Lessons in labour-intensive construction

Modern labour-intensive construction techniques offer major potential for skills development and employment creation during the construction and maintenance of high-quality public infrastructure, where the consulting engineer has an essential role to play. Past examples in Africa prove the point.

By Robert McCutcheon*

South Africa has an insistent demand for public infrastructure and housing; and the demands for public services lie at the core of current community discontent. Levels of unemployment are also extremely high, with job creation being a national priority. Within this context, construction and the maintenance of public infrastructure provide opportunities for the generation of local skills and employment.

Elsewhere in sub-Saharan Africa, these factors have historically been addressed through large-scale, long-term programmes using modern labour-intensive methods for the construction and maintenance of rural roads. These methods resulted in a significant increase in productive employment per unit of expenditure when compared with conventional equipment-intensive methods.

From the mid-1970s to the mid-1990s, in Kenya, Botswana and Lesotho, well over 10 000 km of high-quality, rural roads were constructed and maintained; many hundreds of people trained as hands-on single-site supervisors and multisite supervisors; and tens of thousands of years of employment were created. The requisite skills required at single- and multisite level were generated within the programmes themselves, and the thorough training of skilled, hands-on site supervisors was a key component in the generation of a significant increase in employment per unit of expenditure.

From a South African perspective, given the fact that the 2011 National Development Plan recommended that public employment programmes form a component of employment strategy until 2030, it is considered essential to revisit the principles, theory, potential, practice and lessons learnt from these past African projects. From this re-examination, it will be possible to derive recommendations for future practice and the essential role of consulting engineers.

There are a number of complex factors requiring attention for the successful implementation of large-scale, long-term programmes. These include ‘re-engineering’, which is the responsibility of engineers and senior management, and the training of the ‘missing middle’ required for site implementation.

Although it makes intellectual sense, modern labour-intensive construction goes against the grain of the conventional, heavy-equipment, fuel-powered industry. Proving its viability requires a sophisticated analysis of economic efficiencies. A full explication of concepts, principles and practice is beyond the purview of this short article. Below, only a few important points will be made.

Definition of labour-intensive construction (and maintenance)

“Modern labour-intensive construction (and maintenance) is the economically efficient employment of as great a proportion of labour as is technically feasible – ideally throughout the construction process, including the production of materials – to produce as high a standard of construction as demanded by the specification and allowed by the funding available. Labour-intensive construction results in the generation of a significant increase in employment opportunities per unit of expenditure by comparison with conventional capital-intensive methods.”

This definition is the result of extensive theoretical analysis, practical experimentation and large-scale implementation over a period of at least 40 years.

Modern labour-intensive construction lays the platform for even more labour-intensive methods of maintenance.

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By ‘significant’, what is meant is an increase of at least 300% to 600% in employment generated per unit of expenditure without compromising cost, time or quality. The range varies for different categories of construction.

An illustration is useful here: conventional rural road construction is highly equipment-intensive; less than 10% of construction costs go to labour (a large proportion of this labour cost would be for operators and drivers). A 10% to 50% increase in the numbers employed might sound high, but it only amounts to an 11% to 15% increase in income devoted to labour. By contrast, in labour-intensive, rural road construction, 65% of construction costs goes to labour.

A corollary to this is what it is not: it is not the use of large numbers of people on relatively unplanned emergency/relief projects to construct something of ill-defined quality and value. That is labour-extensive. It is not possible to successfully combine the provision of good infrastructure, constructed using labour-intensive methods with ‘make-work’ projects. This is not to say that humanitarian endeavours are not required in Africa; of course they are. But experience has shown that these cannot be combined with the labour-intensive construction of good-quality infrastructure, particularly high-standard infrastructure where the vast majority of public expenditure takes place. It is important to generate employment in the major economy, not just trivial social welfare expenditures on the periphery. Essentially, modern labour-intensive construction has two main objectives:

• a technically sound (good-quality), economically efficient product: equivalent to that achieved by conventional construction without jeopardising economic cost, time and quality
• a significant increase in the use of labour per unit of expenditure.

**Single-site success**

It is necessary to address many factors in order to establish an alternative socio-technical system, even for single-site operations. Technical matters must be addressed from the outset.

Consulting engineers of the stature of Scott Wilson Kirkpatrick played a major role in addressing technical fundamentals and related organisational factors. It was found that labour-intensive methods are viable for a wide range of construction activities; in particular earthworks (excavation, load, haul, unload and spread), which comprise 50% of expenditure on civil construction.

Success at single-site level requires implementation of the following:

• re-engineering of product and process to enable the use of efficient labour-intensive methods
• prior training of hands-on site supervisors who are capable of the technical and organisational skills required for the productive employment of teams of workers.

On the African projects in question, certain conditions of employment were essential, such as outcomes-based remuneration (ILO terminology). Payment was related to the completion of set tasks. Extensive research and field implementation revealed the output a reasonable person could complete in an eight-hour working day. The extent to which these tasks are reasonable may be judged by the fact that when the worker was told that they could leave the site when they had completed the set task, they generally completed the task in six hours.

Activities within operations were balanced. For example, gravel surfacing consisted of excavation, load, haul, unload and spread activities; and for the excavation, load and unload components. The ratio of workers could be 4:2:1 (varying according to soil conditions).

**Large-scale, multisite success**

Multisite operations on a large scale, over the long term, require the establishment of a formally linked programme of training and construction, which also necessitates institutional building at local, regional and national level.

It cannot be overemphasised that attention to training is far more important than either the amount of construction or the
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amount of employment to be created. The physical construction programme must only proceed at the rate at which competent engineers and supervisors have been produced.

**Ratio of overheads to site expenditure**

Overheads on these projects included the following: institution building at local, regional and national level; re-engineering of product and process; orientation and training of engineers; extensive training of hands-on single- and multisite supervisors; and training of support staff.

In the first three years, overheads represented 84% and site expenditure 16%. Over the 13 years of the programme, the overheads were 16% and site expenditure 84%. When linked training and construction programmes are established, training only amounts to 1.5% to 2% of total costs.

**In summary**

Since the 1970s, several countries in sub-Saharan Africa have used productive modern labour-intensive methods as a core component of public policy to achieve multiple objectives: high-quality infrastructure, skills development, employment creation and institution building at local, regional and national level. However, this was not achieved by superficial tinkering.

To reveal the potential contained in its definition, modern labour-intensive construction requires paying attention to: appropriate policy and legislation regarding conditions of employment, methods of work and remuneration; re-engineering of the project and process; and thorough training, particularly at the level of the hands-on site supervisor (NQF4 in South African terminology).

In general, any skilled artisan generates work opportunities for unskilled people around them, who, besides gaining an income, will also be closer to opportunities to improve their skills. Artisanal development must, therefore, be at the core of national policy. In relation to modern labour-intensive construction, the hands-on site supervisor is the equivalent of the artisan.

Elsewhere in Africa, several of the programmes came to an end. This was not because of the ineffectiveness of the use of labour-intensive methods. During the 1990s, for example, Botswana became too rich to qualify for aid funding; and aid to Kenya was reduced. Since much of this work was carried out from the 1970s to the 1990s, little institutional memory remains. Thus, from a broader African perspective, there are mutual benefits to be gained by countries in Africa from greater knowledge about the multifaceted experience throughout the continent.

From the above, it may be seen that expenditure of public funds on high-standard public infrastructure may be done in such a way as to also develop skills and create employment. But these secondary benefits at the local level will not be achieved through the ‘parachute’ method or mere ‘tinkering’. They can only be achieved through a long-term programme approach that links the whole process, including the following: conception, design and contractual documentation, training at all levels, and site organisation and management.

In South Africa, consulting engineers should play a greater role in re-engineering the provision of high-standard public infrastructure so as to also generate skills and employment. It is also suspected that Africa can relearn lessons from its own successes.

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