

# HAZARDS AND RISKS ASSOCIATED WITH THE OPERATING ENVIRONMENT OF THE N1 HIGHWAY, GHANA.

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## ABSTRACT

*Undesired and negative results that lead to damages and losses on the N1 highway were assessed in the light of target objectives of the MiDA for commissioning the N1 highway in Accra. In this study, risk factors arising from people, systems and processes, and associated events and incidents connected with the functioning of the N1 highway were identified and examined using mixed methods research design. In a survey, 100 respondents who were regular users of the N1 highway including pedestrians, motorists and personnel from the Ministry of Roads and Highways shared experiences in semi-structured interviews. Observations were made about risks, damages and losses on the highway, and controls for managing risks and examined using Preliminary Hazard Analysis (PHA). Inadequate number of locations for user-access on the highway, presence of numerous intersecting cross-streets that feed into the main N1 highway causing interferences, poor design in constructing the N1 highway through human settlement, inadequate provisions of access for certain modes of transport, and unlimited or free access to adjacent property resulting in no protection for property and activities, were among risk factors identified on the N1 highway. The study recommends the fixing of more, higher guard-rails, more bus bay points near foot bridges, additional foot bridges, traffic control points in locations away from bus terminals, and provision of road-user facilities for physically-impaired persons. Education on risks associated with using the N1 highway could prevent pedestrians from competing with motorists when crossing the N1 highway and reduce frequent occurrences of accidents.*

**Keywords:** Risk factors; N1 Highway; Motorway; Construction; Risk Controls;

## 1. INTRODUCTION

In order to upgrade the Tetteh Quarshie-Mallam Road, construction work as stated by the Millennium Development Agency (MiDA), was carried out as part of the transportation project of the Millennium Challenge Account (MCA) Program ([www.mida.gov.gh](http://www.mida.gov.gh), 2012). The MCA indicated in their reports that the 14 kilometer (km) stretch of the N1 Highway constituting the road from the Tetteh-Quarshie Interchange through the Apenkwa Interchange to Mallam Junction. This “George-Walker Bush Motorway” was the first completely urban-

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based Road Project undertaken by the Millennium Challenge Corporation (MCC) under the Millennium Challenge Account (MCA) Programme (mida.gov.gh 2012). The construction project was executed by China Railway Wujia Corporation to realize a national dream of continuing the Phase II of the Accra-Tema Motorway, which was constructed some 43 years ago.

According to MiDA, upgrading the vital 14km road link has been on the drawing board since the Accra-Tema Motorway (one of Ghana's known motorways) was completed in the 1960s. Tackling it under the Transportation Project of the \$547million Millennium Challenge Account (MCA) Program, funded by the Government of the United States of America could alleviate the unacceptable traffic congestion levels experienced on the road corridor. With respect to the MCA programme, President John Agyekum Kufour indicated that, movement on the Tetteh- Quashie -Mallam road was tedious and reconstructing it into a first-class, three lane dual carriages way would reduce travel time and vehicle operating cost (www.mida.gov.gh, 2012).

### **1.1 General characteristics of the motorway and Highway**

There is no formal definition of the English-language words "motorway", "freeway" and "expressway" or of the equivalent foreign-language words auto route, autobahn and auto trade that are accepted world-wide - in most cases these words are defined by local statute or design standards. According to (Cobuild 2001), in the UK sense, a motorway is a major road that has been specially built for fast travel over long distances. Motorways have several lanes and special places where traffic gets on and leaves. The usual American word is freeway. Description also used for motorway included road specially designed and built for motor traffic, which did not serve properties bordering on it, and which: (a) provided, except at special points or temporarily, with separate carriageways for the two directions of traffic, separated from each other, either by a dividing strip not intended for traffic, or exceptionally by other means (e.g. boulders, or by a traffic barrier); (b) did not cross at level with any road, railway or tramway track, or footpath (that is, they are free of any at-grade crossings with other roads, railways, or pedestrian paths, which were instead carried by overpasses and underpasses across the highway); and (c) was specially sign-posted as a motorway and reserved for specific categories of road motor vehicles. In Ghana, for example, entry and exit lanes of motorways were included irrespective of the location of the sign-posts. These entrance and exit to the highway were provided at interchanges by slip roads (ramps), which allowed for speed changes between the highway and arterial thoroughfares and collector roads (OECD, 2004).

### **1.2 The need for commissioning the N1 Highway in Accra**

The N1 highway which forms part of the Tema Motorway was expected to improve the turnaround time from 'farm gate' to the airport and Tema seaport, and hence make immense impact on the economy of the nation. Remarks by the Chairman of MiDA Board indicated that the existing Tetteh-Quarshie-Mallam road which is major for farmers in the Greater-Accra, Western and Central Region becomes severely congested during the greater part of the working day. He revealed that the congestion resulted in high vehicle operating costs and delayed transportation of horticulture products, and this severely impacted on business profits and deterred investments in the Agriculture Sector (mida.gov.gh 2012). These called for the construction of the N1-Highway so as to ease traffic congestion and also to enhance free movement of vehicles (businessghana.com, 2012). The N1 highway was intended to function as motorway, an engineering main-road for fast moving traffic, having limited access with separate carriage ways for vehicles travelling in opposite directions (wikipedia.com) as exist in Britain, where Motorway, a less popular term used mostly is a

system of highways connecting all cities of the country. As highway, the road was expected to function as a system of paved roads linking important cities to provide for high speed transportation of automobiles without any restriction and providing high speed traffic across major destinations. In Ghana the N1 highway connects Tetteh-Quarshie Interchange to Mallam Junction. Inter-city feature is one distinguishing feature of the N1 highway and forms a network of roads that have a number of lanes and connect different towns and cities with intersecting roads via stop lights as a system of highways in any country to reduce the rapid increase in number of automobiles and demands for better, more efficient system of roads to transport between cities. The aim is to promote trade and alleviate poverty in Africa through highway infrastructure development and the management of road-based trade corridors (DeLoach, 2000). In this study, since the N1 highway is contiguous with the Tema motorway, the terms highway and motorway were used interchangeably.

### **1.3 Risks and uncertainties associated with using the N1 Highway**

While each highway project is unique, most projects could be affected by similar risks and uncertainties. Increase in incidences of Road Traffic Accidents on the N1 highway has been reported (myjoyonline.com 2012) with many associated reasons for the accidents which involved small cars, huge cargo and articulator trucks, and pedestrians. As road accidents occurring on the Highway become rampant, the concept of risk management comes to the fore. Risk could be connected with deviations of results from target objectives for constructing of the highway and could lead to damages and losses involving undesired and negative results. Several forms of risks seem to be associated with events or incidents that cause negative consequences that could be linked to the functioning of Highways. Operational risks discussed in this paper are referred to events or incidents that cause negative consequence to the operation of a project after it has been commissioned. This study suggests calling the forms of risks operating after a constructed project became commissioned and being used as, Post Construction Operational Risks (PCOR), since such risks involved events or incidents resulting from negative consequences of the operations of the constructed projects which have been commissioned. Post construction operational risks (PCOR) could be associated with uncertainty about the performance of infrastructure once it has been constructed, during the typically long-lived operating phase of infrastructure projects (Ward and Chapman 2003). Obvious sources of operational uncertainty and risks could be future costs of operations, maintenance and administration, and levels of future use in rapidly changing social, economic and technological conditions (Ward and Chapman 2003). Risk factors were derived from impacts of the operating environment of the N1 highway on stakeholders that forced consequential major changes to operational practices and performance requirements.

### **1.4 Managing Risks and uncertainties on Highways**

One definition of risk that guided this study was the methodical and systematic process of identification and evaluation of pure loss exposures faced by the individual or an organization (Ward and Chapman 2003). In dictionary definition terms 'risk' means: "hazard, chance of bad consequences, loss, exposure to chance of injury or loss" (Concise Oxford Dictionary). Ward and Chapman (2003) considered the selection and application of the most appropriate tools for handling such risk exposures as well. According to Ward and Chapman (2003), risks have to be identified, qualified and quantified before they could be well managed. In this way, risk management could be looked at as a formal process that enables identification, assessment, planning and management of risk, by following the systematic processes of planning for identifying, analyzing, responding to and monitoring projects. It involves tools,

processes and techniques that will help maximize the probability and positive results of positive events and minimize consequences of adverse events.

Research has shown that the construction industry is exposed to more risk and uncertainty than other industries (Dey et al. 2002). NCHRP 658 (2010) also pointed out that “highway design and construction projects could be extremely complex and were most often fraught with risk and uncertainty.” However, several controls on the N1 highway indicated by the GHA and outlined by MiDA ([www.mida.gov.gh](http://www.mida.gov.gh), 2012), and from *Gazette* notification of 11<sup>th</sup> August, 2006, Ghana’s Disability Act 715 on Transportation sought the integration of needs of persons with disability in the construction of the N1 highway. The Act 715, section 23 for instance, ensured that the needs of persons with disability were taken into account in the design, construction and operation of the N1 highway transportation network. The provision considered persons with disability as pedestrian. In section 25 for instance, motorists were expected to stop for a person with disability who showed any intention to cross the road either at the pedestrian crossing or at an appropriately designated point for crossing. Also parking places for persons with disability were expected to be provided. Section 26 sought the demarcation and reservation of special parking places for the exclusive use of persons with disability ([www.mida.gov.gh](http://www.mida.gov.gh), 2012).

In view of all these provisions, in managing the operational risks associated with the construction and functioning of the N1 highway in Accra, specific benchmarks set included 2 Grade Separation Interchanges at the Dimples and Mallam Junctions, 6 Footbridges, 13 Bus Bays, 23 Minor Junctions, Bicycle Lanes and 2 Transport Terminals at Kokroko, near Mallam and at Abeka Lapaz ([www.mida.gov.gh](http://www.mida.gov.gh), 2012). The N1 highway, considered as another section and part of the Tema motorway, was expected to be designed with specific crossings and safety features such as railings and ramps along the road and at traffic intersections to enable all pedestrians to traverse the road safely. Also, traffic signals were expected to be designed with a phase for pedestrians to cross the road at grade level. Pelican crossing markings were also expected to be provided on the road to ensure that vehicular traffic will make way for pedestrian traffic at specific intervals and times ([www.mida.gov.gh](http://www.mida.gov.gh), 2012). In this study, portions of the road were selected for risk assessment, based on the history of these sections of the road of causing various forms of accidents, including motor accidents, and examined against the set objectives for constructing the N1 highway.

### **1.5 Road User – related risks on the N1 Highway in Accra**

In spite of provisions and specified set benchmarks for managing operational risks associated with the construction and functioning of the N1 highway in Accra, several accidents have been known to occur on the N1 highway possibly due to risks not well managed. For instance, “*Three people were confirmed dead in Tuesday night's accident on the George Bush Highway*” as Joy fm reported on the 29th of February, 2012 ([myjoyonlinenews.com](http://myjoyonlinenews.com), 2012). The *George Bush Highway* is also called the N1 highway. One accident occurred when an articulated truck which was loaded with frozen fish overturned and landed on two vehicles at the Lapaz end of the N1 Highway in Accra. The police said three people all on board of a bus died with two others securing severe injuries. The accident was blamed on a blackout which impeded the visibility of an articulated truck driver. But some analysts said the accident was simply the result of indiscipline on the part of motorists. Within the same period, another accident was reported on the Accra-Tema Motorway end of the N1 Highway involving four vehicles. In this accident, [myjoyonlinenews.com](http://myjoyonlinenews.com) (2012) reported that, a Metro Mass bus tipped around Community 18, near the Abattoir Junction and blocked the motorway. Such risks, as identified here if they were well managed would yield effective operational performance of the motorway. One

cannot therefore leave out the talk on the many occurrences of risks that highways, with the N1 highway not being an exception, could pose to the general public in Ghana.

The N1 highway in Accra appears to be dangerous with the occurrences of various forms of risks. For instance, people run from one side of the road to the other crossing six lanes of the road in the midst of fast moving vehicles. Men, women, young and old people climbed walls and metal barriers to cross to other sides of the road. On these roads, drivers using passenger vehicles like “tro-tro” made sudden stops on the outer lanes, picked up and dropped off passengers. As soon as they were done with their “business”, regardless of what speed a vehicle in the same lane behind them would be travelling, “tro-tro” drivers started off and moved on without signaling to other road users ([myjoyonlinenews.com](http://myjoyonlinenews.com)). One comment given by a traveler on the N1 highway for example, was that, ‘the road is beautiful, however beautiful as it is, I did my return journey on that highway with my heart in my hands’. News published by [businessghana.com](http://businessghana.com) on the 1st of March, 2012 reported the efforts made by the Accra Metropolitan Assembly (AMA) in pursuit of a vigorous programme to curb indiscipline and bloodshed on the N1 Highway which forms part of the Accra Beltline. According to city authorities this became necessary due to 12 deaths which were recorded on the highway about two weeks after the highway was commissioned, because pedestrians refused to use the footbridge and hawkers used the sides of the road to ply their trade” ([www.businessghana.com](http://www.businessghana.com), 2012). Close observations of the context of culture for users of highways in Ghana show how people risked their lives. All of these are risks arising from people and have great potential to cause damages on the N1 highway.

## 2.0 METHODOLOGY

Using the mixed methods approach, the study looked into the post construction operational risks on the N1 highway by considering the highway as a technical product and its reactivity, in order to assess the nature and complexity of the associated risks. Hazards and risks or risk control failures of people, systems and processes associated with the functioning of the N1 Highway were identified. To contribute to minimizing losses, improving loss prevention and incident management and controls, the study examined the ways risks were managed by motorists and pedestrians on the highway. Useful and practical answers were given by stakeholders, including the Ghana Highway Authority, National Road Safety Commission and the Ghana Police Service who monitored traffic and pedestrian use of the N1 Highway as well as from regular users of the road.

### 2.1 Analyzing risk factors in the operating environment and layouts of the N1 highway

According to ISO.org, a list of hazards and generic hazardous situations and risks could be formulated. The N1 highway was considered as a technical product with reactivity. Using the PHA risk assessment process, selected portions of the N1 Highway in Accra, which could cause harm or create hazards were assessed from information obtained on the road. The study assumed that the selected portions on the N1 Highway in Accra, Ghana, had potential to represent the highway as any road which could cause harm or create hazards for road users. Only available details of the design of the N1 highway, which were given by the GHA and MiDA, were considered relevant for the study (see ISO 31010, 2009). In the assessment, the operating environment of the road was described and types of hazards and risks that contributed to losses, loss creation and which prevented incident management were examined. In addition, the layouts of the roads were examined by identifying and analyzing risk controls such as road signs, road marks, street lights etc.

Applying the techniques for risk assessment described by ISO.org, Check-lists were used in this study to assess effectiveness of controls on the N1 highway. Here, the focus was on making the list of controls which were inadequate or control failures or making list of

risks resulting from past failures. The list of identifiable controls on the N1 highway was prepared and compared with the expectations of the GHA or MiDA ([www.mida.gov.gh](http://www.mida.gov.gh), 2012) in accordance with ISO 31010 (2012). In doing this, the list of hazards, risks or control failures that have been developed usually from experience, either as a result of a previous risk assessment or as a result of past failures were identified in accordance with ISO 31010 (2012). Since, check-lists could be used at any stage of the life cycle of a product, process and system; they were also used in this study in combination with preliminary hazard analysis (PHA) to inhibit and prevent imaginations by the researchers in the identification of risks factors on the N1 highway. The study was carried out using a combination of personal interviews and a content-validated questionnaire. Additional information was obtained through visits to specific sites of the highway and from general observations while travelling on the road several times, by meeting some users of the highway and having guided chats with selected personnel from the Ministry in-charge of highways. The study took into account limitations of the data used and the possibility of divergence among experts contacted.

## **2.2 The perceptions, attitudes and views of regular users of the N1 highway**

Views of people on the use of the N1 highway provided by pedestrians and physically-impaired persons were shared on check lists where participants indicated their choices of responses to simple statements such as ‘I am aware of potential sources of hazards and risks (primary risks) associated with the N1 highway’, ‘I am afraid to use the highway’, ‘the highway is Not disability friendly’, ‘I have difficulty using the highway’, ‘I cross the highway at any convenient point’, ‘I do not check road signs’, ‘I over-speed on the highway’, and ‘I drive carefully on the highway’ among others, to reflect the perceptions of motorists and pedestrians, attitudes of users of the N1 highway, and abilities of the disabled to use the highway. The responses and observations were examined on the basis of the Persons-with-Disability Act 2006, (Act 715) of Ghana.

## **3. RESULTS AND DISCUSSIONS**

### **Hazards and risks associated with the N1 highway**

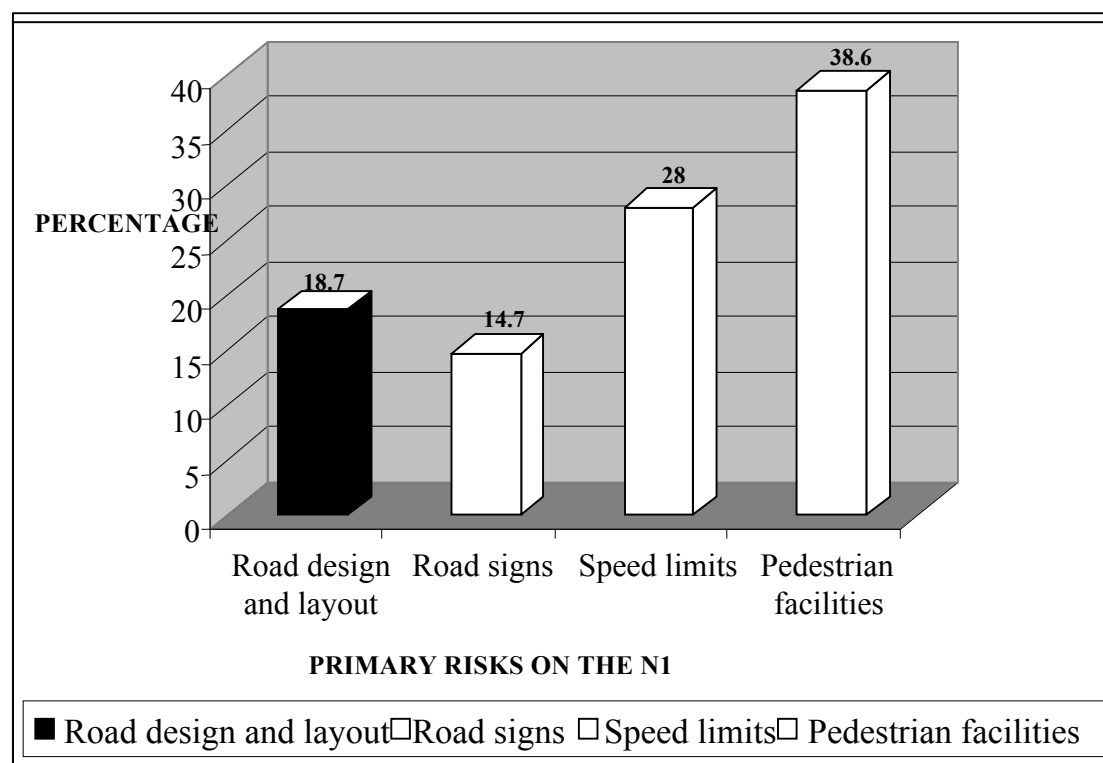
The hazards and risks associated with the operating environment of the N1 highway in terms of undesired negative results obtained from the functioning of the N1 Highway were discussed. Issues captured under this section include, knowledge of pedestrians and motorists about hazards and risks on the highway, perceptions of pedestrians and attitudes of motorists towards use of the highway, the ability of impaired persons to use the highway and kinds of risks arising from people, systems and processes associated with the functioning of the N1 highway. The potential risk sources and controls on the layouts of portions of the N1 highway included road signs, guard rails, pedestrian facilities such as road marks, street lights, School Crossing Patrol, clothing and Equipment. On the highway these could either lead to or reduce post construction operational risks such as damages and losses on the highway. So, they were listed, described and discussed.

### **3.1 Risks arising from people, systems and processes and associated with the functioning of the N1 highway.**

The study identified major potential risk sources (primary risks) on the N1 highway. This was regarded as one of the essential tools for guiding possible measures that could be put in place to manage the risks and hence to promote easy transportation of goods and services. These potential risks sources are presented in Figure 1. The Figure shows that 18.7 percent primary risks on the N1 highway were with errors in road design and layout. Wrong placement of road-signs posed primary risks as indicated by 14.7 percent of respondents,

whereas 28 percent and 38.6 percent of respondents identified the lack of speed limits and inadequate pedestrian facilities, respectively. The implication is that potential risk sources emanating from design of the N1 highway, which we suggest calling primary risks, all seemed to arise from design systems and processes, and posed danger to both motorists and pedestrians especially people with disability. This corroborates with the finding of Caltrans (2007) who reported that, greater number of project risks emanated from the design stage. In this study, road design and layout, road signs, speed limits and the pedestrian facilities were the main potential risk sources on the N1 highway.

**Figure 1:** Potential risk sources (Primary risks) on the N1 highway



Source: Field survey, 2012

### 3.2 Potential hazards and risks sources (primary risks) emanating from controls on the layouts of portions and associated with the operating environment of the N1 highway

Some of the risks sources (primary risks) emanating from controls on the layouts of portions of the N1 highway and associated with the operating environment identified by the respondents were:

- Placing of bus bays for passengers far from foot bridges,
- Inadequate facilities for physically-challenged people, and
- Insufficient number of foot bridges for pedestrians.

The main implication here is that, the N1 highway has a number of potential hazards and risks sources (primary risks) associated with the operating environment of the N1 highway that could prevent motorists and pedestrians from making maximum use of the highway. This could also prevent users of the highway from generating maximum satisfaction from its usage. One motorist commented that, “such errors of placing bus bays for passengers far from foot bridges on the N1 highway and the too few foot bridges for pedestrians have created the situation where pedestrians now compete with motorists on the road in the bid to cross from

one side of the road to the other side.” The situation poses major threats to both motorists and pedestrians. A physically-challenged person, a respondent, also indicated that he is unable to use the highway without the support of others. This finding contradicts the Persons-with-Disability Act 2006 (Act 715), which expects that public facilities and infrastructure should provide for people with disability and make them disability-friendly. However, three respondents from the Ministry of Roads and Highways attributed the lack of disability facilities to financial and technical challenges, while six officials attributed the cause of the challenges to the inability of the Millennium Development Authority to do a wider consultation to include the concerns of users of the road such as persons with disability.

### 3.3 Knowledge of pedestrians and motorists about potential hazards and risks associated with the operating environment of the N1 highway

Knowledge about potential risks associated with the use of highways is essential to reduce the frequency and scale of their occurrences as well as minimize the consequences of their incidence on people, businesses and the economy. Table 1 presents findings on knowledge of pedestrians and motorists about the potential sources of risks (primary risks) on the highway. Sixty-eight (68) percent of the pedestrians admitted that they were aware of the potential sources of risks (primary risks) associated with the N1 highway, whereas 32 percent denied. In addition, majority (72%) of motorists indicated that they knew the potential sources of risks (primary risks) on the highway, while 28 percent were ignorant. The implication is that, majority of the respondents have ample knowledge of potential sources of risks (primary risks) and are likely to adopt practices and strategies to reduce the probable occurrences of risks on the N1 highway.

**Table 1:** Knowledge of pedestrians about potential sources of hazards and risks (primary risks) associated with the N1 highway

Respondents n=100	Category	Frequency	Percentage
Pedestrians	Yes	34	68.0
	No	16	32.0
<b>Total</b>		<b>50</b>	<b>100.0</b>
Motorists	Yes	36	72.0
	No	14	28.0
<b>Total</b>		<b>50</b>	<b>100.0</b>

Source: Field survey, 2012

### 3.4 Perceptions of pedestrians and attitudes of motorists towards the use of the N1 highway.

According to DeLoach (2000) the operational risks associated with a highway shapes people’s attitudes and perceptions which affect its usage. Assessment of people’s attitude towards the N1 highway was therefore critical to know, especially, how the post-construction operational risks were shaping people’s attitude towards the usage of the Highway. The results presented in Table 2 show that, 12 pedestrians, (24%) panicked when using the N1 highway, and attributed their fear for using the highway to the high foot bridges, and the over-speeding by motorists. They explained that these conditions made it less convenient for the aged and children to use the highway. In relation to disability-friendliness of the highway, 20 percent stated that the highway was not disability-friendly, 28 percent reported that they crossed the road at any convenient point because the pedestrian foot bridges were too widely apart, while another 28 percent said it was difficult using the highway. The implication is that



certain diversity in categories of the pedestrians was not considered in the designing of the highway. This may partly be the cause of the rampant casualties on the N1 highway.

**Table 2** Perceptions of pedestrians towards the N1 highway

Respondents n=50      Category      Frequency      Percentage

Perceptions of Pedestrians	Fear to use the highway	12	24.0
	Not disability friendly	20	20.0
	Difficulty using the highway	28	28.0
	Crossing at any convenient point	14	28.0
<b>Total</b>		<b>50</b>	<b>100.0</b>

Source: Field survey, 2012

In Table 3, majority (52%) of the motorists indicated that they have developed the attitude of over-speeding on the highway, whereas 24 percent admitted that motorists paid less attention to road-signs on the highway. From the study, some of the motorists reported that, the wide stretch of the highway made it difficult for them to recognize most of the road-signs. Other motorists said that the nature of the road promotes over- speeding.

**Table 3** Attitudes of motorists towards the N1 highway

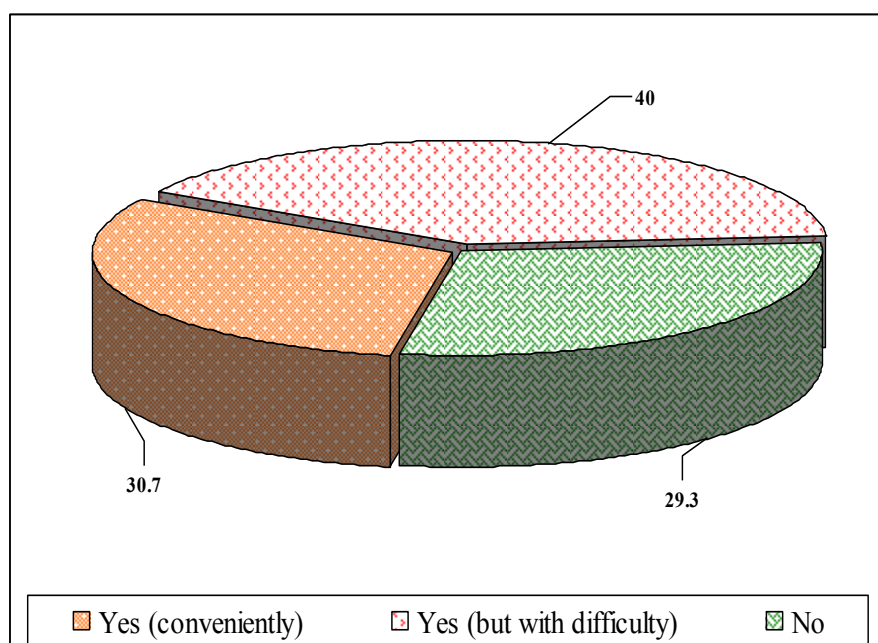
Respondents n=50      Category      Frequency      Percentage

Attitudes of Motorists	Do not check road signs	12	24.0
	Over-speeding on the highway	26	52.0
	Careful driving on the highway	12	24.0
<b>Total</b>		<b>50</b>	<b>100.0</b>

Source: Field survey, 2012

### 3.5 Ability of impaired persons to use the N1 highway

The study examined whether the physically-impaired people were able to use the highway safely and conveniently. This was necessary to access safety of the disabled in the usage of the N1 highway as public facility. In Figure 1, views of people on the use of the N1 highway by physically-impaired persons are displayed. From the Figure, 30.7 percent of persons with disability are able to use the highway conveniently. Forty percent (40%) of respondents reported that, the physically-impaired persons use the highway with difficulty, whereas 29.3 percent of physically impaired persons who use the highway with difficulty become exposed to risk.



**Figure 1:** Ability of the physically-impaired people to use the N1 highway  
Source: Field survey, 2012

#### 4. CONCLUSIONS

Certain diversity in categories of the pedestrians was not considered in the designing of the highway, partly causing rampant casualties on the N1 highway. The wide stretch of the highway made it difficult for motorists to recognize most of the road-signs. Other motorists said that the nature of the road promotes over- speeding. Although persons with disability are able to use the highway conveniently, the physically-impaired persons used the highway with difficulty and become exposed to risks.

The study recommended the fixing of more, higher guard-rails, more bus bay points near foot bridges, additional foot bridges, traffic control points located away from bus terminals, and provision of facilities for physically-impaired persons.

Education on risks associated with using the N1 highway could prevent pedestrians from competing with motorists in crossing and reducing frequent occurrences of accidents on the N1 highway.

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## REFERENCES

- Cobuild C. (2001) Collins Cobuild Advanced Learner's Dictionary Hardback Edition 3, #129624 ISBN 0003751155
- DeLoach, J.W., (2000), Enterprise-wide Risk Management: Strategies for Linking Risk and Opportunity *Financial Times* – Prentice Hall, London.
- Dey, P. K., Ogunlana, S. O., and Takehiko, N. (2002). "Risk management in build operate-transfer projects." *International Journal of Risk Assessment and Economic and Social Research Council* Global Environmental Change Programme, (2000), Risky Choices, Soft Disasters: Environmental Decision-making under Uncertainty, University of Sussex, Brighton.
- GHANANEWS (2012) Uses of a motorway-www.ghananewsagency.org Accessed 10<sup>th</sup> July 2012
- JOY (2012) Accidents on the NI highway-www.myjoyonline.com Accessed 15<sup>th</sup> July 2012
- JOY (2012) Assessments of motorway -www.myjoyonlinenews.com Accessed 17<sup>th</sup> July 2012
- MiDA (2012) Upgrade of N1 Highway: Upgrade of the Tetteh Quarshie-Mallam Road <http://mida.gov.gh/site/?p=4684> Accessed on 7<sup>th</sup> July 2012
- MiDA (2012) Access to pedestrians on the George Walker Bush Motorway <http://mida.gov.gh/site/?p=4684> Accessed on 7<sup>th</sup> July 2012
- MIDA (2012) Highway project objectives.www.dailyguideghana.com Accessed 10<sup>th</sup> July 2012
- MIDA (2012) Development of highway projects-www.mida.gov.gh Accessed 15<sup>th</sup> July 2012
- Ward, S., and Chapman, C. (2003) Transforming project risk management into project uncertainty management *International Journal of Project Management* 21 (2003) 97–105 [www.elsevier.com/locate/ijproman](http://www.elsevier.com/locate/ijproman)