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Research Paper

CONDITION OF ROAD TRAFFIC SIGNS IN THE SEKONDI-TAKORADI METROPOLIS, GHANA

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RTCs are one of the leading causes of premature deaths and acquired disabilities globally. It has been established that a well-maintained and high-performing RTSs is a cost effective means of optimizing road safety. In the STM, RTSs neglect is a commonplace, yet the extent of the situation is unknown. This study therefore aimed to assess the state of RTSs in the STM. With the aid of a detailed road map, inventory of RTSs as well as their conditions was visually evaluated in the STM. In all, 116 RTSs were visually assessed. Of these, only a little over one-half (52.6%) was present. 69% of the RTSs present were in poor condition. The road network in the STM is thus poorly equipped with RTSs, and this presents a significant traffic safety challenge to road users. An innovative, comprehensive, systematic, and regular maintenance programme that is adequately resourced be instituted, to secure long-term performance of road traffic signs in the metropolis, in Ghana's quest at maintaining a healthy and productive population.

Keywords: Maintenance, Road Traffic Signs, Sekondi-Takoradi Metropolis, Ghana

INTRODUCTION

Road facilitates the movement of goods and enhances mobility. Mobility in general, provides access to healthcare, employment, education, connecting families. Besides, it supports national, regional, and international trade, which engenders amity among countries for peaceful co-existence. Road transportation undoubtedly, plays an indispensable role in the socioeconomic and political development of every modern society.

Traffic Control Devices (TCDs), which are basically signs, signals, pavement markings, and other safety installations placed along highways and streets (Federal Highway Administration, 2009b), to provide for the safe and efficient movement of all road users.

Road Traffic Signs (RTSs) are thus, one of the most important components of a highway infrastructure. They are the means to communicate with the highway user regarding regulations, warnings, directional guidance, and other appropriate information (Taori and McGee, 1998). Their performances are therefore paramount for safe and efficient mobility in a transportation system.

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The effectiveness of a TCD is dependent on the fulfillment of five basic requirements: fulfill a need, command attention, convey a clear, simple meaning, command respect from road users, and give adequate time for proper response (Federal Highway Administration, 2009). This principle suggests that RTSs must be conspicuous and legible, by road users, at appropriate distance commensurable with their purpose.

RTSs are basically designed to satisfy the visual requirements underlined by these principles not only for daytime operations but also for night time visibility when the retroreflectivity of traffic sign is most critical (Taori and McGee, 1998). However, as time wears on, the performance of RTSs diminish in a number of ways, but primarily through weathering. As RTSs age, they lose their color and retroreflective properties due to weathering and other associated factors. This culminates in a reduction in their visibility and legibility, and consequently their serviceability. Poorly performing RTSs among others, could contribute to road traffic crashes (RTCs). Degraded RTSs are thus less effective and have dire consequences on traffic safety.

Road transportation is plagued with RTCs, which has deprived affected communities of valuable human resource. Annually, approximately 1.2 million persons die prematurely through RTCs and up to 50 million sustain varying degrees of injuries. Of these fatalities, 45% are within the ages 29-45 (World Health Organization, 2013), depriving the job market of the needed human resource. Low-and-middle income countries are the hardest hit, accounting for 91% of the road traffic deaths even though these countries have approximately half of the world's vehicle (World Health Organization, 2014). It has been estimated that without action, RTCs are predicted to result in deaths of around 1.9 million people annually by 2020 (World Health Organization, 2014). This harrowing experience has irreparable socioeconomic impact on families and communities directly affected. In the event of the demise of a breadwinner, particularly in low-and-middle income countries, this dreary situation further plunges the affected family into poverty.

In Ghana, RTCs account for over 1900 deaths annually. Of these traffic fatalities, approximately 33.3% occurred in the urban environment, with 60.9% of the urban-fatalities being pedestrians (Building and Road Research Institute, 2011). The economic cost due to road RTCs is enormous. Estimate has it that, the economic loss due to RTCs is 1.6% of Ghana's Gross Domestic Product (Building and Road Research Institute, 2006). RTCs indeed stifle Ghana's economy.

There is mounting evidence that, the maintenance of RTSs, markings, and other safety related assets are cost effective ways of optimizing road safety. For instance in 2004, the Global Road Safety Partnership (GRSP) launched a campaign to improve safety on Hungarian roads through the implementation of simple and low cost measures such as, road markings and signals. Three black spots on roads with high fatality rates were chosen for the exercise. Before and after evaluation studies revealed that, all three black spots were practically eliminated and injuries and deaths were reduced to near zero (International Road Federation, 2006). High performing safety devices indeed contribute to safer roads.

Apart from the accident savings, there are also enormous economic benefits associated with the installation and regular maintenance of RTSs and other safety installations. In the United Kingdom (UK), the Royal Society for the Prevention of Accidents (RoSPA) carried out financial analysis after the implementation of a series of simple and low cost measures at improving road signing, markings, and other safety devices. The results were stunning. The financial analysis revealed a first year rate of return of 957% for road markings, 820% for markings and signs, 3491% for warning signings, and 153% for new traffic signals (International Road Federation, 2006).

It is patent that, a well-maintained road network with fully equipped high-performing TCDs is conducive for safe and comfortable driving. However, most often after huge sums of money are invested in their installation, they are neglected. This dereliction diminishes their performance, and has unsavory effect on road user safety.

In the Sekondi-Takoradi Metropolis (STM), in the Western Region of Ghana, RTSs neglect is a commonplace, yet no studies have been conducted to unearth the extent of the situation. This study thus aimed to assess the state of RTSs in the STM. The results of this study will provide the National Road Safety Commission of Ghana (NRSC) and other stakeholder institutions, a snapshot of road safety delivery in the metropolis.

MATERIALS AND METHODS

The Sekondi-Takoradi is an urbanized, vibrant harbor city in the Western Region of Ghana, with a population of 2,376,021 (Ghana Statistical Service, 2012). The region is a hub for most of Ghana's natural resources.

The commencement of crude oil and natural gas production in commercial quantities in the early 2010s has attracted workers, nationally, regionally, and internationally. In every modern society, one of the corollaries of population increase is obviously the demand for mobility. Increased motorization in the STM must be balanced with adequate provision for safe mobility of road users, particularly those who adopt other modes of transport, such as walking, and cycling. To this end, well-maintained and high-performing RTSs are critical.

A detailed road map of STM was obtained. Reconnaissance was then carried out to ascertain the existence of roads identified during the office studies. The reconnaissance aided in establishing familiarity with the road network in the study area, to facilitate efficient data collection.

Chainages were established to correspond with the centerline of each of these road segments, essentially to accurately establish the location of these safety devices. The road environment in the STM was carefully scanned for RTSs and their conditions evaluated in increasing direction of chainage on each road segment, during the day light hours, from 7:00 am -5:00 pm. This enabled accurate visual inspection of the RTSs.

On each link, while walking, the road environment was carefully scanned for the existence or otherwise of RTSs. If present, their locations were noted and conditions closely visually evaluated. A RTS was considered absent if the sign was either missing from the

post or the support vandalized, usually by traffic impact. Only one condition surveyor was used in the field visual inspection, essentially to ensure consistency in the data collection process. Physical assessment of the RTSs was based on the scale: "good", "poor", or "absent".

RESULTS

Characteristics of the Road Traffic Signs Field Condition Survey

In the study, the road environment in the Sekondi-Takoradi Metropolis (STM) was conscientiously scanned for the conditions of RTSs. In all, a total of 14 road segments, which were mostly arterials and collectors, were involved in the field survey. As a whole, 116 RTSs were closely and visually inspected for their conditions. Almost one-half (49%) of these signs were regulatory, two-fifth (38%) informatory, and 13% warning (Table 1).

Overall Condition of Traffic Signs in the Sekondi-Takoradi Metropolis

During the field condition survey, a total of 116

Table 1: State of Traffic Signs in the Sekondi-Takoradi Metropolis, Ghana

	Traffic Signs															
	Regulatory				Informatory				Warning				Total			
	Present	Absent	Condition		Present	Absent	Condition		Present	Absent	Condition		Condition		Present	Absent
			Good n(%)	Poor n(%)			Good n(%)	Poor n(%)			Good n(%)	Poor n(%)	Good n(%)	Poor n(%)		
J B Danquah	1	1	0(0)	1(100)	4	1	1(25)	3(75)	-	-	-	-	1(20)	4(80)	5	2
Kitson	2	4	1(50)	1(50)	1	-	0(0)	1(100)	1	-	1(100)	0(0)	2(50)	2(50)	4	4
New-Site Pipe Ano	3	2	1(33.3)	2(66.7)	-	-	-	-	1	2	0(0)	1(100)	1(25)	3(75)	4	4
T-Poly	4	2	2(50)	2(50)	3	3	1(33)	2(67)	1	-	1(100)	-	4(50)	4(50)	8	5
New-Site Afra	0	5	-	-	1	2	0(0)	1(100)	1	-	0(0)	1(100)	0(0)	2(100)	2	7
Anaji	1	2	0(0)	1(100)	0	1	-	-	-	-	-	-	0(0)	1(100)	1	3
C K Mann	3	3	2(67)	1(33)	-	-	-	-	-	1	-	-	2(67)	1(33)	3	4
Kwamena Annaesi	2	1	0(0)	2(100)	1	2	0(0)	1(100)	1	-	0(0)	1(100)	0(0)	4(100)	4	3
Air Force	3	2	0(0)	3(100)	4	2	3(75)	1(25)	1	1	0(0)	1(100)	3(37.5)	5(62.5)	8	5
Liberation	1	1	0(0)	1(100)	3	-	0(0)	3(100)	-	-	-	-	0(0)	4(100)	4	1
Kofi Annan	1	1	0(0)	1(100)	2	1	1(50)	1(50)	1	-	1(100)	0(0)	2(50)	2(50)	4	2
Ako Adjei	0	1	-	-	1	1	0(0)	1(100)	-	-	-	-	0(0)	1(100)	1	2
John Sarbah	1	1	1(100)	0(0)	2	2	0(0)	2(100)	1	1	0(0)	1(100)	1(25)	3(75)	4	4
Cape Coast	2	7	0(0)	2(100)	6	1	3(50)	3(50)	1	1	0(0)	1(100)	3(33)	6(67)	9	9
Total	24	33	7(30)	17(70)	28	16	9(32)	19(68)	9	6	3(33)	6(67)	19(31)	42(69)	61	55

RTSs were closely and visually inspected for their conditions. Of these, 52.6% (61) were present, while 47.4% (55) absent (Table 1). 65% (42) of the RTSs present were in poor condition, while only 31% (19), in good condition. Of the derelict RTSs, more than one-half (54%) were damaged, and 46% worn out (Table 2). Figures 1 to 3, provide a snapshot of the state of RTSs in the STM.

Road Traffic Sign Type and Condition

The condition survey revealed that, approximately 69% of the existing RTSs were in poor condition. Informatory signs accounted for most (45%) of these poorly performing RTSs. This was followed by regulatory signs (40%) and finally warning signs (14%) as shown in Table 1.

Furthermore, a total of 55 traffic signs, of the 116 surveyed, were missing. Most (60%) of these traffic signs were regulatory. Informatory signs accounted for 29% of the missing traffic signs, and warning signs, 11% (Table 1).

Table 2: Proportion of Decrepit Traffic Signs and Condition Type in the Sekondi-Takoradi Metropolis

Road Name	No. of Signs in Poor State	Condition Type	
		Damaged	Defaced/Worn out
J B Danquah	4	3	1
Kitson	2	-	2
New-Site Pipe Ano	3	1	2
T-Poly	4	3	1
New-Site Afra	2	-	2
Anaji	1	-	1
C.K Mann	1	1	-
Kwamena Annaesi	4	3	1
Air Force	5	3	2
Liberation	4	3	1
Kofi Annan	2	1	1
Ako Adjei	1	-	1
John Sarbah	3	1	2
Cape Coast	6	3	3
Total	41	22	19

Figure 1: A Sample of Vandalized Traffic Sign

Figure 2: Bus Stop Sign Converted into a Bill Post

Figure 3: A U-turn with no Traffic Sign

Road and Road Traffic Sign condition

Only 61 of the 116 traffic signs visually inspected, on the 14 road segments in the STM, during the daytime survey were present. Approximately 69% (42) of these RTSs were in derelict state. Of the 14-road segments, more than one-half (57%) had poorly maintained road signage (Table 1). Five of these road segments: New-Site Afra, Anaji, Kwamena Annaesi, Liberation, and Ako Adjei road segments were observed to have all (100%) the traffic signs in poor condition. Besides, the J B Danquah road had 80% of its traffic signs in derelict state. Finally, both the John Sarbah and New-site Pipe Ano roads had three-fourth (75%) of the traffic signs present in negligent state.

In general, among the 14 road segments surveyed in the STM, the Cape Coast road registered most (16%) of the missing traffic signs, followed by New-Site Afra road (13%). Both T-Poly and Air Force roads recorded average (9%) missing traffic signs, while the liberation road, the least (2%), as shown in Table 1.

DISCUSSION

RTSs are undoubtedly very important components of a transportation system, as they provide information to road users, particularly motorists, for save and efficient navigation of the road environment. The results of the RTSs condition survey, however, revealed that just a little over one-half (52.6%) of the RTSs were present, and 69% of these were in poor condition. More than one-half (54%) of the derelict traffic signs were damaged and the rest (46%) defaced.

These decrepit RTSs clearly indicate that, roads in the STM are poorly maintained and ill-equipped with RTSs. This is a worrying development as it poses unnecessary huge safety challenges for motorists, pedestrians and other road users, in light of the increasing desire for motorization in the metropolis.

Effective RTSs protect motorists against ill-perceived situations in the road environment. Poorly maintained RTSs, however, render them less effective and this has dire consequence on road safety. Without these safety aids, road users, particularly motorists, feel unsafe and become unsure of their required driving behavior (International Road Federation, 2006). This phenomenon elevates confusion among road users, and contributes to a higher frequency of RTCs. For instance, in Massachusetts in the USA, on May 23, 2012, a 72-year old crossing guard was struck down to death by a pick-up truck, while assisting school children in crossing a roadway at an unsignalized pedestrian crosswalk during the daytime. Post-crash investigations revealed that, the crosswalk markings were in poor condition and of the least visible type. Besides, there were no TCDs at the crosswalk location to warn motorists of the crosswalk location (Massachusetts Department of Public Health, 2013). In effect, ineffective RTSs engender unsafe roads.

Much as RTSs are important for safe navigation during the daytime, they are of greater value during nighttime driving, where less of the road environment is clearly seen. However, poorly maintained RTSs lose their retroreflectivity, which is critical for safe and efficient traffic operation during the nighttime, precipitating the vulnerability of road users to RTCs. In Ghana, RTCs and their attendant fatalities and injuries, mostly occur during night time travels (Building and Road Research Institute, 2011). In light of this, it is incumbent on the Department of Urban Roads (DUR) that has jurisdiction over road networks in the urban settings, to ensure regular maintenance of these safety assets, for both daytime and nighttime immaculate performance.

It is well established that, a well-maintained road network with fully equipped and effective RTSs among others, provide a conducive and safe road environment for comfortable driving. Though road network in the STM is in good shape, proving good riding quality, they are not pretty safe for the motoring public owing to non-serviceability of the RTSs. The good roadway condition may stem from regular maintenance, with financial support from the Ghana's Road Fund. The neglect of RTSs in maintenance activities is indicative of how the performance of RTSs is less of a priority to the DUR in the scheme of things. The dereliction is certainly a poor maintenance practice.

Regular maintenance of RTSs has proven to be a low cost means of optimizing road safety. For instance, in United Kingdom, RoSPA carried out detailed analysis after the implementation of a series of simple and low cost measures at improving road signing, markings, and other safety devices. The results were encouraging. The analysis realized accident reductions of 34% and first year rate of return of 957% for road markings; 41% in accident reduction and 820% first year rate of return for markings and signs; 46% in accident reduction and 3491% first year rate of return for warning signings; and 67% in accident reduction and 153% first year rate of return for

new traffic signals (International Road Federation, 2006).

It is clear from the foregoing that, a well-maintained road network though necessary, it is not a sufficient condition to guarantee safety of road users. It should however be complemented with high-performing RTSs and other safety assets. It is therefore a bad economy for huge sums of money to be invested in road maintenance activities without consideration for RTSs, in view of the fact that, in Ghana, road transportation is riddled with RTCs, and these have enormous economic impact on the national purse.

In light of the enormous economic and health benefits associated with high-performing RTSs and other safety installations on a road network, it is expedient that a rigorous, systematic, and regular maintenance program, which is adequately resourced, be instituted to secure a long-term performance of these safety devices in our quest at maintaining a healthy and productive population.

CONCLUSION

The road transportation system in the STM is poorly maintained and ill-equipped with road traffic signs. This presents a significant traffic safety challenge to the travelling public.

RECOMMENDATIONS

1. Decrepit road traffic signs should be replaced immediately.
2. An innovative, comprehensive, systematic, regular maintenance program that is adequately resourced be instituted, to secure long-term performance of road traffic signs in the metropolis, in Ghana's quest at maintaining a healthy and productive population.
3. Further research should be carried out to assess the nighttime retroreflectivity of road traffic signs in the Sekondi-Takoradi Metropolis.

REFERENCES

1. Building and Road Research Institute (2006), *Estimation of the Cost of Road Traffic Accidents in Ghana.* Kumasi, Ghana: Council for Scientific and Industrial Research.
2. Building and Road Research Institute (2011), *Road Traffic Crashes in Ghana Statistics 2010.* Kumasi, Ghana: Council for Scientific and Industrial Research.
3. Federal Highway Administration (2009), *Manual on Uniform Traffic Control Devices for Streets and Highways.* Washington DC: US Department of Transportation. Retrieved on January 11, 2014, from mutcd.fhwa.dot.gov/pdfs/2009/mutcd2009edition.pdfý
4. Fiore M A and Davis L (2013), *MA FACE Occupational Fatality Report: Municipal Crossing Guard Fatally Injured When Struck by a Motor Vehicle.* Boston, Massachusetts, US: Occupational Health Surveillance Program, Massachusetts Department of Public Health.
5. Ghana Statistical Service (2012), *Population & Housing Census: Summary Report of Final Results,* Accra, Ghana: Sakoa Press Ltd.
6. International Road Federation (2006), *Maintenance of Road Signs, Markings and other Safety Assets: A Cost Effective*

Means of Optimizing Road Safety, Geneva, Switzerland: International Road Federation.

7. Massachusetts Department of Public Health (2013), *Municipal Crossing Guard Fatally Injured When Struck by a Motor Vehicle,* Boston, Massachusetts, USA: Occupational Health Surveillance Program.
8. Taori S and McGee H W (1998), "Impacts of Maintaining Traffic Signs within Minimum Retroreflectivity Guidelines", *Transport Research Board*, pp. 19-27, Washington, DC: Transport Research Board.
9. World Health Organization (2013), *Global Status Report on Road Safety 2013: Supporting a Decade of Action,* Geneva, Switzerland: World Health Organization.
10. World Health Organization (2014), *Media Center*. Retrieved January 11, from Road Traffic Injuries: http://www.who.int/mediacentre/factsheets/fs358/en/index.html