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The African Regional Conferences as an Indicator of Research Trends in South Africa

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Abstract. The 2011 African Regional Conference on Soil Mechanics and Geotechnical Engineering is the 15th in the series of 4 yearly conferences. The majority of the early conferences were held in sub-Saharan Africa with significant contributions from South African researchers and practitioners. Recently, more of the conferences have been held in northern Africa with smaller South African participation. An analysis of the origin and type of papers in terms of Academic, Research, practitioner and international over the past 13 conferences has been carried out and shows interesting trends of research in relation to the available research funding in South Africa. It is clear that there is a declining trend in fundamental and basic geotechnical research in South Africa. Recommendations to overcome this problem are suggested.

Keywords. Geotechnical, research, university, CSIR

Introduction

This 2011 African Regional Conference on Soil Mechanics and Geotechnical Engineering (the title has changed a number of times over the past 65 years) is the 15th in the series of 4 yearly conferences. The majority of the early conferences were held in sub-Saharan Africa with significant contributions from South African researchers and practitioners. Recently, more of the conferences have been held in northern and francophone Africa with smaller South African participation. An analysis of the origin and type of papers in terms of countries of origin and the field of activity of the authors since the first conference has been carried out and the results are briefly discussed in this paper.

The role of the South African Council for Scientific and Industrial Research (CSIR) has been specifically assessed and analyzed. The trends in research in relation to the available research funding in South Africa are reviewed, in the context of the apparent declining trend in fundamental and basic geotechnical research in South Africa. Recommendations to overcome this problem are suggested.

The author has been privileged to attend 6 of the past 9 ARC conferences held since 1975 and had papers included in 7 of the Proceedings.

1. History of African Regional Conferences

The first African Regional Conference on Soil Mechanics and Foundation Engineering (ARC) was held in Pretoria in 1955. Although no copy of the Proceedings of this could be located (copies of all other Proceedings were obtained), reference was made to the conference in the preface to the 5th Conference in Luanda. The 1st conference apparently had three themes and a total of 12 papers were included in the Proceedings [1]. The ARCs have been held every 4 years since the first one apart from the 1980 conference in Ghana which was held after a five year delay and then the 1991 ARC in Lesotho which was held only 3 years after the Lagos, Nigeria ARC, apparently to coincide the ARCs better with the relevant International Conferences.

In the early years, it appeared to be an "un-written" rule that the ARC was hosted by the home-country of the immediate past Vice-President for Africa of the International Society for Soil Mechanics and Foundation Engineering (ISSMFE) [2]. This appears to have fallen away after about 1980.

The history of the years and locations of the ARCs is summarized in Table 1.

Table 1. Years and locations of ARC's

ARC number and [reference]	Year	Location	Theme and comments
1	1955	Pretoria, South Africa	Not known
2 [3]	1959	Lourenco Marques, Mozambique	No theme
3 [4]	1963	Salisbury, Rhodesia	African soils present their own problems
4 [5]	1967	Cape Town, South Africa	Soil forming processes and associated engineering problems
5 [1]	1971	Luanda, Angola	Tropical and subtropical soils
6 [6]	1975	Durban, South Africa	No theme
7 [2]	1980	Accra, Ghana	African problem soils in engineering practice (South Africans barred)
8 [7]	1984	Harare, Zimbabwe	No theme
9 [8]	1987	Lagos, Nigeria	No theme (South Africans barred)
10 [9]	1991	Maseru, Lesotho	Geotechnics in the African environment
11 [10]	1995	Cairo, Egypt	No specific theme
12 [11]	1999	Durban, South Africa	Geotechnics for developing Africa
13 [12]	2003	Marrakesh, Morocco	The involvement of geotechnical engineering in infrastructure development in Africa
14 [13]	2007	Yaoundé, Cameroon	Soils of Africa

A number of the ARCs had specific overall themes and these are also summarized in Table 1.

In 1980, just a few weeks before the conference held in Accra, Ghana, the South African delegation was informed that visas would not be issued to them. As a result, a separate conference for South Africans was held in Pretoria, at which the South African contributions to the Accra ARC were presented as well as 17 additional papers, published separately [14].

In 1988 South Africans were barred from attending the Conference in Lagos, Nigeria for political reasons. However, there was one South African at the conference, who was the Vice-President for Africa of ISSMFE at the time and he was given special dispensation to attend.

2. Statistics of papers

A number of the ARCs have published the papers presented in a volume that has been available at the opening of the conference as well as a second volume including the Keynote presentations, summaries of workshops held and, in some cases, papers that were submitted too late for inclusion in the pre-conference Proceedings publication. In this review only the papers included in the first volume have been analyzed.

A summary of the papers presented at the various ARCs is provided in Table 2. This includes the total number of papers included in Volume 1 of the Proceedings, the number prepared by non-African authors, the number of papers prepared by South African University staff and the number of papers prepared by CSIR employees in the fields of Building Technology and Road Technology. Certain papers are more general and have been classified into one of these two groups on the basis of the CSIR unit in which the author was based. Where a CSIR author was not the main author (often included with a University colleague) the paper was taken as originating from the CSIR. The remaining papers are those presented by practitioners, researchers or academics mainly from the country in which the ARC was being held but also from other African countries. It is clear from the contents of the various proceedings that in almost every case (possibly barring Lesotho) the majority of papers, not-unexpectedly, originate from the home country.

Table 2. Statistics of papers in terms of numbers (and percentages).

ARC Year	Total papers	International	South African	Other African	CSIR		SA Universities
					Building	Road	
1955	12	?	?	?	?	?	?
1959	30	2 (7)	13 (43)	15 (50)	2 (7)	6 (13)	2 (7)
1963	42	5 (12)	24 (57)	13 (31)	9 (21)	8 (19)	5 (12)
1967	47	5 (11)	27 (57)	15 (32)	7 (15)	10 (21)	3 (6)
1971	37	18 (49)	13 (35)	6 (16)	2 (5)	5 (14)	2 (5)
1975	36	1 (3)	30 (83)	5 (14)	6 (17)	12 (34)	3 (8)
1980	49	9 (18)	22 (45)	18 (37)	5 (10)	5 (10)	0
1984	63	24 (38)	19 (30)	20 (32)	0	7 (11)	0
1988	74	16 (22)	3 (4)	55 (74)	1 (1)	0	0
1991	50	7 (14)	40 (80)	3 (6)	6 (12)	8 (16)	4 (8)
1995	101	51 (50)	12 (12)	38 (38)	0	1 (1)	2 (2)
1999	84	17 (20)	40 (48)	27 (32)	1 (1)	2 (2)	13 (15)
2003	99	33 (33)	15 (15)	51 (52)	0	2 (2)	0
2007	53	9 (17)	4 (8)	40 (75)	0	4 (8)	0

It should also be mentioned here that session themes at the conferences have changed over the years. The first conference had 3 themes but that has increased and changed with time. A full list is not included in this paper but trends showing the emergence of new technologies are obvious. Aspects such as the use of waste materials, geosynthetics and environmental issues have become important in recent conferences and the ongoing debate regarding education and skills development has been a major issue at recent ARCs.

3. Analysis of paper statistics

The paper statistics have been analyzed in various ways to highlight some of the trends.

3.1. Origin by region

Figure 1 shows a plot of the regions of origin of the papers. It is clear that until about 1980, papers from South Africa generally dominated the conferences. Since then, unless the conference was held in South Africa, papers from other African countries have become more numerous.

At the conferences in Harare (1984), Cairo (1995) and Marrakesh (2003) international papers have been dominant. Other than for Harare, this could be expected as Cairo and Marrakesh are in closer proximity to Europe and Asia/Middle East than to southern Africa. Figure 2 shows an encouraging trend in the growth of the number of papers from Africa (excluding South Africa) since 1988, indicative of the rapid development of geotechnical engineering in Africa in the past two decades or so.

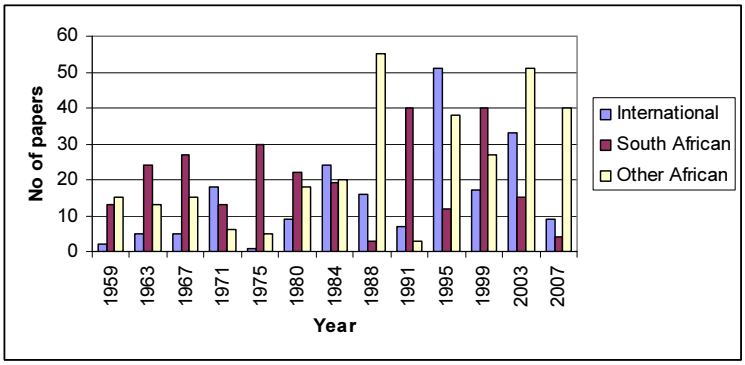

Figure 1. Main areas of origin of papers.

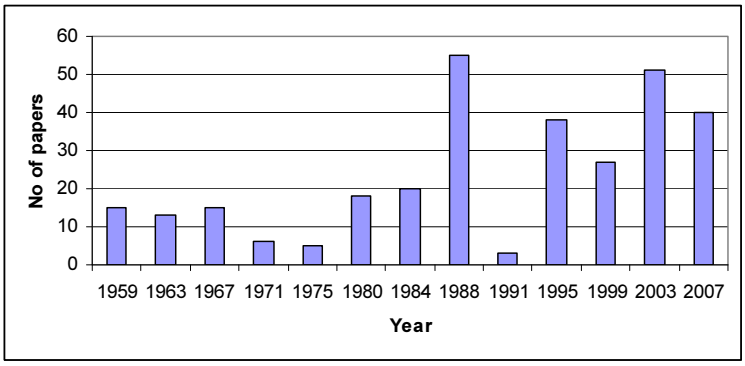

Figure 2. Number of papers from Africa (excluding South Africa).

3.2. Role of CSIR

In the early years, the CSIR played a dominant role in geotechnical research in South Arica. This was primarily through the National Institutes of Road (NIRR) and Building

Research (NIBR), with a smaller contribution from the rock mechanics section of the National Mechanical Engineering Research Institute (NMERI).

Figure 3 shows the overall contribution of the CSIR over the years in terms of the numbers of papers prepared by the two major units. Although NIRR (and its successors, NITRR, Transportek and Built Environment) has generally contributed the major share over the years, the declining trend in number of papers in both research areas and the significant drop after 1991 is quite noticeable (and worrying). CSIR has long been considered the major research organization for geotechnics, but the move from being fully Government funded to carrying out more commercially funded research has had a severe negative effect on research outputs suitable for publication. As the investment in site investigations is usually seen (incorrectly) as one of the lesser important construction activities, the funding of geotechnical research seems to suffer from the same apathy. If it is assumed that the mantle of Geotechnical research has moved more to the universities, this should be reflected in an increase in the numbers of papers emanating from South African universities. Figure 4 includes the contributions from Universities. Although there were a significantly larger number of papers from universities in 1999 (Durban), the overall trend remains negative. This does not bode well for the future of innovative geotechnical engineering in South Africa, particularly when it is noted that only one South African university has full time Professors in geotechnical engineering. This is also reflected in the decrease in the number of geotechnical researchers at the CSIR, from more than 15 in 1976 to only 4 in 2011. It should also be noted that the CSIR had two state-of-the-art soil mechanics laboratories and one rock mechanics laboratory in 1975 and now only has a single downscaled soil testing laboratory and a small rock testing facility.

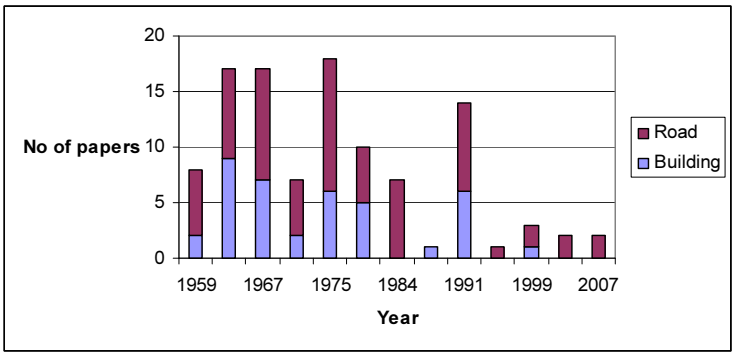

Figure 3. Number of papers from CSIR.

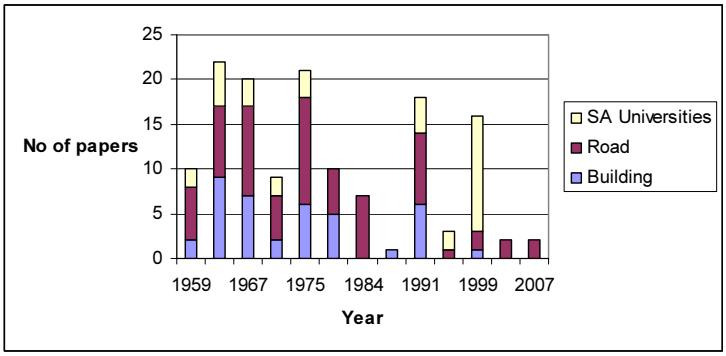

Figure 4. Number of papers from CSIR and South African Universities.

4. Recommendations

As is the case with most public research organizations in the modern world, funding is limited. A reduction in basic/fundamental research work often results in the application of new technologies, usually developed overseas under different environmental and technological conditions, without the necessary fundamental support for local conditions. Failures, which could have been avoided, often result leading to criticism (and often abandonment) of the technology.

The need for ongoing research to support the implementation of new technologies in a developing environment cannot be overemphasized and this requires adequate funding. Although some of these technologies are proprietary and should be funded by the suppliers or agents, many are independent and in the national interest and should be funded by Government. In South Africa, it is important that Government's funding of Research and Development (R&D) be increased from the current level of 0.92% of Gross Domestic Product (GDP) to the proposed level of 1.5% as recommended by Government in 2010 [15]. This would be more in line with the levels achieved in other developing countries such as China.

It is also important that geotechnical engineering facilities and staff at South African universities be expanded and improved. This will facilitate an increase in quality of post-graduate research. Good progress has been made in the establishment of the Centre for Excellence in Foundation Engineering as a joint operation among CSIR BE, the University of Pretoria and a private company, URD, with various government and parastatal bodies also being involved. If adequately funded and utilized, the Centre will assist in the coordination and advancement of post-graduate research in the field of geotechnical engineering in sub-Saharan Africa.

5. Conclusions

The past 14 African Regional Soil Mechanics and Foundation Engineering Conferences (ARC) have provided excellent platforms and opportunities for advancing geotechnical engineering in Africa. These have gone from strength to strength with greater participation form African countries as well as more interchange of ideas with the international geotechnical community. A worrying issue, however, is the steady

decline of geotechnical research in South Africa, shown by the reduction in contributions to ARCs from the CSIR, which is not being replaced by contributions from South Africa Universities. It can thus be concluded that geotechnical research in South Africa is suffering from severe financial cut-backs, a trend that needs to be reversed in the medium to long-term national interest. In general, African governments have indicated their intentions in this regard, but the fruits of increased investment in research are still to be seen.

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