Ropeways in the Urban Environment

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1. Introduction

A ropeway, also known as a cable car, is a means of aerial cable transport in which multiple cabins are hauled above the ground by means of one or more cables. Traditionally, cable cars have been used as the primary means of transport in mountaineous areas but have recently been adapted into urban transport systems. A comprehensive review of ropeway applications in urban transport is provided by the Gondola Project[1.] Ropeways are short distance transit technology and a typical line segment will not exceed 5km. To obtain longer lengths, separate segments are cascaded. By varying the number of cabins on the lines, the daily system capacity can be greatly varied.

A number of cities across the world have embraced ropeway technology as an integral part of their mass rapid transit systems, to solve current and future transport problems. The technology has been very successfully deployed in South America with the largest system being in La Paz[2] and other systems in Medellin[3], Caracas[4] and Rio Brazil. In Africa, Algeria has ropeway systems in five of its cities including Algiers and Constantine[5], whereas systems are under development in Lagos[6] and Mombasa[7.] Urban ropeways can also be found in Singapore[8], London[9] and Koblez[10]

This paper considers the use of cable car systems for urban transport. Modern multi-gondola systems often provide for a very compelling alternative to more conventional means of ground-based transport. For example when it comes to a difficult geographic situation like water or existing buildings (they simply go over the obstacles), a need for a rapidly available and cost efficient solution and where there are severe needs for the rapid deployment of effective mass transport solutions.

The paper is presented as follows. Part 2 provides an outline of implementation of the technology worldwide. The benefits of the technology are enumerated in part 3, followed in part 4 by a consideration of its application for greater mobility in cities. Ropeway projects under development in Kenya are described in part 5 followed by challenges and opportunities therein in part 6. A paper summary and recommendations are given in part 7.

2. Worldwide Implementation

Table 1 provides some information on the capacity of selected urban ropeway system in their use for mass rapid transit

City	No. Lines	Daily Capacity (Pax)
La Paz (Bolivia)	3	252,000
Under construction	*6*	*500,000*
Singapore (Singapore)	3	201,000
Medellin (Columbia)	1	115,000
Constantine (Algeria)	1	68,000
Caracas (Venezuela)	1	30,000

Table 1. Capacity for selected Urban Ropeways

In La Paz, Reuters reported journey times that were taking 1.5- 2 hours on the road, now take 24 minutes on the ropeway[2]. This clearly increases people's quality of life and productivity.

Figure 1 next shows world wide the cities with operating ropeway systems and those under development.

Fig. 1. Cities with (or developing) ropeways worldwide (Courtesy of Gondola Project)

Figure 2 below shows photos of the kind of solutions ropeways can offer. They can easily cross barriers (water systems, settlements etc) since they utilise a separate level.

Fig.2. Typical ropeway installations

3. Benefits of Ropeway Systems

Ropeways provide a secondary transport corridor that complements the ground-based networks. This aerial corridor offers many advantages as enumerated next.

Technical

- Requires very little ground space for towers and stations;
- Very short construction period (typically 12 months for a single line);
- Very low power consumption;
- Accident proof- eliminates most causes of accidents;
- Centralises operations as opposed to multiple drivers;
- System can move at a speed of up to 30 km/hr; and
- System is *Green* and *Sustainable* given zero gas emissions.

Private Sector Funding

- Given the much cheaper cost of implementation/development (1/3 of the typical of cost of a standard light rail system), Aerial Transit Ropeways projects are extremely attractive to private sector investors under the **Public-Private Partnerships (PPP)** frameworks. For example, the Likoni Cable Express Project[7], will be fully funded under a PPP arrangement. It has a price tag of USD 55 Million.

Social-Economic Benefits

- Fares for most journeys will be equal or lower than those charged by mini-vans (matatus.) LCE tickets, for example, start at K.Sh 25/= per ride.
- Improves quality of life of commuters by ensuring guaranteed transit/commute times on a daily basis;
- Predictable commute times improve overall productivity;
- Commuters will be able to spend commute time saved with family and loved-ones;
- Systems implementation and daily operations will create new jobs

4. Ropeway Application for Greater Mobility in Cities

A ropeway can resolve a host of urban transport problems. Some of the functions performed by a ropeway are indicated in figure 3 below.

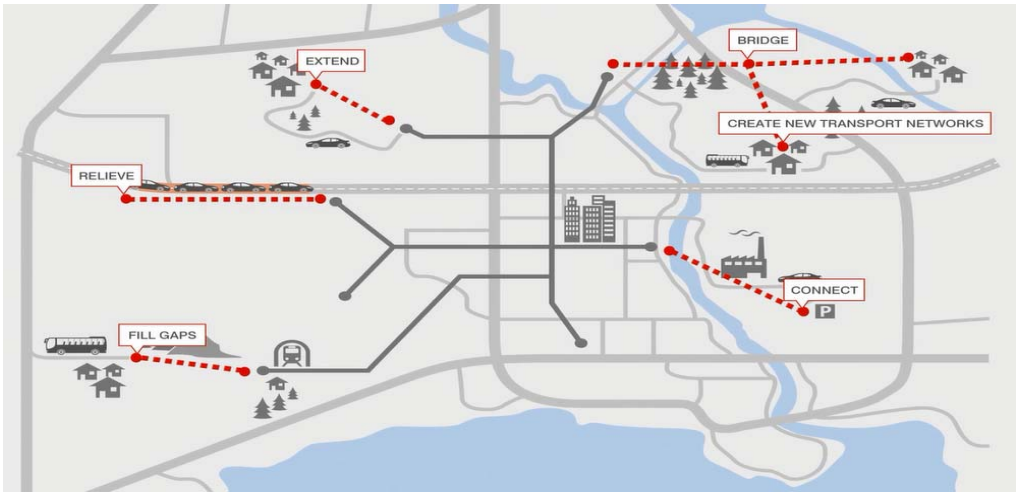

Fig. 3. Functions performed by a ropeway

These functions include:

Fill gaps – ropeways are well suited to filling gaps between facilities that generate traffic, such as hospitals, universities or commercial zones and other outlying infrastructure. By acting as a connecting link, they extend and enhance existing infrastructure.

Connect – ropeways can connect facilities which are organizationally linked but located far apart, such as a campus or factory site. Conventional forms of transport, such as shuttle buses are often too expensive and too personnel intensive.

Bridge – ropeways cross barriers which cannot be passed by conventional means, or only at great expense.

Relieve – when conventional forms of transport and existing infrastructure reach their limits, ropeways can be used to alleviate traffic congestion. For example, to move 10,000 persons per hour, you will require 2000 5-seater saloons, 700 14-seater matatus, 150 65-seater buses or 1 ropeway (appropriately configured with correct no of cabins and line speed).

5. Kenya Ropeway Projects

There are two major ropeway projects under development in the country. The first, Likoni Cable Express (LCE)[7] seeks to provide a complementary pedestrian crossing at Likoni Channel. It is expected to become the anchor for an expanded Mombasa Cable Transit (MCT) solution, as show in figure 4 below.

Fig.4. Likoni Cable Express (LCE) and potential expansion to MCT

The daily ridership capacity of Likoni Cable Express is 180,000 commuters which greater than the current channel crossing demand of 352,000 (as of December 2015 count.) The Mombasa Cable Transit will have a combined capacity in excess of 540,000 commuters which is greater than half the daily demand to and from Mombasa Island. It's expected to cost USD 200M.

The MCT system is envisaged to greatly reduce vehicular traffic on the Island because:

- Public vehicles from Malindi Road would turn left at Kongowea, drop and pick commuters at the ropeway station in Nyali Links road. The commuters will then come to (or leave) Island on the ropeway. A similar solution will be utilised at the Changamwe area.
- The ropeway line between Mwembe Tayari and Likoni will provide the link for commuters between South Coast and CBD using the aerial services only.

Nairobi Cable Transit Project

The Nairobi Cable Transit (NCT) project seeks to provide an aerial mass transit solution for the city to alleviate the current severe traffic congestion. The master plan of the system is shown in figure 5 below.

Fig. 5. Nairobi cable transit master plan.

When fully implemented, MCT will have a capacity of 2 million persons per day, and will have a major impact in resolving transport mobility in the city. Phase 1 of the master plan is under feasibility studies. It has two corridors (Jamhuri-Kibera-Nyayo Stadium-Muthurwa; Muthurwa-Jogoo Rd- Donholm-Taj Mal) and is expected to cost USD 600M.

6. Challenges and Opportunities

Challenges – there a number of challenges that need to be overcome for rapid adoption of the technology. These include;

- Perception, a lot of people still believe this is a technology for mountains;
- Policy makers do not appreciate the technology and therefore do not consider this when seeking options for movement of persons;
- Limited technical skills to design and operate the systems thereby depending on foreigners with the attendant higher costs;
- Poor knowledge of structuring Finance for Infrastructure Projects, making it difficult to achieve bankability status;
- Poor understanding of Public Private Partnership laws – appreciation of the laws is critical to structuring the projects;
- Limited capacity of local investment banks making it difficult to raise equity and debt for the projects;
- Securing of air rights to keep to straight line segments;
- Lack of current regulatory regime to ensure the system operators keep to the standards defined by KEBS.

Opportunities – the technology adoption creates new opportunities, including:

- Potential Investors
- Potential Insurers
- Technical Universities
- Technical Consultants
    - ✓ Feasibility
    - ✓ Owner's Engineers
    - ✓ O & M Specialists

School of Aerial Cable Transit (ACT)

- School Objective- Facilitate deployment of ACT solutions across sub-Saharan Africa countries
- Knowledge Repository on ACT technology, thus:
    - ➢ Sensitize policymakers on need to roll-out this technology
    - ➢ Train pool of ACT engineers and designers
    - ➢ Train Developers on PPP Procedures and Structuring Infrastructure projects

7. Summary and Recommendations

This paper has presented ropeways as an innovative solution for current and future transport challenges in cities. An overview of worldwide implementation of the technology as a mass rapid transit solution was given together with its benefits. Projects under development in Kenya, their challenges and opportunities have been highlighted. It is recommended that policy makers consider evaluation of this technology to alleviate traffic congestion within our cities.

References

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