Earth Consultants International

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Dr. Gurler has 15 years of consulting, teaching and research experience in the geophysical and earthquake engineering fields, with emphasis on earthquake analysis and disaster mitigation techniques to reduce seismic hazards. Her areas of expertise include: dynamic strong ground motion waveform modeling in three dimensions with consideration of near source and site effects with realistic subsurface layers; simulation of variation of peak ground acceleration (PGA) and velocity (PGV) on the ground surface; microzonation and seismic hazard mapping; estimation of site-specific seismic design parameters for deterministic and probabilistic earthquake analyses; and vulnerability investigation of ground and structures with the non-invasive microtremor (ambient noise vibration) technique used for microzonation and land use planning. She has considerable experience applying the microtremor technique to obtain information about the dynamic characteristics of structures, their structural integrity and risk and reliability. She has also been involved with time- and frequency-domain data analysis and interpretation of the collected data for several hazard mitigation studies.

She has an extensive understanding of earthquake hazards in the United States, Turkey, Japan, Mexico, and Italy, and has managed several projects in these countries. Projects that she has worked on include vulnerability investigations of historical monuments in Italy (Pisa Tower, Coliseum, St. Paulo Church); and high-rise buildings, as well as small- to large-scale residential and commercial buildings, and historical monuments in Turkey (Hagia Sophia Museum, Suleymaniye Mosque, Sehzade Mosque). Dr. Gurler participated in a collaborative project for the development of disaster mitigation techniques and their implementation in the Asia-Pacific region, and completed a microzonation study (including vulnerability investigation of the ground and several structures) in Mexico City. Most recently she has generated seismic design criteria for US Navy facilities in Yokasuka, Japan; college buildings at San Bernardino Valley College; San Vicente Dam in California; and Interstate 5 highway bridges in Orange County, California.

Previously, she worked as a senior research engineer for a Japanese consulting and research company for four years. Her work with this firm focused mainly on vulnerability investigations of ground and structures, and real-time monitoring of strong ground motions and early warning systems all over Japan. She also worked at the Istanbul Technical University as a research associate for three years. Her skills include usage of a wide range of computer software. She is fluent in Turkish and English, and moderately fluent in Japanese (fluent – in understanding and speaking, intermediate - in reading and writing).

EDUCATION

Ph.D. Department of Civil Engineering, Earthquake Engineering, University of Tokyo, Japan — 1997

Dissertation: *3D simulation of near-field strong ground motion during the 1995 Kobe, Japan earthquake, including effects of irregularity of underground structure and complexity of rupture process.*

M.S. Institute of Science, Department of Geophysics, Seismology, Istanbul Technical University, Istanbul, Turkey — 1993

Thesis: *The estimation of source time functions and associated source parameters of the March 13, 1992, Erzincan, Turkey, Earthquake aftershocks.*

B.S. Geophysical Engineer, Istanbul Technical University, Istanbul-Turkey 1990
Thesis: The computation of synthetic seismograms with the reflectivity method.

PROFESSIONAL MEMBERSHIPS

Geophysical Society of Turkey
American Geophysical Union

PROFESSIONAL HISTORY

Project Seismologist-Earthquake Engineer, Earth Consultants International 2002-Present
Senior Research Engineer, System and Data Research Co. Ltd., Tokyo, Japan 1997-2002
Graduate (PhD) Research Assistant, Department of Civil Engineering, Earthquake Engineering, University of Tokyo, Japan 1994-1997
Research and Teaching Assistant, Istanbul Technical University, Department of Geophysics, Istanbul, Turkey 1991-1994

SELECTED PROJECT EXPERIENCE

Project Consultant, Site-Specific Probabilistic Seismic Hazard Analysis for Design of a US Navy Wharf Structure at Yokosuka, Japan. Safe and effective design of waterfront structures requires an understanding of the expected earthquake ground motions that the structure may be subjected. A probabilistic assessment of ground motion for design of a US Navy wharf structure was performed in accordance with the requirements of the Naval Facilities Engineering Manual NFESC-TR-2016-SHR. As part of this study we conducted an extensive literature search for the latest information on the tectonics in Japan and historical seismicity of the area to create a database of active faults within a 100-km radius of the site. The project site is subject to high accelerations due both to subduction and near- field crustal faults. The geologic and seismic hazards that may affect the wharf structure were summarized and site-specific 5% damped horizontal and vertical response spectra, to define the level of ground shaking anticipated to occur at the site at specific recurrence intervals, were calculated. The issue of long duration time histories caused by subduction zone fault movements was addressed, and time histories of historical subduction earthquakes were also provided.

Project Consultant, Tectonic Environment and Recommended Seismic Criteria, Site Specific Probabilistic and Deterministic Seismic Hazard Analysis, San Vicente Dam Raise Project, in Lakeside, San Diego County, California. The purpose of this project was to describe the local tectonic environment and provide recommended seismic criteria for the San Vicente Dam Raise Project. To estimate the ground motions that could be experienced at the San Vicente Dam site by any of the seismic sources, both deterministic and probabilistic seismic hazard analyses were conducted. Existing geologic, tectonic and historic seismicity data were reviewed and 5% damped deterministic and probabilistic horizontal and vertical response spectra were calculated.

Project Consultant, Seismic Hazard Screening Study for Selected School Sites in the City of Los Angeles, California. The purpose of this project was to screen the location of several proposed school sites for potential seismic hazards prior to the development of the schools. The highest accelerations that each site may have experienced historically were investigated by looking at the records of past earthquakes. To analyze potential accelerations at each site due to ground shaking during future earthquakes, deterministic and probabilistic analyses were conducted. Deterministic analyses estimated the Horizontal Peak Ground Accelerations (PGAh) that can be expected at these sites, due to earthquakes generated by rupture of any of the individual active and potentially active faults in the region. Probabilistic assessments that combine all seismic sources in a region and consider the likelihood (or probability) of certain ground motions from these sources occurring within a given time period were also performed, and the probability of exceedance of a given ground acceleration value for different time periods were calculated. For the probabilistic analysis, PGAh were also de-aggregated to better understand the contribution of individual earthquake sources to the total hazard at these sites. Finally, the seismic design parameters per the California Building Code were calculated for each site.

Project Consultant, Dynamic Site Characteristics of the Ground at Selected Bridge Locations along the Interstate 5 (I-5) Freeway in Buena Park, Orange County, California. Reliable estimates of the fundamental frequency of the structure and its site are essential during the analysis and design process. The estimation of site frequencies is often made using simple empirical relationships with parametric values and without mathematical modeling. The purpose of this study was to obtain, for seismic design purposes, the dynamic characteristics and the shear wave velocity of the ground. The microtremor technique was applied to obtain the amplification factor (A), the predominant frequency (F), and the approximate shear wave velocity (Vs) of the ground.

Project Consultant, Dynamic Characteristics of the Ground and Structure of a Six-Story Airport Control Tower in Lancaster, California. The purpose of our study was to quantify the degree of damage to be expected in the tower as a result of earthquake-induced ground shaking. Microtremor measurements were conducted both at ground level and on each floor of the tower, and the dynamic characteristics of the tower and its ground were identified. The shear wave velocity and predominant period of the ground were calculated and used to define the liquefaction susceptibility of the site. The data from each floor in the tower were used to obtain the vibration mode shapes and expected deformation of the tower during an earthquake by calculating the story drifts (displacements) at each floor level. Our findings indicated that the control tower vibrates at different frequencies in the two horizontal directions, and that amplification at the roof (compared to the ground floor) is extremely high, with a resultant large story drift at this level. The results corroborated the empirical observations of the air traffic controllers, and provided information to better understand the complex performance of the upper part of the control facility.

Principal Geophysicist, Disaster Risk Assessment and Management - Use of Seismic Ground Motion and Microtremor for Vulnerability Assessment of Ground and Structures in Mexico City. This project was part of a major international program by the Earthquake Disaster Mitigation Center of Japan. The project necessitated the collection, analysis and an interpretation of microtremor data for the entire Mexico City. These data were combined with known geologic information and observations of past damages to assess the site effects and vulnerability of the ground and individual structures and to estimate the destructiveness of different levels of ground motion. First, the damaged areas were divided into several profiles in East-West and North-South directions, and microtremor measurements were collected every 200 meters along these profiles. Various types of buildings were also measured. Analysis of these data allowed us to estimate the fundamental natural frequencies, amplification factors and vulnerability indexes. The distribution of these estimates was confirmed by comparing the modeled results to the data on damage distribution as a result of past earthquakes, and the subsurface geology. The results of these analyses allowed us to make recommendations for reasonable earthquake disaster prevention, including advise on the reinforcement of the ground and structures in specific areas that have high vulnerability indices.

Principal Geophysicist, 3D Numerical Simulation of Long Duration Seismic Pulse Recorded in the Near Field during the 1995 Kobe, Japan Earthquake. The 1995 Kobe earthquake's strong ground motion pattern contained some complicated features, such as severe and specific damage concentrated along a narrow belt parallel to the fault and some long period distinct wave characteristics in the heavily damaged area. These characteristic pulses resulted in fatal damage to many of the short-period and middle-period structures (T<1 sec). Explaining these long period behaviors was the main purpose of the project. Site-specific probabilistic and deterministic earthquake analyses were completed, strong ground motion time series in three-dimensions were numerically calculated, and the design earthquakes for different locations in the area were determined. Time history simulation for this purpose required the consideration of a complicated sedimentary layer structure together with the complex source effect, given that the near-earthquake ground motions of shallow and large earthquakes are principally controlled by these two effects. Peak ground velocities (PGV), peak ground accelerations (PGA) and total damage caused by this model were also provided. This information was used to improve design and engineering decisions for reconstruction and retrofitting.

Principal Geophysicist, Design of Base Isolation Systems for Building Structures. Large peak ground velocity (PGV) and peak ground acceleration (PGA) combined with the long period waves (2 sec) observed after the 1995 Kobe earthquake showed the necessity of new seismic design strategy that considers near-field ground motions. The waves around this period have principal damage potential and result in a sudden input of energy to the structures. The objective of the project was to provide reliable data to be used in the design of the base isolation systems of new, buildings. As part of the project, we provided full time histories of near-field, long-period waves to estimate the performance of the proposed base isolation systems. Elastic wave propagation in and around Kobe City during the Kobe earthquake was simulated in three dimensions up to 1 Hz. These simulated full time histories of strong ground motions are helpful to reduce the risk of base isolation systems during future earthquakes.

Project Manager, Vulnerability Investigation of Historical Monuments in Italy, including the Leaning Tower of Pisa, the Coliseum, and St. Paulo Church. The purpose of the project was to determine the dynamic characteristics of the structures in advance of engineering strengthening, if, and as necessary, to increase their earthquake resistance and thus preservation. The dynamic characteristics of the structures were determined based on microtremor measurements performed on the ground and upper floors of each structure. From spectral analysis of these records, we calculated the predominant frequency, amplification, and vibration characteristics for different frequencies in the horizontal directions for each building. An analysis of these data allowed us to identify the weak points in these structures that could lead to collapse during an earthquake. The maximum acceleration value that each of these structures can accept was also calculated and proposed as a new index of earthquake resistance. We checked the reliability of these indeces by comparing the modeled values to the measured or estimated ground motions that have caused damage to these structures during past earthquakes.

Project Manager, Vulnerability Investigation of Historical Monuments and Residential and Commercial Building Structures in Istanbul, Turkey. The destruction and loss of life caused by the 17 August 1999 Koaceli, Turkey earthquake caused considerable anxiety in Istanbul, given that the next earthquake in this fault system is anticipated to occur in or close to this city. Specifically, government officials and residents were anxious to find out whether the residential and commercial structures in Istanbul can withstand the ground motions expected in the area during the next earthquake on the North Anatolia fault system. Enforcement planning and strengthening to increase the seismic resistance of several residential and commercial structures was proposed. This study was designed to identify the weak points of several common styles of construction so that retrofit of these structures could be conducted effectively. The results of this study were also to be applied in the design of new structures. To that end, we collected data on the ground characteristics at several locations throughout the City, and the dynamic characteristics and quality of several buildings (natural frequency, amplification factors and maximum acceleration that they can withstand) using microtremor techniques. The study included the assessment of three cultural heritage buildings – the Hagia Sophia Museum, and the Suleymaniye and Sehzade Mosques. The dynamic vibration mode characteristics of each of these buildings were modeled to identify weak points in the structures that would require targeted retrofitting. This type of study in highly seismic areas is very promising for future disaster prevention activities.

Application and Research Engineer, Earthquake Simulations for Earthquake Detection and Alarm System for Japan Railways. The Japan Railways authority deployed a new earthquake detection and alarm system (with stations deployed every 20 km along the railway lines) that automatically stops high-speed trains when a moderate to large earthquake occurs, before the train is strongly shaken, and before it enters a potentially highly damaged area at high speed. The new system detects the primary (P) wave of an earthquake and uses these data to calculate preliminary index values from which it judges the potential destructiveness of the earthquake. If deemed significant, the system releases an alarm just a few seconds after the P wave arrival, and before the more damaging strong ground shaking occurs. Once it detects the S wave, it recalculates the earthquake parameters more precisely. We used recorded earthquake sets from several past earthquakes in simulation exercises to develop and fine-tune the index parameters used by the new warning system.

PUBLICATIONS

Gurler, E.D., Sato T., and Nishinaga M., 2000, Local Site Effect of Kobe Based on Microtremor Measurement: 6th International Conference on Seismic Zonation (6ICSZ), November 12-15, 2000, Palm Springs Riviera Resort California, USA, p.64.

Gurler, E.D., Nakamura, Y., Saita, J., and Sato, T., 2000, Local Site Effects of Mexico City Based on Microtremor Measurement: 6th International Conference on Seismic Zonation (6ICSZ), November 12-15, 2000, Palm Springs Riviera Resort, California, USA, p.65.

Nakamura, Y., **Gurler, E.D.**, Saita, J., Rovelli A., and Donati, S., 2000, Vulnerability Investigation of Roman Coliseum Using Microtremor: Proceedings of 12th World Conference on Earthquake Engineering (12 WCEE), 30 January-4 February, Auckland, New Zealand, paper No. 2660.

Nakamura, Y., Saita, J., and **Gurler, E.D**., 1999, Dynamic Characteristics of Rome – St. Paulo Church by Microtremor Measurements: Proceedings of the 25th JSCE, Earthquake Engineering Symposium, Vol.1, pp. 217-220, Tokyo (in Japanese).

Nakamura, Y., and **Gurler, E.D**., 1999, Estimation of Dynamic Characteristics of Ground and Structures with Microtremor Measurements – A supportive tool for strong ground motion instrumentation: Proceedings of Advanced Research Workshop on Strong Motion Instrumentation for Civil Engineering Structures, 2-5 June, Istanbul, Turkey.

Nakamura, Y., **Gurler, E.D**., and Saita, J., 1999, Dynamic Characteristics of Leaning Tower of Pisa Using Microtremor – Preliminary Results: Proceedings of the 25th JSCE, Earthquake Engineering Symposium, Vol.2, pp. 921-924, Tokyo.

Gurler, E.D., and Nakamura, Y., 1998, Slope Effects of Base Rock on Dynamic Characteristics of Sedimentary Ground: Japanese Earthquake Engineering Symposium.

Gurler, E.D., Higashihara, H., and Yoshimi, M., 1998, 3D Simulation of Strong Ground Motions During the Kobe Earthquake – A New Threat to the Base Isolation Systems: 2nd World Conference on Structural Control, Kyoto.

Gurler, E.D., 1997, 3D Simulation of Near Field Strong Ground Motion During 1995, Kobe Earthquake – Effects of Irregularity of Underground Structure and Complexity of Rupture Process: Ph.D. Thesis, University of Tokyo.

Gurler, E.D., and Higashihara, H., 1997, 3D Numerical Simulation of Long Duration Seismic Pulses Recorded in the Near Field During Kobe Earthquake: 8th International Conference on Soil Dynamic and Earthquake Engineering, Istanbul, Turkey.

Gurler, E.D., 1993, Source Time Function of 1992, Erzincan Earthquake Using Empirical Green's Function Technique: M.Sc. Thesis, Istanbul Technical University, Turkey.

Gurler, E.D., and Canitez, N., 1990, Simulation of Seismograms Using Reflectivity Method: Turkish National Petroleum Conference, Ankara, Turkey.