Progress Memo

Monday, August 5, 2019

To: Technical Advisory Committee, David Stevens – Research Project Manager, Utah Department of Transportation

Cc: Kevin Franke BYU, Jonathan Stewart, UCLA

From: Steven Bartlett

Subject: Task 7 – Database Population, Pacific Earthquake Engineering Research (PEER) Next Generation Liquefaction (NGL) Database of case histories of liquefaction-induced lateral spread.

This memo summarizes the progress made to date regarding Phase 1 - Task 7 of the PEER NGL database.

Background:

The primary outcome of this research is a vetted and community database of seismic, topographical, geotechnical and horizontal displacement measurements about case histories of liquefaction-induced lateral spread for further research and model development by other researchers and investigators under the auspices of the Pacific Earthquake Engineering Research (PEER) Center (http://peer.berkeley.edu/). Secondary outcomes are software development and support required to host and disseminate this database and supporting information.

This project has the following research objectives: (1) develop peer-reviewed and consistent methodology for data documentation and archiving of lateral spread case histories, (2) develop quality assurance protocols for assessing and documenting data quality, (3) develop methods and/or protocols to quantify uncertainties associated with the collected data, (4) populate the case history database with well-documented examples of liquefaction-induced lateral spread, (5) explore methods of integrating SPT and CPT data into analyses and evaluations, (6) disseminate this database for general use using web-based software tools.

Project Tasks:

The following is a list of tasks assigned to Phase I of the project: Project Initiation, Database Screening, Structuring and Population.

Tasks

1. Kickoff meeting and procurement of software
2. Development of data quality indicators/metrics, quality assurance, and database population protocols.
3. Defining methods for quantifying the uncertainty of key inputs
4. Development and structuring of database
5. Selection of case histories
6. Obtaining and screening of case history information
7. **Population of case history database (addressed by this progress report)**

Table 1 below shows those case histories that have been selected for inclusion in the NGL lateral spread database. These case histories are being populated and checked by students of the University of Utah and Brigham Young University under the supervision of Drs. Bartlett and Franke, respectively. The database consists of earthquake, seismological, topographic, geology and geotechnical information which has been structured as a spatial database.

Table 1 – List of Case Histories for Databasing as part of Task 7

1906 San Francisco, California Earthquake	Coyote Creek Bridge near Milpitas California
	Mission Creek Zone in San Francisco
	Salinas River Bridge, Salinas California
	South of Market Street Zone in San Francisco
1964 Alaska Earthquake	Bridges 141.1, 147.4, 147.5, 148.3 on Matanuska River, Alaska
	Bridges 63.0, 63.5 on Portage Creek Alaska
	Highway Bridge 629 Placer River, Alaska
	Bridge 605A, Snow River, Alaska
	Bridges, 3.0, 3.2, 3.3, Resurrection River, Alaska
1964 Niigata, Japan Earthquake	Numerous lateral spreads within Niigata City
1971 San Fernando Earthquake	Jensen Filtration Plant, San Fernando, California
	Juvenile Hall, San Fernando, California
1979 Imperial Valley Earthquake	Heber Road near El Centro, California
	River Park near Brawley, California
1983 Borah Peak, Idaho Earthquake	Whiskey Springs near Mackay, Idaho
	Pence Ranch near Mackay, Idaho
1983 Nihonkai-Chubu, Japan Earthquake	Numerous lateral spreads within Noshiro City
1987 Superstition Hills, California Earthquake	Wildlife Instrumentation Array near Brawley, California
1989 Loma Prieta, California Earthquake	Pajaro River
	Moss Landing, Monterey
	Marina District, San Francisco
1990 Luzon Philippines Earthquake	Dagupan City
1991 Costa Rica Earthquake	Railroad and Highway Bridge sites
1994 Northridge, California Earthquake	King Harbor, Redondo Beach
	Balboa Blvd., San Fernando Valley
	Malden Street, San Fernando Valley
	Wynne Avenue, San Fernando Valley
	Potrero Canyon, San Fernando Valley
1995 Kobe, Japan Earthquake	Lateral Spreads on Port Island
	Lateral Spreads on Roko Island
1999 Kocaeli, Turkey Earthquake	Cark Canal Site
	Yakin Street Site

	Cumhuriyet Avenue Site
	Sapanca Hotel Site
	Police Station Site, East Izmit Bay
	Soccer Field Site. East Izmit Bay
	Degirmendere Nose Site
	Yalova Harbor Site
1999 Chi-Chi, Taiwan Earthquake	Wufeng Site C
	Wufeng Site C1
	Wufeng Site B
	Wufeng Site M
	Nantou Site N
	Leuw Mei Bridge
2010 Maule, Chile Earthquake	Port Coronel
	Valparaiso
	Llacolen Bridge
	Juan Pablo II Bridge, Concepcion
	La Mochita Bridge, Concepcion
	Tubul Bridge, Tubul
	Mataquito Bridge, Iloca
2011 Tohoku, Japan Earthquake	Several lateral spreads
2010 Darfield, New Zealand Earthquake	Several lateral spreads in and around Christchurch
2011 Christchurch, New Zealand Earthquake	Several lateral spreads in and around Christchurch

Table 2 shows the progress made by the University of Utah as of August, 2019 for Task 7 in terms of data records for the various data types (e.g., displacement vectors, boreholes, soil information, topology, etc.)

Table 2 – Records Entered for Case History Database

Case history	Site	Displacement vectors	Boreholes	Subsurface data rows	Topology points
1964 Niigata	F10	179	24	359	429
	G10	654	68	1574	256
	H9	155	4	92	235
	J9	442	45	192	297
	K8	285	4	62	302
	Total	1715	145	2279	1519
1983 Noshiro	South	266	128	462	176
	North	147	59	848	348
	Total	413	187	1310	524
1971 San Fernando	Jensen water plant	69	33	494	flatfile

		Juvenile hall	79	6	121	flatfile
		Total	148	39	615	NA
	1964 Alaska	Total	14	20	411	flatfile
	1979 Imperial Valley	Heber road	29	7	135	flatfile
		River park site	NA	4	62	NA
		Total	29	11	197	
	1983 Borah peak, Idaho	Whiskey springs	3	3	54	flatfile
		Pence Ranch	3	6	69	flatfile
		Total	6	3	54	flatfile
	1906 San Francisco	Mission creek zone	9	8	92	flatfile
		South of market area	7	7	80	NA
		Foot of market area	3	NOTE ->		NA
		Total	19	15	172	
	1987 Superstition Hills, California		7	2	53	flatfiles
	1989 Loma Prieta, California		3	15	236	flatfiles
	2010 Chile	Lo Rojas port		8	2494	in progress
		North and South Pier		7		
		Juan Pablo II Bridge		8		
		La Mochita Bridge		2		
		Llacolen Bridge		6		
		Mataquito Bridge		6		
		Tubul Bridge		6		

	Raqui 1 and Raqui 2 Tubul		1		
1990 Luzon Phillipines					
1991 Costa Rica					
1994 Northridge, California					
1995 Kobe, Japan					
Total		**2347**	**435**	**5274**	**2043**

BYU continues to work on the 2010 Maule, 2011 Tohoku, 2010 Darfield, and 2011 Christchurch earthquakes. Cross-checking of the inputs has recently initiated and is still on-going between the two universities. Below is the status of the population of the database for these earthquakes.

Case History	Site	Displacement Vectors	Boreholes	Subsurface Data Rows	Topology Points
2010 Maule, Chile	Juan Pablo II	1	7	685	In Progress
	La Mochita	3	2	45	
	Llacolen	3	5	235	
	Lo Rojas Port Coronel	1	8	1732	
	Mataquito	3	6	556	
	Port Coronel	5	7	575	
	Tubul Bridge	2	6	185	
	Tubul Raqui	2	1	40	
	Total	20	42	4053	0
2011 Tohoku, Japan	Hitachinaka	In Progress	2	30	In Progress
	Isobe		3	68	
	Sodegaura		2	36	
	Tone		1	26	
	Tokyo Bay		In Progress	In Progress	
	Total	0	8	160	0
2010 Darfield,	Avon River	37	In Progress	In Progress	In Progress
	Bottle Lake	3			

New Zealand (September)	Heathcote River	2			
	Styx River	10			
	Courtenay Stream/Kaiapoi River	19			
	Total	71	0	0	0
2011 Christchurch, New Zealand (February)	Avon River	53	In Progress	In Progress	In Progress
	Heathcote River	6			
	Courtenay Stream/Kaiapoi River	3			
	Total	62	0	0	0

I would be happy to discuss this subject further if there are any questions.

Respectfully,

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