2013-08

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International Journal of Engineering And Computer Science

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International Journal Of Engineering And Computer Science ISSN:2319-7242
Volume 2 Issue 8 August, 2013 Page No. 2315-2318

Survey on Intelligent Transport System (ITS) application for vehicle speed limit monitoring and accident reporting:

A case study of Tanzania

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Abstract

Today's transport system has evolved from horse driven carriages and paved roads to a more complex road transport system made up of a variety of vehicles and other infrastructure, all put in place in order to support safe and efficient mobility of vehicles. The next step to further improve the transportation system of today is to make the vehicles and roadside infrastructure more intelligent by making them communicates with each other. This new ability will help find new solutions to current problems like traffic congestion, vehicle accident, monitoring of adherence to traffic rules and alerting the responsible authorities of any traffic rule violation or accident for immediate management.

Speed limit violation and inefficiency accident information dissemination in public road transport are recognized as one of the causes leading to traffic accidents and the failure of emergency Medical Services personnel to reach the victim during the so-called "Golden Hour" after the accident in Tanzania.

This paper surveys the current system being used for speed management and Accident Reporting management in Tanzania. It also suggests recommendations for the implementation of systems that will effectively influence driving speeds and accident reporting management thereby significantly increase public transport safety.

Key words:- Intelligent Transport System (ITS), speed limit, Tanzania, Information Communication Technology (ICT), Emergency services, accident reporting .

INTRODUCTION.

Tanzania is a union of two countries namely, Tanganyika (Tanzania Mainland) and Zanzibar (Unguja & Pemba). The country is located in East Africa, sharing a boarder with Kenya and Uganda (North), Rwanda, Burundi and Republic of Congo (West), Zambia, Malawi and Mozambique (South) and Indian Ocean (East).

Road traffic represents 70 percent of freight and 90 percent of passenger transport in Tanzania. Road transport is essential to the socio economic development of Tanzania. According to Ministry of Infrastructure Development [1], the current level of loss of life and property associated with road accidents in Tanzania is on the increase. Between 1977

and 2008 a total of 379,699 road traffic accidents occurred, where over 48,754 reported fatalities (deaths) were caused and over 347,657 reported injured persons. The number of fatalities (deaths) reported in the year 2004 was 2,366 while in the year 2006 the number of fatalities was 2,884 and in 2007 it was 2,594.

There is clear evidence of the effect of speed on accident rates and accident severity. The energy to be dissipated in an accident is proportional to the square of the impact speed. For example an impact speed of more than 130km/hr involves more than twice the energy of one at 90km/hr [2]. Several studies have shown that there is a clear relationship between speed level and accidents; small speed level changes result in significant changes in the number of accidents [3][4][5]. Another study shows that lower speed variance is correlated with fewer accidents [3][5][6]. These observations indicate that lower speeds effectively reduce the number of accidents and mitigate the outcome of accidents. However, compliance with speed limits is low in Tanzania. A survey of actual speed levels in Europe [7] showed that speeding is a common phenomenon especially widespread on urban roads and motorways. However, by efficiently monitoring speed limit violation still accidents can occur, and a quicker response from emergency services could significantly decrease both the number of injured and dead passengers [8].

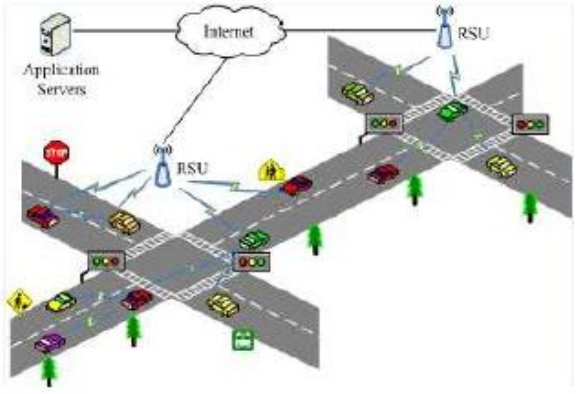

Figure 1: Intelligent Transportation System [9]

Intelligent Transportation System (ITS) applications like approaching emergency vehicle warning, post-accident warning, accident reporting, speed limit violation alert and pre-accident sensing are of greater interest as they make the most meaningful use of Information Communication Technology (ICT) to improve safety on road networks. The big picture of an Intelligent Transportation System would consist of many underlying networks connected to each other in order to support various features as shown in Figure 1.

CURRENT SPEED LIMIT MANAGEMENT

Currently in Tanzania there are two systems used to manage speed limits. The traditional systems of speed management which includes Road signs and markings, Speed bumps, scheduling legislation and Physical traffic police. The automatic system commonly employed is speed governors / speed delimiters and speed recorder.

Road signs and markings

Road signs are part of traditional road systems. They convey significant safety benefits as well as user amenity. Signs remain functional and achieve their safety objectives only if they are adequately maintained. They fade under sunlight, are subject to damages by vehicles and vandalism, and often do not command a high profile in an agency's maintenance program. Tignor [10] indicated that the installation of curve warning signs leads to a 20 % average accident reduction. Pak-Poy and Kneebone [11] quoted a Canadian study which in turn drew on other references which claimed a reduction of 20-57 percent reduction in accidents when warning signs were provided.

With almost every newly built/rehabilitated road in Tanzania road signs and markings are provided. However with time these are vandalized, stolen and some removed during accident events.

Speed bumps

This is another traditional means of speed management which concentrates on the road and its environment (road engineering measures). Engineering measures such as traffic calming may be effective in reducing speed at isolated sites, of which the most successful measures appear to be those which physically force drivers to lower their speed (e.g. road bumps). Nonetheless, the effects are localized in time and space.

Physical Traffic Police

Traffic Police monitors speed limit violators by means of special equipment (Radar) which captures the vehicle speed remotely. Drivers inform each other of the presence of

Traffic Police through radios and mobile cell phones. Drivers are forced to slow down on sections where monitoring of speeds is being carried out and speed up above the limits at all other uncontrolled sections.

Scheduling legislation

Another current means of controlling upcountry bus speeds limit violation is through scheduling legislation. The Surface and Marine Transport Regulatory Authority (SUMATRA) is responsible for setting bus time tables for buses going upcountry and towards Dar es Salaam. Legislation requires buses not to exceed 80 km/hr. However time tables issued to bus operators force drivers to travel at speeds higher than this.

Speed governors/Speed recorders

Since 1997 the Government of Tanzania introduced mandatory speed governors / speed delimiters or speed recorder for public service vehicles. The system monitors the speed of the vehicle and automatically decelerates the vehicle when the travelling speed is higher than the allowable speed limits preset in the system. Speed governors are too easily manipulated and have no automatic feed back or report to the enforcing authorities.

EMERGENCY SERVICES MANAGEMENT

Currently, the old method of rescue using a cellular phone when an accident occurred is used in Tanzania. The emergency personnel and traffic rely on passing motorists, pedestrian, or survivors to report accidents. Often the individual reporting the accident may not know where he or she is, let alone be able to direct help to his or her location. These delays can be especially lengthy in rural, relatively unpopulated, areas where an accident site may go undetected for hours – and occasionally days. Old method of rescue using a cellular phone when an accident occurred is depicted in Figure.1:

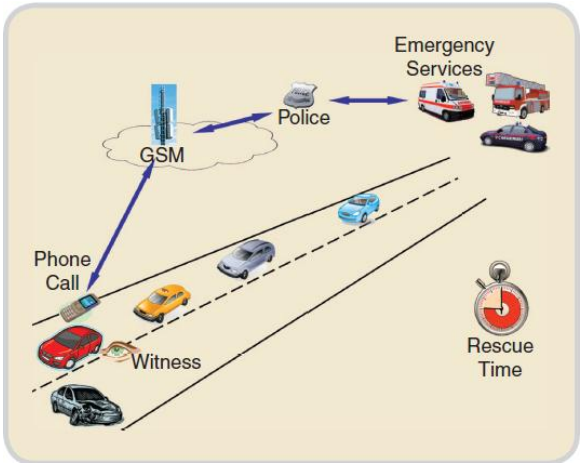

Figure.1: Old method of rescue using a cellular phone (Francisco J. Martinez *et al*, 2010)

TECHNOLOGY BASE LINE

The rapid advances in information technology and telecommunications and more specifically wireless, mobile communications and optical fiber and their convergence are leading to the emergence of a new type of information infrastructure that has the potential of supporting an array of advanced Intelligent Transport System (ITS).

Since the National Telecommunications policy (NTP) was launched in 1997, Tanzania has witnessed the advancement in communication technology. The telecommunication sector has become liberalized and competition has grown in mobile cellular phone services. Currently there are seven Telecommunication companies operating and own mobile cellular communication infrastructure along various major roads in the country. Apart from this telecommunication companies, the government of Tanzania is constructing the National Fiber Optic Cable network named as National ICT Broadband Backbone (NICTBB) with a view to achieve its ICT vision. The Backbone is managed and operated by the Tanzania Telecommunications Company Ltd (TTCL) on behalf of the government, through the ministry of Communication Science and Technology (MCST). The infrastructure will enhance usage of ICT applications for sustainable socio-economic development including implementation of e-government, e-learning, ITS, e-commerce and much more locally and globally. Figure 2: shows the Map of Tanzania national ICT backbone network. This entire ICT infrastructure available along major roads provides opportunity to design a low cost effective ITS

application for vehicle speed limit monitoring and accident reporting in Tanzania.

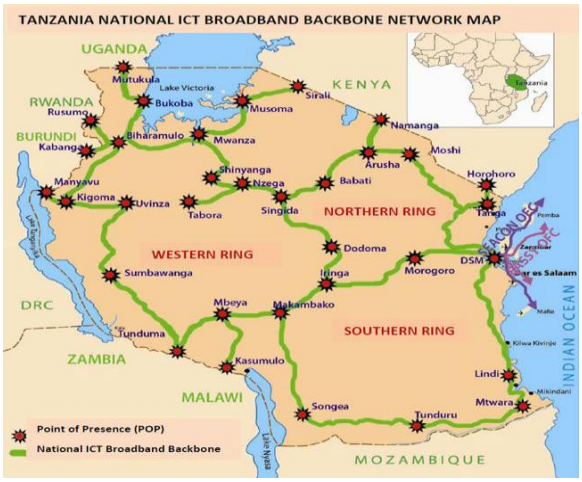

Figure 2: Tanzania National ICT Backbone Map

CONCLUSION

The visible enforcement at specified sites, directed towards certain groups of drivers and administered regularly at times when many of the passing drivers are commuters and buses, usually results in an immediate speed reduction. Still, the cost of such enforcement is relatively high and the extent of speed reduction in time and space is very small. The old method of rescue using a cellular phone when an accident occurs is inefficient and the rescue time is too long. Thus we recommend development of a new ITS model to utilize the available ICT infrastructure along major roads to enhance speed limit monitoring and accident reporting. The design should focus on reliability, low cost, durability, and flexibility of information technology.

The introduction of a speed limit monitoring and accident reporting system once implemented and tested should be carried out step-by-step with due consideration to safety and other advantages, acceptance, technical reliability and availability. The final goal for implementation should be the mandatory speed limit monitoring and accident reporting system, as it offers the highest safety gains.

However, it should start with voluntary usage supported with educational measures.

REFERENCES

[1] Ministry of Infrastructure Development, (2009), *Tanzania National road safety policy*. Dar es salaam.

[2] Ogden, K.W. (1992) *Urban Goods Movement: A Guide to Policy and Planning.* Hampshire, England: Gower House.

[3] Salusjärvi, M. (1981) *The Speed Limit Experiments on Public Roads in Finland*. Technical Research Centre of Finland. Publication 7/1981. Espoo, Finland.

[4] Nilsson G (1982) *The Effect of Speed Limits on Traffic Accidents in Sweden*. VTI Report 68, Linköping, Sweden.

[5] Finch DJ, Kompfner P, Lockwood CR & Maycock G (1994) *Speed, Speed Limits and Accidents*. Project Report 58. Transport Research Laboratory, Crowthorne, UK.

[6] O'Cinnéide D & Murphy E (1994), *The Relationship between Geometric Road Design Standards and Driver/Vehicle Behavior, Level of Service and Safety*. Traffic Research Unit, University of Cork.

[7] Draskóczy M & Mocsári T (1997), *Present Speeds and Speed Management Methods in Europe*.Deliverable R 2.1.1 in the MASTER project. VTT, Espoo, Finland.

[8] P. E. Rieth, and J. Remfrey, (2008), *Telematics-The Essential Cornerstone of Global Vehicle and Traffic Safety*, Proc. SAE Convergence 2008, Detroit, USA, 20th October 2008, pp. 08CNVG-0034 .

[9] Gongjun Yan. *Bibliography on qos of ad hoc communications.*

[10] Tignor S.C, (1993), *Traffic Control Devices: Overview, in the Traffic Safety toolbox*: A primer on Traffic Safety pp 45-52. (Institute of Transportation Engineers, Washington, DC).

[11] Pak-Poy & Kneebone Pty Ltd (1988) *Road safety benefits from rural road improvements.* FORS Report CR 71. 171 P. (Federal Office of Road Safety, Canberra Australia).

[12] Francisco J. Martinez, Chai-Keong Toh, Juan-Carlos Cano, Carlos T. Calafate, and Pietro Manzoni (2010) *Emergency Services in Future Intelligent Transportation Systems based on Vehicular Communication Networks*. IEEE Intelligent transportation systems magazine, pp 6, summer 2010