ADDIS ABABA UNIVERSITY (AAU)
SCHOOL OF GRADUATE STUDIES
ADDIS ABABA INSTITUTE OF TECHNOLOGY
SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

Assessment of Road Traffic Crash Data Collection and Management System of Ethiopia.

A Thesis Submitted to the School of Graduate Studies in the Partial Fulfillment of a Masters Degree in Civil Engineering (Road and Transport Engineering)

Submitted by

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Approved by Board of Examiners

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DECLARATION

I hereby declare that the thesis entitled **Assessment of Road Traffic Crash Data Collection and Management System of Ethiopia** has been carried out by me under the supervision of Doctor Bikila Teklu, from Addis Ababa University, School of Civil and Environmental Engineering, during the year 2014-15 as part of Master of Science Program in Road and Transport Engineering. I further declare that this work has not been submitted to any other University or institution for the award of any degree or diploma.

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Abstract

Crash reports and statistics of roads, generally, are of importance to many organizations and institutions; the output of the reports/ statistics will help decision makers in the field of road safety, in adopting a suitable safety program consistent with the actual size of the problem.

However, without reliable and detailed Crash data recorded over a long period of time, it is unthinkable to make an in-depth Crash analysis and be aware of the magnitude of the problem. In general, without the basis of a dependable Crash data recording system there could be no effective road safety work in any country.

This research thesis focuses on investigating the road traffic Crash data collection and management system of Ethiopia and suggests a standard and consistent method of reporting system based on the practice employed in various countries in the world.

To meet these objective, current situation of Crash Data Collection and Management System of Addis Ababa City Administration, Amhara, Benishangul-Gumuz, Oromia and Southern Nations, Nationalities and People's (SNNP) Regions has been assessed. These four regions and the city administration constitute more than 83% of the overall road traffic Crash of the country in the last 11 years (2003/2004-2013/2014). The assessment is carried out mainly based on the best practices of United States of America's Model Minimum Uniform Crash Criteria (MMUCC, 2012) Guideline and WHO's (2010) Road safety data System manual. Moreover, Epi Info™ 3.5 software is used to create police road Crash data collection forms to the country.

When the police Crash data collection forms assessed based on MMUCC guide line the percentage of compliance level were only **23%.** Moreover, when police Crash data collection forms assessed based on WHO's Road safety data System manual, percentage of compliance level were limited to **29%** only.

Consequently, this study has found major deficiencies of the existing road traffic Crash data collection and management system and discovered that the current system could not serve the needs of all stakeholders. Subsequently, the paper proposed specific recommendations to overcome such limitations. Based on the shortfalls of the existing data elements and best practices of other countries, road traffic Crash reporting (recording) form was created by using Epi Info™ 3.5 software, which enables users even to record the data in softcopy in addition to collecting and managing the data in hard copy. The application of the established police road Crash data collection forms and road traffic Crash statistics forms will bring improvement in road traffic safety and it will act as a valuable instrument for the creation of comprehensive, reliable and accurate road traffic Crash database.

Key Words: Ethiopia, Road Crash Data, Minimum Data Elements, Police Road Crash Data Collection Forms.

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1. Introduction

1.1. Background

Most of the goods needed for everyday life are transported by road and the current generation has far greater opportunities for motorized travel in the course of work and leisure than their forefathers. Their advantages have been achieved, however, at a large cost [5].

The experience of many countries has shown that it is perfectly possible to introduce measures that greatly reduce this important economic and human cost but that reliable data are needed to quantify the scale of the problem and to identify the most effective solutions[5]. Collecting road Crash data is not "simply form filling", because it provides the essential information that each country needs to tackle one of the most widespread and serious problems that it faces [5].

Collecting good quality data on exposure can be expensive, but these data are essential in order to calculate Crash risks reliably and then to develop optimal policies for reducing those risks [5]. Better policies based on more reliable information will lead to fewer casualties, so the cost of data collection will be amply justified by the benefits of the resultant casualty reduction [5].

Road safety is an emergent problem world-wide over the last 50 years, so the developed nations have recognized that road Crash are both a major health problem and a serious economic drain on society [10]. By the early 1970s developing countries were becoming aware that they are facing a growing road safety problem and road Crash as a leading cause of death. In 1972, following requests for aid and guidance (in the field of road safety) from developing countries, the TRRL Overseas Unit formed a team to investigate this problem in some developing countries [10].The emphasis of the work has been placed on the collection and analysis of data so that the magnitude and the nature of the problem could be identified [10].

More recently, Countries have given emphasis towards monitoring road Crash trends, improving road Crash data collection and analysis systems and assessing low-cost countermeasures [10].

Ethiopia has experienced a rapid growth in population and vehicle ownership levels in the last two decades [11]. Motor-vehicles have revolutionized road transport and have brought invaluable benefits to the community. Unfortunately, as a consequence of that revolution, the number of fatalities and injuries due to road Crash has risen dramatically [10]. Such an increase in road Crash should be dealt within implementing a well-organized road safety program supported by reliable data recording and management system. Unfortunately, such system does not exist in Ethiopia.

Most countries collect basic information on road traffic crashes and injuries every day. Police

officers write reports on reported crashes. Insurance companies document client crashes [16]. Health workers keep medical records on road traffic injuries they have treated [16]. The main purpose of documenting this information is usually to assist an agency in carrying out its specific function; i.e. investigation, law enforcement, provision of health care [16]. While such information may be useful to individual agencies, it cannot be used for identifying risks, selecting interventions, or measuring outcomes at an aggregate level unless is it properly coded, entered in a computerized database system, processed, analyzed and disseminated [16].

Pursuant to the WHO manual at a minimum, good road crash data systems should [16]:

- capture nearly all crashes that result in death and a significant proportion of those that result in serious injuries;
- provide adequate detail on the vehicle, the road user and the road/environment to assist with identification of causes, and selection of countermeasures;
- include accurate crash location information;
- provide reliable output in a timely manner to facilitate evidence-based decisions

Moreover PIARC (World Road Association) states that to effectively analyze, compare and make informed conclusions from the Crash data it is necessary to fulfill the following basic requirements[12]:

- Accuracy (to exactly describe the individual parameters)
- Complexity (to include all features within the given system)
- Availability (to be accessible to all users)
- Uniformity (to apply standard definitions)

1.2. Definitions Used in this Research

There are some common terms used in any road Crash study for any country.

Based on the different definitions in literature review, this research defines these terms in the following manner:

1. Road Traffic Crash (A):

A road traffic Crash (road Crash) is defined as a Crash which occurs on a public road, causes personal injury or property or vehicle damage, and involves at least one vehicle.

2. A fatal Crash:

The definitions of fatalities vary from one country to another. Some countries consider the Crash

as fatal if the victim dies on the spot, others, if the victim dies within 24 hours and for other groups of countries if the victim dies within 3 days of the Crash...etc. Due to the variation of the definitions of fatal Crash a bias may appear if one compares the fatal Crash data from different countries which have different definitions. Therefore, care must be taken in such a comparison.

For the purpose of this study the following definition of fatal road traffic Crash is used:

"A Crash in which one or more vehicles either collides with one another, or a pedestrian, or an obstacle, or an animal, or are involved in a vehicle turnover and which results in the death of one or more people within 30 days of the Crash". This definition includes the explosions of vehicles. But, police in Ethiopia is not using this definition.

3. A serious Crash (seriously injured Crash):

A serious road traffic Crash is a Crash in which one or more vehicles either collide with one other, or a pedestrian, or an obstacle, or an animal, or are involved in a vehicle turnover which may result in the detention in hospital as an "in-patient" of one or more of the parties involved.

4. A slight Crash (slight injury Crash):

The slight Crash is any road traffic Crash in which one person or more is injured and only requires first aid treatment.

5. Road-user:

Road-user is any user of the road facility, including drivers, passengers in vehicles, and pedestrians.

6. Fatalities (F):

The fatalities are the people, who die as a direct result of a road traffic Crash, within 30 days of the occurrence of the Crash.

7. Injuries (I):

The injuries are the people who are slightly or seriously injured in a road traffic Crash.

8. Casualties (C):

The casualties are the people who are killed or injured in a road traffic Crash.

C=F+I.

9. Road Crash data rates:

Two types of road Crash data rates are used in this research:

a) Rates per head of population (usually per 100,000 persons).

b) Rates per registered vehicles (usually per 10,000 vehicles).

The fatality rate (per registered vehicle) for a country in a certain year is the number of fatalities (F) in that year divided by the number of registered vehicles (V). The road Crash data rates are usually used as indicators (parameters) of measuring the safety situation in a certain country.

10. Severity Index (Si):

Severity index is the total number of fatalities in a certain period divided by the total number of casualties (Fatalities+ Injuries) in the same period Si=F/(C= F+I).

11. Fatality index (Fi):

Fatality index is the total number of fatalities in a certain period divided by the total number of Crash in the same period Fi=F/A = (deaths ÷ total casualties).

12. Vehicle ownership level or Motorization level (V/P):

The vehicle ownership level for a country in a certain year is the number of registered vehicles (V) in that year divided by the population (P) of the country.

13. Low, Middle and High-income Countries

The WHO defines the income levels of countries according to the Gross National Product per capita per annum. Accordingly, countries which have incomes $935 or less per capita per annum are considered as Low-income, middle-income countries are whose per capita income is $936 to $11,455, whereas high-income countries are those countries which have per capita income of $11,456 or more [15].

1.3. Statement of the Problem

Each year, road traffic Crash cause a great loss of human and economic resources in Ethiopia. This problem is increasing from year to year at alarming rate accompanying the rapid increase of population and the number of vehicles [17].

The occurrence of traffic Crash in the country is increasing as the exposure to this risk increases with rapid motorization (without appropriate regulation), rapid population growth, and increase in the road network coupled with poor attitude and safety culture of road users. Although there are limited activities towards combating the problem, it is insufficient by any standard relative to the worsening situation [14]. Developing countries, like Ethiopia, face many challenges and have many resource needs [11]. Road safety data management tends not to receive due consideration

because of non-availability of research carried out on the area [11].

Hence, creating sound road traffic Crash database is very important to identify the major causes of Crash and work towards improvements. In general, without the basis of a dependable Crash data recording system there could be no effective road safety work in any country.

1.4. Research questions

Keeping in view the research Statement of the Problem, the research tries to answer the following questions:

- What are the shortcomings in road Crash data handling system of Ethiopia?
- What are the contents of a sound traffic Crash reporting system?
- did police officers assigned for road Crash data collection and management system in Ethiopia get trainings related with their work

1.5. Objectives of the Research

1.5.1 General objective

The objectives of this study are to assess the contents of road traffic crash database and the crash data system in Ethiopia. It will suggest that a standard and consistent method of reporting format based on the practice employed in various countries in the world will be proposed.

1.5.2 Specific objectives

The research has the following three objectives:

I. To investigate the road traffic Crash data collection and management system of Ethiopia
II. To assess best practices in road traffic Crash data collection and management of other countries
III. To identify the gaps and propose improvements in the road traffic Crash data collection and management system of Ethiopia

1.6. The Study Site

The study site is Ethiopia, which is a land-locked country after the independence of Eritrea in 1993. It is located in eastern Africa known as the horn of Africa with a total area of approximately 1.13 million square kilometers [1]. The World Factbook estimated its population as of July 2014 at 96,633,458 growing at rate of 2.89 percent [9]. About 83 per cent of the population are living in rural areas, while the population of the capital, Addis Ababa, is estimated at 2.863 million in 2009[9]. Whereas, according to the Central Statistical Agency of Ethiopia total population size of

the Country as of 2014 is 87,952,000 among this figure Male Population constitute 44,204,000 and the remaining 43,748,000 is the total female Population. The Agency also stated that the GDP per Capital as of 2006/07 is 255.4 US dollars [7].

Since 1996, Ethiopia has been divided into nine ethnically based and politically autonomous regional states and two chartered cities the latter being Addis Ababa and Dire Dawa. The regional states are subdivided into sixty-eight zones, and then further into 550 Woredas and several special Woredas [8]. In this study, traffic Crash reporting format and/or systems of **Addis Ababa City Administration**, **Amhara**, **Benishangul-Gumuz**, **Oromia** and **Southern Nations, Nationalities and People's (SNNP) Regions** are considered; where more than 83% of the road traffic Crash are concentrated on the last 11 years.

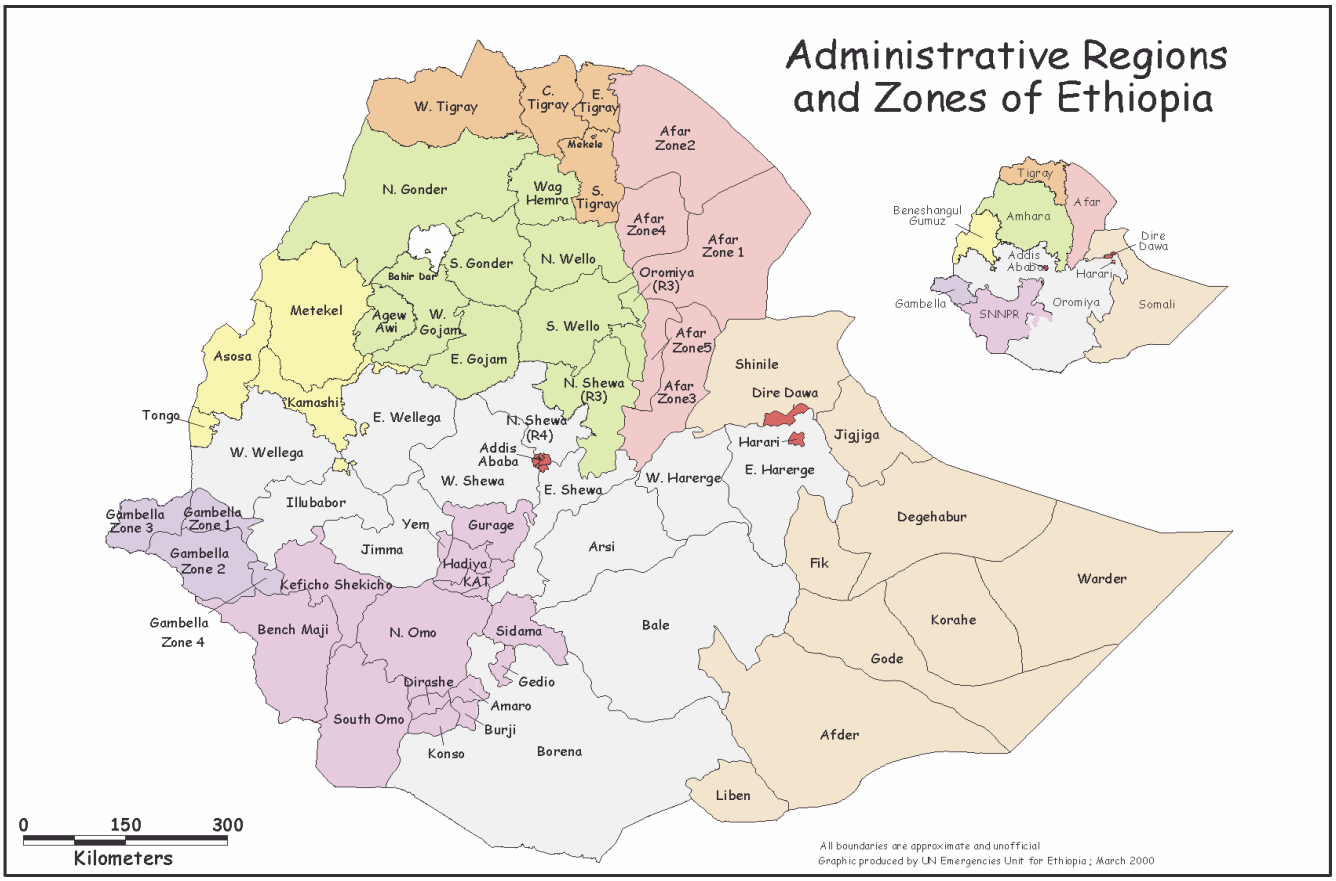


Figure 1: Map of Ethiopia, showing Administrative Regions and Zones of Ethiopia

(Source: Wikipedia, 2014)

1.7. Methodology

This section of the thesis presents the research methodology adopted for attaining the specific objectives of this work. The methodologies are presented as follows:

The main government bodies at the federal and regional levels concerned with road safety are contacted for the study. These organizations are National Road Traffic Safety Council (NRTSC), Transport Authority, Ethiopian Roads Authority, Federal Police Commission, City/Regional Police Commissions and police stations at the study site.

A wide-ranging literature review on the road traffic Crash data collection and management system from different manuals such as World Health Organization (WHO), Model Minimum Uniform Crash Criteria (MMUCC) and Permanent International Association of Road Congresses (PIARC), World Road Association, was carried out. The Model Minimum Uniform Crash Criteria (MMUCC) which was first created in 1998 and then updated in 2003, 2008 and 2012. In this paper the 2012 edition was used to assess the contents of road Crash data and the Crash data collection system of the Country. MMUCC recommends that law enforcement should collect 77 of the 110 data elementals at the Crash scene, which include 19 crash data elements, 30 vehicle data element and 28 personal data elements, were each elements has several attributes. The remaining data elements should be obtained after linkage to the other state data files such as driver history, roadway inventory data, hospital and other health/injury data.

The World Health Organization (WHO), Road safety data System manual, was published in association with Global Road Safety Partnership (GRSP), the FIA foundation and World Bank (WB) in 2010.

The WHO manual defines minimum data elements and specify uniform definitions and criteria so that the definition shall provide a dataset for describing road traffic crashes, and the resulting injuries, that will generate the information necessary for national analysis and road safety improvements.

The WHO manual also states that the minimum data elements selected for the Common Crash Dataset (CADaS) were based on extensive research on data sources and systems available in 25 European countries, and stakeholders' needs and priorities for crash data analysis at the national level. Moreover, the manual also states the data elements of CADaS were finalized after more than four years of consultation with road safety data experts and practitioners in several low- and middle-income countries, and revised for relevance and feasibility. According to this road safety manual, the minimum data elements of CADaS were reviewed and selected bearing in mind the unique challenges faced in low- and middle-income countries. On top of that, the data elements of CADaS are currently being applied in the European CARE (Community database on Crash on the Road in Europe) database.

The WHO manual recommends that Crash collection form needs to have at least 10 Crash related elements, 9 Road related element 8 Vehicle related and 15 personal related data elements, were each elements has several attributes. The data elements are described in detail in Appendix H of this document.

More than 10 years traffic Crash data, covering full Ethiopia, is collected from federal police commission; and based on the traffic Crash statistics, study site is selected.

Traffic Crash reporting format and/or systems of the study site, which are Addis Ababa City Administration, Amhara, Benishangul-Gumuz, Oromia and Southern Nations, Nationalities and People's (SNNP) Regions, where more than 83% of the road traffic Crash are concentrated for the last 11 years; has been collected and assessed in this study to have a solid understanding of what is already available in the country, and know the limitations of collection and management of the Crash data system.

In addition, informal interviews with police officers were conducted in order to gather more specific information on the concepts that emerged from both the document reviews and the analysis of the documents with the international practice.

Accordingly, the data elements from MMUCC and the World Health Organization (WHO) Manual are employed separately to evaluate the dataset elements from the police Crash Report Forms for Ethiopia.

As used by Dr. Jamal Almatawah's published Journal (2014),which evaluated process of collecting and maintaining Crash data system in Gulf countries, the compliance levels and its corresponding percentages based on the availability of the attributes from the police Crash Report Forms for each element in the report is evaluated for Ethiopia too. For example, if the number of the attributes that are available in the crash report for a specific item is nearly the same as in the MMUCC or WHO manual, then this item will deserve 3 points of MMUCC and WHO attributes and the compliance level will be called "Full". If the number is more than the half of the MMUCC attributes then the item will deserve 2 points, whereas if the number obtained is less than half of the MMUCC attributes then the item will deserve 1 point. If the item is not appear or the attributes are marginally mentioned the item will deserve 0 point. Table 1 shows the method of calculation for compliance level of Ethiopian police Crash reporting form.

Accordingly, major amendments were made on the previously used police Crash reporting forms as variables not considered before are included in the final Crash reporting forms. The developed Crash reporting forms includes the minimum Crash data elements that contains the necessary

information that can serve for different sectors/professionals; as these sectors/professionals (i.e. Traffic Engineers, Police forces, Researchers, Policy-makers, Prosecutors, Insurance companies and Vehicle manufacturers) require a variety of road safety related data for their day-to-day functioning.

Finally, Crash report form was created in hard copy based on the best practices and same is created in soft copy by using EPI Info 3.5 software, which enables users even to record the data in softcopy an addition to handling the data in hardcopy.

Table 1: (0-3) points possible per element based on attribute matching count

Points number	**MMUCC or WHO attributes (%)**	**Compliance Level**
3	100	Full
2	>50	High compliance
1	<50	Low compliance
0	0	No compliance

(This table is adopted from reference [4].)

2. The Road Crash Data Collection System and Road Traffic Crash Situation in Ethiopia

2.1 The Road Crash Data Collection System

A road traffic Crash data collection system is satisfactory only if it can produce information which can be used in analyzing important road traffic problems [10].

However, in Ethiopia very little effort is devoted to providing enough road Crash information.

Regional departments of Police are responsible for the recording of all traffic Crash under their jurisdictions. The Federal Police Commission is responsible for national Crash data compilation and processing. In each Region's Woreda or Sub-City Police Station, road traffic Crash data are reported manually on paper. A police officer attending a Crash collects the data through Crash recording form which is different from region to region, and makes a decision on fault at the scene of the Crash. The police officer uses his/her decision on who among the involved parties is to be blamed for the Crash. On average, some of the basic Crash data parameters, which is available on the road traffic Crash reporting form, that the attending officer is expected to collect include:

- Involved parties or road users: road user type (pedestrian, car drivers, passengers, bicyclists etc.), age, sex etc. (among the selected regions only Oromia region has full description of the type of road user)
- General information such as year and hour/time,
- Injury details such as fatal, serious, slight or non-injury Crash (except Oromia region, this data is not fully described in other police forms)
- Location of the Crash where road/street names, land marks or area names are used (this data element is marginally described in the forms)
- Vehicle: where type of vehicle such as small cars, taxes, buses, bicyclists are identified (among the selected police forms, this data type is only available in Oromia, SNNPs & AAs' police reporting forms only)
- Road environment which include weather and lighting conditions(it is available only in SNNPs & AAs' police reporting forms),
- Road obstacles presence of animals on the roads (Marginally described in the forms)

The attending officer is then expected to finally fill in the details about the Crash in a hard-covered booklet at the police station.

With respect to reporting scenarios, the Regional Woreda Police Stations submit daily 24 hour

Crash reports, Monthly, Quarterly, Bi-annually and Annually reports to related Zonal police Commissions. The Zonal police Commissions also submit daily24 hour Crash reports, Monthly, Quarterly, Bi-annually and Annually reports to the Region Police Commissions. A monthly, quarterly, biannually and yearly reports from the Region Police Commission will then be submitted to the Federal Police Commission to generate national Crash statistics.

However, in the City administrations (AA and Diredewa), Sub-City Police Stations inform the 24 hour Crash to the Cities' Police commission through phone. In addition to this, the monthly, quarterly, biannually and yearly reports from the Cities' Police commission will then be submitted manually to the Federal Police Commission where the national Crash statistics is generated.

In Ethiopia, much of the information collected on traffic Crash is needed for the traffic police's own activity, mainly, to enforce the law and carry out prosecutions [6]. But, it is vital to know that some of the Crash data are of no direct interest or use to the police, but are vital to the work of other organizations [6].

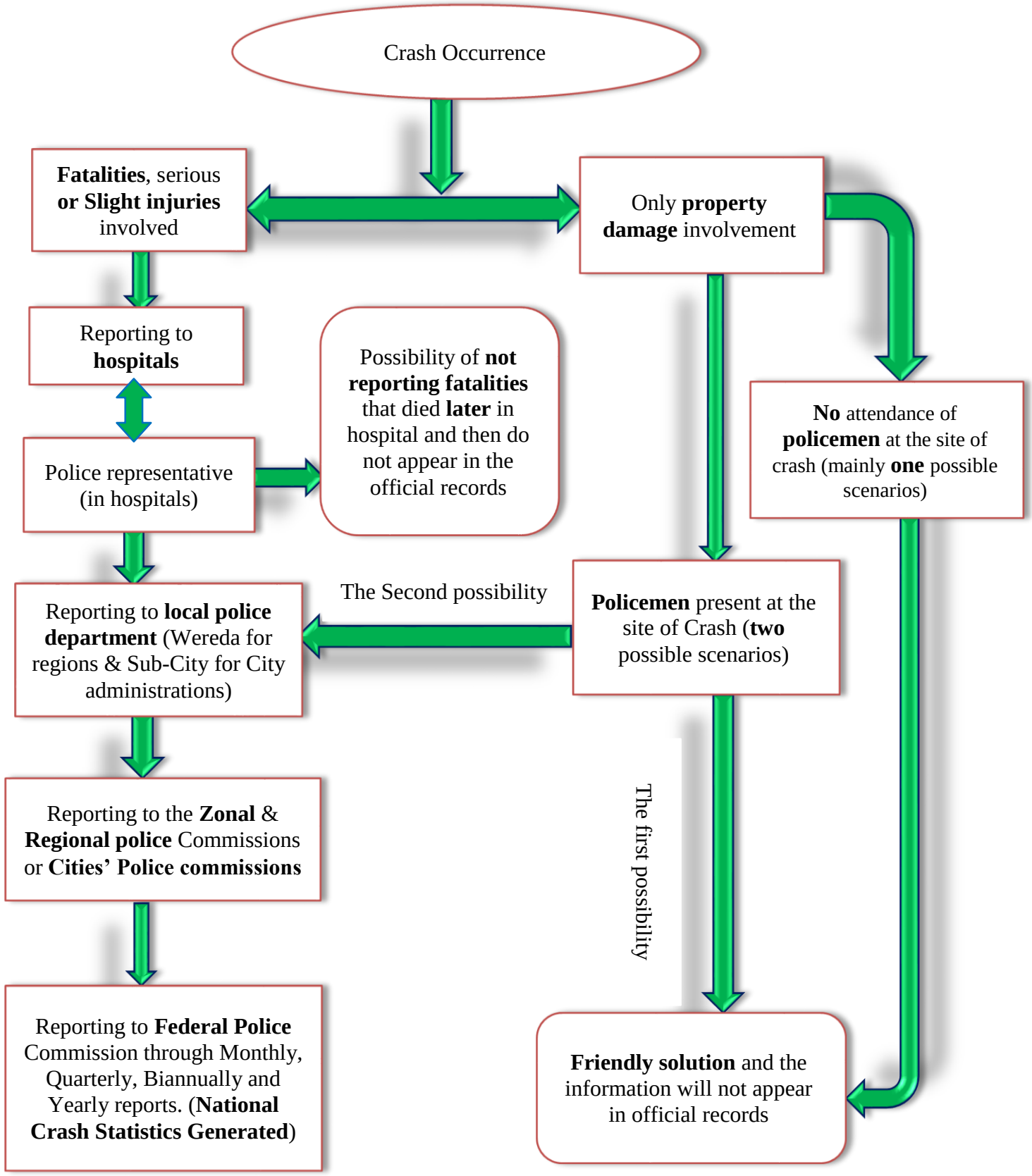


Figure 2: The Process of Crash Data Collection & Reporting System of Ethiopia (adapted from reference [10])

2.2 Road Traffic Crash Situation in Ethiopia

2.2.1. Introduction

Being a land-locked country after the independence of Eritrea in 1993; Ethiopia is located in eastern Africa known as the horn of Africa with a total area of approximately 1.13 million square kilometers [1].

Road transport has been serving the major mode of transport for both domestic and international transport services in Ethiopia. In Ethiopia more than 90 percent of all the inter-urban freight and passenger movements are contributed by the road transport [1], [11]. However, this figure could be changed in the coming years as the government is investing huge amount of money on railway construction.

Regardless of having a very low road network density and vehicle ownership level, the country, Ethiopia, has high Crash record. In this country the motorization level is low as around 33 vehicles per 10,000 populations in 2014 (calculated based on specified figures in table 3 below and taking estimated population of the country as 96,633,458.00 on same year).

For illustration, when we take the data from federal police commission, in 2013/14 of Ethiopian fiscal year, for example, there were **28,439** reported road traffic Crash out of which **2,664** were fatal, **3,558** were serious injury, **3,474** were slight injury, and **18,743** were property damage only Crash. This shows that the road Crash problem is a very serious problem in the country, which needs sustainable solutions as promptly as possible. This is clearly a very high figure in comparison to the vehicle population in the nation. Table 6 illustrates eleven years of reported road traffic Crash in Ethiopia.

The road traffic Crash situation in the country apparently underlines the dangerous road user behavior, the unsafe roads and their environment, and worn-out vehicles on the road network[11].This circumstance is, probably, not clear and does not seem imperative to politician and society at large. The road Crash problem however is a very serious problem which needs sustainable solutions without delay [11].

2.2.2. Road Network and Traffic Growth in Ethiopia

Ethiopia has shown a considerable progress in road sector development in recent years through the construction of many roads [11]. The Road Sector Development Program (RSDP) of the country has put as a strategy can take the major share for this progress [11]. This has brought a significant improvement in the country's road network [11].

Table 2: Growth of the Classified Road Network and Change in Road Density (2000 – 2014)

No.	Year	Road Network (km)					Growth Rate (%)	Road Density /1000 Popn.	Road Density /1000 sq.km
		Asphalt	Gravel	Rural	Wereda	Total			
1	1997	3,708	12,162	10,680		26,550	-	0.46	24.1
2	1998	3,760	12,240	11,737		27,737	4.5%	0.46	25.2
3	1999	3,812	12,250	12,600		28,662	3.3%	0.46	26.1
4	2000	3,824	12,250	15,480		31,554	**10.1%**	0.50	28.69
5	2001	3,924	12,467	16,480		32,871	4.2%	0.50	29.88
6	2002	4,053	12,564	16,680		33,297	1.3%	0.49	30.27
7	2003	4,362	12,340	17,154		33,856	1.7%	0.49	30.78
8	2004	4,635	13,905	17,956		36,496	**7.8%**	0.51	33.18
9	2005	4,972	13,640	18,406		37,018	1.4%	0.51	33.6
10	2006	5,002	14,311	20,164		39,477	**6.6%**	0.53	35.89
11	2007	5,452	14,628	22,349		42,429	**7.5%**	0.55	38.6
12	2008	6,066	14,363	23,930		44,359	4.5%	0.56	40.3
13	2009	6,938	14,234	25,640		46,812	**5.5%**	0.57	42.6
14	2010	7,476	14,373	26,944		48,793	4.2%	0.58	44.39
15	2011	8,295	14,136	30,712	854	53,997	**10.7%**	0.66	49.1
16	2012	9,875	14,675	31,550	6,983	63,083	**16.8%**	0.75	57.3
17	2013	11,301	14,455	32,582	27,628	85,966	**36.3%**	1.00	78.2
18	2014	12,640	14,217	33,609	39,056	99,522	**15.8%**	1.10	90.5

Source: Ethiopian Roads Authority, 2015

From Table 2 we can understand that in the last fifteen years the total road network of the country has significantly increased from 31,554 km with a road density of 0.50 per thousand people and 28.69 per thousand square km in the year 2000 to 99,522 km with a road density of 1.1 km per thousand people and 90.5 km per thousand square km in the year 2014. The average annual growth rate is about 9.0%. Moreover, the URRAP program, which started in the year 2011, has contributed a lot for increase of road network in the country; though its functionality needs further research.

The country has also been showing a considerable increase in traffic volume as a result of the economic development registered with an average annual GDP growth of 6.5% for the past ten to fifteen years [11].

Table 3 shows that the total number of vehicles experienced significant increase, which is about 9% average growth, from 2005/2006 to 2013/2014

Table 3: Cumulative number of Registered Vehicles by Type

No.	Description	Up to 2005/06	Up to 2006/07	Up to 2007/08	Up to 2008/09	Up to 2009/10	Up to 2010/11	Up to 2011/12	Up to 2012/13	Up to 2013/14	Not Specified	Total
1	Automobile	58,801	64,560	70,642	77,332	84,691	92,070	100,202	109,147	118,987	30,818	**149,805**
2	Ambulance	200	218	237	258	281	324	386	455	530	190	**720**
3	Crane	386	471	515	563	616	689	785	890	1,006	434	**1,440**
4	Double Cabin	11,901	12,850	13,957	15,175	16,514	17,873	19,383	21,044	22,872	8,737	**31,609**
5	Dry Cargo	29,929	33,553	37,040	40,876	45,095	49,334	54,012	59,158	64,819	15,048	**79,867**
6	Dump Truck	4,873	6,292	6,700	7,149	7,643	8,157	8,737	9,375	10,077	5,664	**15,741**
7	Farm Tractor	43	43	60	79	100	141	201	267	339	346	**685**
8	Farm Trailer	-	-	-	-	-	20	57	98	143	4	**147**
9	Field Vehicle	16,368	17,773	18,991	20,331	21,805	23,299	24,957	26,781	28,787	10,807	**39,594**
10	Fire Fighting	17	18	18	18	18	38	75	116	161	18	**179**
11	Glas Van Dry	129	137	155	175	197	239	300	367	441	184	**625**
12	Higher Bus	917	965	998	1,034	1,074	1,134	1,215	1,304	1,402	877	**2,279**
13	Liquid Cargo	1,736	1,934	2,113	2,310	2,527	2,764	3,039	3,342	3,675	989	**4,664**
14	Low Bed	48	62	66	70	75	100	142	189	240	125	**365**
15	Midium Bus	1,156	1,281	1,424	1,581	1,754	1,947	2,174	2,424	2,699	1,269	**3,968**
16	Mini Bus	13,548	15,202	17,500	20,028	22,809	25,610	28,706	32,111	35,857	9,765	**45,622**
17	Mixer	109	144	164	186	210	254	318	388	465	261	**726**
18	Mobile Garage	42	49	53	57	62	87	129	176	227	29	**256**
19	Mobile House	391	443	498	559	626	713	823	944	1,077	106	**1,183**
20	Moter Cycle	4,248	5,461	7,150	9,008	11,052	13,116	15,401	17,915	20,680	9,670	**30,350**
21	Panal Van Dry	221	235	293	357	427	517	631	757	895	1,568	**2,463**
22	Pick Up	1,516	1,566	1,649	1,740	1,840	1,960	2,107	2,269	2,447	2,701	**5,148**
23	Power Dry	1,690	2,085	2,397	2,740	3,118	3,516	3,968	4,465	5,012	2,227	**7,239**
24	Power Liquid	113	131	149	169	191	233	294	361	435	115	**550**
25	Refrigerator	2	5	5	5	5	25	62	103	148	27	**175**
26	Refuse Collector	66	67	83	101	120	159	217	281	352	70	**422**
27	Semi Trailer Dry	961	1,166	1,229	1,298	1,374	1,470	1,591	1,724	1,870	1,958	**3,828**
28	Semi Trailer Liquid	191	205	230	258	288	338	408	485	570	113	**683**
29	Special Trailer	37	45	49	53	58	83	125	172	223	56	**279**
30	Trailer Dry	5,580	6,375	6,797	7,261	7,772	8,303	8,902	9,561	10,285	2,313	**12,598**
31	Trailer Liquid	981	1,028	1,254	1,503	1,776	2,069	2,407	2,779	3,188	521	**3,709**
32	undefined	162	456	781	1,139	1,532	1,945	2,415	2,932	3,500	766	**4,266**
33	Not Specified	20,171	20,466	20,620	20,789	20,975	21,181	21,423	21,689	21,982	10,737	**32,719**
Total		**176,533**	**195,286**	**213,817**	**234,202**	**256,625**	**279,708**	**305,592**	**334,069**	**365,391**	**118,513**	**483,904**
Growth (%)		9%	11%	9%	10%	10%	9%	9%	9%	9%		

(Source: Ethiopian Transport Authority, 2014)

2.2.3. Current Crash Situation

Recent year data from federal police is collected consequently Table 4 summarizes distributions of number of road Crash fatalities by road user type, sex, and age group in Ethiopia covering from periods 2008/2009 -2012/2013 and Table 5 summarizes Vehicles which were responsible for road Crash in same period.

Table 4 shows that age group 7 to 50 are most vulnerable and Passengers and pedestrians are most vulnerable. Furthermore, females most vulnerable are pedestrians.

Table 4: Distributions of number of road Crash fatalities by road user type, sex, and age group (2008/2009 -2012/2013)

Age group	Drivers		Passengers		Pedestrians		Total		Total (%)	
	M	F	M	F	M	F	M	F	M	F
Below 7	0	0	58	33	229	125	287	158	3%	5%
7-13	0	0	149	72	536	296	685	368	7%	11%
14 - 17	47	10	299	152	760	249	1106	411	11%	13%
18 - 30	402	30	2131	565	1505	502	4038	1097	39%	33%
31 - 50	550	26	1196	494	1263	306	3009	826	29%	25%
Above 50	107	8	328	162	674	257	1109	427	11%	13%
Unknown	0	0	0	0	0	0	0	0	0%	0%
Total	237	7	1,072	194	1,139	466	10,234	3,287	100%	100%
Total (%)	8%	0%	34%	6%	37%	15%				

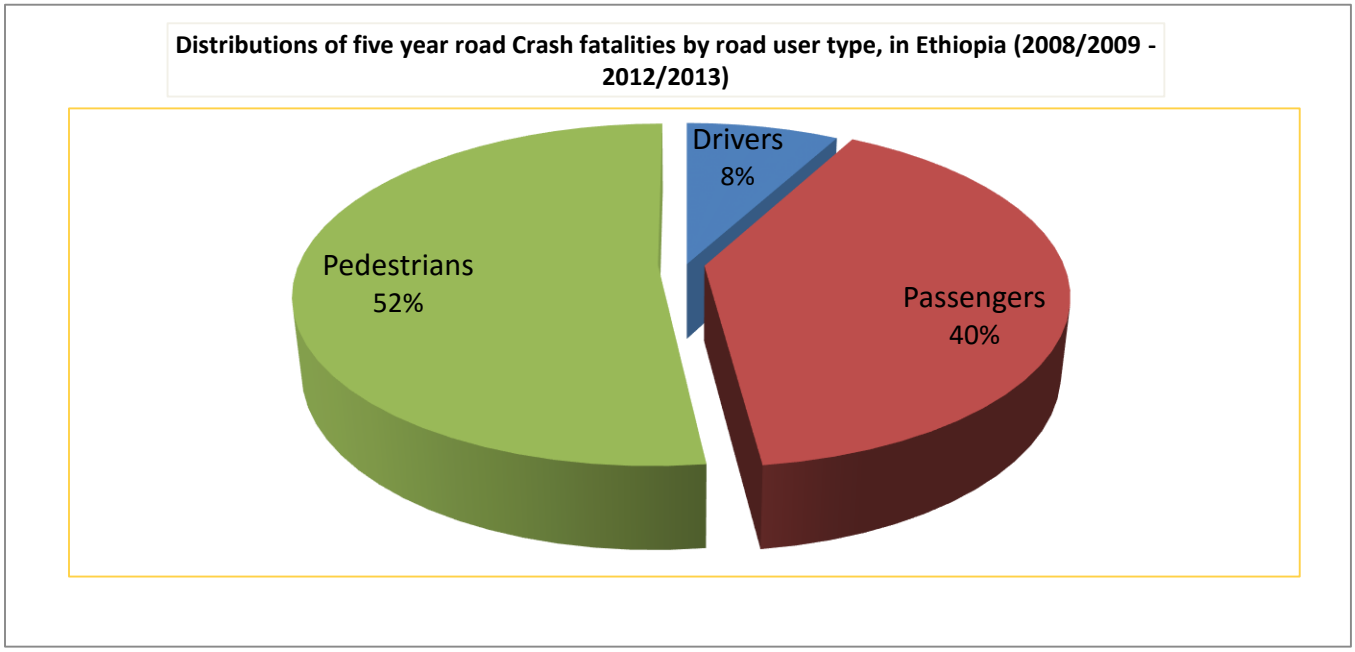


Figure 3: Distributions of road Crash fatalities by road user type, in Ethiopia (2008/2009 -2012/2013),

N.B. 2012/2013 data doesn't include SSNPs and Gambella Region

Table 5: Vehicle Involvement in Road Crash (2008/2009 -2012/2013)

Crash Severity	Bicycle	Motor Bicycle	Small Car	Station Wagon	Pick -up 10 qt	Truck 11-40 qt	Truck 41-100 qt	Truck Trailler	Taxi	Public transport Up to 12 Seat	Public transport Up to 13-45 Seat	Public transport above 46 Seat	Others	Total
Fatal	207	387	596	433	951	1,251	1,117	639	1,909	1,089	1,127	497	959	**11,162**
Serious	216	407	3,248	978	1,273	1,074	1,058	353	3,026	1,166	862	330	741	**14,732**
Fatal and Serious Total	**423**	**794**	**3,844**	**1,411**	**2,224**	**2,325**	**2,175**	**992**	**4,935**	**2,255**	**1,989**	**827**	**1,700**	**25,894**
Percent of Fatal and Serious (%)	2	3	**15**	**5**	**9**	**9**	**8**	4	**19**	**9**	**8**	3	**7**	
Slight	200	577	1,452	817	1,174	1,032	1,138	332	3,592	1,533	803	306	911	**13,867**
Damage Only	127	551	12,599	5,506	5,534	4,240	5,171	1,666	9,948	4,303	2,528	1,513	3,044	**56,730**
Total	**750**	**1,922**	**17,895**	**7,734**	**8,932**	**7,597**	**8,484**	**2,990**	**18,475**	**8,091**	**5,320**	**2,646**	**5,655**	**96,491**

Source: Federal Police Commission, Road Traffic Crash Statistics Office, 2014

From the Table 5, we can see that Small cars, Station Wagons, Pickups, Trucks of all type, Taxis and Public Transport constitute 89% of the vehicles involved in fatal and serious injury Crash. The remaining 11% of the fatal and serious injury Crash are due to Bicycle (2%), Motor Bicycle (3%) and unspecified or other types (7%) of vehicle. The unspecified or other types of transportations are as listed in Federal Police Commission Statistics report form Table No. 9 items 14 to 19. And the form is attached as Appendix A of this thesis.

Furthermore, Taxis and public transportation constitute for 39% of fatal and serious injury Crash of all vehicles.

Moreover, the Crash situation in each region and city administration of Ethiopia from2003/2004 to 2013/14 reporting year (i.e. for the last 11 years) is indicated in table 6.From this table we can see that more than 83% of the road traffic Crash are concentrated in Addis Ababa City Administration, Amhara, Benishangul-Gumuz, Oromia and Southern Nations, Nationalities and People's (SNNP) Regions. The remaining 5 regions and a city administration contribute only less than 17% of the road traffic Crash.

Table 6: National Level Road Crash Data (from 2003/04 to 2013/14)

Region	No. of Traffic Crash					Victims of Motor Vehicle Traffic Crash									
						Fatal Injury		Serious Injury		Slight Injury		Total		General Total	Total (%)
	Fatal Injury	Serious Injury	Slight Injury	Property Damage	General Total	Male	Female	Male	Female	Male	Female	Male	Female		
Tigray	2,055	2,423	1,143	3,863	9,484	2,006	634	3,347	1,119	2,850	964	8,203	2,717	**10,920**	8.44%
Afar	473	266	163	1,147	2,049	540	106	582	157	666	145	1,788	408	**2,196**	1.70%
Amhara	4,997	3,972	5,359	9,897	24,225	5,017	1,641	6,308	2,461	10,365	3,706	21,690	7,808	**29,498**	22.79%
Oromia	8,132	6,964	6,701	14,181	35,978	8,096	2,807	9,593	3,095	9,021	3,268	26,710	9,170	**35,880**	27.72%
Somalia	403	259	49	85	796	480	154	661	184	434	119	1,575	457	**2,032**	1.57%
Ben. Gumuz	174	295	494	325	1,288	174	56	476	149	814	234	1,464	439	**1,903**	1.47%
S N N P	2,313	2,775	2,866	2,234	10,188	2,230	693	3,495	858	3,706	1,068	9,431	2,619	**12,050**	9.31%
Gambella	113	347	568	199	1,227	91	25	299	49	458	75	848	149	**997**	0.77%
Harari	186	364	624	625	1,799	164	44	336	149	651	331	1,151	524	**1,675**	1.29%
Addis Ababa	3,871	9,658	11,015	92,788	117,332	3,240	902	8,858	3,060	9,769	3,374	21,867	7,336	**29,203**	22.56%
Dire Dawa	209	732	1,043	1,762	3,746	221	62	725	320	1,150	612	2,096	994	**3,090**	2.39%
Total	**22,926**	**28,055**	**30,025**	**127,106**	**208,112**	**22,259**	**7,124**	**34,680**	**11,601**	**39,884**	**13,896**	**96,823**	**32,621**	**129,444**	**100.00%**

Source: Federal Police Commission, Road Traffic Crash Statistics Office, 2014

3. Review of Studies on Road Traffic Crash Data Collection and Management System

3.1. Introduction

According to the recently published World Health Organization (WHO) Global Status Report on Road Safety (GSRRS; WHO 2009), road traffic injuries (RTIs) pose a major global public health threat that has long been neglected. As per the report, over 1.2 million people die each year on the worlds' roads with between 20 and 50 million people sustaining nonfatal injuries[15]. Though 2004 estimates place road traffic crashes as the ninth leading cause of death (responsible for 2.2% of all deaths globally), modeled projections of predict made by WHO states that traffic crashes will rise to the fifth leading cause by 2030 (3.6% of all deaths) if nothing is done to mitigate this escalating problem[15].

Accordingly, Most countries have found that there is a need for there to be a legal requirement for road Crash (or particular severalties of Crash, e.g. involving personal injury) to be reported to the Police, and it is advisable that this is reinforced by insurance company rules requiring claimants to follow this law [2]. The best source of validated Crash data will, therefore, be the Police force: either the policemen attending the scene of a Crash or when reported to an officer at a police station by the involved parties/witnesses [2].

A 2009 World Health Organization report states, Low-income and middle-income countries have higher road traffic fatality rates (21.5 and 19.5 per 100, 000 population, respectively) than high-income countries (10.3 per 100,000 population) [15]. Moreover, the report also asserted that over 90% of the world's fatalities on the roads occur in low-income and middle-income countries, which have only 48% of the world's registered vehicles [15].

The situation also tends to be worsening as these countries' vehicle fleets are growing rapidly, and efforts to improve safety are not keeping pace [2]. However, methods applied in many of the developed countries have demonstrated that it is possible to slow or arrest this growth in Crash [2]. To achieve this requires dedicated safety workers to carry out regular, in-depth analyses of patterns of Crash and to then target many of these with various (low-cost) remedial actions that are likely to yield the most effective results [2].

Hence, the establishment of a reliable road Crash database and analysis system is of paramount importance, and this must be made accessible to all those bodies able to contribute to Crash reduction (like the Police, highway engineers, vehicle engineers, education services, etc)[2].

The World Health Organization report pointed out that huge gaps remain in the quality and coverage of

the data that countries collect and report on road traffic injuries. The report also stated that Reliable data on fatalities and non-fatal injuries are needed by countries to assess the scope of the road traffic injury problem, to target responses to it, and to monitor and evaluate the effectiveness of intervention measures [15].

3.2. Road Crash Classifications

Various countries have got their own definition to treat a certain Crash as road traffic Crash. In Belgium, these are Crash occurred on a public road, which are reported to the police and which lead to casualties whereas Crash involving material damage only have not been included in the Crash statistics since 1973[11].In Canada, it is a traffic collision which occurs on a public roadway that involves at least one motorized vehicle and results in death or injury to at least one involved person, or property damage exceeding a specified monetary amount [11].

In Germany, it is defined as a Crash occurring on public roads or squares involving at least one moving vehicle and resulting in human injury or death and/or in material damage on the condition that material damage only are registered if the cause of Crash is an offence such as driving while under the influence of alcohol[11]. A Crash is said to be road Crash, in Britain, if it occurs on a public road and if it involves at least one vehicle and resulting in human injury or death whereas damage-only Crash are not compiled. Road Crash has been defined in United States as an event that produces injury and/or damage, involves a motor vehicle in transport, and occurs on a traffic way or while the vehicle is still in motion after running off the traffic way [11].

Most countries in the world use nearly similar definition on different level of Crash severities [11]. The standard definition of a fatal Crash, as is used by UN, is a Crash as a result of which any person was killed outright or died within 30 days [11]. On the other hand a serious injury Crash is the one a person is admitted to hospital as a result of injuries from a road crash (Australia) [11]. A Crash making the victim suffers non-fatal injuries that result in hospitalization, including for observation only, for a period of at least 24 hours is serious injury Crash (Canada). UN defines a serious injury Crash as a Crash that creates fractures, concussion, internal lesions, Crashing, severe cuts, laceration, or severe shock requiring medical treatment and any other serious lesion entailing hospitalization [15]. A Crash is said to be **fatal Crash** if one or more victims die within 30 days of occurrence of the Crash [11]. The choice of 30 days was based on research which showed that most persons who die as a result of a crash succumb to their injuries within 30 days of sustaining them and that, while extension of this 30-day period resulted in a marginal increase in numbers, it required a disproportionately large increase in surveillance efforts[15].

At the global level, WHO (2009) report, stipulated that only 80 countries (45%) use a 30-day definition

for a road traffic fatality [15].The same report also shown that even within the European Region, which has made considerable efforts to bring countries in line with the 30-day definition of a road traffic fatality, there is wide variation in fatality definition. Figure 5, which is adopted from WHO (2009) report, shows time period used to define a road traffic fatality by country/ area and income group [15].

According to TRL (1995), cited in Murad Mohammed (2011) MSC thesis stated that Most European countries define different Crash severity level as follows [11]:

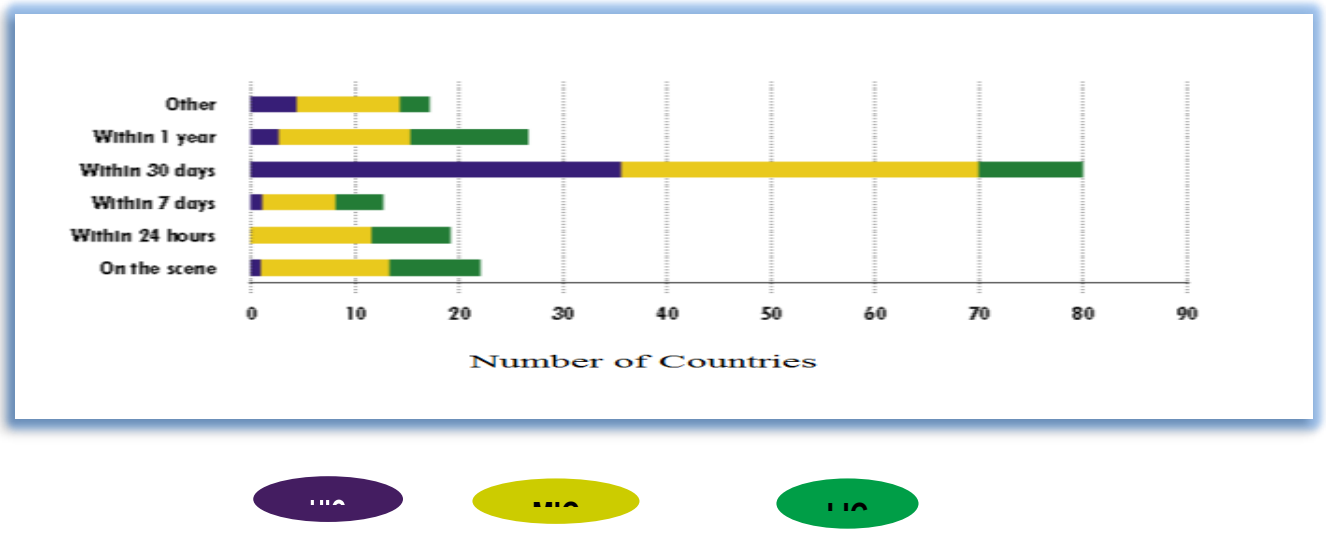
A Crash is termed as a **Serious Injury Crash** if one or more victims are seriously injured as a consequence of the Crash but there are no deaths.

A **serious injury** is defined in the UK as either one for which a person is retained in hospital as an "in patient", or if any one of the following injuries are sustained whether or not he or she is held in hospital:- fractures, concussion, internal injuries, Crashing, severe cuts and lacerations, or severe general shock requiring medical treatment.

A ***Slight Injury Crash*** is a Crash as a consequence of which there are no deaths or serious injuries but the victim is slightly injured (outpatient).

A ***slight injury*** is an injury of a minor character such as a cut, sprain or bruise.

Damage-only Crash is one in which no one is injured but damage to vehicles and or property is sustained.



HIC = high-income countries; MIC = middle-income countries; LIC = low-income countries

Figure 4: Time period used to define a road traffic fatality by country/ area and income group

(Source: WHO, 2009)

3.3. Current Crash Severity Definition in Ethiopia

Murad Mohammed (2011) in his MSC thesis stated that in Ethiopia, there is no a documented definition of different Crash severity levels in Ethiopia. In this paper, the author also proofed that though not complied properly, some police stations have documents which define crash severity levels. Hence, to have a clear picture, informal interviews with police officers has been made and the Crash severity level definitions of the Country is as stated below:

A **fatal Crash** is the one in which one or more individuals die as a result of traffic Crash within the **same reporting year** of the occurrence of the Crash. This definition is totally different from the standard definition of UN which limits within 30 days period.

A **serious injury** is one in which a victim sustains severe cuts, bleeding, breaks, and other damages which requires him a medical treatment as "in-patient" in hospital.

A **slight injury** is the one as a result of which the victim sustains only small cuts, scratches, and other small damages which may be treated as an out-patient without requiring admission to a hospital.

Damage only Crash is the one as a result of which no person is injured only one or more vehicles involved in the Crash are damaged.

3.4. Importance of Data systems for road safety

Road transport is vital to growth by facilitating the movement of people and goods; it improves access to schooling, well-being care, employment, and cost-effective markets [16]. Multilateral development banks invest billions of dollars each year to build and repair road networks in low- and middle-income countries, thereby generating economic growth and employment [16]. Unfortunately, in the absence of adequate attention to safety, an emphasis on maximizing the efficiency of road transport systems has led to significant loss of lives, health and wealth [11]. More than 2000 people die each year as a result of road traffic crashes and many people suffer non-fatal injuries [11]. These crashes and injuries have devastating economic and social costs, for families and for society [16]. Policies and programs in the transport, law enforcement, health and other sectors have a direct impact on the safety of road transport, making road safety a critical public policy issue [16].

Without ongoing, data-led diagnosis and management of the leading road injury problems, there will be no significant, sustainable reductions in exposure to crash risk or the severity of crashes [16].

Reliable, accurate data can also help build political will to prioritize road safety by [16];

- documenting the nature and magnitude of the road traffic injury problem;
- demonstrating the effectiveness of interventions that prevent crashes and injuries;
- Providing information on reductions in socio-economic costs that can be achieved through effective prevention.

The use of reliable data to identify problems and target resources more effectively is a key element of the Safe System approach to road safety–an approach increasingly recognized as the most effective way to make road transport systems safer for all users [16].

3.5. Data Requirements for Assessment of Road Safety Performance

There is growing recognition in the international community that effective road safety management requires more data than the crash data [16].Crash statistics do not provide a complete picture of the road safety situation. Crash data must be interpreted in light of other information that cannot usually be derived from police records, such as population size, or the number of vehicles on the road [16].

Crash data do not capture information on risk factors such as helmet use or speeding among the general population, and therefore other road safety related data are important for monitoring performance and achieving results [16].

Road safety management involves all institutions, their strategies and interventions, and the results of such strategies and interventions. Results, or outcomes, occur at different but related levels [16].The most visible results are the outputs that result from policies and programs implemented by various institutions: random breath testing checks, campaigns to promote helmet use, legislation, installation of speed cameras. Through such outputs, policies and programs influence how the road traffic system operates: e.g. the proportion of people wearing helmets, average travel speeds, safety of vehicles admitted to the system (also known as intermediate outcomes or safety performance indicators) [16].

These ‘operational conditions’ directly influence the likelihood of deaths and injuries from road crashes, or final outcomes, that road safety practice aims to prevent [16].Finally, the ultimate result of effective road safety management is the reduction of social costs (such as medical costs, property damage) associated with road traffic deaths and injuries [16].

A comprehensive road safety data system would therefore encompass data collection and analysis mechanisms that cover [16]:

- final outcomes – including at least deaths and serious injuries to road users, and characteristics of the crashes that result in them;
- exposure measures – e.g. demographic data, number of licensed drivers, traffic volume data, infrastructure factors, to help interpret of crash data and measure indicators;
- intermediate outcomes – e.g. mean traffic speeds, seat-belt and helmet wearing rates, drink–driving, and vehicle and infrastructure safety ratings;
- socio-economic costs associated with road traffic injuries;
- Outputs – including various enforcement efforts.

3.6. The Roles and Data Needs of Different Sectors

The work of the **transport**, **law enforcement** and **health sectors** directly influences the risk and outcomes of road traffic crashes, whether or not that work is consciously considered to be 'road safety work'[16].These sectors require a variety of road safety related data for their day-to-day functioning. As background to conducting a situational assessment on road safety data systems, it is helpful to understand the function of these sectors, what data they require and what data they may have [16].

PIARC Road safety manual, 2004, states information on road Crash is extremely valuable for [13]:

- **Traffic engineers:** who have the technical tools required to eliminate hazardous situations on existing roads and to prevent such problems on future roads;
- **Police forces:** who can use the data for planning their actions, and focusing on hazardous locations and traffic situations;
- **Researchers:** who use the data in carrying out preventive investigation studies, making recommendations for improving the situation in similar locations elsewhere in the network or introducing restrictive measures for a particular group of road users (for example, graduated driver licensing for young people);
- **Policy-makers:** who set Crash reduction targets and develop road safety action plans at the national, regional, and local levels based on the findings of safety analyses;
- **Prosecutors:** who can use the data on the circumstances of the Crash, eyewitness statements, police Crash reports and evidence provided by the parties involved;
- **Insurance companies:** who set their insurance rates and premiums based on driving records, types of vehicle, safety devices used and risks entailed by a particular road network;
- **Vehicle manufacturers:** who may use these data to develop safer cars.

3.7. Crash Location

World Health Organization, in its Road Safety Manual stipulated that the exact crash location identification is not always easy for police, and often data on location are inaccurate or not specific enough to allow for detailed analysis by location. The specificity of location identification varies considerably between countries and also between different areas of the road network (e.g. inside and outside built-up areas) [16].

As per the PIARC (World Road Association); various road safety studies are aimed at improving the quality of road parameters. The biggest problem when conducting these studies is to determine the exact road Crash location. Therefore, the availability of a localization method is a crucial element of any road information system. Without reliable knowledge of the Crash localization and without relevant data, the opportunities for solving the local deficiencies are limited [12].

Generally, PIARC (World Road Association), 2007, recommends that accurate localization system should enable the [12]:

- exact localization of road feature according to localization data stored in the database
- storage of recorded data to the appropriate location in the database

PIARC (World Road Association) describes different Crash location methods as follows [12]:

I. Route – km post; stationing
II. Node network
III. GPS

Each of the location methods are described below as stated in PIARC (World Road Association), 2007, guide line [12]:

3.7.1 Route – km post; stationing

Stationing is the traditional and most commonly used method for road location identification. Road stationing is similar to a node system. They both identify location with distance between known points. This method uses values assigned to road sections. Distances are indicated by km post markers.

If the distance between posts is too long, as it is often the case in rural areas, there may be certain problems with the localization of road Crash. A sufficient density of stationing posts is, therefore, of immense importance. The markers should be typically placed every 200 meters at main roads, and at 500 meters on other roads.

Disadvantage of this system is its burdensome inadaptability to infrastructural changes that result in a change of the road length (e.g. bypasses).

Therefore, police staff at road Crash departments should have some sort of stationing review to keep it updated every year. Review should cover all roads in the relevant area with the values of stationing at every orientation point.

3.7.2 Node Network

The method is based on nodes that are usually placed at junctions. A unique number is attributed to them. Node systems are defined as a network of nodes and the sections between them. Sections are simple linear elements with defined stationing. Each node is connected with at least one other node. Each location may then be identified by the distance between nodes and the stationing direction. The simple network can be displayed as a web with nodes at junctions. Other objects and locations along the road (bridges, channels, borders, etc.) may be also considered as nodes. They can facilitate the localization in case of long distances between adjacent nodes. Nodes may also contain information about traffic volume.

A node localization system contains, Node number, Administration unit number, Crossing road numbers, Municipality number, Node characteristic and adjacent node numbers.

3.7.3 GPS

The use of GPS (Global Positioning Systems) is the fastest and most accurate way of obtaining reliable data about Crash locations. GPS is also the cheapest way to identify Crash locations. GPS is the cheapest method of Crash registration in those countries which have existing Crash data collection programs.

This method is suitable for safety analysis issues – road Crash locations and Crash black spots can be easily identified. For road Crash visualization, digital geographic localization can be performed. Different background maps can be conveniently used. Localization has to be performed at the road Crash location immediately after the Crash occurrence when the causes and circumstances can be examined more precisely. For these purposes, mobile Geographic Positioning System (GPS) devices that have sufficient accuracy to obtained location data should be used. The data can be then transferred into a PC.

This method uses localization in geographic coordinates. GPS offers the fastest and cheapest localization method; hence, its advantages are getting wider recognition and greater use.

Localization application should contain the following features:

- loading data from GPS to application
- manual typing of the localization to a map
- data visualization in form of a map
- export of localization data to a text file

GPS localization systems have to be used on site – no results will be filed without following the procedures exactly. The only method of post-processing is with the input of coordinates from the map background.

During GPS localization of road Crash, cause of road Crash, location of road Crash and distinction between rural and urban areas has to be recorded.

Moreover, data on Municipality Street, house number, traffic direction, lane type, road type and road number and stationing has to be recorded in detail.

3.8. Minimum Data Elements that Every Crash Report Has to Have

In this section data elements that has to be recorded in the crash report form is reviewed based on:

i. United State of America, Department of Transportation, Federal Highway Administration, National Highway Traffic Safety Administration's Model Minimum Uniform Crash Criteria (MMUCC) 4th edition revised on 2012,
ii. Global Road Safety Partnership (GRSP), World Health Organization (WHO), the FIA foundation and World Bank (WB) Road safety data System manual, which is published in 2010.

3.8.1 Minimum Data Elements based on United State of America

In United State of America, Department of Transportation, Federal Highway Administration, National Highway Traffic Safety Administration," has established the Model Minimum Uniform Crash Criteria (MMUCC) which was first created in 1998 and then updated in 2003, 2008 and 2012.

In addition to bringing greater uniformity to crash data, the purpose of the Model Minimum Uniform Crash Criteria (MMUCC) is to provide a necessary dataset describing the road traffic Crash in order to improve road safety within the United State and national. MMUCC recommends that law enforcement should collect 77 of the 110 data elementals at the Crash scene, which include 19 crash data elements, 30 vehicle data element and 28 personal data elements, were each elements has several attributes. The remaining data elements should be obtained after linkage to the other state data files such as driver history, roadway inventory data, hospital and other health/injury data.

In America, the state which comply with a minimum set of standardized data element (about 75%), will receive fund for crash data improvement from the National Highway Traffic Safety Administration (NHSA) collection and to provide national guidance to data collectors 2008 [4]. Table 7summarizes the minimum data elements as set forth in the Minimum Uniform Crash Criteria (MMUCC) 2012.

Table 7: Model Minimum Uniform Crash Criteria of FHWA, USA

	Variables for MMUCC	Definition
Crash data elements	C1. Case Identifier	The unique identifier within a given year that identifies a given crash within a State
	C2. Crash Classification	Is used to identify **ownership** of the **land** where the crash occurred OR the characteristics of the crash with respect to its location on or off a traffic way.
	C3. Crash Date and Time	The date (year, month, and day) and time (00:00-23:59) at which the crash occurred
	C4. Crash County	The county or equivalent entity in which the crash **physically** occurred.
	C5. Crash City/Place (political jurisdiction)	The city/place (political jurisdiction) in which the crash occurred.
	C6. Crash Location	The exact location on the roadway to document **where the first harmful event** of the crash occurred. (Name &GPS)
	C7. First Harmful Event	The first injury or damage-producing event that characterizes the crash type.
	C8. Location of First Harmful Event Relative to the Traffic way	The location of the first harmful event as it relates to its **position within or outside t**he traffic way.
	C9. Manner of Crash/Collision Impact	collision between two motor vehicles in transport--the manner of collision
	C10. Source of Information	Affiliation of the **person** completing the **crash report**.
	C11. Weather Conditions	The prevailing **atmospheric conditions** that existed at the **time** of the crash.
	C12. Light Condition	The type/level of **light** that existed at the **time** of the motor vehicle crash.
	C13. Roadway Surface Condition	The roadway **surface** condition at the time and place of a crash.
	C14. Contributing Circumstances, Environment	Apparent **environmental conditions** which may have **contributed** to the crash.
	C15. Contributing Circumstances, Road	Apparent **condition of the road** which may have contributed to the crash.
	C16. Relation to Junction	It identifies the crash's location with respect to presence in a junction or proximity to components typically in junction or interchange areas.
	C17. Type of Intersection	An **intersection** consists of two or more roadways that intersect at the same level.
	C18. School Bus-Related	Indicates whether a **school bus** or motor vehicle functioning as a school bus for a school-related purpose is involved in the crash.
	C19. Work Zone-Related (Construction/Maintenance/Utility)	A crash that occurs in or related to a **construction, maintenance,** or utility **work zone**, whether or not workers were actually present at the time of the crash.

Table 7: Continued…

	Variables for MMUCC	Definition
Vehicle Data Elements	V1. Motor Vehicle Identification Number (VIN)	A unique combination of alphanumeric characters assigned to a **specific** motor vehicle that is designated by the manufacturer.
	V2. Motor Vehicle Unit Type and Number	Motor vehicle unit **type** and **number** assigned to uniquely identify each motor vehicle involved in the crash.
	V3. Motor Vehicle Registration State and Year	The **State** issuing the registration **plate** and the year of registration as indicated on the registration plate displayed on the motor vehicle.
	V4. Motor Vehicle License Plate Number	The alphanumeric identifier or other characters, exactly as displayed, on the registration plate or tag affixed to the motor vehicle.
	V5. Motor Vehicle Make	The distinctive (coded) **name** applied to a group of motor vehicles by a manufacturer.
	V6. Motor Vehicle Model Year	The year which is assigned to a motor vehicle by the manufacturer.
	V7. Motor Vehicle Model	The **manufacturer**-assigned **code** denoting a family of motor vehicles (within a make) that have a degree of similarity in construction, such as body, chassis, etc.
	V8. Motor Vehicle Body Type Category	The category indicating the general configuration or shape of a motor vehicle distinguished by characteristics such as number of doors, rows of seats, windows, or roof line.
	V9. Total Occupants in Motor Vehicle	The total number of injured and uninjured occupants in this motor vehicle involved in the crash, including persons in or on the motor vehicle at the time of the crash.
	V10. Special Function of Motor Vehicle in Transport	The type of **special function** being served by this vehicle regardless of whether the function is marked on the vehicle.
	V11. Emergency Motor Vehicle Use	Indicates operation of any motor vehicle that is legally authorized by a government authority torespond to emergencies with or without the use of emergency warning equipment
	V12. Motor Vehicle Posted/Statutory Speed Limit	The posted/statutory speed limit for the motor vehicle at the time of the crash.
	V13. Direction of Travel Before Crash	The direction of a motor vehicle's travel on the roadway before the crash.
	V14. Traffic way Description	Indication of **whether or not the traffic way** for this vehicle is divided and whether it serves **one-way or two-way** traffic.
	V15. Total Lanes in Roadway	Total **number** of **lanes** in the roadway on which this motor vehicle was traveling.
	V16. Roadway Alignment and Grade	The geometric or layout and inclination **characteristics** of the **roadway** in the direction of travel for this vehicle.
	V17. Traffic Control Device Type	The type of traffic control device (TCD) applicable to this motor vehicle at the crash location.
	V18. Motor Vehicle Maneuver/Action	The controlled maneuver for this motor vehicle prior to the beginning of the sequence of events.
	V19. Vehicle Damage	The approximate **contact point** on this vehicle associated with this vehicle's initial harmful event.
	V20. Sequence of Events	The **events in sequen**ce related to this motor vehicle, including both non-collision as well as collision events.
	V21. Most Harmful Event for this Motor Vehicle	Event that resulted in the most **severe injury** or, if no injury, the greatest property damage involving this motor vehicle.
	V22. Bus Use	This element describes the common type of bus service this vehicle was being used as at the time of the crash.
	V23. Hit and Run	Refers to cases where the vehicle or the driver of the vehicle in transport is a **contact** vehicle in the crash and departs the scene without stopping to render aid or report the crash.
	V24. Towed Due to Disabling Damage	Disabling damage implies damage to the motor vehicle that is sufficient to require the motor vehicle to be towed or carried from the scene.
	V25. Contributing Circumstances, Motor Vehicle	Pre-existing motor vehicle defects or maintenance conditions that may have contributed to the crash.
	V26. Motor Carrier Identification	The identification number, name and address of an individual, partnership or corporation responsible for the transportation of persons or property as indicated on the shipping manifest.
	V27. Gross Vehicle Weight Rating / Gross Combination Weight Rating	The Gross Vehicle Weight Rating (GVWR) is the amount recommended by the manufacturer as the upper limit to the operational weight for a motor vehicle and any cargo (human or other) to be carried.
	V28. Vehicle Configuration	Indicates the general configuration of this motor vehicle.
	V29. Cargo Body Type	The type of body for buses and trucks more than 10,000 lbs GVWR.
	V30. Hazardous Materials (Cargo Only)	Indication of whether or not the motor vehicle had a hazardous materials placard as required by Federal/State regulations, and whether or not hazardous materials were released.

Table 7: Continued…

Variables for MMUCC		Definition
Person Data Elements	P1. Name of Person Involved	The full name of the individual involved in the crash.
	P2. Date of Birth	The year, month, and day of birth, (or age to be used only when date of birth cannot be obtained), of the person involved in a crash.
	P3. Sex	The sex of the person involved in the crash.
	P4. Person Type	Type of person involved in a crash.
	P5. Injury Status	The injury severity level for a person Involved in a crash.
	P6. Occupant's Motor Vehicle Unit Number	The **unique** number assigned for this crash to the **motor vehicle** in which this person was an occupant. Persons ejected or who fall from a vehicle are still considered occupants.
	P7. Seating Position	The **location for this occupant** in, on, or outside of the motor vehicle prior to the first event in the sequence of events.
	P8. Restraint Systems / Motorcycle Helmet Use	The restraint equipment in use by the occupant, or the helmet use by a motorcyclist, at the time of the crash.
	P9. Air Bag Deployed	**Deployment** status of an **air bag** relative to the position in the vehicle for this **occupant.**
	P10. Ejection	Occupant **completely or partially thrown** from the interior of the motor vehicle, excluding motorcycles, as a result of a crash.
	P11. Driver License Jurisdiction	The geographic or political entity issuing a driver license
	P12. Driver License Number, Class, CDL and Endorsements	A unique set of alphanumeric characters assigned by the authorizing agent issuing a driver license to the individual.
	P13. Speeding Related	Indication of whether the investigating officer suspects that the driver involved in the crash was speeding based on verbal or physical evidence and not on speculation alone.
	P14. Driver Actions at Time of Crash	The actions by the driver that may have contributed to the crash.
	P15. Violation Codes	All motor vehicle-related violations codes, if any, which apply to this driver.
	P16. Driver Distracted By	Distractions which may have **influenced the driver performance**. The distractions can be inside the motor vehicle (internal) or outside the motor vehicle (external).
	P17. Condition at Time of the Crash	Any **relevant condition of the individual** (motorist or non-motorist) that is directly related to the crash.
	P18. Law Enforcement Suspects Alcohol Use	Driver or non-motorist involved in the crash suspected by law enforcement to have used alcohol.
	P19. Alcohol Test	Indication of the **presence of alcohol** by test, type, and result.
	P20. Law Enforcement Suspects Drug Use	Driver or non-motorist involved in the crash suspected by **law enforcement to have used drugs.**
	P21. Drug Test	Indication of the **presence of drug test**, type, and result. Excludes drugs administered post-crash.
	P22. Non-Motorist Number	The unique number assigned to the **non-motorist involved** in the crash.
	P23. Non-Motorist Action/Circumstance Prior to Crash	The action of the non-motorist immediately prior to the crash and an indication of whether the non-motorist was walking/cycling to/from school.
	P24. Non-Motorist Actions/Circumstances at Time of Crash	The actions/circumstances of the non-motorist that may have contributed to the crash. This data element is based on the judgment of the law enforcement officer investigating the crash.
	P25. Non-Motorist Location at Time of Crash	The location of the non-motorist with respect to the roadway at the time of crash.
	P26. Non-Motorist Safety Equipment	The safety equipment(s) used by the non-motorist.
	P27. Unit Number of Motor Vehicle Striking Non-Motorist	Number assigned to identify the motor vehicle that struck the non-motorist in the crash.
	P28. Transported to First Medical Facility By	Type and identity of unit providing transport to the first medical facility receiving the patient.

3.8.2 Minimum Data Elements based on World Health Organization Manual

Global Road Safety Partnership (GRSP), World Health Organization (WHO), the FIA foundation and World Bank (WB) has published Road safety data System manual in 2010.

The purpose of the manual is to define minimum data elements and specify uniform definitions and criteria so that the definition shall provide a dataset for describing road traffic crashes, and the resulting injuries, that will generate the information necessary for national analysis and road safety improvements [16].

The publishers of the manual believe that for modifying an existing system or building something new, the common dataset composed of minimum data elements will be a key tool for ensuring the appropriate data are captured to enable analysis, and for maximizing consistency and compatibility of data collected across different jurisdictions [16].

The common dataset recommended in this manual is based on the Common Crash Dataset (CADaS), developed to provide a common framework for road crash data collection in Europe. The manual states that the minimum data elements selected for CADaS were based on extensive research on data sources and systems available in 25 European countries, and stakeholders' needs and priorities for crash data analysis at the national level. The data elements of CADaS were finalized after more than four years of consultation with road safety data experts and are currently being applied in the European CARE (Community database on Crash on the Road in Europe) database [16].

The minimum data elements of CADaS were reviewed and selected according to the criteria listed below, bearing in mind the unique challenges faced in low- and middle-income countries. The resulting common dataset was reviewed by experts and practitioners in several low- and middle-income countries, and revised for relevance and feasibility.

Data elements and values must be useful for road crash analysis. These elements should be routinely collected when a road traffic crash occurs. Data that will not be used should not be collected.

Data elements and values should be comprehensive and concise. Each variable must include a description and definitions of the possible data values (see minimum data elements at the end of this module).

Data which are very difficult to collect should not be included**,** regardless of their value for road crash analysis.

The manual also advises users when planning for the introduction of minimum data elements (as summarized in table 8), to minimize changes to the definitions and values of existing data elements, as these can cause problems with consistency and comparability of data over time. If definitions or data element changes are made, clearly note in official records the date of change and allow for some misclassification during the transition [16].

The manual has also stressed that the proposed dataset specifies **minimum** data elements, with an emphasis on those variables that will be useful for national analysis. Jurisdictions may need to collect additional variables to facilitate local analysis, law enforcement follow-up and in-depth crash studies. Extra variables can easily be added to this dataset, according to specific requirements and circumstances [16].

Finally, the manual recommends that Crash collection form needs to have at least 10**Crash related** elements, 9 **Road related** element 8**Vehicle related**and**15 personal related** data elements, were each elements has several attributes.Table8 summarizes the minimum data elements as set forth in the World Health Organization (WHO), Road safety data System manual, 2010.

Table 8: the Minimum Data Elements from WHO Manual

Variables for WHO Minimum Data		**Definition**
Crash related	C1. Crash identifier (unique reference number assigned to the crash, usually by police)	The **unique** identifier (e.g. a 10-digit number) within a given year that identifies a **particular** crash.
	C2. Crash date	The date (day, month and year), on which the crash occurred
	C3. Crash time	The time at which the crash occurred, using the 24 hour-clock format
	C4. Crash municipality/ place	The **municipality** (C4.1) and **county** or equivalent entity (C4.2) in which the crash occurred
	C5. Crash location	The exact location at which the crash occurred. Optimum definition is route name and GPS/GIS coordinates
	C6. Crash type	The crash type is characterized by the first injury or **damage-producing event** of the crash.
	C7. Impact type	Indicates the **manner** in which the road motor **vehicles involved** initially collided with each other.
	C8. Weather conditions	Prevailing atmospheric conditions at the crash location, at the time of the crash.
	C9. Light conditions	The **level** of natural and artificial **light** at the crash location, at the time of the crash.
	C10. Crash severity	Crash Data Elements Derived from Collected Data (**Crash severity**)

Variables for WHO Minimum Data		Definition
Road related	R1. Type of roadway	Describes the type of road, whether the road has two **directions of travel**, and whether the carriageway is physically divided.
	R2. Road functional class	Describes the character of service or **function** of the road where the first harmful event took place.
	R3. Speed limit	The legal speed limit at the location of the crash.
	R4. Road obstacles	The presence of any **person** or **object** which obstructed the movement of the vehicles on the road.
	R5. Road surface conditions	The **condition** of the road surface at the time and place of the crash.
	R6. Junction	Indicates whether the crash occurred at a **junction** (two or more roads intersecting) and defines the type of the junction.
	R7. Traffic control at junction	Type of **traffic control** at the junction where crash occurred. It applies only to crashes that occur at a junction.
	R8. Road curve	Indicates whether the crash occurred **inside a curve**, and what **type of curve**.
	R9. Road segment grade	Indicates whether the crash occurred on a **road segment** with a **steep gradient**.
Vehicle	V1. Vehicle number	Unique vehicle number assigned to identify each vehicle involved in the crash.
	V2. Vehicle type	The type of vehicle involved in the crash.
	V3. Vehicle make	Indicate the make (distinctive name) assigned by motor vehicle manufacturer.
	V4. Vehicle model	The code **assigned** by the **manufacturer** to denote a family of motor vehicles (within a make) that have a degree of similarity in construction.
	V5. Vehicle model year	The year assigned to a motor vehicle by the manufacturer.
	V6. Engine size	The size of the vehicle's engine is recorded in cubic centimeters.
	V7. Vehicle special function	The type of special function being served by this vehicle regardless of whether the function is marked on the vehicle.
	V8. Vehicle maneuver (what the vehicle was doing at the time of the crash)	The controlled maneuver for this motor vehicle prior to the crash.
Person	P1. Person ID	Number assigned to uniquely identify each person involved in the crash.
	P2. Occupant's vehicle number	The unique number assigned for this crash to the **motor vehicle** in which the **person** was an **occupant** (V1).
	P3. Pedestrian's linked vehicle number	The unique number assigned for this crash to **the motor vehicle** which **collided with this person** (V1).
	P4. Date of birth	Indicates the date of birth of the person involved in the crash.
	P5. Sex	Indicates the sex of the person involved in the crash.
	P6. Type of road user	This variable indicates the **role** of each **person** at the time of the crash.
	P7. Seating position	The **location** of the **person** in the vehicle at the time of the crash.
	P8. Injury severity	The injury severity level for a person involved in the crash.
	P9. Safety equipment	Describes the use of occupant restraints, or helmet use by a motorcyclist or bicyclist.
	P10. Pedestrian maneuver	The **action** of the **pedestrian** immediately **prior** to the crash.
	P11. Alcohol use suspected	Law enforcement officer suspects that person involved in the crash has used alcohol.
	P12. Alcohol test	Describes alcohol test status, type and result.
	P13. Drug use	Indication of suspicion or evidence that person involved in the crash has used illicit drugs.
	P14. Driving license issue date	Indicates the date (month and year) of issue of the person's first driving license, provisional or full, pertaining to the vehicle they were driving.
	PD1. Age	The age in years of the person involved in the crash.

4. Analysis and Discussion

4.1. Introduction

This chapter presents the assessment results for compliance level, discussion and analysis of the police road traffic Crash reporting forms of selected Regions and the City Administration of Ethiopia. Generally, in the selected Regions the police road traffic Crash reporting forms were assessed for compliance level first based on MMUCC guide line of United States of America; and then with respect to World Health Organization (WHO), Road safety data System manual. Finally, the contents of the Crash reporting forms were compared and contrasted, for designing a standard and uniform police road traffic Crash reporting form.

4.2. Assessment/Investigation (Gap Analysis) of Police Road Traffic Crash Recording Forms

4.2.1. Assessment Based on MMUCC Guideline of United States of America

As stated in section 1 of this document, Minimum Uniform Crash Criteria (MMUCC) guide line of USA recommends that law enforcement should collect 77 of the 110 data elementals at the Crash scene, which include 19 crash data elements, 30 vehicle data element and 28 personal data elements, were each elements has several attributes. The remaining data elements should be obtained after linkage to the other state data files such as driver history, roadway inventory data, hospital and other health/injury data.

Table 9 shows the compliance levels of the four regions and the City Administration of Ethiopia. The compliance levels and the corresponding percentages is based on the availability of the attributes for each element in the traffic Crash report form of the regions and A.A City Administration. Table 1, in section 1, summarizes method of computations for each elements.

Table 9: Compliance Levels of Each Regions for the 77 Variables of MMUCC

Variables From MMUCC Guideline		Amhara	Oromia	SNNPs	B. Gumuz	Addis Ababa
1. Crash data	C1. Case Identifier	3	0	2	2	3
	C2. Crash Classification	0	0	1	0	1
	C3. Crash Date and Time	3	3	3	2	3
	C4. Crash County	2	3	3	2	2
	C5. Crash City/Place (political jurisdiction)	2	3	2	2	2
	C6. Crash Location	1	1	1	1	1
	C7. First Harmful Event	1	2	3	1	2
	C8. Location of First Harmful Event Relative to the Trafficway	0	0	0	0	0
	C9. Manner of Crash/Collision Impact	0	0	0	0	0
	C10. Source of Information	0	3	3	3	3
	C11. Weather Conditions	0	0	3	0	3
	C12. Light Condition	0	0	3	0	3
	C13. Roadway Surface Condition	0	0	3	0	3
	C14. Contributing Circumstances, Environment	1	1	1	0	1
	C15. Contributing Circumstances, Road	0	0	2	0	2
	C16. Relation to Junction	0	0	3	0	3
	C17. Type of Intersection	0	0	0	0	0
	C18. School Bus-Related	0	0	0	0	0
	C19. Work Zone-Related (Construction/Maintenance/Utility)	0	0	0	0	0
Count out of 57 Points from Crash Data Elements		13	16	33	13	32
Percentage Compliance Level of Crash Data Elements		23	28	58	23	56
2. Vehicle Data Elements	V1. Motor Vehicle Identification Number (VIN)	0	0	0	0	0
	V2. Motor Vehicle Unit Type and Number	0	1	1	0	1
	V3. Motor Vehicle Registration State and Year	0	1	1	0	1
	V4. Motor Vehicle License Plate Number	0	3	3	3	3
	V5. Motor Vehicle Make	0	0	0	0	0
	V6. Motor Vehicle Model Year	0	0	0	0	0
	V7. Motor Vehicle Model	0	0	0	0	0
	V8. Motor Vehicle Body Type Category	0	3	3	0	3
	V9. Total Occupants in Motor Vehicle	0	0	0	0	0

Variables From MMUCC Guideline		Amhara	Oromia	SNNPs	B. Gumuz	Addis Ababa
	V10. Special Function of Motor Vehicle in Transport	0	0	0	0	0
	V11. Emergency Motor Vehicle Use	0	0	0	0	0
	V12. Motor Vehicle Posted/Statutory Speed Limit	0	0	0	0	0
	V13. Direction of Travel Before Crash	0	3	0	3	0
	V14. Trafficway Description	0	0	2	0	2
	V15. Total Lanes in Roadway	0	0	0	0	0
	V16. Roadway Alignment and Grade	0	0	2	0	2
	V17. Traffic Control Device Type	0	0	0	0	0
	V18. Motor Vehicle Maneuver/Action	0	0	3	0	3
	V19. Vehicle Damage	0	0	0	0	0
	V20. Sequence of Events	0	0	0	0	0
	V21. Most Harmful Event for this Motor Vehicle	2	3	3	3	3
	V22. Bus Use	0	0	0	0	0
	V23. Hit and Run	1	0	0	0	0
	V24. Towed Due to Disabling Damage	0	0	0	0	0
	V25. Contributing Circumstances, Motor Vehicle	0	3	3	0	3
	V26. Motor Carrier Identification	0	0	0	0	0
	V27. Gross Vehicle Weight Rating / Gross Combination Weight Rating	0	0	0	0	0
	V28. Vehicle Configuration	0	0	0	0	0
	V29. Cargo Body Type	0	0	0	0	0
	V30. Hazardous Materials (Cargo Only)	0	0	0	0	0
Count Out of 90 Points from Vehicle Data Elements		3	17	21	9	21
Percentage Compliance Level of Vehicle Data Elements		3	19	23	10	23
3. Person Data Elements	P1. Name of Person Involved	3	3	3	3	3
	P2. Date of Birth	0	2	2	0	2
	P3. Sex	3	3	1	0	3
	P4. Person Type	0	3	0	0	0
	P5. Injury Status	2	3	2	2	2
	P6. Occupant's Motor Vehicle Unit Number	0	0	0	0	0
	P7. Seating Position	0	0	0	0	0
	P8. Restraint Systems / Motorcycle Helmet Use	0	0	0	0	0

Variables From MMUCC Guideline		Amhara	Oromia	SNNPs	B. Gumuz	Addis Ababa
	P9. Air Bag Deployed	0	0	0	0	0
	P10. Ejection	0	0	0	0	0
	P11. Driver License Jurisdiction	0	3	0	0	0
	P12. Driver License Number, Class, CDL and Endorsements	0	3	0	0	0
	P13. Speeding Related	0	0	0	0	0
	P14. Driver Actions at Time of Crash	0	3	3	0	3
	P15. Violation Codes	0	0	0	3	0
	P16. Driver Distracted By	0	0	0	0	0
	P17. Condition at Time of the Crash	0	0	0	0	0
	P18. Law Enforcement Suspects Alcohol Use	0	0	0	0	0
	P19. Alcohol Test	0	0	0	0	0
	P20. Law Enforcement Suspects Drug Use	0	0	0	0	0
	P21. Drug Test	0	0	0	0	0
	P22. Non-Motorist Number	0	0	0	0	0
	P23. Non-Motorist Action/Circumstance Prior to Crash	0	0	2	0	0
	P24. Non-Motorist Actions/Circumstances at Time of Crash	0	0	0	0	0
	P25. Non-Motorist Location at Time of Crash	0	0	0	0	0
	P26. Non-Motorist Safety Equipment	0	0	0	0	0
	P27. Unit Number of Motor Vehicle Striking Non-Motorist	0	0	0	0	0
	P28. Transported to First Medical Facility By	0	0	0	0	0
Count out of 84 points from Person Data Elements		8	23	13	8	13
Percentage Compliance Level of Person Data Elements		10	27	15	10	15
Count out of 231Points from Overall MMUCC data Elements		***24***	***56***	***67***	***30***	***66***
Overall Percentage of Compliance Level (Arithmetic Mean of Crash, Vehicle and Person Data Elements)		***12***	***25***	***32***	***14***	***32***

The assessment of crash, vehicle and person data elements for Amhara, Oromia, SNNPs, Benishal-Gumuzregions and Addis Ababa City Administration based on MMUCC can generally be summarized as shown in Table 10.

Table 10: Assessment of crash, vehicle and person data elements for Ethiopia based on MMUCC Guide Line

Type of data elements Based on MMUCC [A]	No. of data elements [B]	Points Set for the Data Elements [C]=3*[B]	Actual Points with Respective Percentage Achieved by Each Regions or City Administration of Ethiopia									
			Amhara		Oromia		SNNPs		B.Gumuz		Addis Ababa	
			Points	%	Points	%	Points	%	Points	%	Points	%
Crash Data Elements (C)	19	57	13	23	16	28	33	58	13	23	32	56
Vehicle Data Elements(V)	30	90	3	3	17	19	21	23	9	10	21	23
Person Data Elements(P)	28	84	8	10	23	27	13	15	8	10	13	15
Total No. of data elements	**77**	**231**	**24**	-	**56**		**67**		**30**		**66**	
Total %		**100**	**12**		**25**		**32**		**14**		**32**	

Table 10 shows that all the regions & City administration are much below the requirements set forth in MMUCC guide line. Relatively, SNNPs Region and Addis Ababa City administration has more data elements in their police Crash report. Oromia region's percentage of compliance is limited to only 25%. It was perceived that Amhara and Benshangul-Gumuzregions' police Crash reporting formats has the lesser details; their overall percentage of compliance is only 12% for Amhara and 14% for Benshangul-Gumuz regions. It was also found form Table 10 that the crash date elements has the highest percentage of compliance. Moreover, when compared with among the region's police Crash reporting forms, Amhara and Oromia regions' police Crash reporting formats has the lowest percentage of Vehicle data elements.

However, SNNPs Region's and Addis Ababa City administration's police Crash reporting formats has the lowest percentage of Person data elements. Conversely, Benshangul-Gumuzregion's police Crash reporting formats has equal percentage of compliance (10% of the MMUCC) for Vehicle and Person data elements. This shows that road traffic Crash reporting format, in Ethiopia, is affected by the lack of uniformity between regions or city administrations. The lack of uniformity in road traffic Crash data in the national will result failure to perform problem identification, establish goals and performance measures, allocate resources, determine the progress of specific programs, and support the development and evaluation of highway and vehicle safety countermeasures.

Moreover, non-uniformity of national road traffic Crash data hinders the performance of problem identification and establish goals.

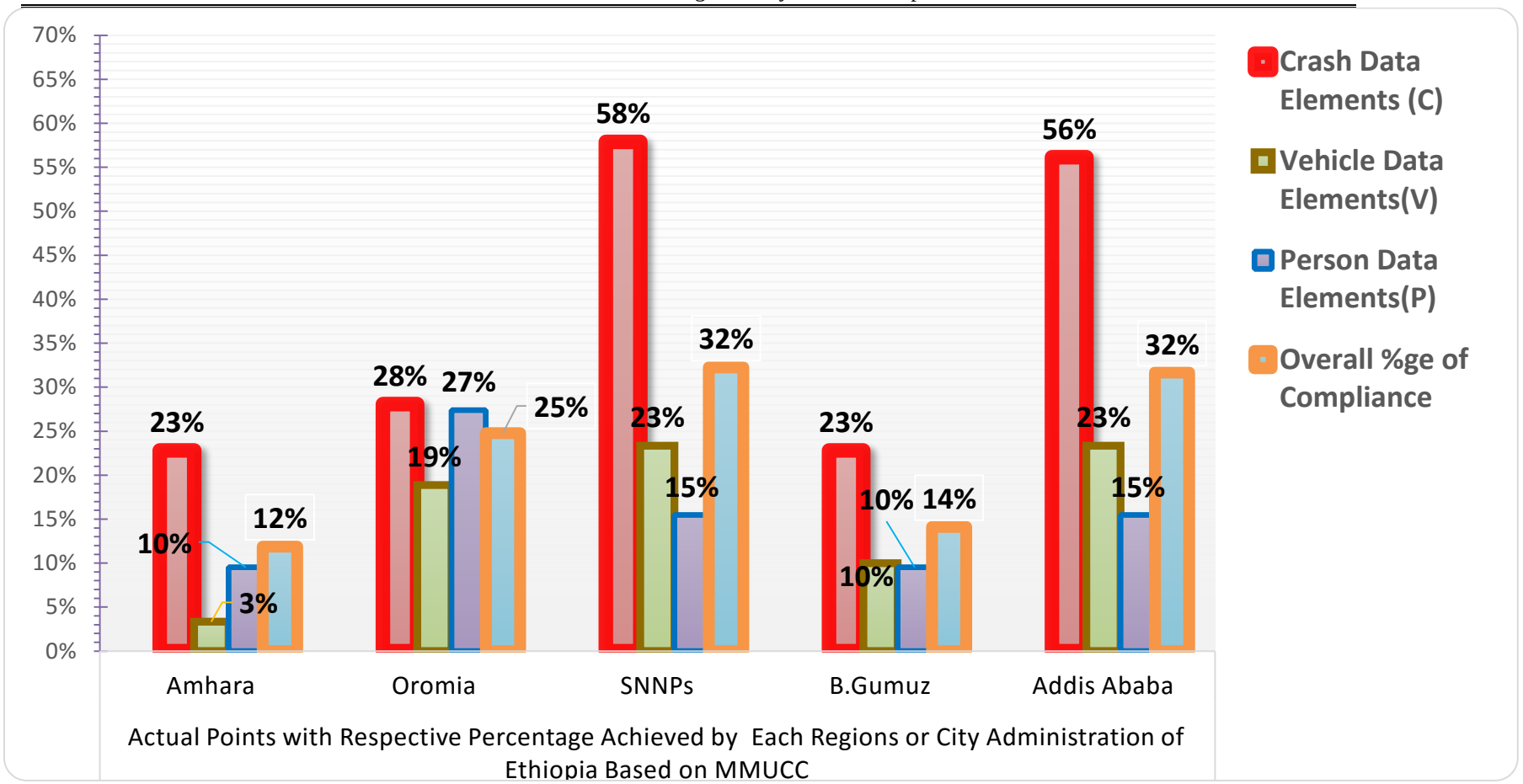
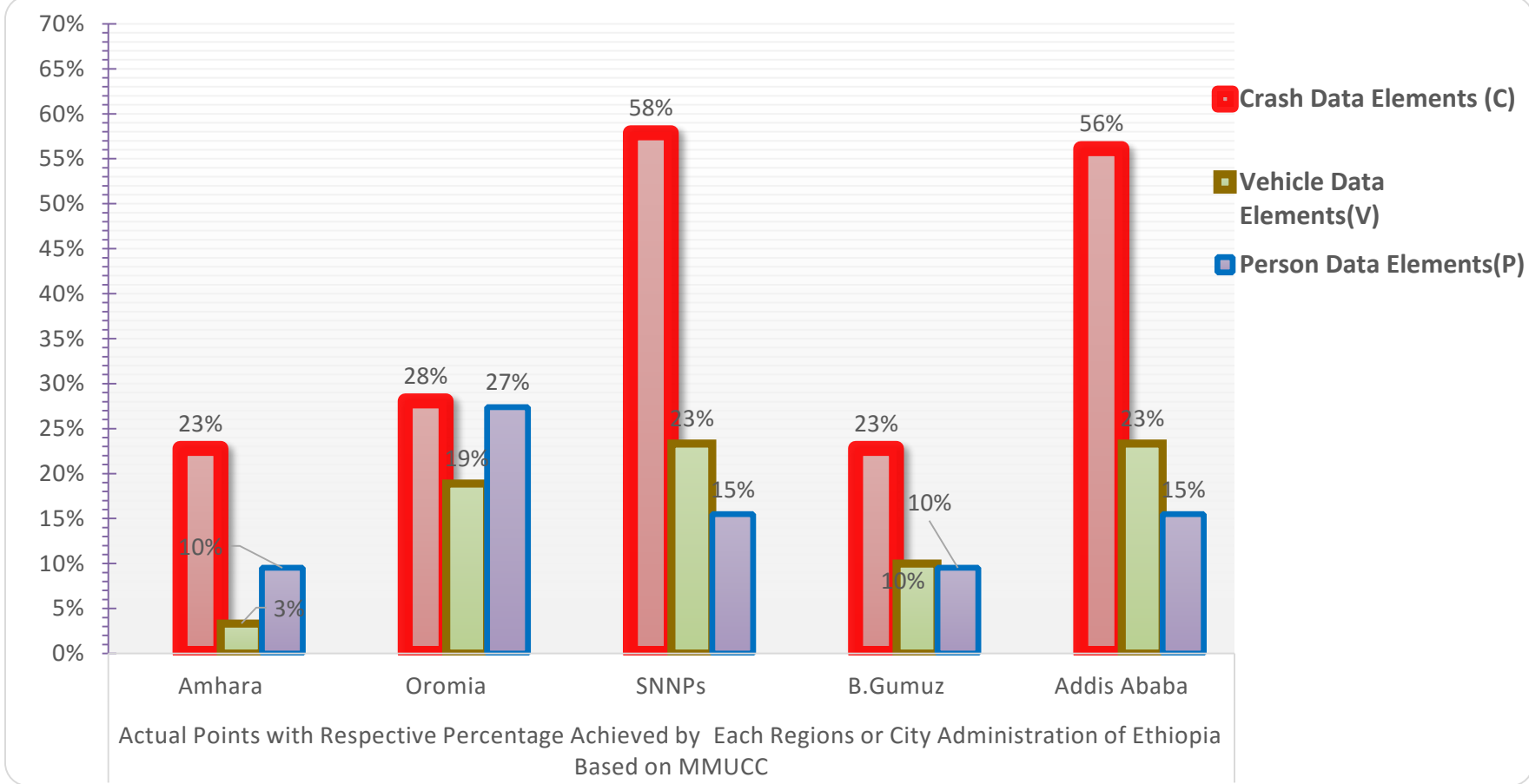


Figure 5: Percentage of Compliance Level by Each Regions or City Administration of Ethiopia Based on MMUCC guide line



4.2.2. Assessment Based on WHO Manual.

The Police Crash reporting forms of the four regions and the City administration of Ethiopia is assessed for the compliance levels with respect to World Health Organization (WHO), Road safety data System manual, in same way as assessed for MMUCC.

Accordingly table 11 shows the assessment of the Compliance Levels of Each Regions and the City administrations for the 42 Variables (i.e.10 Crash data, 9 Road data, 8 Vehicle data and 15 personal data elements) of WHO minimum Data Elements.

Table 11: Compliance Levels of Each Regions for the 42 Variables of WHO minimum Data Elements

Variables From WHO Manual		*Amhara*	*Oromia*	*SNNPs*	*B.Gumuz*	*Addis Ababa*
Crash related	C1. Crash identifier (unique reference number assigned to the crash, usually by police)	3	0	2	2	3
	C2. Crash date	3	3	3	0	3
	C3. Crash time	3	3	3	3	3
	C4. Crash municipality/ place	1	3	3	1	1
	C5. Crash location	1	1	1	1	1
	C6. Crash type	3	3	3	3	3
	C7. Impact type	0	0	0	0	0
	C8. Weather conditions	0	0	3	0	3
	C9. Light conditions	0	0	3	0	3
	C10. Crash severity	2	3	2	2	2
Count out of 30 Points from Crash Data Elements		**16**	**16**	**23**	**12**	**22**
Percentage Compliance Level of Crash Data Elements		**53.33**	**53.33**	**76.67**	**40.00**	**73.33**
Road related	R1. Type of roadway	0	0	1	0	1
	R2. Road functional class	0	0	1	0	1
	R3. Speed limit	0	0	0	0	0
	R4. Road obstacles	1	2	3	1	2
	R5. Road surface conditions	0	0	3	0	3
	R6. Junction	0	0	3	0	3
	R7. Traffic control at junction	0	0	0	0	0
	R8. Road curve	0	0	1	0	1
	R9. Road segment grade	0	0	1	0	1
Count out of 27 Points from Road related Data Elements		**1**	**2**	**13**	**1**	**12**
Percentage Compliance Level of Road related Data Elements		**4**	**7**	**48**	**4**	**44**

Variables From WHO Manual		*Amhara*	*Oromia*	*SNNPs*	*B.Gumuz*	*Addis Ababa*
Vehicle	V1. Vehicle number	0	1	1	0	0
	V2. Vehicle type	0	3	3	0	3
	V3. Vehicle make	0	0	0	0	0
	V4. Vehicle model	0	0	0	0	0
	V5. Vehicle model year	0	0	1	0	1
	V6. Engine size	0	0	0	0	0
	V7. Vehicle special function	0	0	0	0	0
	V8. Vehicle maneuver (what the vehicle was doing at the time of the crash)	0	1	3	0	3
Count Out of 24 Points from Vehicle Data Elements		**0**	**5**	**8**	**0**	**7**
Percentage Compliance Level of Vehicle Data Elements		**0**	**21**	**33**	**0**	**29**
Person	P1. Person ID	0	0	0	0	0
	P2. Occupant's vehicle number	0	0	0	0	0
	P3. Pedestrian's linked vehicle number	0	0	0	0	0
	P4. Date of birth	0	0	0	0	0
	P5. Sex	3	3	1	1	3
	P6. Type of road user	0	3	0	0	0
	P7. Seating position	0	0	0	0	0
	P8. Injury severity	2	3	2	2	2
	P9. Safety equipment	0	0	0	0	0
	P10. Pedestrian maneuver	0	0	3	0	0
	P11. Alcohol use suspected	0	0	0	0	0
	P12. Alcohol test	0	0	0	0	0
	P13. Drug use	0	0	0	0	0
	P14. Driving license issue date	0	3	0	0	0
	P15. Age	0	3	3	0	3
Count out of 45 points from Person Data Elements		**5**	**15**	**9**	**3**	**8**
Percentage Compliance Level of Person Data Elements		**11**	**33**	**20**	**7**	**18**
Count out of 126 Points from Overall WHO data Elements		***22***	***38***	***53***	***16***	***49***
Overall Percentage of Compliance Level (Arithmetic Mean of Crash, Road, Vehicle and Person Data Elements)		***17***	***29***	***45***	***13***	***41***

The investigation of road Crash reporting forms of Amhara, Oromia, SNNPs, B.Gumuz regions and Addis Ababa City Administration for compliance levels of crash, Road, vehicle and person data elements from WHO's road safety data manual can generally be summarized as shown in Table 12.

Table 12: Assessment of crash, vehicle and person data elements for Ethiopia based on WHO Manual

Type of data elements Based on WHO[A]	No. of data elements [B]	Points Set for the Data Elements [C]=3*[B]	Actual Points with Respective Percentage Achieved by Each Regions or City Administration of Ethiopia									
			Amhara		Oromia		SNNPs		B.Gumuz		Addis Ababa	
			Points	%	Points	%	Points	%	Points	%	Points	%
Crash Data Elements (C)	10	30	16	53	16	53	23	77	12	40	22	73
Road Data Elements (R)	9	27	1	4	2	7	13	48	1	4	12	44
Vehicle Data Elements(V)	8	24	0	0	5	21	8	33	0	0	7	29
Person Data Elements(P)	15	45	5	11	15	33	9	20	3	7	8	18
Total	**42**	**126**	**22**	-	**38**	-	**53**	-	**16**	-	**49**	-
Total %		**100**	**17**		**29**		**45**		**13**		**41**	

As illustrated in table 12, all the regions& City administration are much below the requirements from WHO's road safety data manual. Relatively, SNNPs's Region and Addis Ababa City administration's police road Crash reporting form has more data elements. Oromia region's police road traffic Crash reporting form complies only 29% of the minimum data elements of WHO manual.

Moreover, it was observed that Amhara and Benshangul-Gumuz regions' police Crash reporting formats has the lesser details; the overall percentage of compliance is only 17% for Amhara and 13% for Benshangul-Gumuzregions. Additionally, one can see form Table 12 that the crash date elements has the highest percentage of compliance. Moreover, when compared with among the region's itself or City Administration's itself police Crash reporting forms, Amhara's and Benshangul-Gumuz's police Crash reporting formats has the lowest percentage of Vehicle data elements. However, SNNPs Region's and Addis Ababa City administration's police Crash reporting formats has the lowest percentage of Person data elements. On the other hand, Oromia region's police road Crash reporting formats has lowest percentage for Road data elements.

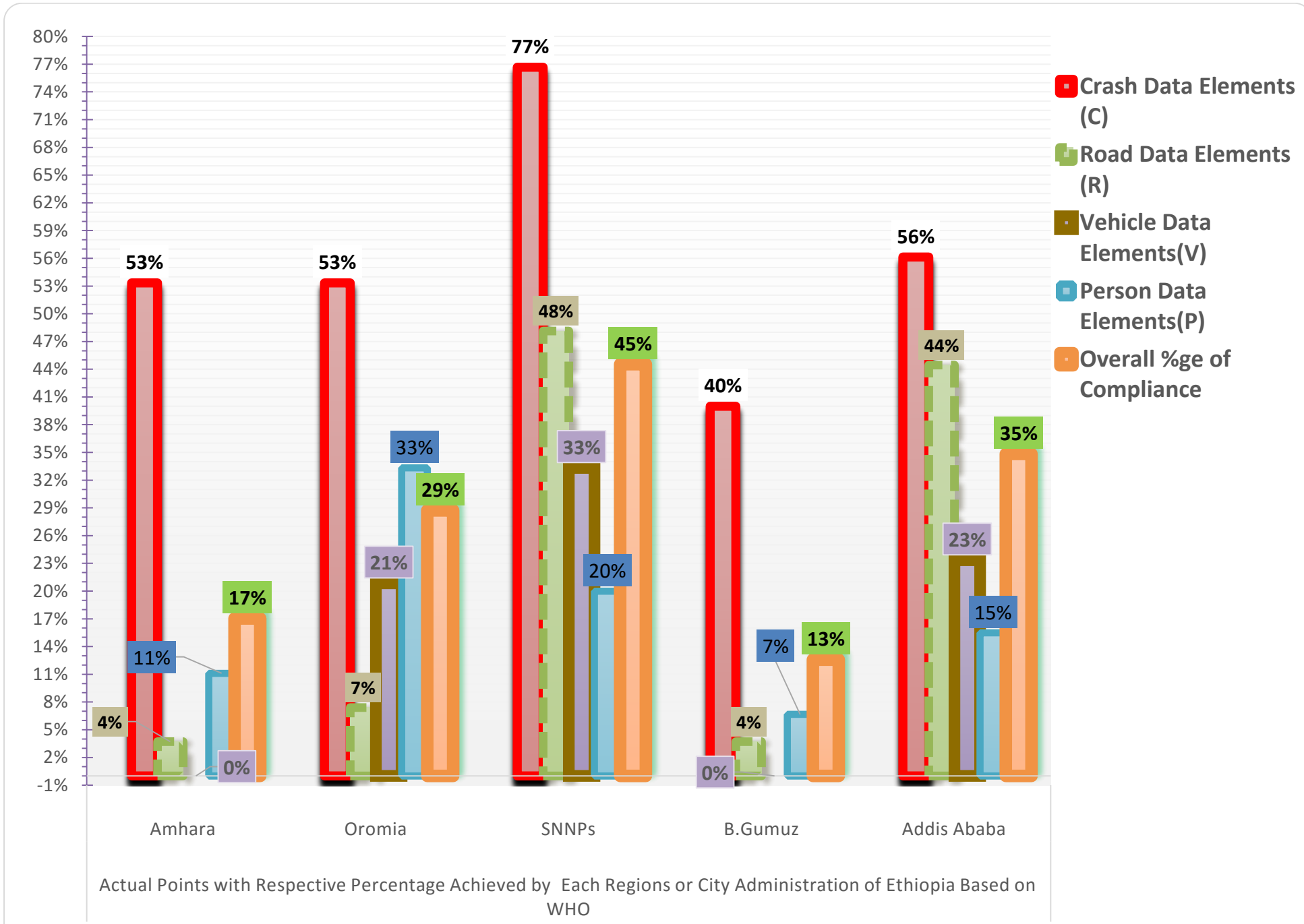


Figure 6: Percentage of Compliance Level by Each Regions or City Administration of Ethiopia Based on WHO Road Safety Manual

4.3. Discussion on Gap Assessment of Ethiopian Police Road Traffic Crash Recording Forms/System

4.3.1. Police Road Traffic Crash Recording Forms

This thesis paper discovered that very few data elements on road traffic Crash is collected by the police departments in each Sub-city or Wereda of Ethiopia. This is because of the very poor contents of the road traffic Crash recording forms in nationwide. Moreover, the police in each concerned police station fills data with the designed forms manually which revealed that pen and simple paper form is the only medium used to collect and record crash data in Ethiopia.

This thesis paper also discovered that the road traffic Crash reporting forms of Ethiopia has more data on Crash related variables and as per assessment based WHO's minimum data elements all the study area forms scored more than 50% of the threshold set forth by the WHO manual.

On top of that, the paper also proved the conclusions made by (Berhanu, G, 2000) which stated that the content of the road Crash records in the country miss relevant details of a Crash report required for any road safety improvement work. The reporting forms, in each concerning police station of the country, are not designed to include details of each crash, road, vehicle and person data elements.

As presented in section 2.2, passengers and pedestrians are most vulnerable road users in Ethiopia. Hence, to rescue these vulnerable road users more data related to pedestrian Crashes such as **pedestrian activity before the crash**, **location**, and **type of pedestrian crossing near the crash site** also need to be collected for pedestrians. For passengers, **Seating Position of the passengers**, which is the location of the person in the vehicle at the time of the crash, and the **vehicle type** responsible for passenger Crash also need to be collected. These information will help to identify the cause of a crash more accurately, to evaluate occupant protection programs, and to analyze the crash risk by vehicle type and road user type [16]. The police Crash recording forms also lack more information related to the **vehicle**; which shall give information on usage of **seat belts**, **brake condition**, **tire condition**, and so on. These data will help to undertake necessary steps to minimize road traffic Crash. None of the regions police forms have Crash variable associated with traffic Control system at junction or intersections. Hence, It is impossible to ascertaining the relationship between the use of various traffic control devices and crashes; consequently creating difficulty in assessment of traffic control systems for upgrading at specific crash locations. For example, recently, yellow line technology is introduced at selected intersections of Addis Ababa. So, without recording the traffic control system whenever Crash occurs, it might be very difficult to practice the technology in other regions.

The main data element which is very important for traffic and road engineers is precise location of a Crash; but, it is not recorded properly. This data is important to identify engineering causes, carry out engineering measures and assess their effectiveness; and improve the design standards for safer new roads[1].The location of a Crash is reported broadly by the name of the Wereda and Sub-city or the name of the surroundings.

Moreover, this research paper discovered that the road traffic Crash recording forms are much below the minimum standards set by WHO (2010) road safety manual. For example, Amhara and Benishangul-Gumuz Regions' police road Crash recording forms totally do not have vehicle related data elements as required by the aforementioned manual.

According to the assessment of this paper, the current police road Crash reporting of the nation is quite brief, which is not sufficient to serve the needs of all concerned organizations. This is because the forms are designed to meet the need of the police. The paper also revealed that it is high time for the nation to have an in-depth police road Crash recording form and database systems to meet the need of all stockholders working in road safety and to meet Road Safety Vision 2020:"Making Ethiopian Roads Safer for Every One" [14].

In addition to limited information on the police road traffic Crash recording forms of the Country, this paper also discovered the limitations on training and engaging skilled personnel in the road Crash data collection process of the country. However, as per the informal interview made with the police officers in different regions and Addis Ababa City Administration, the police colleges in the Country, the entity responsible for police staff development and training, provides some training for traffic police officers and Crash investigators. As per the responses of some police officers, there is no routine trainings on road Crash data collection and management system in their respective police stations. As a result, the information filled in the existing forms may not be accurate.

There is no police road traffic Crash recording form in the nation which is pre-coded; and this makes it non-standardized and an inconvenient to be filled. In other words, the police who fills the data need to write on the dashed space whether he understands or not the attributable events.

After comparing the selected current forms of the country with other international best practices of road crash report form, the author came to know that existing forms cannot be modified to meet the minimum requirements. Hence, the only option was to design completely new road traffic Crash report or recording form as per international practices, which shall incorporate at least minimum data elements.

Finally, the designed form has also considered specific case of the country where there is no information derived from the other sources (say hospitals though data linkage) because of non-integration among organizations and all details have to be collected from the spot by the officer. Moreover, the form is designed in such a way that it can be used in hard as well as in soft copy which is believed to strengthen the data handling system of the Country by providing a better information for politicians and administrators, researchers, traffic and road engineers, and organizations engaged in driver training and/or road safety education. The newly created road traffic Crash recording form is shown in table 13.

4.3.2. Police Road Traffic Crash Statistics Recording Forms/System

The good thing the country currently have is a uniform traffic Crash statistics forms nationwide.

Traffic Crash data collected by different traffic police offices in different administration areas (regions and

city administrations) are reported using the standard traffic Crash statistics forms, which is attached as Appendix A of this paper, to the Federal Police Commission.

The statistics forms contains 30 tables describing the Crash in terms different patterns. However, the form also misses some important data elements, for example it is not possible to trace out of which **vehicle types** (i.e. Bicycle, Motor Bicycle, Small Car, Station Wagon, Pick -up 10 qt, Truck 11-40 qt, Truck 41-100 qt, Truck Trailer, Taxi, Public transport Up to 12 Seat, Public transport Up to 13-45 Seat, Public transport above 46 Seat are vehicle types listed in the traffic Crash statistics forms) are responsible for victimizing the road users (pedestrians, passengers and drivers). This data element is mandatory as per WHO's, 2010 edition, road Crash manual and it can be used for analysis of crash risk by vehicle type and road user type. Moreover, this data element is also important for evaluation of countermeasures designed for specific vehicles or to protect specific road users [16].

Additionally, the road Crash statistics forms of the nation and the regions lacks information on **vehicles' make** and **model** involved in road traffic Crash. Nowadays it is common to hear that, in Ethiopia, Sino tracks and Isuzu are more involved in many fatal/serious injury Crash. However, it is not possible to conduct research as these data elements are not recorded elsewhere in the nation. Hence, including these data elements in the national and regional Crash recording forms is very important as it allows for crash analyses related to the various motor vehicle models and makes. Road Crash statistics data related with **traffic control system** at junction or intersections is not also included in the uniform traffic Crash statistics forms. With the absence of this data element it is difficult to understand the relationship between crashes at intersections and the type of traffic control device present. The traffic Crash statistics form also lack information on **Safety equipment**, which is vital data variable for evaluating the effect of safety equipment on injury outcomes. Moreover, data on **Seating Position of passengers** is not also included in the standard form and excluding this data element hinders the full evaluation of occupant protection programs [16]. It is also common to hear that there is problem associated with driving license issuance as it is exposed for bribery.

Hence, to control the effectiveness of the trainings given by trainings schools is also good if **driving license issuing region** be included in the police Crash recording forms. Based on the established police road Crash data collection form, as set forth in table 13, Revised Police Road Traffic Crash Statistics Recording Form is created. Appendix B shows the revised Crash statistics recording form.

4.3.3. Developed Police Road Traffic Crash Report Form

Based on Global Road Safety Partnership (GRSP), World Health Organization (WHO), the FIA foundation and World Bank (WB) 2010 Road safety data System manual and the prevailing condition of the country, Ethiopia, the road traffic Crash report form is developed. The established form is tried to be, as much as, coded as the coding makes the format simple to practice, easy to understand and convenient in use. The developed form is given in Table.13.

Table 13: Developed Police Road Crash Data Collection Form

C1.File No.	C1.1 Reporting Officer	C1.2 Police Station	C2 Crash date
_____	Name_____	Name _____	DD/MM/YYYY _____

C2.1 Crash day		C3.Crash Time	C4.Crash municipality/Region
Man	Fri	HH_____	_____
Tue	Sat	MM_____	_____
Wed	Sun		
Thu			

No. of Vehicles	Road User/Severity	Driver	Passenger	Pedestrian
Involved _____	Killed_____	_____	_____	_____
Damaged _____	Injured_____	_____	_____	_____

C5. Crash Location

N_____ Distance (KM) or (M) _____

E_____ from _____(known points)

C6. Crash Type	C7. Crash Impact Type	C8. Weather Conditions		C9. Light Conditions
1. Crash with pedestrian	1.No Impact	**8.** Side by side-same. Direction	1. Clear	7.Strong wind	1.Daylight
2. Crash with parked vehicle	2.Rear end impact		2.Cleudy	8.Smoke/Dust	2.Twilight
3. Crash with fixed obstacle	3.Head on impact	9. Side by side Opposite Dir.	3. Fog/mist	9.Very Hot	3.Darkness
4. Non-fixed obstacle	4.Angle-impact Same Dir.	10. Rear to side impact	4.Light Rain	10.Very Cold	4. Darkness with Street light unlit
5. Crash with Animal	5.Angle--impact Opposite Dir.	11. Rear to rear impact	5.Heavy Rain	11.Others_____	5. Darkness with Street light lit
6. Single vehicle crash/non-collision	6.Angle--impact Right Angle		6.Sleet/Hail		6.Unkown_____
7. Crash with two or more vehicles	7. Angle—impact-Direction not Specified				
8. Other crashes _____					

C10. Contributing Factors		C11. Crash Severity	
1. Fault of driver	6.Fault of passenger	1.Fatal	2.Serious Injury
2. Bad weather	7.Fault of pedestrian	3.No Injury	3.Slight Injury
3. Defect in road	8.Poor light condition		
4. Fault of cyclist	9.Mechanical fault in Vehicle		
5. Fault of driver of another Vehicle	10.Other_____		

R1.Type of Road way		R2.Rode Functional Class		R3.Speed Limit
1. Motorway/freeway	5. Road outside a built-up area	1. Principal arterial	3.Collector	_____
2. Express road	6. Restricted road	2. Secondary arterial	4.Local	
3. Urban road, two-way	7. Other			
4. Urban road, one-way	8. Unknown			

R4. Road Surface Condition		R5. Road Obstacle		R6. Junction	
				1. At-grade, crossroad	5. At-grade, other
1. Dry	5 .Flood	0. No	1.Yes	2. At-grade, roundabout	6. Not at grade
2. Snow frost, ice	6. Asphalt	3. Unknown		3. At-grade, T or staggered junction	7. Not at junction
3. Slippery	7. Gravel			4. At-grade, multiple junctions	8. Other
4. Wet, damp	8. Other_____				

R7. Traffic Control at junction		R8. Road Curve
1. Authorized Person	6. Automatic traffic signal (out of order)	1.Tight Curve
2. Stop sign		2. Open curve
3. Give way sign or Marking	7. Yellow Line	3. No curve
4. Other traffic signs	8. Uncontrolled	4. Other_____
5. Automatic traffic signal (working)	9.Other_____	

R9. Land Mark Feature		R10. Road segment grade (steep gradient)
1. Near to Religious	7. Near Offices	1. Yes
2. Near to school	8. Near Hospital	2. No
3. Near/Inside Village	9. Open Area	3. Unknown.
4. Near Recreational Place	10. Near Bus Stop	
5. Near Factory/Industrial Area	11. Near Petrol Pump	
6. At- Pedestrian Crossing	12. Market/Bazaar	

Vehicle Information	Vehicle 1		Vehicle 2		Vehicle 3	
1. Vehicle Plate No.						
2. Registration Year and Region						
3. Vehicle Make						
4. Vehicle Model						
5. Model Year						
6. Engine No.						
7. Chassis No.						
8. Renewed Fitness Certificate	1.Yes	2. No	1.Yes	2. No	1.Yes	2. No
9. Third Party Insurance	Company		Company		Company	
	Expiry date		Expiry date		Expiry date	
10. Vehicle type(See coding panel)						
11. Vehicle Defect(See coding panel)						
12. Tire Burst	1.Yes	2. No	1.Yes	2. No	1.Yes	2. No
13. Vehicle Maneuver(See coding panel)						
14. Vehicle Special Function(See coding panel)						
15. Vehicle Damage(See coding panel)						
16. Vehicle Loading	1. legal	2. illegal	1. Legal	2. illegal	1.Legal	2. illegal
17. Ownership of Vehicle (See coding panel)						
18. Driven By(See coding panel)						

Driver Information	Driver 1		Driver 2		Driver 3	
Name						
1. Gender	Male	Female	Male	Female	Male	Female
2. Age						
3. license Type						
4. License No.						
5. Driving license issue Region and city						
6. Driver Injury severity (See coding panel)						
7. Injury Type (See coding panel)						
8. Driver's Education (See coding panel)						
9. Alcohol/Drug used	1. Yes	2.No	1. Yes	2.No	1. Yes	2.No
10. Safety equipment(See coding panel)						
11. Used Mobile Phone	1. Yes	2.No	1. Yes	2.No	1. Yes	2.No
12. Driver Error(See coding panel)						

Passenger Details

Name	Vehicle No.	Sex		Age	Injury Severity(See coding panel)	Deceased		Injury Type (See coding panel)	Seating Position(See coding panel)	Action(See coding panel)	Safety equipment(See coding panel)
		M	F			1.On Spot	2. On Way				
		M	F			1.On Spot	2. On Way				
		M	F			1.On Spot	2. On Way				
		M	F			1.On Spot	2. On Way				
		M	F			1.On Spot	2. On Way				
		M	F			1.On Spot	2. On Way				
		M	F			1.On Spot	2. On Way				

Pedestrian Details

Name	Vehicle No.	Sex		Age	Injury Severity(See coding panel)	Deceased		Injury Type(See coding panel)	Pedestrian Location (See coding panel)	Pedestrian maneuver(See coding panel)
		M	F			1.On Spot	2. On Way			
		M	F			1.On Spot	2. On Way			
		M	F			1.On Spot	2. On Way			
		M	F			1.On Spot	2. On Way			
		M	F			1.On Spot	2. On Way			

Crash Diagram

Table 14: Coding Sheet

Vehicle type

1. Bicycle
2. Motor Bicycle
3. Small Car
4. Station Wagon
5. Pick -up 10 qt
6. Truck 41-100 qt
7. Truck Trailer
8. Taxi
9. Public transport Up to 12 Seat
10. Public transport Up to 13-45 Seat
11. Public transport above 46 Seat
12. Rail

Vehicle Defect

1. None
2. Lights (Head, tail, Signal)
3. Brakes
4. Exhaust System
5. Suspension
6. puncture/Blowout
7. Worn /Slick tires
8. Wheels
9. Body Doors
10. Windshield/ Windows
11. Wipers
12. Cng Cylinder
13. Truck Coupling
14. Trailer Hitch
15. Safety Chains

Vehicle Driven By

1. Owner
2. Employee
3. Borrowed
4. Stolen
5. Other
6. Unknown

Vehicle Maneuver

1. Reversing
2. Parked:
3. Entering or leaving a parking position
4. Slowing or stopping
5. Moving off
6. Waiting to turn
7. Turning
8. Changing lane
9. Avoidance maneuver
10. Overtaking vehicle
11. driving Straight forward /normal
12. Other_____

Vehicle Special Function

1. No special function
2. Taxi
3. Vehicle used as bus
4. Police
5. Military
6. Emergency vehicle
7. Other

Vehicle Damage

1. None
2. Front
3. Rear
4. Right
5. Left
6. Top
7. Undercarriage
8. Multiple
9. Other

Ownership of Vehicle

1. Government
2. Public Organization
3. Military
4. P0lice
5. Private
6. Diplomatic
7. UN
8. AU
9. International
10. Other
11. Unknown

Driver's Education

1. Illiterate
2. primary
3. Secondary
4. Matriculation
5. Intermediate
6. Graduate
7. Post Graduate
8. Other

Injury Severity

1. Fatal Injury
2. Serious Injury
3. Slight Injury
4. Non-Injury(Property Damage)
5. Unknown

Driver Error

1. None
2. starting off
3. carelessly
4. Exceeded lawful speed
5. Did not give right of way to pedestrian
6. followed too closely
7. Asleep/tired
8. Disregarded
9. traffic light sign
10. Improper overtaking
11. Over took on curve
12. Cut in sharply after overtaking on wrong side of the road
13. Failed to give signal
14. Wrong Signal
15. improper turn
16. Disregarded traffic sign
17. Lack of attention
18. wrong parking location
19. Failed to give way to Vehicle
20. Disregarded police officer
21. Wrong use of headlight
22. Other

Pedestrian Maneuver

1. Crossing
2. Walking on the carriageway
3. Standing on the carriageway
4. Not on the carriageway
5. Other _____

Injury Type

1. Dead before report made
2. Visible signs of injury as bleeding, wound or distorted member or had to be carried from scene
3. Other visible injury
4. Bruise abrasions, Swelling, limping etc
5. No visible injury, but complaint of pain or momentary unconsciousness

Passenger Seating Position

1. Front seat
2. Rear seat
3. Left
4. Middle
5. Right
6. Not applicable
7. Other Unknown

Passenger Action

1. Sitting
2. Standing
3. Boarding
4. Alighting
5. Falling
6. Other

Pedestrian Location

1. On pedestrian Crossing
2. Within 50 m of on traffic
3. island
4. In center of road
5. On footpath
6. On shoulder
7. Other

Safety equipment

1. Seat-belt available, used
2. Seat-belt available, not used
3. Seat-belt not available
4. Child restraint system available, used
5. Child restraint system available, not used
6. Child restraint system not available
7. Not applicable
8. No restraints used
9. Other restraints used

5. Conclusions and Recommendations

5.1. Conclusions

This paper has revealed the necessity of formulating a new system of Crash data collection, management and analysis in Ethiopia after a review of the current practices of road traffic Crash data collection and management system of Ethiopia with best practices of other countries. The Current road Crash data collection forms of the nation are much below the best practices of other countries and it could not serve the needs of all stakeholders. Hence, the police data collections forms need to be modified completely so that the minimum data elements can be incorporated in the data collection forms and the nation will have a uniform crash reporting format. This can be further illustrated by the findings of the assessment of the police Crash reporting forms of the nation with respect to MMUCC and WHO data elements; which only scored only 23% of the MMUCC's data elements and 29% of WHO's road safety data manual requirements.

This study has found major deficiencies of the existing road traffic Crash data collection system and proposed specific recommendations to overcome such limitations. Moreover, it is also discovered that there is no harmonized data recording and storing system in the nation. Hence, it necessitates the development of a structure for collecting, storing and managing the road traffic Crash data for the nation, Ethiopia. Consequently, this study has developed/modified a structure for recording or storing the road traffic Crash in the whole nation which might serve the needs of all stockholders in the regional or national level.

Furthermore, as there is no police road traffic Crash recording form in the nation which is pre-coded; use of terminology was not uniform among Crash investigating police officers. As a result of this confusing road, vehicle, person and Crash related variables were encountered. Among the Crash variables Crash location, which is very important for engineers to assess road safety, is more confused by filling vague street and Wereda names.

Moreover, as there is no detailed traffic Crash records stored in Crash databanks that contains relevant information, including the precise location of Crash on the road network, the effects of roads and their environment on road safety are generally less understood, and have not been diagnosed by highway and traffic engineers [1].Major causes of Crash in Ethiopia as reported by police is driver's error this is not because the road conditions in Ethiopia are absolutely safe, but this is due to the lack of awareness about road and traffic engineering factors and insufficient training, to police officers, in road Crash reporting[1]. Hence, the efforts of the police in Ethiopia is inefficient mainly due to the

poor contents of the already established Crash recording forms and inadequate training.

The current Crash reporting system of Ethiopia classifies Crash into four Crash severity classes, namely: fatal, serious injury, slight injury, and property damage. The distinction between serious and slight injuries is not well established. The 30-day period definition of fatal Crash, which used by WHO and many other countries, is not applied in Ethiopia.

In addition to the indicated limitations on the content of Crash reporting structure, there is no established system of computerized Crash databank to store Crash records in the country. However, the Federal Police Commission, whom is responsible to generate the national Crash statistics, uses simple Microsoft word program to keep the Crash statistics in Amharic through its standard form, which is attached as Appendix A. Consequently, research showed missing data and inaccurate information are being expected in this kind of process [4].

The proposed road Crash data collection and management system, in this study, is carefully designed to include more data related with Crash, road, vehicle and person variables in the data recording forms. The proposed structure, if implemented, would resolve most of the difficulties encountered during data collection and management. Additionally, the proposal would also show better national Crash picture which can facilitate for easy monitoring and the overall effectiveness of any safety program.

5.2. Recommendations

Based on the findings of the study the following are the main recommendations, which will benefit the implementation of the Road Safety Vision 2020 (i.e. reducing the fatality rate to 25 fatalities per 10,000 vehicles in Ethiopia by 2020 from the base rate, which is 136 fatalities per 10,000 vehicles, in 2002/2003 E.C);

- There is a need to improve the current Crash reporting system and to build up an accurate and relevant database in order to provide a reliable system for storing, retrieving and analyzing a road traffic Crash data.
- The implementation of the developed the police road Crash data collection forms and road traffic Crash statistics forms will bring improvement in road traffic safety and it will act as a valuable instrument for the creation of comprehensive, reliable and accurate road traffic Crash database. Further, the data collected can be used as an evidence for the evaluation of road safety interventions.

- The author also recommends for provision of nationwide common training program to police officers who work on road traffic Crash investigation and data collection process before implementing the newly developed road traffic Crash data collection and management system. A part from such program there should be regular trainings, on collecting road traffic Crash data from the Crash sites and filling up the road traffic Crash forms accurately, to road Crash data investigators.

- Finally, the author recommend practicing of GPS and GIS system, in Ethiopia, to identify the exact road traffic Crash location in order to introduce an appropriate countermeasures. In relation with this practices, research in various countries has shown that road planning, design and engineering countermeasures can lead to significant Crash reductions and reductions in the severity of injuries [4].

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APPENDIX A

NATIONAL ROAD TRAFFIC CRASH STATISTICS FORMAT.

APPENDIX B

REVISED NATIONAL ROAD TRAFFIC CRASH STATISTICS FORMAT

APPENDIX C

SAMPLE POLICE ROAD TRAFFIC CRASH RECORDING FORM of ADDIS ABABA CITY

APPENDIX D

SAMPLE POLICE ROAD TRAFFIC CRASH RECORDING FORM of AMHARA REGION

APPENDIX E

SAMPLE POLICE ROAD TRAFFIC CRASH RECORDING FORM of BENISHANGUL-GUMUZ REGION

APPENDIX F

SAMPLE POLICE ROAD TRAFFIC CRASH RECORDING FORM of OROMIA REGION

APPENDIX G

SAMPLE POLICE ROAD TRAFFIC CRASH RECORDING FORM of SNNPS REGION

APPENDIX H

MINIMUM DATA ELEMENTS from WHO MANUAL