Hot Deserts: Engineering, Geology and Geomorphology
Engineering Group Working Party Report

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Hot Deserts: Engineering, Geology and Geomorphology
Engineering Group Working Party Report

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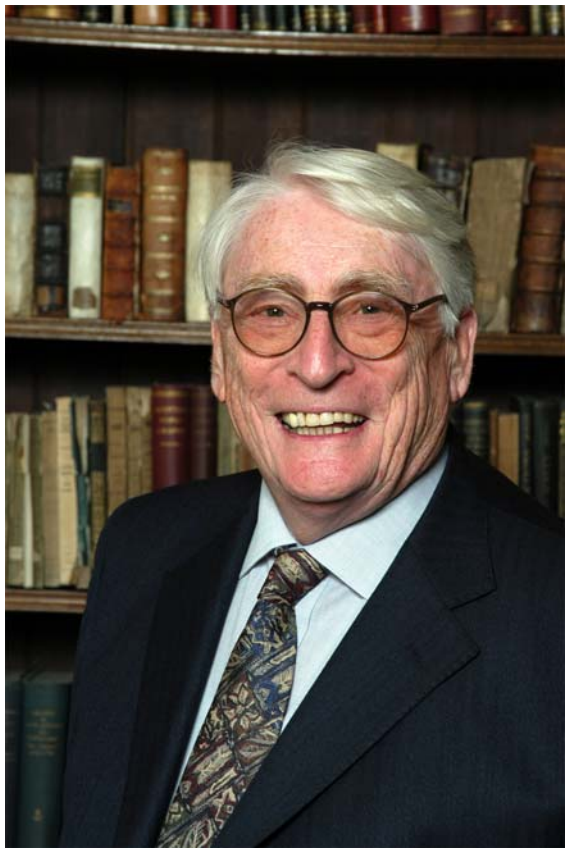

Dedicated to Professor Peter G. Fookes, FGS, FREng, Hon FRGS in recognition of his enthusiastic support to the Engineering Group of the Geological Society. He is a past-Chairman of the Group and has initiated and chaired many working party reports, often milestones in the advancement of the subject. He continues to inspire and amuse all who work with him.

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Foreword

For many years, ground engineering and construction in hot deserts has been the work of organizations based in temperate lands. To many, hot deserts were *terrae incognitae*, alien and inhospitable places. In addition, they were certainly known to be hazardous, as many failed construction projects showed – from unexpectedly rapidly silting reservoirs to inexplicably damaged foundations. Since the middle of the last century, experience has slowly been accumulated from construction sites and routes in deserts, so that today many of the hazards are understood, and they can be effectively managed provided that there is adequate appraisal of ground conditions before engineering work begins. Engineering geomorphology, led by Peter Fookes and others, has played a very significant role in this growing understanding, and it has now become indispensable. At the same time, the technical basis of desert research has been transformed by, for example, the advent of new techniques for ground and material appraisal, and by the arrival of GPS, GIS and satellite phones.

Engineering geomorphologists and geologists have learnt many important lessons from hot deserts, which this report seeks to bring together. Perhaps the most important of these was that geomorphologists can provide a very cost-effective and early contribution to site appraisal and geotechnics by evaluating the context and the surroundings of a proposed development, and by identifying potential hazards. Their work usually draws on available remote-sensing and archival data, followed by both reconnaissance and detailed field investigations that are precursors to geotechnical studies of materials and soils, and engineering design studies.

A second vital lesson was that, because the desert realm is so vast and varied, it is dangerous to oversimplify and to assume that ground conditions in one area, say Arizona, are similar to those in, for example, the Arabian Gulf. Certainly, we can identify tectonic, geological and climatic zones whose characteristics create distinctive assemblages of landforms that are useful models for anticipating, rather than predicting, terrain conditions. However, specific sites invariably raise unexpected problems and surprises. Take an apparently simple alluvial plain – seemingly inactive, stable and benign for most of the time. In reality, however, it is usually a complex network of rills, channels and interfluves, which are not only rarely activated by runoff events, but also react very differently from perennial streams and unpredictably in terms of both the nature and location of runoff. In trying to understand this plain, the surface can reveal much on close inspection: pavements, crusts, soils and similar are often valuable archives of evidence of current processes, the evolution of the area and potential hazards.

A very common problem pervading the interpretation of desert landscapes is the need to distinguish between active and 'fossil' features, not least because some features may appear to be quiescent but may only be resting between rare events. Indeed, human disturbance of apparently stable features, such as 'stable' dunes, can lead to renewed movement. Certainly, climate change, both long-term and short-term, has always been crucial to understanding many desert landscapes. But, alas, suitable climatic records are often rare in thinly populated areas. Without doubt, climate in deserts, with its distinctive problems of magnitude, frequency and duration of events, can never be taken for granted. This problem is accompanied by another: it is dangerous in deserts to assume that a feature is everywhere the consequence of the same processes. Thus, for example, 'mushroom' rocks are often attributed to wind erosion, but they may also be caused by salt weathering. Likewise, stone pavements are often assumed to be formed by wind deflation when, in fact, there are many other causes that can be revealed by careful study of the stones and their matrices.

All of these challenges, and others, emphasize the importance of geomorphological studies early in any development. This comprehensive state-of-the-science review successfully brings together the experience gained over recent years of many engineering geomorphologists and geologists into one volume. It integrates knowledge of the landforms and the processes that have worked on them over time with studies of the nature and behaviour of materials, appropriate techniques of analysis, and guidelines for the choice of engineering designs, construction methods and materials. It should be an essential guide to all who seek to develop land in hot deserts.

Ron Cooke
August 2010

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The Working Party was inaugurated in 2003 and completed its collective work in 2008, after which finalization and editing of the report/book was overseen by the Working Party officer team.

*Served on the Steering Committee, 2002–2003.

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