

CAPACITY BUILDING IN TRANSPORTATION AND DEVELOPMENT ENGINEERING AT WITS UNIVERSITY

Innovative Research and Education at the Research Centre for Employment Creation in Construction

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Introduction

"Unemployment is a major problem in South Africa; the government has committed itself to employment creation strategies. We can contribute to alleviation of poverty and unemployment in the construction of economically efficient physical transportation infrastructure. Instead of conventional equipment-intensive construction methods employment-intensive methods should be used. However, this mode of employment has to be technically feasible and economically efficient."

This statement indicates the need for research and capacity building in this field and shows links between employment, construction and economy in general. The full spectrum of superstructure and infrastructure items, including housing, has become a rallying point and a potentially contentious issue. These problems are set within a low level of industrial, individual and community capacities, which means that provision of housing, transportation infrastructure and employment requires innovative engineering informed by an understanding of economic and socio-political factors.

Employment-Intensive Construction in South Africa

Besides high levels of unemployment, South Africa has a widely acknowledged need for housing and transportation infrastructure, both urban and rural. These needs have been aggravated by a lack of adequate technical and institutional capacities to solve them. From a theoretical perspective, supported by experience elsewhere in Africa, there are reasons for considering that properly structured programmes based on the use of employment-intensive methods, rather than conventional equipment-intensive technology, should be established. Such a programme would construct and maintain the required physical infrastructure, thus creating employment, skills and institutional capacities [1]. However, job generation in this manner has to be socio-economically viable to make best use of the scarce resources.

The origins of current interest in employment-intensive methods on a world-wide scale can be traced to the instigation of the World Employment Programme (WEP) by the International Labour Office (ILO) in Geneva in 1969. The objective of the WEP was to try to define an employment-oriented development strategy. Even though concern for employment remains a cornerstone of the employment-intensive programmes, other considerations strengthen the arguments for adopting an employment-intensive approach to public works. First are the modest development prospects confronting many developing countries, especially the majority in Sub-Saharan Africa. Secondly, there have been positive achievements with employment-intensive road works since the WEP was launched. These achievements have shifted the debate from both a theoretical argument and concern with employment per se to such an extent that current employment-intensive projects and programmes embrace a multiplicity of objectives.

From the socio-economic viewpoint, an employment-intensive operation is generally known as an operation in which proportionately more labour is used than other production factors. Employment-intensive construction has been defined as follows [1]:

The economically efficient employment of as great a proportion of labour as is technically feasible to produce as high a standard of construction demanded by the specification and allowed by the funding available.

Conventional road construction is highly equipment-intensive, with only some 10 per cent of the total construction costs going to labour. Research has shown that in employment-intensive rural road engineering up to 65 to 70 per cent of total construction costs could go to labour; i.e. more than 600% as much [2]. This is achieved largely through the creation of individual, community and institutional capacities by the establishment of large, carefully planned, long-term national programmes. Hence, employment-intensive construction is the effective substitution of labour for equipment and results in a significant increase in employment opportunities per unit of expenditure (for example from 10% to 50%, as opposed to contractors who claim to be "employment-intensive", with a "15%" increase, meaning an increase from 10% to 11,5%).

National reconstruction and development, in which provision of housing and employment creation are pivotal variables, will be impossible without multi-disciplinary research and knowledge. Performance indicators based on relationships between the following variables are being derived and applied: potential for employment generation in production of building materials; greater use of local resources; environmental criteria; living patterns; role of public and private sectors; small-scale contractor development and socio-economic factors.

To avoid confusion, Employment-intensive Construction is not the use of large numbers of people on relatively unplanned emergency or relief projects to construct something of ill-defined quality and value; that is "labour-extensive" [1]. Labour-extensive construction emphasises the size of the labour force rather than the product or productivity. Emergency relief appears to be incompatible with the achievement of development objectives, but, the reverse might be possible.

Progress in productive employment generation is severely limited by engineers and planners who express reservations regarding the financial and socio-economic costing, product quality, time consumption and labour management of employment-intensive works by comparison with equipment-intensive construction methods. Although these assertions may be challenged from both a theoretical and practical perspective, these views are still widely held. Numerous practical and research projects have shown that employment-intensive construction is an option well worth considering under certain conditions. The World Bank carried out extensive studies and showed that employment-intensive projects can be technically feasible and economically efficient. But, this research was a mammoth work [3, 4] and cannot be easily repeated. However, this question of cost-competitiveness between employment-intensive and machine-intensive techniques cannot be ignored, because it is so often raised in debates. The majority of properly planned operations in South Africa has been cost-competitive and studies of work elsewhere in Africa have come to the same conclusion.

Innovation in Research and Education

The Research Centre for Employment Creation in Construction, at the University of the Witwatersrand, has made significant contributions in the following endeavours that are important for development in South Africa [5]:

1. Innovative research has indicated that employment-intensive methods of construction and maintenance may be used for high-volume, high standard urban and rural roads and not just low-volume, low-standard rural roads.
2. Research has indicated the necessity of a greater understanding of the spectrum of matters that require attention for the successful implementation of employment generation programmes.
3. Civil engineering education has been broadened to include an understanding of the importance of socio-political factors, while making sure that the engineering is technically and economically sound.
4. Competent human resources are being produced to contribute to the resolution of the socio-technical problems confronting this country.
5. Transfer of technical research findings into practical field engineering projects needs to be further developed.
6. Incorporation of policy research findings into the policies and strategies of the nation has taken place (although not necessarily implemented properly).

The Research Centre's work is extremely pertinent to the needs of South Africa. Good progress in relation to research, education, fieldwork, policy and institutional development has been made. The work has been recognised locally and internationally.

The Research Centre's news and information, publications and research can be found on the Internet, at the following World Wide Web site [6]:

<http://www.civil.wits.ac.za/rmc/rcindex.htm>

This service enables the customer, researcher or student to get a quick insight into the various options the Research Centre has to offer.

The Research Centre's Past, Present and Future

General

Since its establishment in 1992, the Research Centre for Employment Creation in Construction has provided approximately local and international 80 MSc and PhD students and numerous undergraduate students with topics and supervision for their research projects. The Centre continues producing high quality and ground-breaking research, conducting contract research, consulting on various employment-intensive construction projects throughout Africa, and organising numerous seminars and courses for the construction industry. While part of the Centre's work explores the "scourge of unemployment", the majority of the work is focussed upon creation of work opportunities in the construction industry, the provision of the urban infrastructure for developing communities and the provision of the major infrastructure required to underpin economic development in both urban and rural areas.

Each research project is carried out by a Research Team that consists of staff members, undergraduate and postgraduate students of the Research Centre. Project Leader and Principal Supervisor of research is Professor Robert T. McCutcheon, Director of the Research Centre. He has been closely involved with employment-intensive construction programmes in Iran, Kenya, Botswana and South Africa, generally under the auspices of the ILO.

The Centre was established with the following aims [7]:

- to carry out multi-disciplinary research into technical, organisational, management, institutional, economic, social and political aspects of employment-intensive construction;
- to disseminate the results of the research, particularly the implications for the planning and implementation of employment generation programmes; and
- to develop skilled human resources in the field of employment-intensive construction in particular and in the field of development in general.

History

During 1992 the University of the Witwatersrand approved the establishment of the Research Centre for Employment Creation in Construction within the Department of Civil Engineering. An educational and research programme in Development Engineering, with particular emphasis on productive and cost-effective employment generation in construction, was established in the Research Centre.

The Research Centre for Employment Creation in Construction is entirely self-sufficient. Although the Centre is an officially recognised and established research entity within the University structure, the University does not provide any financial contribution. All present monetary resources are from external grants, contracted research and consultation projects. The research is largely funded by the Department of Transport (DoT) with a contribution from the National Research Foundation (NRF).

Thanks to the research capacity initiated by support from the NRF, links with the people responsible for research in the DoT led to the DoT awarding several specific pieces of research, from 1992 to the present. The NRF funding and subsequent DoT support, have enabled us to secure the services of competent researchers [5].

Current Activities

Undergraduate Research and Teaching

At undergraduate level, the Research Centre is involved in various courses that deal with Development Engineering. These courses cover topics such as employment intensive construction principles, design, planning and management. Figure 1 gives an overview of the relevant undergraduate courses during the 2nd, 3rd and 4th year of the Bachelor of Science in Engineering degree. At second year level there is Construction and Development, and in the third year Urban and Development Engineering. If they so wish, students can build on the foundation given by these two courses through the Investigational Project, in the fourth year of study. This course is a four-month research project, on a topic selected by the student, where the student comes to grips with practical problems of design, analysis, management or planning of civil engineering projects. Over the past years, several of these Investigational Projects dealt with employment-intensive topics. At the end of their research, the students give a public presentation of their work.

Over the past few years a number of final year design projects have had a developmental basis. For example, in 1997 a group of fourth year Civil Engineering students visited the settlement of Klipfontein in the Northern Cape province and drew up a development plan incorporating water supplies, VIP latrines, stormwater control and an accessroad; similarly for the 1998-2002 courses, for a development project in Mohlaletsi, Sekhukhuneland.

Postgraduate Research and Teaching

Through the Faculty of Engineering, the Research Centre offers GDE, MSc and PhD degrees, both by coursework and investigational projects or by dissertation only.

Research Seminars for postgraduate students are run on average every 3 weeks. During these seminars, two or three students present their research to a select audience of fellow students, supervisors and relevant members of the industry. As these seminars are held approximately every 3 weeks, a postgraduate student will present his or her research 3 or 4 times before handing in the final draft to the supervisor. This enables the student to get a regular feedback on his or her work, and gives the audience an indication about the progress and interests of the student.

An overview of the various undergraduate and postgraduate courses and selected research topics for MSc and PhD students that are on offer in the Research Centre may be found in Figure 1.

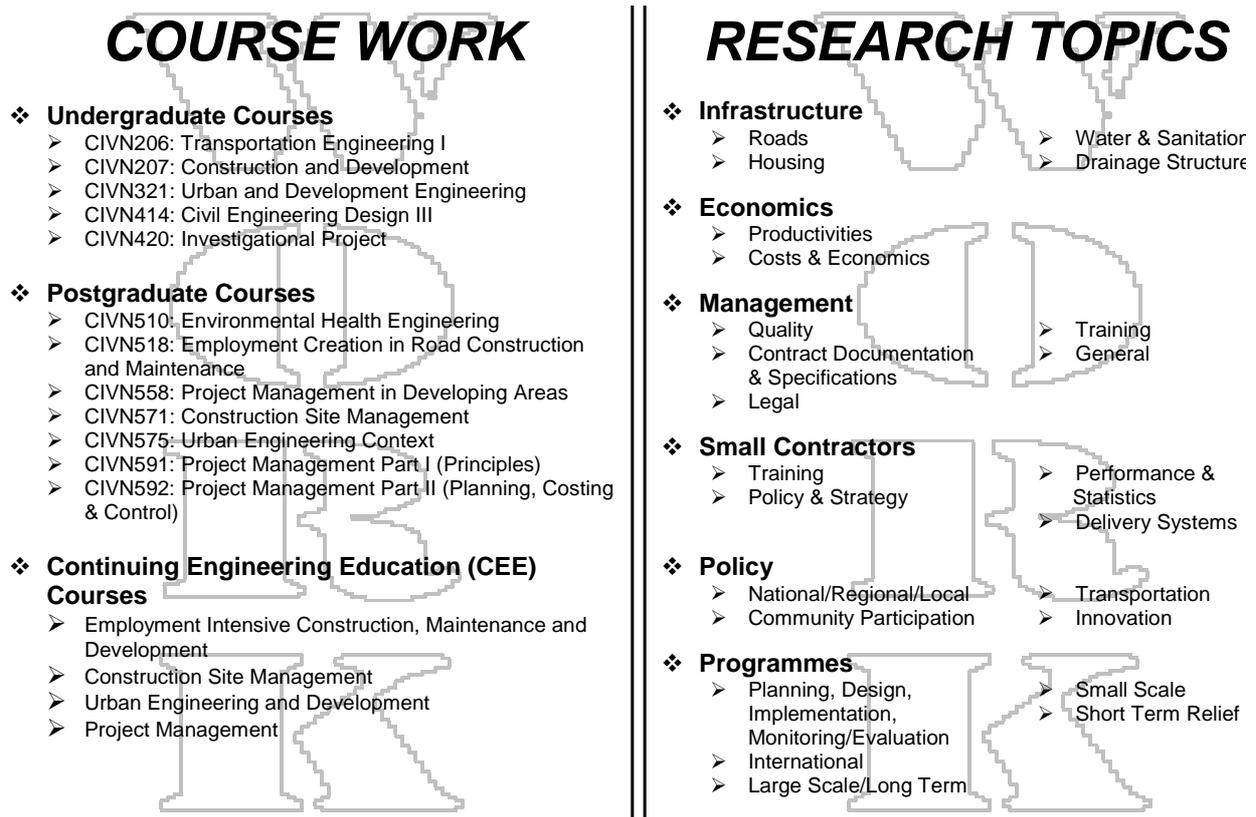


Figure 1 Overview of courses and research topics

Continuing Engineering Education (CEE) Courses

CEE courses are the link between the academic world and the professional civil engineering industry. The courses are loosely based on a number of the postgraduate courses that are on offer in the Research Centre and in the Department of Civil Engineering. Students of the postgraduate courses are often required to attend the corresponding CEE course, and thus they are able to interact with professionals in that field. We have found this to be very beneficial for the students' progress and general understanding of the topic.

The courses can be summarised in the following categories:

1. Project management
2. Construction site management
3. Employment-intensive construction, implementation, maintenance & development
4. Urban Engineering and Development
5. Small business training; profit development through practice management
6. Regional Seminars for employment-intensive experts in the road sector in sub-Saharan Africa

These courses are generally attended by representatives from the national and international Civil Engineering industry and from local and regional government.

Co-operation and Contacts

The Research Centre was initiated to provide a framework for multi-disciplinary research towards developing the knowledge base and human resources required for successful employment creation through employment-intensive construction. The Research Centre presently has links with the Schools of Civil and Environmental Engineering, Building Science, History and Sociology at the University of the Witwatersrand.

Furthermore, good links exist with various Civil Engineering and Transportation Departments throughout South Africa and with the National Department of Transport, through its exciting initiative of the Centres of Development, which operates in four main regions in South Africa. We have also initiated a collaborative research project with the Faculty of the Built Environment of the University of West England.

So far, over 50 students from the University of Twente, one of the leading Dutch universities for several years running, visited the University of the Witwatersrand and the Research Centre (October 1996 to present). They carried out research towards their Dutch Master's degrees and they came for internships. So far, 4 of these students have returned to continue studies or take up employment with us or our partners.

Furthermore, good contacts exist with the ILO, through the ILO-ASIST programme, and through the African Universities Network for Civil Engineering.

Contacts with the International Forum for Rural Transport and Development (IFRTD) exist through the participation of staff of the Research Centre in South Africa's branch of the IFRTD, the National Forum Group South Africa (NFG-SA).

The Way Forward

As from 1999, the CEE courses mentioned in section 0 will be offered as customised in-house courses, to be held at the University or at the clients' premises. The Research Centre has had several enquiries about giving similar CEE courses for a specific company or interest group, both in South Africa and abroad. From 1999 onwards the CEE courses were run on demand, for several organisation and (national and provincial) government departments

Currently, the possibility of a formal co-operation and exchange agreement with the University of Twente and University of the Witwatersrand is under investigation. Numerous other students, from both Universities, have expressed interest for this kind of research and training exchange.

Continuing, improving and expanding the existing research and projects in this age of budget cuts, calls for the need of external sponsors and funding. The Research Centre approaches potential donors on a regular basis: donors who are interested in improving the understanding of the means of creating job opportunities could contribute to the Research Centre in many ways: monetary donation, individual student bursaries, requests for courses or seminars, offering consulting opportunities, sponsoring equipment or transport, or engaging in some sort of professional co-operation.

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