MOVING ON SUSTAINABLE GROWTH VIA INCREASED RURAL CONNECTIVITY

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ABSTRACT

For South Africa to grow, rural communities must be allowed to develop. A major constraint to rural development is the lack of connectivity to the main road network which restricts market access for perishable goods and hinders safe access to schools and healthcare. Bridges are a fundamental component of rural access.

Bridging also plays a vital role in modernisation. Rural development projects attract investment from both the private and public sectors and encourage the move towards cleaner, greener sources of energy production. In turn, collaboration with industry creates jobs and secures rural growth and poverty alleviation.

Although technological innovations play an important role in rural development - and have a direct impact on the speed and cost-efficiency of project implementation – it is the sustainable relationships that are established throughout the life of a project and beyond, which have a significant long-term social, economic and environmental impact on the local community.

In this paper I will illustrate how working closely with local communities has helped secure finance for rural development programmes. I'll explore how local partnerships can deliver immediate cost-savings in materials and manpower, how training can have a positive impact on long-term maintenance costs and sustainability, and how skills-transfer can help improve future opportunities for local labour.

I'll draw on my experience of a wide range of bridging programmes to demonstrate that it is the 'people factor' that will deliver real growth in rural Africa in the years to come.

INTRODUCTION

The economic benefits of building bridges in rural areas in Africa are well documented. Less well documented are the environmental and social benefits that a local community can receive as the result of a new road bridge. Yet these are of increasing value to that community.

In this paper, I'll explore what those environmental and social benefits now comprise. I'll use recent bridging projects that my company (Mabey) has carried out in Africa - in collaboration with local Road Development Authorities - as case studies to support my argument and will illustrate how the adoption of a more holistic approach can accelerate the development of rural communities.

For the purposes of this paper, references to new bridges will include both replacement bridges and new ones. It will also cover both road bridges and pedestrian bridges, but will exclude rail bridges.

Mabey has been building bridges across Africa for over 50 years. Following the utilisation of Bailey Bridging in Africa in the 1940s, it commenced manufacture of original Bailey Bridging in 1963 and started supplying the Super Bailey into Africa in the 1970s. Since then, it has repaired and replaced numerous Bailey Bridges and delivered over 500 bridging projects across the African continent.

In South Africa, projects have ranged from the delivery of a replacement Bailey bridge in 1978 to the installation of the Tsomo, Bengu and Thabane bridges. All these bridging projects addressed urgent rural development requirements and promoted economic growth.

We have observed first-hand how our efforts to continually innovate our bridge design and manufacture translate into socio-economic benefits for rural communities. Our innovations have reduced the cost of bridges – so more bridges can be supplied and maintained more easily. They have reduced construction times – so the benefits of new bridges can be felt more quickly. They have increased sustainability and reduced environmental impact.

Furthermore, our innovative approach has not been limited to bridge manufacturing techniques or the materials used. It has included working practices as well.

Increasingly, by working very closely with the local communities, we are achieving further considerable cost savings and leaving behind a legacy that extends beyond the bridge structure itself. Most notable, is the transfer of skills, both technical and non-technical.

BRIDGE BUILDING INNOVATIONS TRANSLATE INTO SOCIO-ECONOMIC BENEFITS FOR RURAL COMMUNITIES

The following represents a summary of those innovations and how they translate into benefits for rural communities

Innovation in bridge materials

Bridges made from steel offer considerable advantages over those made from concrete or other materials, including timber. The basic raw material (iron) used in steel is the most abundant of all the earth's elements, and steel can be recycled indefinitely.

Sustainability is built into steel products all along the supply chain,

FIGURE 1 Tsomo Bridge, South Africa

FIGURE 2 A bridge launch, South Africa

from responsible sourcing of raw materials through a manufacturing process dedicated to continuous improvement in the production of modern and efficient bridges.

Steel bridges now have a proven life span extending to well over 100 years, with minimal maintenance. Steel has a predictable endurance and the structural elements are visible and accessible; Any signs of deterioration are readily apparent, without the need for extensive investigations.

Corrosion is a surface effect, which rarely compromises the structural integrity of a bridge, and any problems with the galvanising may be swiftly addressed by simple local repair. Advances in coating technology and an industry-wide commitment to training coating applicators mean that the latest protective systems can be expected to last well beyond 30 years before requiring maintenance.

Innovation in bridge design

Pre-fabricated steel bridges that are transported and then assembled on-site offer considerable advantages over bridges built using concrete. On average, a pre-fabricated steel bridge can be built in less than one-quarter the time it takes to build a comparable concrete bridge. In addition to the time savings, the environmental impact associated with its construction is reduced too. A relatively small construction site is required to install a pre-fabricated bridge, whereas a concrete one requires a significantly larger site area, together with the means to store, mix and test the concrete.

Slump and cube tests also introduce the risk of test failure, resulting in additional construction costs and programme delays. All testing for pre-fabricated steel bridges without any site welding is carried out during material manufacture and component fabrication, thereby eliminating the need for site tests.

Innovations are not restricted to superstructures but to substructures too. One such recent innovation has been to replace concrete abutments with those made from steel. The cost savings achieved here include consultancy fees, the contractor's time on site, the amount of plant and equipment required on site and the infrastructure itself, in terms of both cheaper abutments and bridging.

Client cost savings associated with smaller abutments (lighter superstructure) and speed of installation are considerable. It is estimated that predesigned steel bridges typically reduce construction durations in excess of 50%, compared with construction times for conventional concrete bridges. Furthermore, the cost savings for steel bridges compared with concrete are likely to be in excess of 40%.

Innovation in bridge maintenance

Equipping the local community with the means to carry out ongoing bridge maintenance themselves can have a significant impact on costs.

Now that South Africa has a widespread mobile cellular coverage, those responsible for maintaining the bridge can have immediate, direct contact with staff based overseas. These telephone conversations, email exchanges and, increasingly, video conferences, reduce the need for UK-based site engineers to return to the bridge sites and so further reduce costs.

THE ECONOMIC BENEFITS OF BUILDING BRIDGES IN RURAL AREAS

A number of academics have noted the paucity of empirical data evidencing the socio-economic impacts of roads (and by implication, road bridges). A Protocol* written by John Hine et al in 2014 suggested that, "Despite the importance of the topic, there is some dissatisfaction with the evidence to demonstrate the impact of rural road investment".

Dominique van de Walle, similarly noted, 'Despite their popularity, very few aid-financed rural road projects in developing countries have been the subject of rigorous impact evaluations".

However, at a macro level, roads and bridges form an important part of infrastructure and investments in infrastructure alleviate poverty. Two robust results arose from a research study carried out by Luis Serven and Cesar Calderon on behalf of the World Bank (2004).

These were: (1) growth is positively affected by the stock of infrastructure assets, and (2) income inequality declines with higher infrastructure quantity and quality. "These two results combined suggest that infrastructure development can be highly effective to combat poverty", they said in their report.

More specifically in Africa, Lombard and Coetzer noted that "Rural roads infrastructure in Africa is a specific area of concern, as the development of such infrastructure has been neglected to a large extent in the past, thereby imposing significant limitations on growth and development of rural communities.

An increased interest in rural roads investment potential has developed in recent years. This is mainly due to the need for development of rural infrastructure as well as the positive impact that road investment could generate on rural communities, should they have an adequate support road infrastructure network that is sustained over the long term".

A key success factor naturally depends on the ability of road or development agencies to secure funds to finance a project in the first place. Our experience suggests that - as was the case with a project in Angola - significant experience in financed bridge programmes is required in order to secure funding, so that vital projects are not delayed or cancelled.

Strong local partnerships and relationships with international and local banks can facilitate access to up to 100% of the project funds. These funds can be made available for the purchase of bridges and services, local administration of the project, site surveys, geotechnical analysis and substructure design, and local construction works at each bridge site.

Impact on transport

After local connectivity has been improved by, say, the construction of a new road bridge, the most immediate impact will be transport-related. The list of outcomes might comprise some or all of the following changes;

- transport tariffs and fares
- traffic composition from, say, walking to vehicles
- traffic volume along roads
- household trip making
- trip distance or journey time
- changes in vehicle accident rates.

An example of where bridging enabled a change in traffic composition was the Thabane bridge, installed across a steep valley in the Drakensburg mountains in South Africa. The bridge was initially built for pedestrian usage but was designed for vehicle loading. A change to vehicular usage enabled the local authority to 'future-proof' the capacity of the bridge in keeping with their plans for future road infrastructure development.

Impact on local agricultural

A wide range of agricultural impacts are often reported when rural road networks are upgraded. These may take the form of changes in the growing of new key crops (or livestock) or changes in the marketing of key crops.

Impact of enhanced local connectivity

Improved access will stimulate local economies. In the absence of a bridge, in some cases, rivers cannot be crossed for significant periods in a year (in one notable case, for up to six months) thereby severely limiting the local community's ability to interact with communities located

FIGURE 3 Building the Groot Aub Bridge, Namibia

FIGURE 4 The completed Groot Aub Bridge

FIGURE 5 Before - Bridge collapse, DRC

FIGURE 6 After - Replacement bridge, DRC

across the river. Providing a river crossing via a road and / or pedestrian bridge provides year round access.

In Namibia, the Groot Aub bridge was installed to enable access for a poor rural community to the Capital, Windhoek. Prior to that, the community had been cut off for several weeks when the fast-flowing Uiseb River had been uncrossable.

In the Democratic Republic of Congo, following the collapse of an original Bailey Bridge that had been in-situ since 1949, a new bridge was installed which served to shorten a 400km journey made by traders whilst the old bridge was out of action.

When one of the two Juba Nile bridges was damaged in 2010, leaving it completely unusable for heavy vehicles, it had major implications; the bridges provided the only access over the River Nile in South Sudan. Repairs to the bridge allowed the normal passage of traffic, goods and trade to resume.

Impact of enhanced long distance connectivity

Improved access provides rural communities with the means to transport produce to markets located further afield than hitherto. This not only gives them access to a greater number of customers, but can also increase the prices charged, especially if it means they are no longer restricted to supplying goods to intermediaries who have historically been able to take advantage of the imperfect market conditions that this inaccessibility had created.

More importantly, it breaks the poverty cycle exerted on rural communities. As Fukubayashi and Kimura noted in their paper* "Due to the difficulty of reaching markets to sell their agricultural produce and other goods in the rainy seasons, rural people are locked into subsistence farming. Buyers also cannot reach the village; thus, the cash crops cannot be exchanged for money, and the crops rot.

Better market incentives for farmers are blunted because of the physical barriers and economic costs of transporting goods to and from local markets. The impassability of the rural access roads also hampers the provision of basic social services, such as health, education and information".

Impact on the local economy

The use of local labour on bridge construction sites has a significant multiplier effect on the local economy. Not only does the workforce spend its wages locally, but the creation of a local supply chain (for the duration of the construction period) and expenditure on ancillary goods and services both further stimulate the local economy.

This local supply chain comprises those bridge components, goods and services not supplied from outside the area. These might comprise earth moving equipment, generators, diesel fuel, protective clothing, temporary accommodation and other goods. Our experience is that

FIGURE 7 Galana Bridge, Kenya

FIGURE 8 Galana Bridge, Kenya

the appearance of a construction site in a rural area quickly creates opportunities for food and drink vendors to set up stalls near the site. In particularly remote sites, the contractor may provide the workforce with meals, using food supplied locally and cooked by personnel hired locally.

Impact on the macro economy

At a macro level, there are economic benefits to be had too. The Tsavo National Park in Kenya remains a bio-diverse stronghold home to more than 60 major mammal species, as well as 1000 plant and 500 bird species. It attracts almost half a million visitors each year and generates significant revenues from safari tourism. A new bridge built there in 2014 facilitated year-round access to the Park and enabled further investment in tourism so as to secure further economic growth and stability for the region.

THE ENVIRONMENTAL BENEFITS OF BUILDING BRIDGES IN RURAL AREAS

Where a replacement bridge improves traffic flow, considerable environmental benefits will arise from the reduction in traffic pollution as the amount of queuing traffic is reduced. As steel bridges have longer clear spans they also require fewer in-river piers. This can have a significant effect on improving the river flow and results in less disruption for the waterways overall.

Additionally, long clear-span bridges are not dependent on the structural integrity of intermediate piers which might be washed away in floods or damaged by river debris.

THE SOCIAL BENEFITS OF BUILDING BRIDGES IN RURAL AREAS

Access to Education, Health Care and other Local Amenities

Improved local access can lead to improved attendance at schools, health centres and markets. The results may be extremely positive in terms of improved supervision of schools or improved maternal mortality

Upskilling and skills transfer

Where local people are employed on bridge construction projects, it results in a considerable number of skills being transferred. These skills can be both technical and non-technical.

Experience suggests that the skills evident amongst the locally recruited workforce on day 1 of a new project are very different from those in evidence at the end of the project. This rapid movement along the learning curve creates a more proficient workforce that can, in turn, compress the amount of time needed to complete the project (and so get the bridge open more quickly) but also leads to a safer

FIGURE 9 Bridge-building in Namibia

FIGURE 10 Bridge-building in Namibia

FIGURE 11 Before - Crossing the river, Mali

FIGURE 12 After - Crossing the river, Mali

work environment with fewer accidents.

Stringent Health & Safety training regularly delivered on-site to the locally recruited workforce leads to greater safety awareness and fewer accidents. This training can be delivered as informal 'Toolbox talks' that cover a wide range of subjects.

In South Africa, following the construction of the Tsomo Bridge, the local installation team were able to call on their knowledge and expertise to go on to build the Bengu Bridge safely and efficiently in just 6 days, despite facing the challenge of a steep-sided valley over a fast flowing river.

Furthermore, having been exposed to this training (and the heightened safe working culture that it creates), most local communities apply that training to other work environments, e.g. in agriculture or manufacturing. This can in turn reduce the number of accidents and so relieve pressure on the local healthcare providers.

Skills transfer is not just restricted to those working on the site. Formal 'cascade' (or 'train the trainer') programmes can ensure that the numbers reached go far beyond those employed on-site.

And some of these technical skills translate into life skills. Bridge construction requires a high degree of close teamwork. It follows that teamwork skills need to be acquired quickly and, once acquired, can be transferred into other environments, thereby increasing the employability factor.

The local stakeholder consultation programmes carried out as part of the environmental assessments can sufficiently 'empower' the local community so as to take a more active role in the governance of their region.

Reduced fatalities

Reduced fatalities can arise from introducing a safer road network, e.g. where the old bridge had poor visibility in the approach to it, or the protective barriers or fences had fallen into disrepair.

Reduced fatalities can also be achieved when the bridge replaces a water-borne river crossing, such as a ferry or canoes. Prior to installing a bridge in Mali, the local population crossed the river by canoe and an estimated 25 to 40 people perished each year using this means of transport. The road bridge eradicated those fatalities.

REDUCED RURAL URBAN DRIFT

Enefiok Ibok* conducted a study in 2003 to assess the impact that improving rural roads and bridges had on the socio-economic development of the Akwa Ibom State in Nigeria. Amongst his findings was that "the provision of rural roads and bridges has equally helped to reduce the cost of transportation in the state. Above all, it has reduced rural urban drift in the state".

CONCLUSIONS

Innovation in bridge design is on-going, but the direct engagement, local partnerships and collaboration on the ground – the people factor – represent the real innovations in rural connectivity and will deliver the most significant long term benefits to South Africa.

RECOMMENDATIONS

In order to benefit from the significant long-term benefits enabled through innovation, it is vital that the impact of innovative technology on rural connectivity, specifically in steel over concrete, for permanent infrastructure applications is recognised. Innovative steel bridges offer a 'fast track' solution and save time and money. For these fast track solutions to be available, specifications must allow steel to be considered. This requires a change in the current procurement process to allow innovative alternatives to concrete to be considered.

Furthermore, the importance of adopting a more holistic approach to decision making, and the significance of 'the people factor' on the long-term social, economic and environmental development of the local community should be fully recognised in order to enable it to grow.

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