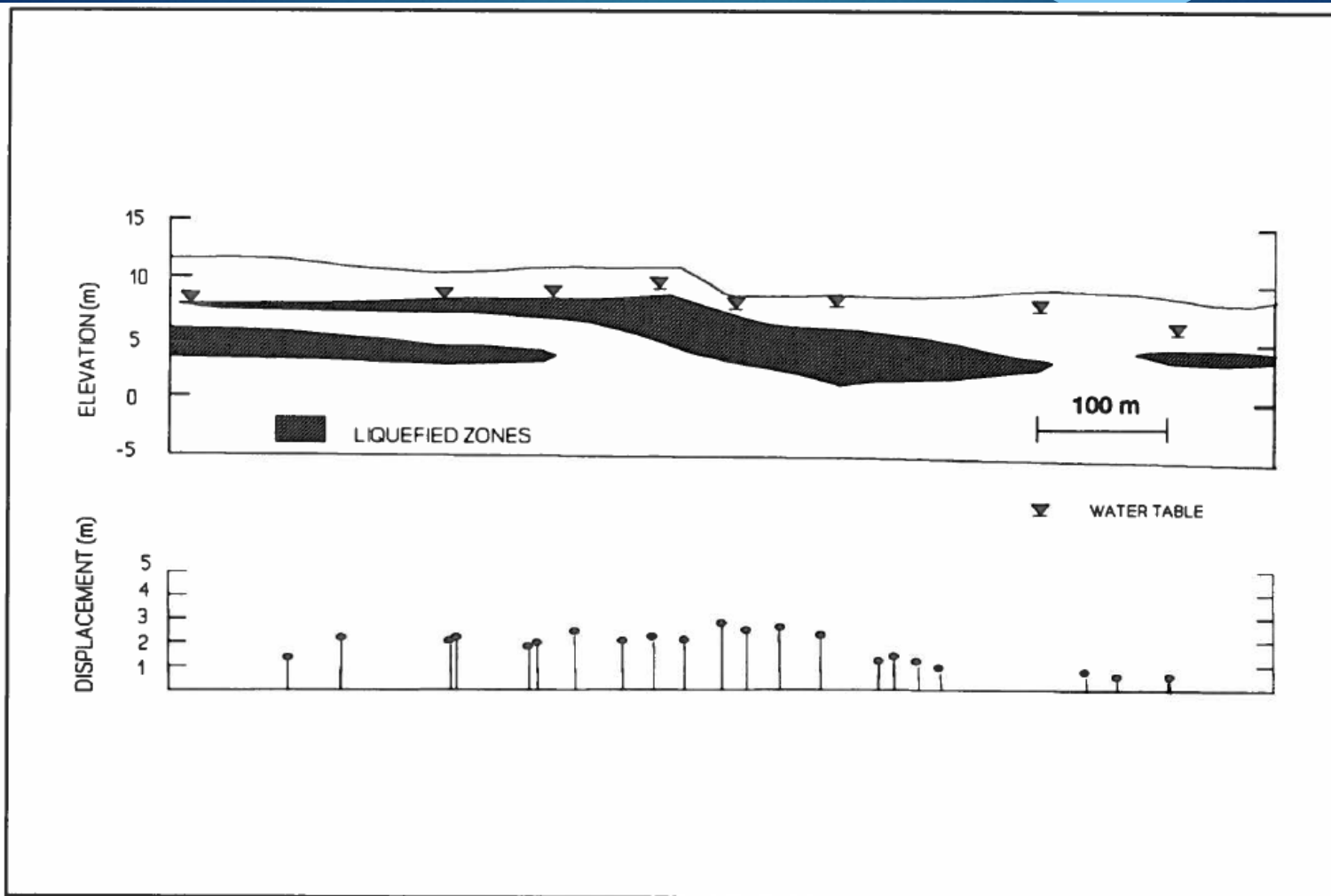
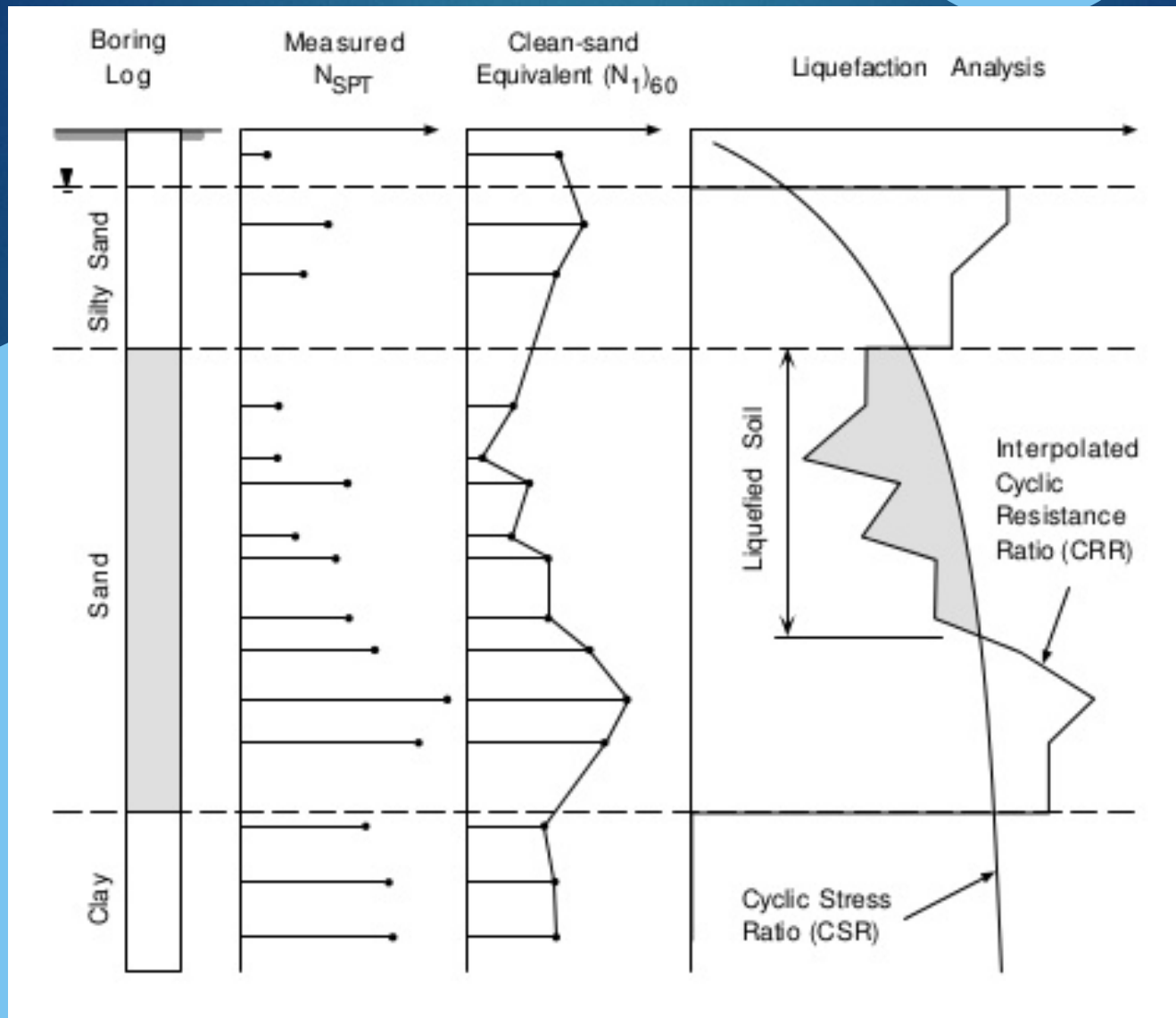


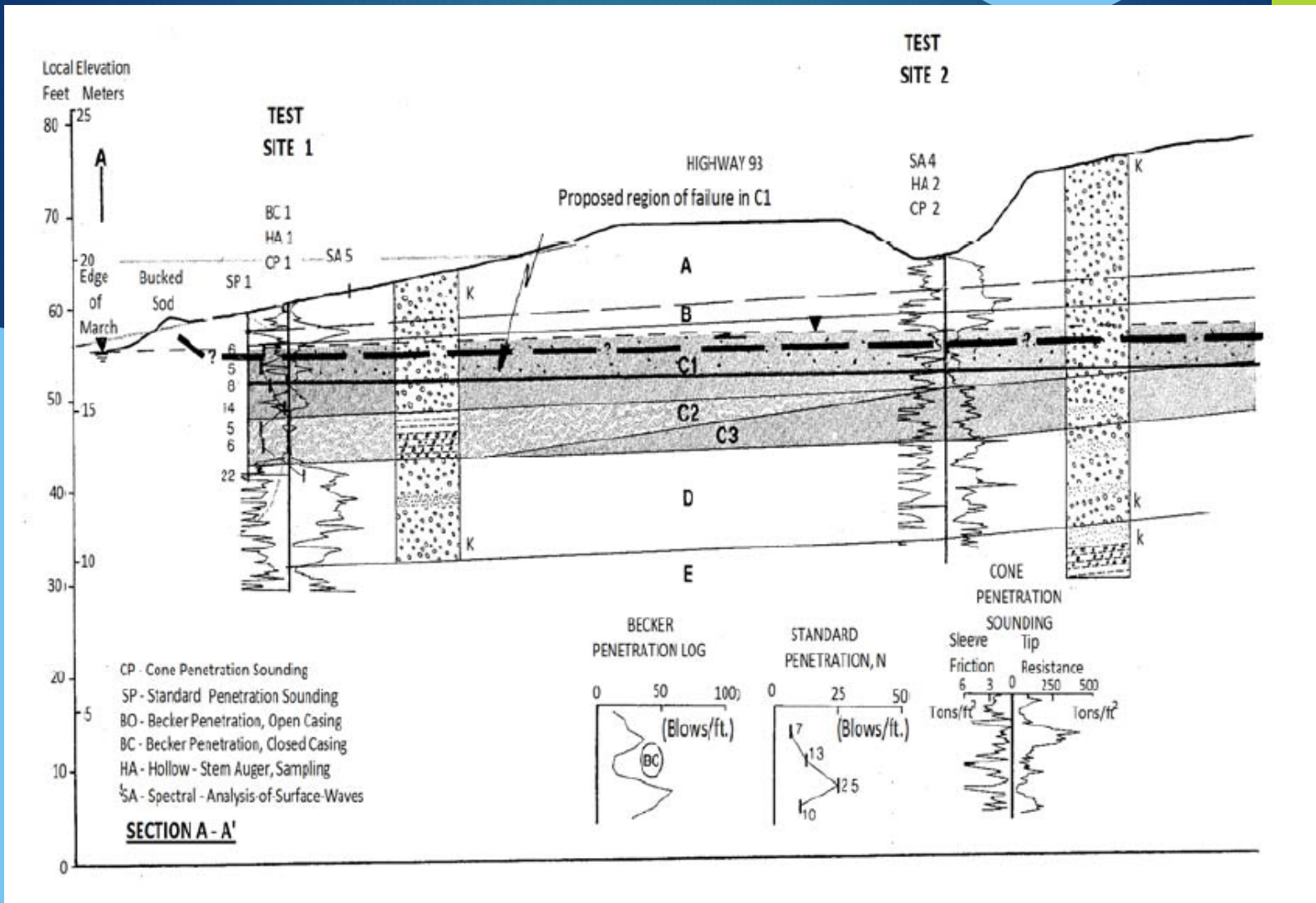
Figure 3-12 Typical topography and ground displacement pattern for ground slope failures in Noshiro, Japan, (after Hamada et al., 1986).

1983 Nihonkai-Chubu, Japan Earthquake

# Subsurface Data



# Subsurface Profiles



1983 Borah Peak Idaho Earthquake

# Conclusions

- Lateral spread database must accommodate various data types that is spatially located
- All data has value if the quality and uncertainty can be quantified
  - Data quality ranking scheme
  - Uncertainty estimates or statistical distribution about estimates
- More information req'd
  - Instrumented sites
  - Vector displacement maps
  - Estimates of strong motion
  - Large subduction zone earthquakes
  - Silty and gravelly soils
  - Aging effects