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**Proceedings
from the
Fifth U.S.-Japan Workshop on
Earthquake Resistant Design of
Lifeline Facilities and Countermeasures
Against Soil Liquefaction**

held at the
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PREFACE

The Fifth U.S.-Japan Workshop was held near Salt Lake City, Utah, several kilometers from the Wasatch fault zone. This fault zone is the longest and most active normal-slip fault in North America. Workshop participants were taken on a field trip by the Utah Geological Survey to several trenches crossing the Wasatch fault zone, where evidence of previous surface faulting was preserved in the form of rupture planes and colluvial wedges in the walls of the trenches. This evidence is a striking reminder that the Salt Lake Valley is an active seismic area. Over 80 percent of Utah's 2.3 million residents live and work in the vicinity of the fault zone.

The Fifth U.S.-Japan Workshop was not only an international event, but a forum for engineers and utility personnel in the Salt Lake City area to learn about state-of-the-art developments and to participate in the presentations and discussions as experienced members of a community which must implement seismic resistant design of lifeline facilities and countermeasures for soil liquefaction. It is our hope that research results presented in these proceedings will be applied in engineering decisions and planning, and that the workshop has acted as a catalyst in promoting the transfer of technology from theory to practice.

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TABLE OF CONTENTS

SECTION	TITLE	PAGE
I	OBSERVATIONS DURING PAST EARTHQUAKES	
	Liquefaction-Induced Ground Failures and Displacements Along the Shiribeshi-toshibetsu River Caused by the 1993 Hokkaido Nansei-oki Earthquake <i>R. Isoyama</i>	1
	Liquefaction-Induced Ground Surface Disruption <i>T.L. Youd and C.T. Garris</i>	27
	Ground Deformations and Their Effects on Structures in Midorigaoka District, Kushiro City, During the Kushiro-oki Earthquake of January 15, 1993 <i>K. Wakamatsu and N. Yoshida</i>	41
	Geotechnical Observations at the Van Norman Complex After the 1994 Northridge Earthquake <i>C.A. Davis and J.P. Bardet</i>	63
	Observed and Predicted Ground Deformation - Miller Farm Lateral Spread, Watsonville, California <i>T.L. Holzer, J.C. Tinsley III, M.J. Bennett, and C.S. Mueller</i>	79
	Characteristics and Damage Investigation of 1993 Hokkaido Nansei-oki Earthquake <i>T. Iwatate, Y. Sawada, D. Inoue, and Y. Sakamoto</i>	101
	Liquefaction of Calcareous Sands and Lateral Spreading Experienced..... in Guam as a Result of the 1993 Guam Earthquake <i>S. Vahdani, R. Pyke, and U. Siriprusanen</i>	117
	Effects of Remedial Measures Against Liquefaction at 1993 Kushiro-oki Earthquake <i>S. Iai, Y. Matsunaga, T. Morita, M. Miyata, H. Sakurai, H. Oishi, H. Ogura, Y. Ando, Y. Tanaka, and M. Kato</i>	135
	Water Systems Performance: Northridge Earthquake, January 17, 1994..... <i>L. Lund</i>	153
II	MECHANISMS OF LIQUEFACTION AND LARGE GROUND DEFORMATION	
	Construction of Stress-Strain Histories from Recorded Dynamic Response <i>R. Dobry, M. Gutierrez, M. Zeghal, and A-W. Elgamal</i>	171
	Behavior of Sand After Liquefaction <i>N. Yoshida, S. Yasuda, M. Kiku, T. Masuda, and W.D.L. Finn</i>	181
	Post Liquefaction Deformation of Cohesionless Soil..... <i>A.K. Hussein and H.E. Stewart</i>	199
	A Consideration of the Mechanism for Liquefaction-Related Large Ground Displacement <i>M. Hamada, H. Sato, and T. Kawakami</i>	217
	A Comparative Study of Predictive Methods for Liquefaction Induced.. Embankment Displacements <i>G R. Martin and P. Qiu</i>	233

TABLE OF CONTENTS (Cont'd)

SECTION	TITLE	PAGE
	Torsional Shear and Triaxial Compression Tests on Deformation	249
	Characters of Sands Before and After Liquefaction <i>S. Yasuda, T. Masuda, N. Yoshida, H. Nagase, H. Kiku, S. Itafuji, K. Mine, and K. Sato</i>	
	Ground Motion Characteristics and Their Relation to Soil Liquefaction at the Wildlife Liquefaction Array, Imperial Valley, California <i>R.E. Kayen, J.K. Mitchell, and T.L. Holzer</i>	267
	Experimental Study on Mechanical Properties of Liquefied Sand	285
	<i>T. Kawakami, N. Suemasa, H. Hamada, H. Sato, and T. Katada</i>	
	Review of Energy-Based Liquefaction Research at Case..... Western Reserve University <i>J.L. Figueroa, A.S. Saada, and L. Liang</i>	301
	Post-Liquefaction Ground Flow in Shaking Table Tests	315
	<i>H. Toyota and I. Towhata</i>	
	Evaluation of Liquefying Soil through Time Using System Identification	331
	<i>S. Glaser and R. Chung</i>	
	Recent Research on Liquefaction of Silts and Silty Sands at Santa Clara University <i>S. Singh</i>	347
	CANLEX (Canadian Liquefaction Experiment): A One Year Update	353
	<i>P.K. Robertson, B.R. List, and B.A. Hofmann</i>	
III	LIQUEFACTION AND DYNAMIC RESPONSE OF UNDERGROUND STRUCTURES	
	Evaluation for Earthquake Ground Motion of Sediment- Filled Basin Under Seismic Observation <i>K. Sato, T. Iwatate, S. Sasaki, and H. Yajima</i>	367
	Dynamic Analysis of Lateral Flow of Liquefied Ground.....	377
	<i>I. Towhata and H. Toyota</i>	
	VELACS Project: A Summary of Achievements	389
	<i>M.T. Manzari, K. Arulanandan, and R.F. Scott</i>	
	An Experimental Study of Effects of Laterally Flowing Ground on In-Ground Structures <i>H. Sato, M. Hamada, and M. Doi</i>	405
	An Assessment of VELACS "Class A" Predictions	415
	<i>J H. Prevost and R. Popescu</i>	
	A New Interpretation Method of Surface Wave Measurements to Obtain Representative Shear Wave Velocity Profiles of Soils <i>C.J. Poran, J A. Rodriguez-Ordenez, T. Satoh, and R. Borden</i>	425
IV	MITIGATION OF EARTHQUAKE AND LIQUEFACTION EFFECTS	
	Experiments on Force Acting on Underground Structures in Liquefaction-Induced Ground Flow <i>M. Miyajima and M. Kitaura</i>	445

TABLE OF CONTENTS (Cont'd)

SECTION	TITLE	PAGE
	Evaluation of Pile Response to Liquefaction-Induced Lateral Spread.....	457
	<i>T.D. O'Rourke, W.D. Meyersohn, Y. Shiba, and D. Chaudhuri</i>	
	High Ductility Aseismic Joint Spliced Pile Behavior When Subjected	481
	to Liquefaction-Induced Large Ground Displacements	
	<i>F. Miura, T. Miyasaka, and T. Hirata</i>	
	Mitigation of Liquefaction Hazards at Three California Bridge Sites	495
	<i>K. Jackura and A. Abghari</i>	
	Assessing Vulnerability of BC Gas Pipelines to Lateral Spread Hazards.....	515
	<i>D.G. Honegger</i>	
	Pipeline Design Against Sand Liquefaction in Isla Del Carmen, Mexico	531
	<i>V. Trueba-López and R. Flores-Berrones</i>	
	Preliminary Evaluation of the Use of Compaction Piles for Improvement of	547
	the Foundation Soils of the Coastal Dikes of Lake Maracaibo, Venezuela	
	<i>B. Villegas and J. Murria</i>	
V	LIFELINE PERFORMANCE AND LIQUEFACTION DURING EARTHQUAKES	
	Minimization of Seismic Damages.....	561
	<i>K. Kubo</i>	
	Estimation of Indirect Losses Caused By Disruption of Lifeline	565
	Service: A Pilot Study of the Memphis Light, Gas and Water System	
	<i>R.T. Eguchi and H.A. Seligson</i>	
	Time History Analysis of Seismic Serviceability of a. Water	577
	Supply System	
	<i>I.J. Markov, M.D. Grigoriu, and T.D. O'Rourke</i>	
	Troubles People Have to Suffer When Lifelines Fail to Function After	593
	Earthquake	
	<i>H. Hayashi, H. Kameda, and N. Nojima</i>	
	Guide to Documenting Earthquake Damage to Power Systems.. ..	601
	<i>A.J. Schiff</i>	
	Probabilistic Evaluation of Liquefaction Spread for Lifeline Structures	617
	<i>I. Katayama, J A Pires, and A.H.-S. Ang</i>	
	Failure Criterion for Buried Pipe Subject to Longitudinal PGD: Benchmark.. ..	639
	Case History	
	<i>M.J. O'Rourke and X. Liu</i>	
	Changing Needs for Hazard Information for Pipeline Loss Estimation.....	653
	<i>D. Ballantyne</i>	
	Shaking Table Tests on Floatation of Buried Pipes Due to Liquefaction.....	665
	of Backfill Sands	
	<i>S. Yasuda, H. Nagase, S. Itafuji, H. Sawada, and K. Mine</i>	
	Earthquake Performance of Gas Transmission Pipelines.....	679
	<i>T.D. O'Rourke and M.C. Palmer</i>	
	Magnitude Scaling Factors for Analysis of Liquefaction.....	703
	<i>T.W. Loertscher and T.L. Youd</i>	
	Damage to Water Pipes During the 1994 Northridge Earthquake	717
	<i>M. Hamada, T. Tazoh, T. Iwamoto, N. Suzuki, J. Ejiri, and K. Ohtomo</i>	

U.S.-JAPAN COOPERATIVE RESEARCH PROGRAM AND WORKSHOPS

The U.S.-Japan Research Program on Earthquake Resistant Design of Lifeline Facilities and Countermeasures Against Soil Liquefaction focuses on the earthquake performance of lifelines, with emphasis on liquefaction-induced large ground deformations. Large ground deformations are the principal cause of subsurface structural damage during earthquakes. Currently, there is a growing recognition in the civil and earthquake engineering communities of the importance of large ground deformations. Our understanding of the mechanisms of large ground deformations and their effects on lifeline facilities, and our ability to predict the magnitude and distribution of ground displacements have improved substantially in recent years to provide a rational framework for siting, design, and protective measures. Both Japanese and U.S. researchers have been working on this topic, and it was recognized that considerable benefits will result from their cooperative effort to collect case history data and their recommendations about the most appropriate analytical methods and design procedures.

The program was initiated formally in November, 1988 with the signing of a Memorandum of Understanding between the Japanese and U.S. sides. The document was signed at a ceremony during a workshop in Tokyo, Japan by K. Kubo, Professor Emeritus of Tokyo University, and M. Shinozuka, Sollenberger Professor of Civil Engineering of Princeton University. Professor Kubo signed on behalf of the Association for the Development of Earthquake Prediction (ADEP), the Japanese sponsoring agency. Professor Shinozuka signed on behalf of Robert L. Ketter, the Director of the National Center for Earthquake Engineering Research (NCEER), the U.S. sponsoring agency. A second Memorandum of Understanding was signed in December, 1990 to continue the cooperative program of research. The signatures were K. Kubo, representing ADEP, and M. Shinozuka, the Director of NCEER.

The research program has concentrated on case histories of ground deformations and their effects on lifeline facilities. The case histories were collected in two volumes and published in May, 1992 as a joint Japan-U.S. effort by NCEER. The earthquakes included in the Japanese case histories are: 1923 Kanto, 1948 Fukui, 1964 Niigata, 1983 Nihonkai-Chubu, and 1990 Luzon, Philippines earthquakes. The earthquakes included in the U.S. case histories are: 1906 San Francisco, 1964 Alaska, 1971 San Fernando, 1979 Imperial Valley, and 1989 Loma Prieta earthquakes. The Japanese and U.S. case history studies were coordinated by Professor T.D. O'Rourke of Cornell University and Professor M. Hamada of Waseda University. Case studies are in progress for the 1993 Kushiro, 1993 Hokaido Nansei-oki, and 1994 Northridge earthquakes.

In addition to the publication of the case history volumes, the products of the cooperative research include U.S.-Japan workshops and associated publications of the proceedings covering case history data, analytical modeling, experimental studies and recommendations for improved practices.

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