Reanalysing existing data to enhance understanding on safe motorcycle and three-wheeler use for rural transport in Ghana

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***Abstract*—The use of motorcycles and motorised three-wheelers in Africa has increased greatly in recent years. In rural areas, motorcycles are now the most common type of vehicles in many countries, playing a crucial role in connecting people to services. They are often operated as taxis, charging a fare to carry passengers and goods.**

Ghana is one of four countries in which a research study on "Enhancing understanding on safe motorcycle and three-wheeler use for rural transport and the implications for appropriate training and regulatory frameworks" is being supported by the African Community Access Partnership (AfCAP). The other countries are Kenya, Tanzania and Uganda.

A key part of the study in Ghana is to reanalyse relevant existing data, but with a rural focus, thereby providing a detailed understanding of issues in rural areas. For example, crash data is currently categorised as 'urban' and 'rural', but the rural category includes both low-volume roads and highways passing through rural areas. Through this study, the data has been reanalysed to establish the magnitude and pattern of motorcycle-related deaths and injuries on low-volume rural roads. Similarly, data from other government departments has also been reanalysed with a rural focus.

The research also involves a survey of motorcycle and three-wheeler riders, owners and users, as well as non-users, to understand the benefits and disbenefits of these modes. A review of policy and legislation will identify opportunities to increase the effectiveness of regulation.

The study's findings will inform decision-makers as they undertake a review of the existing ban on motorcycle taxis in Ghana.

Keywords—Motorcycles, Motorcycle taxis, Okadas, Three-Wheelers, Rural Transport, Rural Access, Safety, Ghana, Africa

I. INTRODUCTION

The project 'Enhancing understanding on safe motorcycle and three-wheeler use for rural transport and the implications for appropriate training and regulatory frameworks' is being undertaken by a consortium which is led by Transaid and includes Amend and the Transport Research Laboratory.

The project covers four countries: Ghana, Kenya, Tanzania and Uganda, shown in the map in Fig. 1.

Fig. 1. The four project countries

In each country, the project is being supported by government through the local Africa Community Access Partnership (AfCAP) partner institutions.

This paper focuses on the task 'to reanalyse existing data to enhance understanding on safe motorcycle and three-wheeler use for rural transport in Ghana', a key aspect of the research activities being carried out in Ghana.

II. BACKGROUND

The use of motorcycles has increased greatly in Africa in recent years, both in urban and rural areas. In the rural areas of many African countries, motorcycles are often the most commonly found vehicles, and journeys that were previously made by foot or bicycle are now made using a motorcycle.

Motorcycles are often used as taxis, with riders charging a fare to carry passengers or goods. In rural areas, motorcycle taxis play a crucial role in connecting people to services, and farms to markets. They provide employment, largely for young men who hire the motorcycles on a temporary basis to use as taxis, generating income for themselves and the owners.

Motorcycles often fill a gap in the provision of 'conventional' transport services such as minibuses and rural taxis, by providing transport directly from people's homes to

main roads, village centres and essential services such as hospitals and markets. Supported by the now widespread use of mobile phones in rural Africa, motorcycle transport is very convenient, and as such is very popular with rural populations.

However, motorcycle transport in rural areas is certainly not without risk. Previous AfCAP research has found high rates of crashes and injuries among rural motorcycle taxi riders, and while many of these crashes are relatively minor single-vehicle incidents, others have been found to cause more serious injury [1]. A serious injury to a household's primary wage earner can push a family into poverty.

Attempts by governments to regulate the use of motorcycle taxis have largely failed to keep pace with the rapid influx of motorcycles into the continent and the high demand for their services by local populations.

The number of motorised three-wheelers in rural Africa is also increasing, although to nowhere near the same extent as motorcycles.

III. Existing Situation in Ghana

The number of motorcycles in Ghana grew rapidly from the early 2000s until 2012. The World Health Organization (WHO)[2]estimates that by 2012, there were approximately 350,000 registered motorcycles in the country.

They were originally used for private purpose but later became commonly used as taxis, known locally as 'okadas', a term that has spread across anglophone West Africa from Nigeria.

In 2012, the Road Traffic Regulations (LI 2180) came into force banning the use of motorcycles for commercial activities, mainly on safety grounds. From then, the number of motorcycles being registered each year has fallen steadily.

However, strict enforcement of the ban has been a challenge due to limited resources available to enforcement agencies. Although registration of motorcycles in the country does not disaggregate private use from commercial use, it has been observed that, in spite of the ban, there is growth in the use of motorcycles as taxis. Okadas provide several benefits, including filling a much-needed transport gap and providing employment and income generation, especially for young men.

Okadas are found in both urban areas and in most rural areas, especially in the southern part of the country. In the northern part of the country, however, motorcycles are mostly privately owned, with their use as taxis being far less prevalent than in the south. Three-wheelers are also commonly found in rural areas, used to transport agricultural produce and passengers.

Outside the large cities, okadas are found mostly at junctions and villages along the main roads, providing feeder services to the hinterlands. In many rural areas, they are the main means of transport, and are very popular with the rural population.

Authorities in rural areas often turn a blind-eye to the use of motorcycles for commercial purposes due to the obvious benefits to the local communities. The result of this is that there is also very limited enforcement of other regulations, such as on helmet use, vehicle overloading, insurance and rider under-age limit, particularly on low volume roads.

There is currently a movement to review the legislative instrument that bans the use of motorcycles as taxis to reflect the current transport needs, especially in rural areas.

Documented data on rural motorcycle and three-wheeler crashes that occurred on low volume rural roads is largely unavailable. For example, in official data, the location of road traffic crashes is disaggregated only as 'urban' or 'non-urban', and non-urban includes highways as well as low volume roads in rural areas. As such it is not easy to ascertain the number of crashes on rural roads. However, digging into the raw data held by the Building and Road Research Institute has the potential to reveal specific details about crashes on low volume rural roads.

IV. Research Objectives

The aim of the overall project is to improve knowledge and understanding concerning effective ways of enabling rural people to benefit from the safe use of motorcycles and three-wheelers, with emphasis on rural motorcycle taxis, rider training, appropriate regulatory frameworks and realistic enforcement methods.

The research objectives are to work with relevant stakeholders in each country in order to achieve the overall project aim. The essence of the research is to use country studies and the synergies of inter-country exchanges to compile and present research evidence of best practices and appropriate regulatory frameworks for enabling the safe operation of rural motorcycles and three-wheelers to provide good, affordable and inclusive rural access for different groups of people.

Currently, only limited data is available about motorcycles and three-wheelers in Ghana. The data that is available largely focuses on urban areas: very little data is available related to their use in rural areas. Without more data and a better understanding of both the positive and negative aspects of motorcycles and three-wheelers in rural areas, any decisions taken by policy-makers in considering legalisation and regulation will be inadequately informed.

During the Inception Phase of this project, it was identified that through reanalysing existing data held by government institutions and partners, more could be learned about the issues surrounding motorcycles and three-wheelers in rural areas.

The output of the activity to reanalyse data with a rural focus will help decision-makers to consider how the decision on whether or not to lift the ban will impact rural communities. It may also enable recommendations to be made on the future use of data.

V. METHODOLOGY

Data on vehicle registrations was obtained from the Driver Vehicle and Licensing Authority (DVLA). Vehicle registrations are issued by DVLA's regional branches. Data was obtained for each of Ghana's ten regions, covering the full calendar years from 2012 to 2017, inclusive.

Traffic data was sought from the Department of Feeder Roads (DFR) within the Ministry of Roads and Highways. However, very limited data on traffic flows on rural feeder roads was available. The only data that could be obtained were one-day, thirteen-hour (05:00-18:00) multimodal traffic counts undertaken in two districts (Asunafo District and Tano District) of Brong Ahafo region in 2017.

In Ghana, the collection of primary data on road traffic crashes is the responsibility of the Motor Traffic and Transport Directorate (MTTD) of the Ghana Police Service. This data is then shared with the Building and Road Research Institute (BRRI) for analysis, with a report being shared with the National Road Safety Commission annually for publication.

For this study, the raw data that BRRI obtains from MTTD prior to coding was requested from BRRI. Data was provided by BRRI for the years 2012 to 2016 inclusive. As this study is specifically interested in issues related to motorcycles and motorised three-wheeler in rural areas, and in particular on rural feeder roads, the raw data was re-coded, to differentiate between crashes that had occurred on rural feeder roads and rural highways.

Data from the 2010 Housing and Population Census was also obtained from the website of the Ghana Statistical Service.

The data from the various sources was entered into Excel spreadsheets for analysis and cross-referencing.

VI. REANLYSIS OF VEHICLE REGISTRAITON DATA

Data on vehicle registrations was obtained from the DVLA. Vehicle registrations are issued by DVLA's regional branches. Data was obtained for each of Ghana's ten regions, covering the full calendar years from 2012 to 2017, inclusive.

Upon registration of a vehicle, the vehicle type is recorded. Up until the end of May 2017, the vehicle type 'Motorcycles of all categories' covered both motorised two-wheelers and motorised three-wheelers. From June 2017, this category was divided in two, in recognition of the increase in the numbers of three-wheelers.

As well as motorcycles and three-wheelers, there are fourteen other different vehicle types. For the sake of this analysis, the different vehicle types have been categorised as:

- Motorcycles (including three-wheelers)
- Cars and vans
- Buses and coaches
- Lorries and trucks
- Agricultural, construction and mining vehicles

Fig. 2 shows the total number of each category of vehicles registered between the years from 2012 to 2017, inclusive.

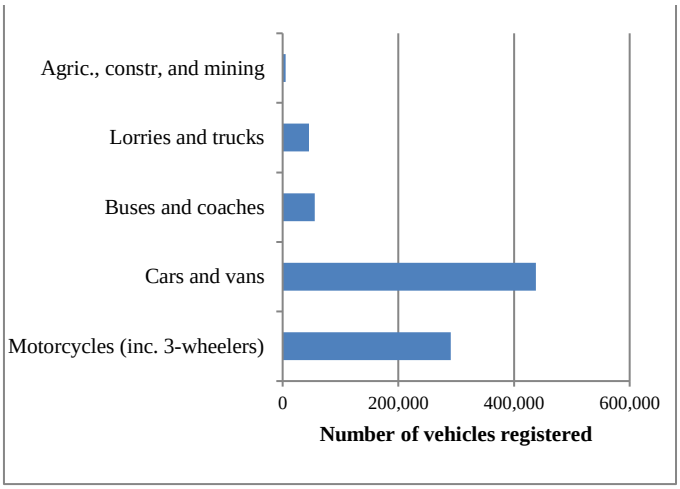

Fig. 2. Numbers of vehicles registered in Ghana, 2012 to 2017 (inclusive), by vehicle type

Source: DVLA, 2018

The chart shows that the number of motorcycles (including three-wheelers) was the second highest of all categories of vehicle, behind cars and vans.

Fig. 3 below shows the number of motorcycle (including three-wheelers) registrations per full calendar year from 2012 to 2017.

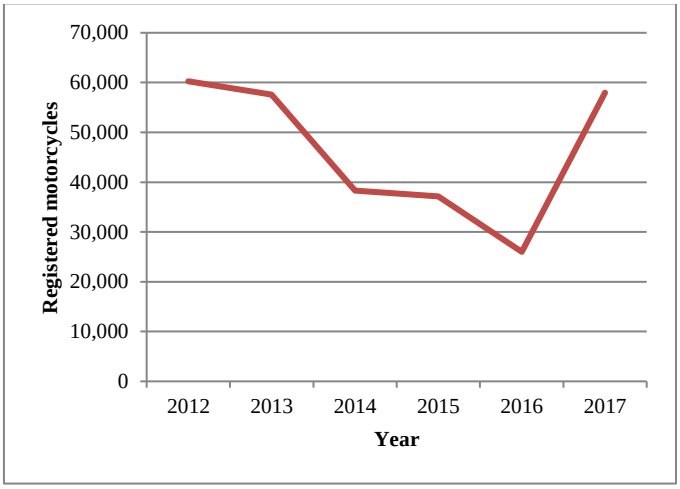

Fig. 3. Numbers of motorcycles (including three-wheelers) registered per year, 2012 to 2017 (inclusive)

Source: DVLA, 2018

The chart shows that in 2012, just over 60,000 motorcycles (including three-wheelers) were registered. This number then fell year-on-year from 2012 to 2016, to a low of around just 26,000. In 2017, however, the number of motorcycles registered returned to nearly 58,000, almost reaching the levels seen in 2012. The drop in the number of

registrations from 2012 may be related to the introduction of the Road Traffic Regulations, 2012 (Legislative Instrument 2180), which made it illegal to carry a fare-paying passenger on a motorcycle or three-wheeler.

Ghana is divided into ten different regions. The 2010 Population Census [3]details the breakdown of the country's population by region, and further, by the proportion of the population living in urban and rural areas. The total population of each region, and the percentage living in rural areas, is shown in Table I.

TABLE I. RURAL POPULATION BY REGION

Region	Total population	Rural population	Percent of population living in rural areas
Ashanti	4,780,380	1,883,090	39.4%
Brong Ahafo	2,310,983	1,282,510	55.5%
Central	2,201,863	1,163,985	52.9%
Eastern	2,633,154	1,489,236	56.6%
Greater Accra	4,010,054	379,009	9.5%
Northern	2,479,461	1,728,749	69.7%
Upper East	1,046,545	826,899	79.0%
Upper West	702,110	587,457	83.7%
Volta	2,118,252	1,404,517	66.3%
Western	2,376,021	1,368,052	57.6%
Total	**24,658,823**	**12,113,594**	**49.1%**

Source: Ghana Statistical Service, 2012

Table I shows that just under half of Ghana's population live in rural areas. It also shows that there is a big difference from region to region in the proportion of the population living in rural areas. In Greater Accra, less than 10% of all people live in rural areas, while in Upper West, almost 84% of people live in rural areas. The three regions with the highest percentage of people living in rural areas are Upper West, Upper East and Northern.

Fig. 4 shows motorcycle (including three-wheeler) registrations by region for the total period from 2012 to 2017, inclusive. After being registered in one region, motorcycles and three-wheelers may be ridden or otherwise taken to other regions. However, as motorcycles and three-wheelers are commonly used for local trips, it is assumed that a large proportion of the numbers registered in any one region has remained there.

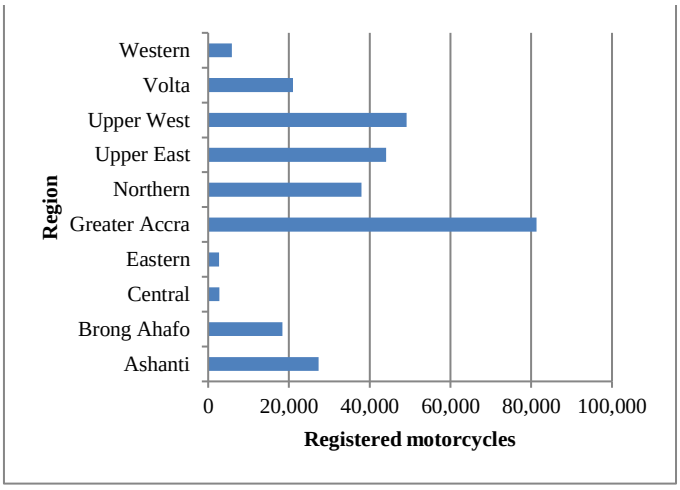

Fig. 4. Number of motorcycles (including three-wheelers) registered by region, 2012 to 2017 (inclusive)

Source: DVLA, 2018

The chart shows that Greater Accra had by far the highest number of registrations during that period, totalling 81,296.

Following Greater Accra, the next three regions with the highest number of registrations were Upper West, Upper East and Northern. Referring back to Table I, it can be seen that these are the three regions with the highest percentages of people living in rural areas.

By comparing Table I and the information in Fig. 4, it is possible to calculate the number of motorcycle registrations per 1,000 of the population, per region.

Table II shows that Upper West and Upper East –the two regions with the highest percentage of population living in rural areas – have by far the highest number of motorcycle (including three-wheeler) registrations per 1,000 of the population.

TABLE II. MOTORCYCLE (INCLUDING THREE-WHEELERS) REGISTRATIONS PER 1,000 OF THE POPULATION, BY REGION, 2012 TO 2017 (INCLUSIVE)

Region	Total population	Motorcycles registered, 2012 to 2017 (inclusive)	Motorcycle registrations per 1,000 population
Ashanti	4,780,380	27,364	5.72
Brong Ahafo	2,310,983	18,420	7.97
Central	2,201,863	2,812	1.28
Eastern	2,633,154	2,726	1.04
Greater Accra	4,010,054	81,296	20.27
Northern	2,479,461	37,967	15.31
Upper East	1,046,545	44,068	42.11
Upper West	702,110	49,129	69.97
Volta	2,118,252	20,981	9.90
Western	2,376,021	5,839	2.46
Total	**24,658,823**	**290,602**	**11.78**

Source: Ghana Statistical Service, 2012 and DVLA, 2018

Fig. 5 shows the percentage of the total number of registered vehicles that is made up of motorcycles (including three-wheelers) in each region.

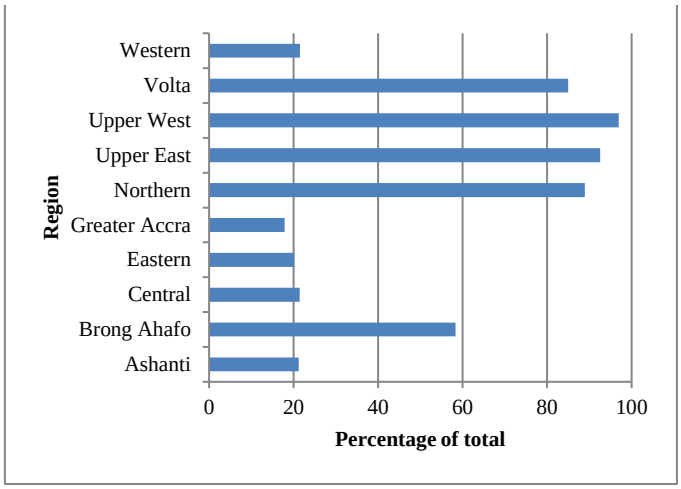

Fig. 5. Percentage of total registered vehicles made up of motorcycles (including three-wheelers) by region, 2012 to 2017 (inclusive)

Source: DVLA, 2018

The chart shows that motorcycles (including three-wheelers) made up the vast majority of total vehicle registrations in Northern, Upper East, Upper West and Volta regions. Referring back to Table I, it can be seen that these are the four regions with the highest percentages of people living in rural areas.

From June 2017, DVLA began distinguishing between motorcycles and motorised three-wheelers. Fig. 6 shows this data broken down by region.

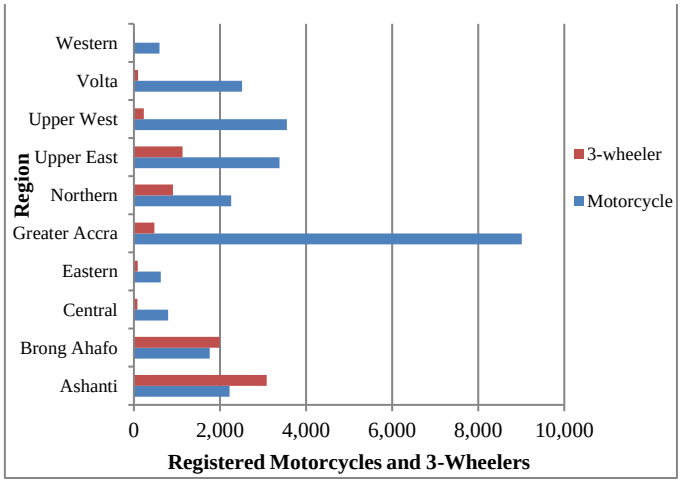

Fig. 6. Numbers of motorcycles and three-wheelers registered by region, June to December 2017

Source: DVLA, 2018

The chart shows that in two regions – Ashanti and Brong Ahafo – the numbers of three-wheelers registered was greater than the number of two-wheeler motorcycles. In both Upper East and Northern regions, the number of three-wheelers registered was approximately one-third of the number of motorcycles. In all other regions, the number of three-wheelers registered was small in comparison to the number of motorcycles.

VII. Reanlysis of Traffic Data

Traffic data was sought from the DFR. However, very limited data on traffic flows on rural feeder roads was available. The only data that could be obtained were one-day, thirteen-hour (05:00-18:00) multimodal traffic counts undertaken in two districts (Asunafo District and Tano District) of Brong Ahafo region in 2017.

In both districts, the results of the traffic counts were similar, including:

- Non-motorised vehicles, including bicycles and animal-drawn carts, were the most common form of transport, making up 35% of all vehicles
- Motorcycles and three-wheelers were the most common form of motorised transport, making up over 25% of all vehicles, and almost 40% of motorised vehicles
- Cars, light trucks and pick-up trucks were the next most common modes of transport

VIII. Reanlysis of Road Traffic Injury Data

A. Crash data in Ghana

In Ghana, the collection of primary data on road traffic crashes is the responsibility of the MTTD of the Ghana Police Service. All traffic crashes, including both those in which an injury is sustained and those that are damage-only, are required by law to be reported to and investigated by the MTTD.

At the crash scene, information is recorded by a police officer using a paper-based, hand-written report form. Information collected includes the date, time, weather, location, road characteristics, and details on the vehicles and people involved, including any injuries, and information from witnesses. Once the report forms have been completed by the investigating officer, dockets are prepared mainly for prosecution purposes.

Analysis of the road traffic crash data is undertaken by the BRRI. Once per year, officials from BRRI visit all police stations in the country to transfer the crash information from the dockets onto a standard accident reporting form. From the form, the information is coded, entered into a computerised crash database and analysed.

BRRI carries out detailed analysis with the help of the Microcomputer Accident Analysis Package (MAAP), Windows version 5. Results are reported in the form of annual accident statistics for the National Road Safety Commission (NRSC). The raw data is further used for research by the BRRI, academia and private consulting firms. The road agencies use the data to identify hazardous crash locations and for road safety auditing.

Fig. 7 shows the process of crash data management at BRRI.

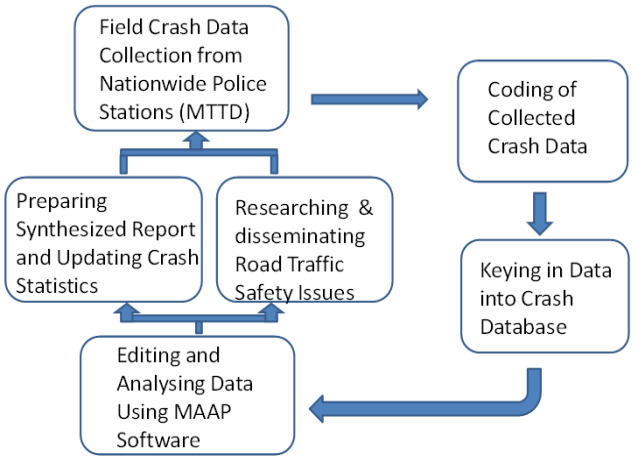

Fig. 7. Crash data management at BRRI

The management and use of crash data in Ghana is often highlighted as an example of best practice in Africa. However, it does have a number of recognised flaws, including:

- The location is recorded as a description only. No Global Positioning System (GPS) coordinates are recorded
- When the information from the dockets is coded for entry into MAAP, the location is classified only as either 'urban' or 'rural'. The rural category includes both highways passing through rural areas and rural feeder roads
- It is thought that there is significant under-reporting of crashes[4]. The figures do not follow the normal 'injury pyramid' [5]

As a result of the flaws, WHO classifies Ghana as a 'country without eligible death registration data' [2]. WHO therefore uses its own model to calculate an estimate of the number of fatalities. In 2012, the BRRI/NRSC official statistics reported 2,240 fatalities, while WHO estimated the number to be 6,789.

B. Motorcycle crashes in Ghana

The BRRI data breaks down crashes by road user class and by injury severity. The data is categorised into eight different road user classes:

- Pedestrian
- Car Occupants
- Goods Vehicle Occupants
- Bus Occupants
- Motorcyclists
- Pickup Occupants
- Cyclists
- Others

In these classifications, 'Motorcyclists' includes both riders and passengers of both motorcycles and motorised three-wheelers. It should be noted that the data on motorcyclist injuries does not include, for example, pedestrians or cyclists who were injured in a crash involving a motorcycle.

The data is categorised by three different levels of injury severity:

- Killed
- Seriously injured
- Slightly injured

'Killed' is defined as someone who dies within 30 days of the crash. A 'Serious injury' is one that requires the crash victim to be hospitalised for more than 24 hours. A'Slight injury' is one that requires the crash victim to be given first-aid only.

Fig. 8 shows the numbers of motorcyclists killed, seriously injured and slightly injured, in Ghana as a whole, each year from 2007 to 2016 (the most recent year for which data is available), inclusive.

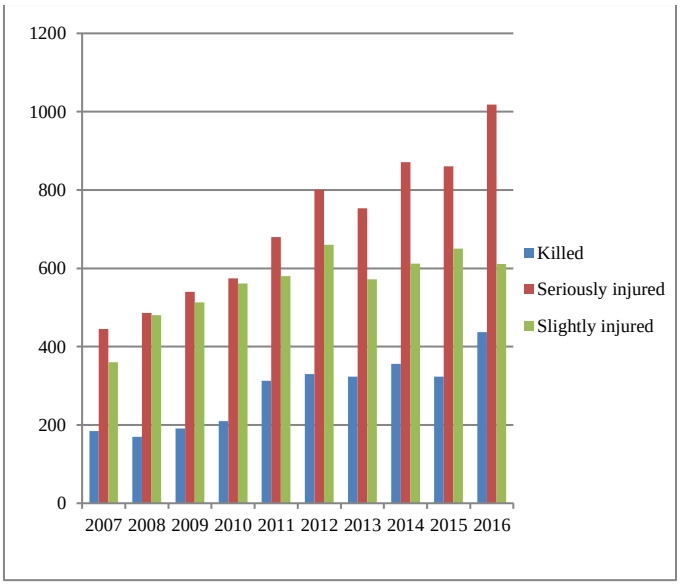

Fig. 8. Numbers of motorcyclists (including three-wheelers) killed, seriously injured and slightly injured, 2007 to 2016, inclusive

Source: BRRI, 2018

Fig. 8 shows that the numbers of motorcyclists killed and injured have shown a general increase from 2007 to 2016. The number of deaths was reasonably steady from 2007 to 2010, then increased in 2011 and remained reasonably steady to 2015, then increasing again in 2016. The number of serious injuries rose steadily from 2007 to 2012, then somewhat stabilised to 2015, before increasing again in 2016. The number of slight injuries rose steadily from 2007 to a peak in 2012, then fell in 2013 and remained reasonably steady to 2016.

The pattern of the severities of injuries – with the numbers of slight injuries being less than the numbers of serious injuries – is inconsistent with the 'injury pyramid', shown in Fig. 9. WHO [5]explains that the relative numbers of fatal and non-fatal injuries are often depicted in the form of a pyramid, with the most severe injuries (those resulting in death) at the top of the pyramid as they occur in the lowest numbers, and the least severe (those not requiring any treatment) at the base of the pyramid as they occur in the greatest numbers.

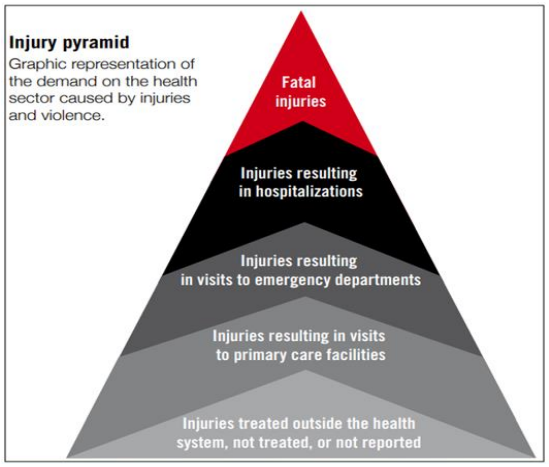

Fig. 9. The injury pyramid

Source: WHO, 2014

In the case of injuries involving motorcyclists in Ghana, it can be assumed that a high proportion of slight injuries go unreported.

Fig. 9 shows that the numbers of motorcyclists killed and injured remained reasonably stable from 2012 to 2015. This coincides with the introduction of the Road Traffic Regulations, 2012 (Legislative Instrument 2180), which made it illegal to carry a fare-paying passenger on a motorcycle or three-wheeler, and with the subsequent drop in the numbers of motorcycles being registered each year.

Fig. 10 shows the proportion of motorcyclists killed and seriously injured (KSI) as a percentage of the total number of road users killed and injured, in Ghana as a whole, each year from 2007 to 2016, inclusive. Slight injuries have not been included in this analysis, as it has been identified that these are probably under-reported.

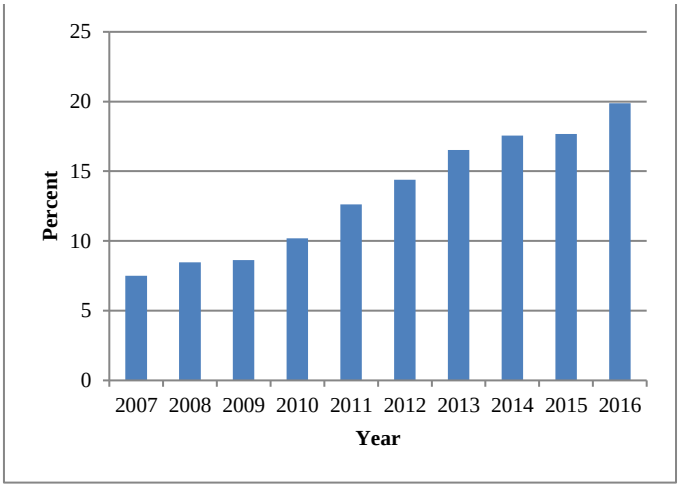

Fig. 10. Proportion of motorcyclists (including three-wheelers) KSI as a proportion of all road users, 2007 to 2016

Source: BRRI, 2018

Fig. 10 shows that the proportion of motorcyclists killed and seriously injured, as a percentage of the total number of road users killed and seriously injured, has risen year-on-year from 2007 to 2016.

C. Reanalysis of crash data with a rural focus

For this study, the raw data that BRRI obtains from MTTD, prior to coding, was requested from BRRI. Data was provided by BRRI for the years from 2012 to 2016, inclusive.

As this study is specifically interested in issues related to motorcycles and motorised three-wheeler in rural areas, and in particular on rural feeder roads, the raw data was re-coded, to differentiate between crashes that had occurred on rural feeder roads and rural highways.

Table III shows the numbers and percentages of motorcyclists killed and seriously injured on the different classifications of road: Urban roads; Rural highways; and Rural feeder roads, for the full five-year period from 2012 to 2016, inclusive. Slight injuries have not been included in this analysis, as it has been identified that these are probably under-reported.

TABLE III. NUMBERS AND PERCENTAGES OF MOTORCYCLISTS (INCLUDING THREE-WHEELERS) KSI, BY ROAD TYPE, 2012 TO 2016 (INCLUSIVE)

Road classification	Number of motorcyclists KSI	Percentage of all motorcyclists KSI
Urban roads	3,060	50.4%
Rural highways	2,197	36.2%
Rural feeder roads	815	13.4%

Source: BRRI, 2018

Table III shows that more than half (50.4%) of all motorcyclists' deaths and serious injuries are caused in an incident on urban roads. More than one-third (36.2%) are caused in an incident on rural highways. Only a little over

one-eighth (13.4%) of motorcyclists' deaths and serious injuries are caused in an incident on rural feeder roads.

Table IV shows the number of motorcyclist deaths and serious injuries on the different classifications of road, as well as the percentage of each of the overall total of motorcyclists killed and injured, for the full five-year period from 2012 to 2016, inclusive.

TABLE IV. NUMBERS OF MOTORCYCLISTS KILLED AND SERIOUSLY INJURED, AND PERCENTAGES OF EACH OF THE OVERALL TOTAL, BY ROAD TYPE, 2012 TO 2016 (INCLUSIVE)

Road classification	Motorcyclists killed		Motorcyclists seriously injured	
	Number	*Percent of total*	*Number*	*Percent of total*
Urban roads	684	22.4%	2,376	77.6%
Rural highways	801	36.5%	1,396	63.5%
Rural feeder roads	284	34.8%	531	65.2%

Source: BRRI, 2018

Table IV shows that serious injuries sustained on rural highways and rural feeder roads are more likely to result in the death of the motorcyclist, than serious injuries sustained on urban roads.

Fig. 11 shows the numbers of motorcyclists killed and seriously injured on all roads in each of Ghana's ten regions, for the full five-year period from 2012 to 2016, inclusive.

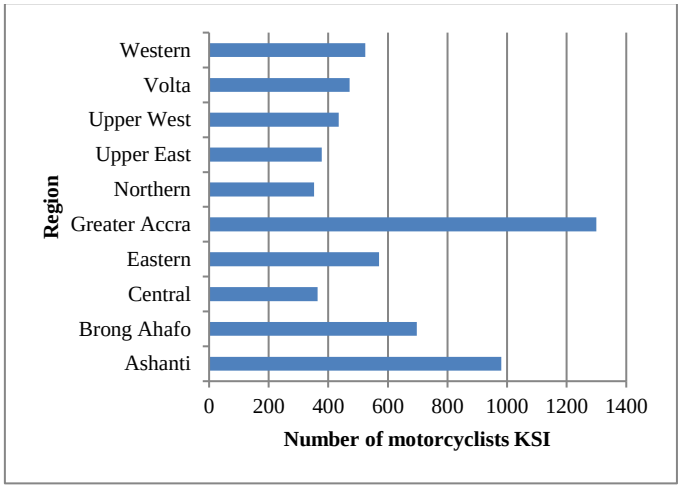

Fig. 11. Numbers of motorcyclists KSI on all roads, by region, 2012 to 2016 (inclusive)

Source: BRRI, 2018

Fig. 11 shows that Greater Accra has by far the highest number of motorcyclist deaths, followed by Ashanti region. As shown earlier in Table I, it can be seen that these are the two regions with the lowest percentage of the population living in rural areas.

Three of the four regions with the lowest numbers of motorcyclists killed and seriously injured – Northern, Upper East and Upper West – are the three regions with the highest percentage of the population living in rural areas.

However, perhaps more interesting are the numbers of motorcyclists killed and seriously injured on all roads per the population and per the number of registered motorcycles, taking numbers from the previous section on vehicle registrations. These numbers are shown in Table V.

TABLE V. NUMBERS OF MOTORCYCLISTS KSI ON ALL ROADS, AND PER 100,000 OF THE POPULATION AND PER 1,000 REGISTERED MOTORCYCLES, BY REGION, 2012 TO 2016 (INCLUSIVE)

Region	Number of motorcyclists KSI	Total population (2010)	KSI per 100,000 of the population	Motorcycles registered, 2012 to 2016 (inclusive)*	KSI per 1,000 registered motorcycles
Ashanti	981	4,780,380	20.5	18,194	53.9
BrongAhafo	697	2,310,983	30.2	12,309	56.6
Central	364	2,201,863	16.5	1,721	211.5
Eastern	570	2,633,154	21.6	1,614	353.2
Greater Accra	1,300	4,010,054	32.4	65,967	19.7
Northern	352	2,479,461	14.2	31,776	11.1
Upper East	378	1,046,545	36.1	37,366	10.1
Upper West	435	702,110	62.0	41,889	10.4
Volta	471	2,118,252	22.2	16,990	27.7
Western	524	2,376,021	22.1	4,829	53.9

Source: BRRI, 2018 / Ghana Statistical Service, 2012

**Note: Number of motorcycles registered as shown in this table is for the period from 2012 to 2016 (inclusive) only. Thus, the figures are different from those in Table 3, as these covered the period from 2012 to 2017 (inclusive).*

Table V shows that Upper West region has by far the highest number of motorcyclist deaths and serious injuries per 100,000 of the population. However, this appears to be because it has a low population and a very high number of registered motorcycles.

Looking at the three regions with the highest proportions of the population living in rural areas – Upper West, Upper East and Northern – these all have high numbers of registered motorcycles and low numbers of deaths and serious injuries per 1,000 registered motorcycles.

Central and Eastern regions have very low numbers of registered motorcycles, but very high numbers of deaths and serious injuries per 1,000 registered motorcycles.

The raw data from BRRI classifies ten different collision types which have been grouped into the following categories:

- Involving another moving vehicle, including:
    - Head-on
    - Ran off road
    - Rear end
    - Right angle
    - Side swipe
- Involving a pedestrian or animal
    - Hit pedestrian
    - Hit animal
- Involving no moving third party
    - Ran off road
    - Hit parked vehicle
    - Hit object off road
    - Hit object on road
- Other

Fig. 12 shows the percentages of these different categories of crash types, for crashes that resulted in a motorcyclist death or serious injury, comparing rural feeder roads with urban roads and rural highways, for the period from 2012 to 2016 (inclusive).

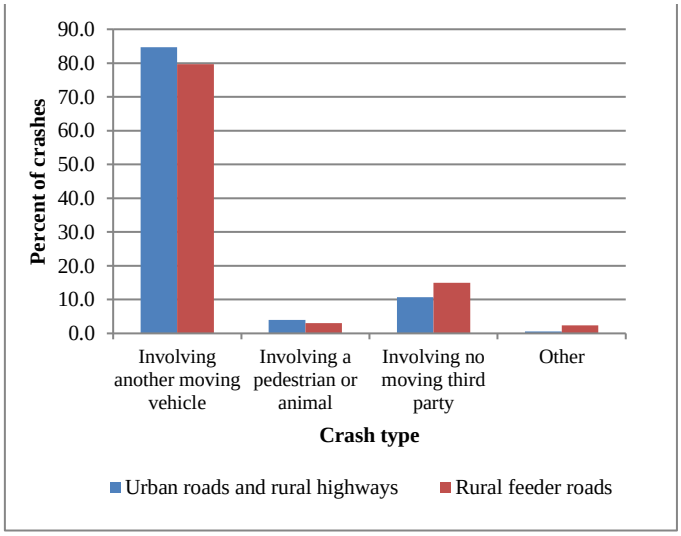

Fig. 12. Percentages of crash types for crashes that resulted in motorcyclists KSI, 2012 to 2016 (inclusive)

Source: BRRI, 2018

Fig. 12 shows that the vast majority of crashes that resulted in the death or serious injury of a motorcyclist involved another moving vehicle, although the percentage of such crashes was slightly lower on rural feeder roads than on urban roads and rural highways. It also shows that the percentage of crashes involving no other moving third party was higher on rural feeder roads than on urban roads and rural highways.

For crashes in which a motorcyclist was killed or seriously injured on all road types, 'Head-on' is the most common collision type. Fig. 12 shows the percentage of all crashes that caused death or serious injury to a motorcyclist that were head-on.

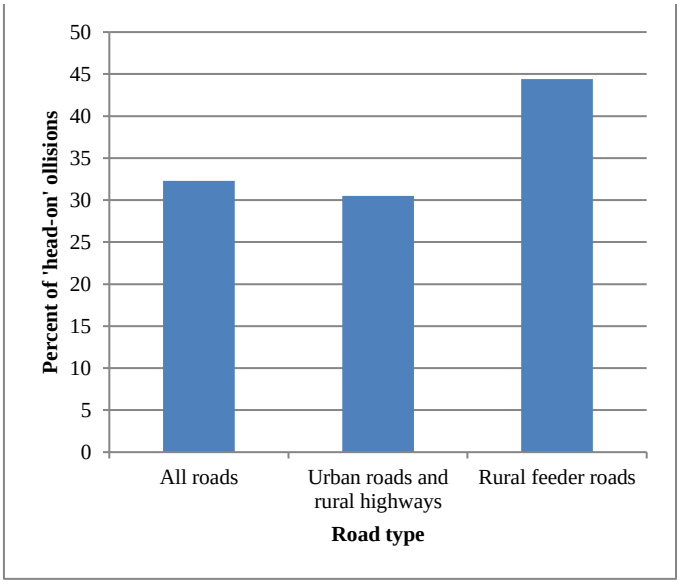

Fig. 13. Percent of collisions that resulted in motorcyclists KSI that were 'head-on', by road type, 2012 to 2016 (inclusive)

Source: BRRI, 2018

On all road types, head-on collisions accounted for almost one-third (32.3%) of motorcyclist deaths and serious injuries. However, on rural feeder roads, this number increases to 44.4%, showing that head-on crashes are more likely to be the cause of motorcyclist deaths and serious injuries than on urban roads and rural highways.

IX. Conclusions

The research to date has yielded some very interesting findings.

Through the reanalysis of the vehicle registrations data, it has been identified that:

- The numbers of motorcycles and three-wheelers being registered annually fell year-on-year from 2012, when legislation prohibiting the carriage of fare-paying passengers was introduced, to 2016, but then increased greatly in 2017
- Other than Greater Accra, the three regions with the highest numbers of motorcycle (including three-wheeler) registrations are the three regions with the greatest proportion of the population living in rural areas

- The two regions with the highest percentage of the population living in rural areas have by far the highest numbers of motorcycle (including three-wheeler) registrations per 1,000 of the population
- The four regions where motorcycles (including three-wheelers) make up the highest proportion of the total registered vehicles are the regions with the highest proportion of the population living in rural areas

Through the reanalysis of the road traffic injury data, it has been identified that:

- There appears to be a high degree of under-reporting of slight injuries suffered by motorcyclists
- Data on motorcycle-related deaths and injuries only includes 'motorcyclists' – riders and passengers. They do not include any other road users, such as cyclists or pedestrians, injured in an incident involving a motorcycle
- The three regions with the highest proportions of the population living in rural areas all have high numbers of registered motorcycles and low numbers of deaths and serious injuries per 1,000 registered motorcycles
- The percentage of 'head-on' collisions that resulted in death or serious injury of a motorcyclist was higher on rural feeder roads than on other types of roads

These findings will be reviewed in light of the findings of the other activities of the overall project, and will be written into a Ghana Country Report, for presentation to and discussion with relevant stakeholders.

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