

What can be done to protect Sierra Leone’s highway assets?

This paper is an opinion piece prepared by Rokel Technical Advisory Panel (RoTAP), following two recent bridge failures in Sierra Leone. RoTAP is a UK diaspora organisation comprising engineering and technical professionals. The paper offers suggestions on possible solutions to address the problem of protecting the country’s highway assets.



Recent landslide at King Jimmy resulting from bridge failure



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Mabang bridge collapse

Sierra Leone has embarked on a programme of renewal and extension of its strategic highway network with a number of major roads being constructed or near completion in the past 5 years. The highway network has been extended to link major towns and cities.

As the programme of much needed highway improvements is moving ahead we were recently reminded of the importance of maintaining and protecting the existing highway assets. In August this year during the heavy rains, the King Jimmy Bridge and supporting earth embankments collapsed resulting in a high number of fatalities. This is not the first failure of an existing bridge structure in Sierra Leone. Earlier on in the year the Mabang Bridge in the Moyamba area failed resulting in over 30 fatalities.

The Catastrophic failure of these bridges is alarming, especially as the King Jimmy bridge collapse happened in a built-up part of the city with high volumes of pedestrian and vehicle traffic. The re-occurrence of such disastrous incidents is a real possibility when considering the condition and state of the country’s ageing bridge structures and earthworks. There is a need for urgent action to get to grips with the causes and to put in place a programme of mitigation and preventive action.

The objective of this piece is to raise awareness and to encourage policy makers to realise that as strides are taken in building the country’s highway infrastructure they should be cognisant of the importance of maintaining and renewing the existing highway assets.

As our contribution to the debate, we have identified four priority areas where urgent action and focus should be applied to prevent future occurrences. The priority areas are:

1. **Funding and Governance:** Setting up credible client and delivery functions to improve accountability, quality and efficient local maintenance regimes. Ring fencing road user revenues for highway maintenance activity to guarantee uninterrupted routine maintenance programmes.
2. **Asset Management:** Understanding the classification, location and condition of highways assets including bridges, culverts and earthworks and developing a system for repair and renewal.
3. **Engineering design and construction.** Establishing robust processes for engineering design management and construction quality management regimes for new highway structures.
4. **Enforcement:** Identifying and protecting the highways boundary from activities that damage the integrity of structures including weight and traffic restrictions.

Governance and Funding

Assigning responsibilities to the party most capable of delivering all aspects of the highway infrastructure framework is a key requirement to addressing the problem of inadequate maintenance and to securing ring-fenced funding for maintenance activity. At the highest level under the laws of Sierra Leone, the Government has devolved its responsibility to three agencies for delivering the function of highway and transport authority. These authorities are the Roads Authority, Road Transport Authority and the Road Management Fund Authority.

The Roads Authority is led by a nominated board, appointed by the Minister of Works under the Roads Authority Act (Amendment 2010). The Roads Authority has full responsibility for feasibility, funding, procuring and maintaining all aspects of the highway infrastructure network. Our opinion is that although this model has adequately served the country since 1992 we believe it should be considered for review for two reasons: a significant client role that has the professional and managerial clout to provide challenge and hold the Roads Authority to account is absent from this arrangement. In essence, the Authority has limited accountability to demonstrate value for money or fairness in deployment of resource based on approved policy and priorities which has broad political endorsement and buy-in. The second, as road transport is Sierra Leone's main means of internal movement of people and goods, there is the need to develop an integrated transport policy under a single ministry, such as the Ministry of Transport and Aviation with specific responsibility for developing road maintenance priorities and funding strategies.

The Road Management Fund Authority is accountable to the Minister of Finance with responsibility for revenue raising under the Road Maintenance Fund Administration Act (2010). The Act gives the Road Management Fund Authority as an agency of the Ministry of Finance fund raising powers through road user charges levied on fuel; vehicle licence fees; vehicle registration fees and any capital gains or profits made from investments.

The funds raised under this Act are 'ear-marked' for maintaining the core road network. It is not unimaginable that as revenue collection and disbursement are managed by separate agencies reporting to different ministries, that funding for highway maintenance is not consistently made available to support planned maintenance activity on the national or local road network.

Another issue is one of governance and accountability at the regional and local levels. We are aware that there is provision within the Road Authority Act for the maintenance of local roads to be managed by district councils in the provinces and the City Council in Freetown. We understand that these local authorities have not been adequately resourced to deliver this function which has therefore remained with the SLRA. Before the setting up of the Roads Authority over 20 years ago, the Ministry of Works through the Public Works Department (PWD) was responsible for highway works and had regional based units in towns around the country that managed specific sections of the network.

The economic case for having an effective maintenance regime by far outweighs the benefits that ensue from most new highway links. Some observers have commented that for every pound spent on a planned maintenance regime the return on investment is up to 3-4 times. This is not a justification to stop or slow down the new build programme but it highlights the urgent requirement to address the long neglected discipline of routine and planned maintenance. Several villages and agricultural

communities are cut off from access to markets due to inadequately maintained roads and bridges and this situation is worsened during the rainy season. The recently issued Agenda for Prosperity highlights the improvement in physical infrastructure as a pre-requisite to achieving the country's objectives in becoming a middle income country. Several observers have commented on Africa's growth being hampered by an infrastructure deficit.

In conclusion the government should continue to explore all avenues for financing new highway projects and their subsequent maintenance programmes. Increasingly, African countries are embracing the use of toll schemes to fund the building and maintenance of strategic highway links thus freeing up tax revenues for on-going maintenance of the regional and local road networks.

Asset Management

Since the collapse of King Jimmy Bridge we have read several comments on the poor condition of a number of the bridges across the country, but this is anecdotal without a clear understanding of the location of these bridges, the class and usage of the routes they are on, and information on their condition.

Increasingly an asset management framework is being adopted by highway authorities for effective management of highway infrastructure assets. It allows for the deployment of resource where it is most required and seeks to minimise risk of failure by identifying timely and cost effective solutions. Implementing a highway asset management regime requires developing six components of the system.

The first stage is having an asset management policy that has full endorsement of decision makers in government departments and agencies responsible for highways related works. The policy should provide a high level position of the government's aspirations for protecting the national highway assets. Without a clear policy position reaction to events will dictate priorities resulting in imbalances in regional funding and discrepancies in standards across the network.

The second stage will be followed by developing comprehensive strategies that take into account national and local highway development plans. The asset management strategy for roads and bridges should be aligned with the plans for significant new road building or upgrading of the highway network.

The third stage is agreeing a set of performance criteria against which the system's effectiveness is to be assessed. This is a key aspect of the asset management regime. The criteria must be realistic but should offer the appropriate incentives and penalties for delivering or failing to meet the criteria.

The fourth component of a robust asset management regime is a reliable database on the location and condition of all main highway assets with a high focus on highway structures cannot be overemphasised. Without reliable data on asset condition the asset system cannot objectively identify the priority areas and action plans.

Good asset management practice dictates that an inspection regime is in place to enable any defects which may cause unacceptable safety or serviceability risks or serious maintenance requirement is detected in good time in order to safeguard the public and the structure. This is the fifth component of the Asset Management system.

As bridge structure are the most critical of highway infrastructure assets, bridge inspections are an important aspect of the data collection process under an asset management regime. Bridge management codes of practice recommend that all highway structures should be subject to one or more of the following regular inspection types namely:

1. Routine Surveillance
2. General Inspections
3. Principal Inspections
4. Special Inspections
5. Inspections for assessments prior to a structural assessment

Only after the conditions and critically of key highway assets has been assessed will there be a possibility of developing life cycle work plans that address deteriorating asset condition and prolong the life of highway assets as the sixth and final stage.

Engineering design and construction

Generally it is assumed that all new bridges in the highway network are designed and constructed to conform to international standards by the design and construction contractors. However, we understand that this is not always the case with the range of contractors and consultants operating in Sierra Leone from different countries and regions.

We are aware that in order to rectify this situation, in 2012, the European Union provided an assistance mission to the Sierra Leone Road Authority by commissioning consultants to review its road design manual's structure and content. The review entailed adopting and adapting the Association of State Highway and Transportation Officials (AASHTO) LRFD Bridge Design Specifications, 2nd edition, 1998, to meet SLRA's specific requirements for its highways and bridges manual and to bring it in harmony with the international standards. The AASHTO standards are believed to be one of the most technically advanced standards in the world.

The SLRA Design Manual for Roads and Bridges is in the draft final stage. The bridge standards proposed for the SLRA's Manual for Roads and Bridges are based mainly on the American standards. The manual deals with all stages of bridge design from planning and site investigation to preliminary and detailed design.

The prospect of adopting national design standards should ensure a degree of consistency on design requirements and the complementary design assurance and on-site quality management prior to client handover and acceptance.

To enforce consistency of standards and to increase the reliable design life of highway assets, the highway authority should consider mandating by law or construction regulation the design and build standards for all highway and bridges. The failure of bridge structures is of high risk to life and property and should therefore be brought under greater statutory control. In addition, a more stringent bridge design and construction certification system should be instituted so that designers or contractors (including international consultants) are made liable in the event of structural failure of new bridges resulting from inadequacies in design or construction, this system should be implemented urgently so that the major bridges currently under construction across the country are covered by a more rigorous certification system.

There is the possibility the shortage of suitably experienced engineers in the area of design and assessment of bridge structures in the country could contribute to the shortfall in good industry practice in terms of design assurance and construction supervision. To address this and other related potential skill gaps, the training institutions should seek assistance from international agencies and organisations to explore opportunities for Sierra Leonean engineers to develop their skills in these areas.

Enforcement

As the Highway Authority, Sierra Leone Government has a duty under the Highways Act to maintain its highways to safe and serviceable standards and protect public rights on the country's roads. This is done by ensuring that the highways including its bridges are free from interference, encroachment, nuisance, danger, obstructions and unlawful stopping up.

In many cases across the country there are no well-defined boundary lines between local community land and the public infrastructure. This often leads to boundary land disputes, lack of clear ownership and therefore impacts on the maintenance and protection of the highway assets.

Encroaching on public land and highway boundary land by farming related activities has led to deforestation, thereby affecting watercourses and the general terrain of the land. A common problem faced by highway authorities in parts of Africa is difficulties faced with ghettos being set up within or in close proximity to bridges and other highway structures. This raises a number of concerns including damage to public structures, land and the landscaping, debris and other unsanitary conditions including the accumulation of hazardous waste which can be costly to remove and all of which can restrict the opportunity for regular bridge inspections to be carried out.

Enforcement is therefore important to both protect the structure including verges and embankments from unwanted human activity and encroachment. The best form of enforcement is that which is policed by the citizens or self-enforced through physical restrictions.

The government through publicity campaigns should sensitise the population of the risks of damaging the public highway embankments by felling of trees and clearing vegetation which can lead to landslides. Local chiefs and elders that have the respect of the communities should be encouraged to enforce this message.

Bridges can also be made safer by applying legally enforceable restrictions to impede highway usage and these include weight, height and width restrictions (or a combination of one or more of these measures). Weight restrictions are usually applied to bridges when defects or other causes result in the structure becoming unsuitable to carry heavy vehicles. Such a restriction will protect the bridge until the opportunity arises for the structure to be strengthened or the structure or elements of the structure replaced. Height restrictions are usually put in place to protect overhead objects or structures whilst width restrictions can restrict vehicles exceeding a specified width from crossing the bridges. In situations where enforcing a weight restriction is difficult a combination of width and/or height restrictions could potentially prevent or discourage large vehicles from abusing the restriction.

It is however unclear how the Highway Authority in Sierra Leone conveys information about weak bridges to road users as it is our view that adequate signing in advance of the structure will warn drivers of the restriction and will reduce the likelihood of vehicles breaching the statutory protection relating to structure. All this can be theoretical if the weak bridge is the only possible access to a location and then replacement of the structure becomes high priority.

Questions the Highway Authority may want to consider in relation to enforcing restriction relating to the highway network:

1. Is the section of the network vulnerable to unlawful occupation/trespass?
2. Has a process been set for the Highway Authority to be notified about any unauthorised activity?
3. If the police are notified of unauthorised activities on structures or adjacent to structures, do they know who in the Highway Authority should be notified?
4. If the powers of persuasion by Highway Authority officers (or police/ enforcement officers) does not result in people leaving the structure/ land and taking down any illegal encampment is there a clear decision making process on what enforcement action is to take next?
5. At what level of the Highway Authority organisation will that decision be made?
6. How will that decision-maker be notified?

There are routes of the highway network with a series of bridges which are unsuitable to carry heavy goods vehicles, overloading of bridges is a significant contributor to structural failure and in such situations the use of weighbridges could be applied to enforce the weight limit on that route. Weighbridges should be appropriately located to allow diversions to alternative routes at the point where the vehicle is turned away. At the SLIE conference in June 2012, the damage to the highway from heavy mining freight vehicles in the area around Tonkolili was highlighted and the installation of weighbridges at appropriate locations was identified as a means of improving enforcement.

The Sierra Leone Government as the Highway Authority have a duty to protect the public rights on its roads and bridge structures. The effectiveness of this legislation in protecting the public is dependent on the compliance of others.

Recommendations

RoTAP (a UK diaspora organisation of engineering and technical professionals) in responding to two major bridge failures this year has offered the following recommendation for consideration by policy makers in Sierra Leone to protect the nation's highway assets:

1. The governance and responsibility for highway works should be reviewed to provide a separate professionally experienced and qualified client function from the project delivery organisation that is suitably resourced with the capacity ensure Value for Money and prioritisation of works.
2. As part of the review of local and regional administration, the development and maintenance of the non-strategic highway network should be devolved to locally accountable representatives that are proportionately resourced through the Road Management Fund.
3. The government should develop a highway asset management policy that has full endorsement and support of key decision makers in central and local government administration.
4. A stringent design certification and construction system for new bridges should be implemented, making designers and contractors liable for inadequacies in the design or in the construction of bridges.
5. Highway encroachment and activities that damage the highway infrastructure should be enforced more rigorously and programmes of education and sensitisation implemented to make the population aware of the dangers to human life and national property.
6. The training institutions and government bodies should seek assistance from international agencies and organisations for opportunities for Sierra Leonean engineers to develop capacity in areas such as bridge design quality assurance, construction quality control or other related areas of skills shortage.
7. The government should consider piloting the option of raising revenue for maintaining certain strategic roads by levying a toll or road user charge for specific or all classes of vehicles.

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