

BIOGRAPHIES

Some of the world's leading seismologists as well as tunneling engineers and other experts were involved in preparing or independently reviewing two geotechnical studies that examined engineering issues and earthquake risks associated with building a subway station in Century City or tunneling through Beverly Hills, Westwood and Century City as part of the planned Metro Purple Line. Background about these individuals is provided below for informational purposes. Views they express about the Westside Subway Extension are their opinions and are not positions of any organization or institution with which they are or have been affiliated. The list includes:

FAULT EXPERTS

James Dolan Consulting Earthquake Geologist

Dr. James Dolan is a professor of Earth Sciences at USC specializing in the mapping and analysis of active faults and seismic hazards. He has worked at USC since 1996. Dr. Dolan has studied active earthquake faults all over the world including the Middle East, Caribbean, Mongolia, and New Zealand. He is a widely acknowledged expert on the faults and seismic hazards of the Los Angeles region having conducted many of the basic studies that reveal the locations, rates of activity, and ages and magnitudes of past earthquakes on the region's many faults. He and his colleagues at Harvard University and the U. S. Geological Survey have pioneered the analysis of the so-called "blind thrust faults" that underlie much of the Los Angeles region. Dr. Dolan also was senior author of a seminal 1995 paper focused on prospects for future earthquakes on the region's "urban" faults – that is, faults that directly underlie the metropolitan region. A particular area of his expertise is the Santa Monica fault zone and its associated structures. In the 1990s Dolan led the teams that generated the first detailed maps of these major faults, and defined their paleo-earthquake activity. He also led the team that named the West Beverly Hills lineament in 1992.

Thomas Rockwell Consulting Earthquake Geologist

Dr. Thomas Rockwell is a professor in the Department of Geological Sciences at San Diego State University. He is a nationally and internationally renowned paleoseismologist and geomorphologist. Having served as Geology Group Leader for the Southern California Earthquake Center for many years, he is an expert on the tectonics and earthquake hazards of southern California and Baja California, has conducted extensive trenching programs to date earthquakes on faults in the western U.S., South and Central America, the Middle East and Asia, and routinely uses soil stratigraphy and geomorphology combined with various radiometric dating techniques to assess rates of fault activity, determine recency of faulting, and date past earthquakes. His research focuses on understanding earthquake occurrence in time and space. Current projects include the characterization of fault systems behavior by understanding patterns of past recurrence of large earthquakes on faults in southern California, northern Mexico, Panama, Argentina, Portugal, Turkey, India, and Israel. This work includes resolving information on slip per event, as it relates to understanding the controls on segmentation and

rupture termination. He has also worked extensively on the affects of tectonism on the landscape, and using geomorphology to constrain rates and timing of tectonic events. Included in this latter aspect is detailed mapping and dating of marine terraces along the west coast of North America and assessment of paleosea level during the late Quaternary.

Thomas Henyey
Consulting Seismic Geophysicist

Dr. Henyey is Professor Emeritus of Earth Sciences at USC. His major interests include fault mechanics, crustal structure, and seismic hazard analysis. His Ph.D work at Caltech and early research at USC dealt with the mechanics of the San Andreas fault and the thermal regime of southwestern North America. Important papers by Henyey and Wasserburg (1971) and Brune, Henyey and Roy (1969) used the results of heat-flow observations to estimate the magnitude of shear stress on the San Andreas fault.

His more recent work dealt with the application of reflection seismology to crustal structure and evolution in the southwestern U.S. He was also a Principal Investigator for seismic transects across the Transverse Ranges in southern California and the Southern Alps in New Zealand.

In 1991, after chairing the Department of Geological Sciences at USC for 2 years, Henyey was asked to assume the role of Executive Director of the new Southern California Earthquake Center. In March of 1996, he was appointed Center Director, and served in that capacity until the end of the Center's first 11 years in 2002. From 2002 to 2003, he assisted the re-constituted Earthquake Center as Deputy Director for Planning. Then, from September 2003 until his retirement in 2006 he served a second term as Chair of the USC Department of Earth Sciences.

MTA TUNNEL ADVISORY PANEL (TAP)

Edward Cording
Geotechnical Consultant

Dr. Cording is Professor Emeritus of Civil and Environmental Engineering at the University of Illinois at Urbana-Champaign where he taught and conducted research in geotechnical engineering, focusing on engineering geology and rock mechanics, soil-structure interaction and tunneling. He directed University field research, monitoring the stability and ground deformations of the first subway tunnels and stations constructed on the Washington D.C. Metro. He developed criteria used world-wide for evaluating the effect of excavation and tunneling on surface structures, and has designed measures to protect buildings, including a monumental 1870 building in City Hall square in Philadelphia, 400-year old military buildings in old San Juan, Puerto Rico, and 19th century masonry structures in the historic district of Savannah, GA.

Dr. Cording has consulted on mining and civil engineering projects for 45 years, and has been engaged in the planning, design, and construction of major underground transit projects in New York, Washington DC, Boston, Atlanta, Seattle, Toronto, San Francisco, San Jose, and in Los Angeles, where he is serving as a member of Metro's Tunnel Advisory Panel. He is currently working on the SR 99 viaduct replacement tunnel beneath downtown Seattle, on the Transbay transit project in downtown San Francisco, and on the MTA's Number 7 Line Extension and 2nd Avenue Subway in Manhattan.

From 1991 to 1997 he had a presidential appointment to the U.S. Nuclear Waste Technical Review Board reviewing siting for the Yucca Mountain high level underground nuclear waste facility. He recently served on the Large Cavity Advisory Board for siting and design of Neutrino caverns for the Deep Underground Science and Engineering Laboratory at Homestake Gold Mine. He is recipient of the 2003 Moles Non-member Award for Outstanding Achievement in Construction, and was elected a member of the National Academy of Engineering in 1989.

Geoffrey Martin
Geotechnical Earthquake Engineering Consultant

Dr. Martin is Professor Emeritus of Civil Engineering at USC, where he was actively engaged in teaching and research related to geotechnical engineering, and in particular, to the seismic design of tunnels, slopes, retaining structures, and foundations, before retiring in 2009. He has continued working as an independent consultant whose professional services are regularly sought as an expert on geotechnical or foundation seismic design. Since 1995, he has served on Metro's Tunnel Advisory Panel where his responsibilities include review of seismic hazard assessment, geotechnical design and construction monitoring for tunnels. He also is a member of the Caltrans Seismic Advisory Board on seismic design guidelines for bridges and the Los Angeles County Sanitation District's Tunnel Advisory Panel.

Dr. Martin is internationally recognized for his expertise in the field of geotechnical and earthquake engineering, particularly as related to ground liquefaction, ground improvement, site response, earth structure design and the seismic design of tunnels, and foundations for bridges, port and offshore structures. He has authored more than 100 papers relating to geotechnical and earthquake engineering on these topics.

Harvey Parker
Tunnel Consultant

Dr. Parker is an independent consultant with over 45 years of engineering experience, including planning, concept & corridor development, investigation, design, contracting practices & contract documents, cost & risk assessment, construction consultation, instrumentation, and project/program management for major facilities. He has been primarily engaged as a member of a Board, an expert, or in a senior review capacity on planning, design, construction, & instrumentation of major facilities for highway, transit, railroad, water and wastewater, hydroelectric, port, defense, and development of surface and underground schemes in over a dozen countries. He is experienced with geotechnical & underground design and construction of underground facilities, in selecting alignments & construction methods, and in evaluating the tradeoffs between underground and surface construction.

Dr. Parker has consulted on design, instrumentation, and/or construction aspects of the following transit systems: New York; San Francisco; Chicago; Washington, D.C.; Boston; Atlanta; Baltimore, Pittsburgh; Seattle; Honolulu; Portland, and Los Angeles. Dr. Parker also served as President of the International Tunneling and Underground Space Association (ITA) from 2004 to 2007. He was Chair of the U.S. National Committee on Tunneling Technology (USNC/TT) and Chair of the Underground Technology Research Council (UTRC).

INDEPENDENT REVIEW PANEL

Lloyd Cluff

Consulting Earthquake Geologist

Lloyd Cluff was Director of the Geosciences Department for Pacific Gas and Electric Company (PG&E) from 1985 to 2011, managing earthquake risks for all PG&E facilities. Prior to joining PG&E, he was Vice President, Principal Geologist, and Director of Woodward-Clyde Consultants in San Francisco, (1960 to 1985) evaluating earthquake hazards and seismic safety for critical facilities.

Cluff has conducted Post-earthquake field studies of destructive earthquakes throughout the world, traveling to over thirty earthquake sites in California, Montana, Alaska, Mexico City, Japan, Turkey, Taiwan, Nicaragua, Guatemala, Iran, Venezuela, Romania, Armenia, Tibet and Sumatra. He has advised governments of many countries regarding the evaluation of earthquake hazards and formulation of seismic safety public policy in siting, design, and construction of critical facilities. He has served on consulting boards to evaluate and improve seismic safety on projects throughout the world. Recent and current projects include the Seismic Safety Consulting Board for the existing and new Panama Canals; earthquake upgrade of UC Berkeley Memorial Stadium; and Technical Advisory Board for dams of the Santa Clara Valley Water District.

Cluff was appointed by the US Department of Interior in 2002 for a five-year term as Chairman of the Scientific Earthquake Studies Advisory Committee. He was chairman of the working group of the National Earthquake Prediction Council, which published two reports (1988 and 1990) on the probabilities of large earthquakes on the San Andreas and associated fault systems in California. He served as Chairman of the Earthquake Engineering Research Institute (EERI). He was awarded the Alfred E. Alquist Medal for his achievements in seismic safety for California from the California Earthquake Safety Foundation, and was awarded the John Wesley Powell Medal in 2000 from the US Department of Interior (USGS) the highest award to a private citizen contributing to the success of the National Earthquake Hazards Program. He was elected to the National Academy of Engineering in 1978.

Paul Jennings

Structural Earthquake Engineering Consultant

Dr. Jennings, an expert and consultant on structural earthquake engineering, is Professor Emeritus of Civil Engineering and Applied Mechanics at Caltech. He served as Provost at Caltech from 2004-2007. He was elected as a member of the National Academy of Engineering in 1977 and has been Chair of several committees on earthquake engineering and related issues for the National Academies and National Research Council. He was a member of the Governor's Board of Inquiry on the 1989 Loma Prieta Earthquake. He is a former president of the Seismological Society of America and of the Earthquake Engineering Research Institute (EERI). He is a member of the California Council on Science and Technology Board of Directors and a Fellow of the American Association for the Advancement of Science.

Dr. Jennings has been a consultant on earthquake engineering problems for many projects for private industry including earthquake design of high rise buildings, nuclear power plants and

offshore drilling platforms. He has been an invited lecturer around the world on seismic and earthquake engineering issues and is internationally recognized for his expertise in the field of structural earthquake engineering. He has been the recipient of many honors and awards for his contributions to the profession, including the Housner Medal from the Earthquake Engineering Research Institute in 2006, and the Nathan Newmark Medal from the American Society of Civil Engineers in 1992.

Lucile Jones

Chief Scientist, Science Application For Risk Reduction (SAFR), USGS

Dr. Jones has been a research seismologist with the United States Geological Survey (USGS) since 1983 and has advised on earthquake hazards in many roles. Her research interests include the mechanics of the earthquake source, probabilistic assessment of short-term earthquake hazards; properties of foreshocks; and seismotectonics structure.

She was the USGS Regional Coordinator for Southern California from 1998-2006 where she began major initiatives on a statewide seismic network (the California Integrated Seismic Network) and on the establishment of a comprehensive seismic hazard analysis (the Regional Earthquake Likelihood Model). She served on the California Seismic Safety Commission from 2002-2009. She served for 6 years on the Board of Natural Disasters of the National Research Council, advising the federal government on natural hazards and participating in the UN International Decade for Natural Disaster Reduction. Since 2006, as Chief Scientist of the USGS Multi Hazard Demonstration Project, she has set priorities and facilitated research directed toward improving Southern California's resilience to hazards that include earthquake, flood, wildfire, landslide, tsunami, and coastal erosion. She has expanded research on the southern San Andreas Fault, which poses a major threat to the Los Angeles region. The research effort includes investigation of a series of paleoseismology sites, and development of remote sensing imagery of the fault system. She proposed and led the implementation of the Great Southern California ShakeOut, the largest public earthquake drill ever in the United States, with 5.5 million participants. In 2011, Dr. Jones was appointed as Chief Scientist, Science Application for Risk Reduction, of the USGS. Dr. Jones continues to serve as a Visiting Research Associate at Caltech.

Dr. Jones advises the State of California on short-term probabilities in every earthquake crisis in California. As a member of the California Earthquake Prediction Evaluation Council, she evaluates earthquake predictions and forecasts and advises the State on their reliability. She was Woman of the Year, Muses of the California Science Center in 1999 and recipient of the Alfred E Alquist Award, Earthquake Safety Foundation in 2000. She received the Shoemaker Award for Lifetime Achievement in Communications, USGS, 2005.

Thomas O'Rourke

Earthquake, Lifeline, and Underground Engineering Consultant

Professor O'Rourke is the Thomas R. Briggs Professor of Engineering, School of Civil & Environmental Engineering at Cornell University. His teaching and professional practice include geotechnical engineering for earth retention systems, foundations, and soil/structure interaction; earthquake engineering; underground construction technology, and engineering of large, geographically distributed systems such as water supplies, gas and liquid fuel systems, electric power, and transportation facilities. He has authored or co-authored over 340 publications on

geotechnical, underground, earthquake engineering, and impact of extreme events on civil infrastructure. He is an elected member of the US National Academy of Engineering (1993) and a Fellow of the American Association for the Advancement of Science (2000). He has received numerous honors and awards. Among these include his delivery of the 2009 Rankine Lecture in London, UK, sponsored by the British Geotechnical Association and the Ralph B. Peck Award from ASCE.

In 1998 he was elected to the Earthquake Engineering Research Institute (EERI) Board of Directors and served as President from 2003-2004. He testified before the US House of Representatives Science Committee in 1999 on engineering implications of the 1999 Turkey and Taiwan earthquakes and in both 2003 and 2009 on the reauthorization of the National Earthquake Hazards Reduction Program (NEHRP). He has served on numerous earthquake reconnaissance missions worldwide. He is a member of the NIST Advisory Committee for Earthquake Hazards Reduction, which serves as the national advisory committee for NEHRP. Dr. O'Rourke consults for government and private industry on earthquake engineering, lifeline engineering, and underground engineering. He has served as chair or member of the consulting boards of many large underground construction projects, as well as the peer reviews for projects associated with highway, rapid transit, water supply, and energy distribution systems. Many of these projects have included seismic design assessments.

Professor O'Rourke has developed engineering solutions for problems concerning foundation performance, ground movement effects on structures, earth retaining structures, pipelines, earthquake engineering, tunneling, and infrastructure rehabilitation, both on a research and consulting basis. He has investigated and contributed to the mitigation of the effects of extreme events, including natural hazards and human threats, on civil infrastructure systems. He has developed techniques for evaluating ground movement patterns and stability for a variety of excavation, tunneling, micro-tunneling, and mining conditions. He has developed analytical methods and siting strategies to mitigate pipeline and tunnel damage during earthquakes, analyzed and designed high pressure pipelines, and has established full-scale testing facilities for underground facilities and pipelines.