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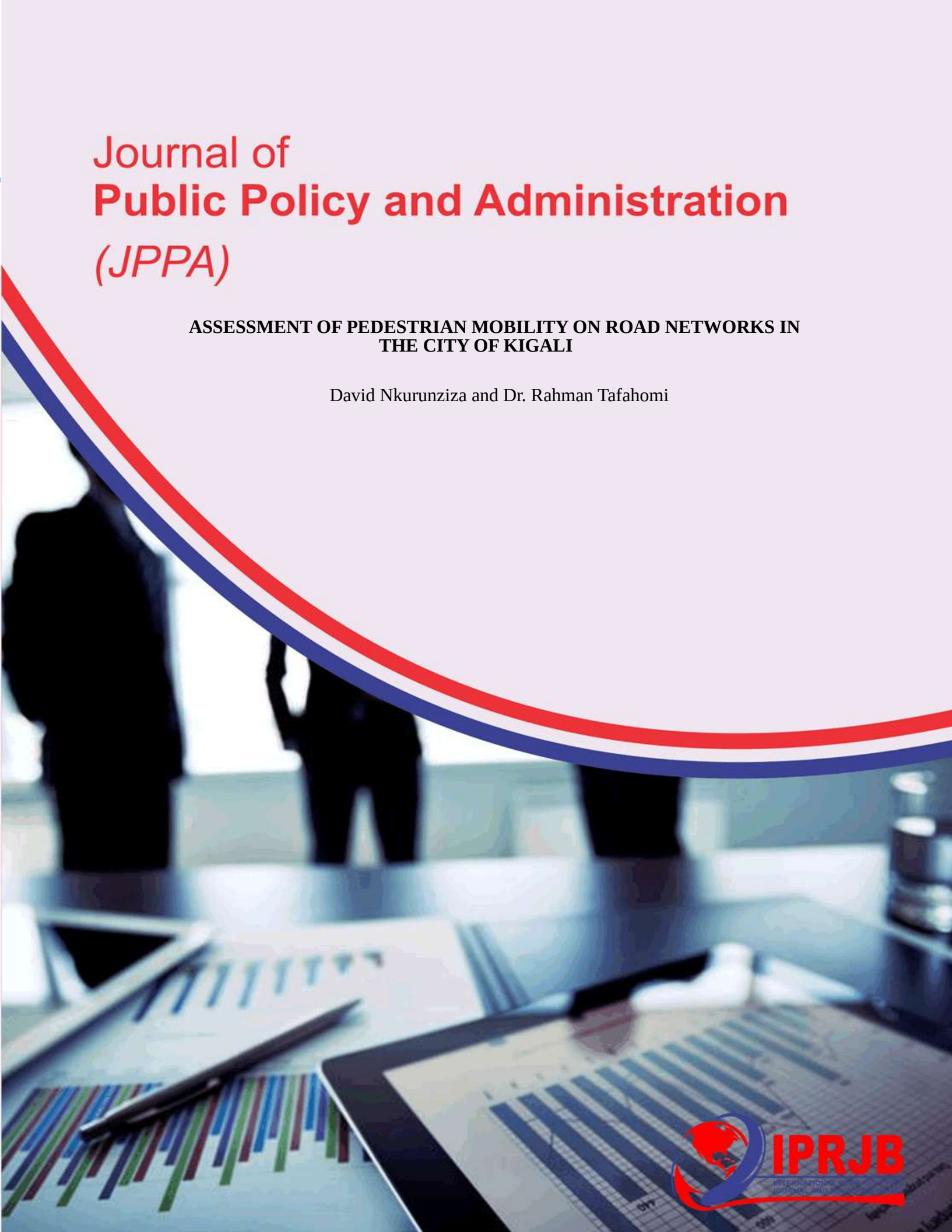

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Assessment of Pedestrian Mobility on Road Networks in the City of Kigali

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Abstract

Purpose: The aim of this study is to analyze and assess the pedestrians' mobility issues that are affecting their free movement and safety in the City of Kigali by outlining the major challenges in the City and providing alternative solutions and measures for improving the mobility and safety of Pedestrians.

Methodology: This study was designed based on qualitative method with application of structured and unobtrusive. Referring to the paper findings about the mobility challenges of pedestrians within the City of Kigali, it is noted that the mobility of the pedestrians and their safety is still low and typical problems including road crossing viewed as the second challenges about pedestrians mobility, walking along the road networks due to lack of footpaths, lacking of enough road signs, lacking of information about pedestrian behavior on road networks, and improper functioning of existing traffic signals as the first challenge.

Findings: The study found that the majority of road networks in the City of Kigali did not provide walkways, traffics signals designs and availability is very poor and some of them not functioning, zebra crossing facilities were not provided adequately, pedestrians shelter on bus stop are almost absent and ignored, vehicles travelling speed is still high and does not allow pedestrians to move freely and the mobility of disables people has been forgotten and there is a need of introducing the pedestrian overpass bridges in clouded zones of Nyabugogo, Kicukiro Sonatube and Remera Giporoso areas of the City of Kigali.

Unique Contribution to Theory, Practice and Policy: maintaining pedestrian's safety by using the traffic lights to warn the drivers to be aware of the pedestrians' safety and to think of how the implementation of the pedestrian overpass can be introduced in the City where more a great number of pedestrians crossing the road reduced to be killed in the accident.

Keywords: *Mobility, Pedestrian Safety, Road Networks, Traffic Signals, Pedestrians.*

INTRODUCTION

The growth of the City should be hand in hand with the development of the transportation facilities for easing the movement of people and goods from each part of the City. According to the Kigali City Master plan 2013 the road network in the City were supposed to be developed to fully meet the requirements of a modern City that is promoting the higher quality of life for its residents.

The City of Kigali is actually doing good to improve the existing road networks in various projects specifically in a project termed as Kigali Urban Road Upgrading Project of 54.56 Km where widening and traffic management by means of roundabout and traffic lights have been implemented since 2016 till now. It is therefore important to upgrade the and revitalizes existing major master plan road networks for vehicles but surprisingly very little has been implemented for the City pedestrian in the matter of their crossing facilities.

This paper sought to examine the constraints faced by the Kigali City pedestrians on the road networks around the City at various critical locations mostly characterized by the accidents at Nyabugogo, Remera and City Center roads. The study was carried to identify the possible mobility challenges and establish technical proposals to overcome the matter for the safety of residents.

LITERATURE REVIEW

According to Peter Wright (2012), the pedestrian safety should be promoted by awakening both pedestrians and drivers about the importance of acting safely in all traffic environments by using and providing pedestrians' facilities appropriately.

Tiwari and Chatterjee (2013) observed that pedestrians on Delhi roads are often exposed to high risks. This is because the basic needs of pedestrians are not recognized as a part of the urban transport infrastructure improvement projects in India. Also Dulaski and Liu (2013) discussed that the interaction between the pedestrian and vehicular driver at un-signalized mid-block locations when pedestrian is waiting at curb and stepping off the curb, the driver yield behavior is more when the pedestrian steps off from the curb and it is more during morning peak hours. However, Charles, (2010) said that the best way of teaching the pedestrians how to use road is to using communication designs and this can facilitate their mobility. Dyaz (2002) highlighted that there is less likely risk to cross a roadway in the presence of motor vehicles in an urban area than rural area due to different design speeds.

Holland and Hill (2010) collected adult pedestrian accident data which demonstrated that the risk of being killed or seriously injured varies with age and gender. With increasing age, women were shown to make more unsafe mobility like crossing decisions, to leave small

safety margins and to become poorer at estimating their walking speed. However, the age effects on all of these were ameliorated by driving experience. Men differed from women in that age was not a major factor in predicting unsafe pedestrians' mobility.

Zhuang and Wu (2011) studied that pedestrian's mobility, crossing out of crosswalks (unmarked roadway) and those crosswalks contributed much to traffic accidents, so the safety of pedestrians would be more in danger if not provided.

Granie and Brenac (2014) wrote about pedestrian behavior of being strongly dependent on biological gender, and it has also been found to depend on the psychological masculinity of an individual. Pedestrian speeds are also significantly related to pedestrian age, and the speeds of pedestrians are slower as they get older. Pedestrians especially oldest one continues to develop their physical, cognitive and psychosocial abilities to cross road (Lim, 2008).

According to Satish Chandra and Rajat Rastogi (2014), Consideration of the safety aspect is recommended for design of crossing facilities like signal at locations where female or old pedestrians are substantial to cross.

METHODOLOGY

This paper analyzed the problems faced by pedestrians in the City of Kigali, looked at their needs, existing infrastructure to facilitate them and adequate measures that would be taken to improve their mobility and safety.

The methodology of this paper was designed based on the qualitative methods (Groat & Wang, 2002; Neuman, 2006) with application of observation technique specifically the structured observation (Miller, et al., 2004; Marshall & Rossman, 2006; Tafahomi & Nadi, 2016) and the unobtrusive (Bonnes & Bonaiuto, 2002; Tafahomi & Nadi, 2020), which applied in the urban spaces and in a sensitive areas to study human behaviors. The descriptive approach was selected to explain the observation through storytelling (Groat & Wang, 2002) and then analysis based on the collected for a period of three months.

The methodology adopted to conduct this research was descriptive research design by field observations on the selected road networks of the City of Kigali selected randomly within three Districts of Nyarugenge, Kicukiro and Gasabo .A field data collection and checking of six working days including Saturdays for the entire period of three months was used for the whole selected road samples where some forms were developed and filled accordingly.

The Primary data included the field data collection for pedestrian spot point's prone areas to accidents, crossing Location without facilities identified and interview to experts and some pedestrians to get their views. The following are pedestrian needs parameters that were assessed and include the Crosswalks (Zebra crossings and over bridges),Sidewalks

(Paved ways and over bridges),Warning marks, Shelters, Road Visibility, Density of pedestrians, Traffic lights.

RESULTS

From data collection the following were pedestrian needs that were assessed and included Crosswalks (Zebra crossings and over bridges), sidewalks (Paved ways and over bridges), Warning marks, buses shelters, Road Visibility, Density of pedestrians, Traffic lights availability. Also the existing facilities were noted down for further comparison.

Table 1: List of Assessed Roads within the City of Kigali

S/N	Name of Assessed Roads	S/N	Name of Assessed Roads
1	City center (KN1– Remera [KN3Rd]	10	Mukanogo – Nyabugogo [KN7Rd]
2	Remera – Kabeza – Rubirizi [KK18Ave]	11	Nyabugogo Taxi Park – Gitikinyoni
3	Kigali Convention center – City center [KN5Rd]	12	Zindiro – Chez Lando
4	Kigali City center Nyamirambo [KN2Ave]	13	Kigali Convention Centre – Nyabugogo [KG7Ave], [KN8Ave]
5	Nyamirambo – Nyarurama [KN9Ave]	14	Sonatube – Kicukiro Nyanza Park [KN15Rd]
6	Nyamirambo – Nyabugogo [KN20Ave]	15	Rwandex – Kicukiro Center [KK8Ave]
7	KN1 Roundabout – Nyabugogo [KN1Rd]	16	Kimironko Taxi Park – RBC & Airtel Rwanda Head Quarter [KG17Ave]
8	Remera – Kimironko	17	Remera – Murindi [KK3Rd]
9	Kigali City Center roads	18	Kanogo- Gikondo [KK2Ave], [KK4Ave]

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Zebra Crossing Facilities

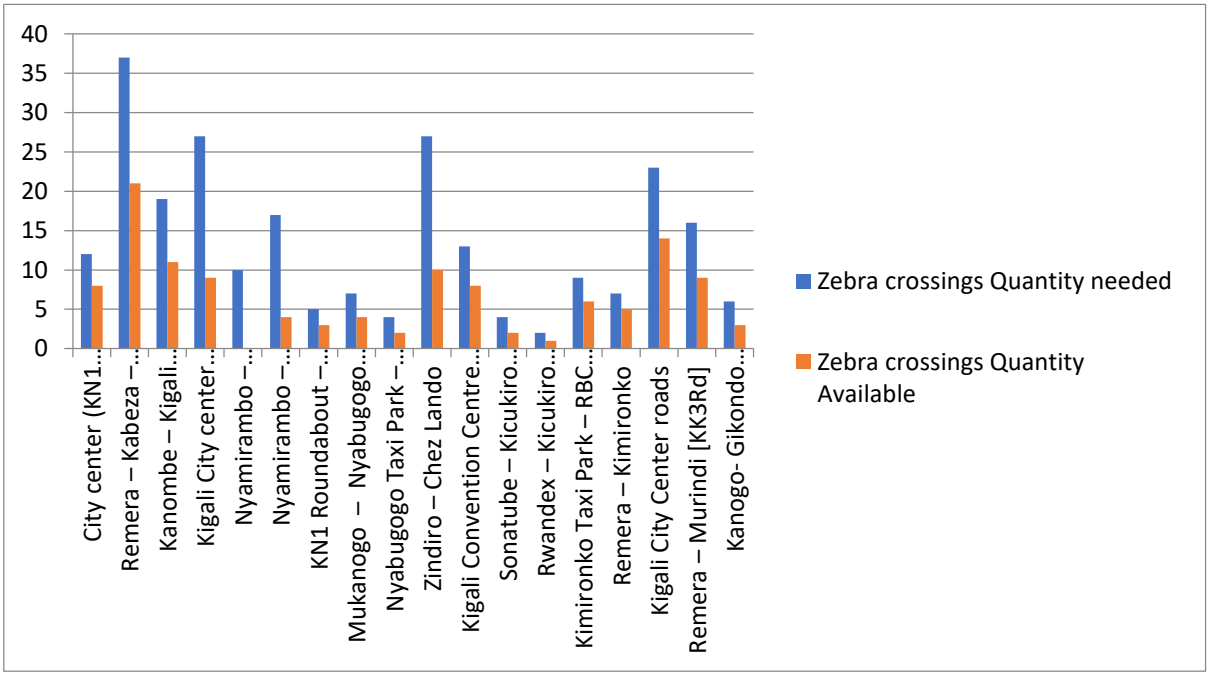

Figure 2: Comparison between Available and Needed Pedestrian Crossing facilities

Traffic Lighting Facilities

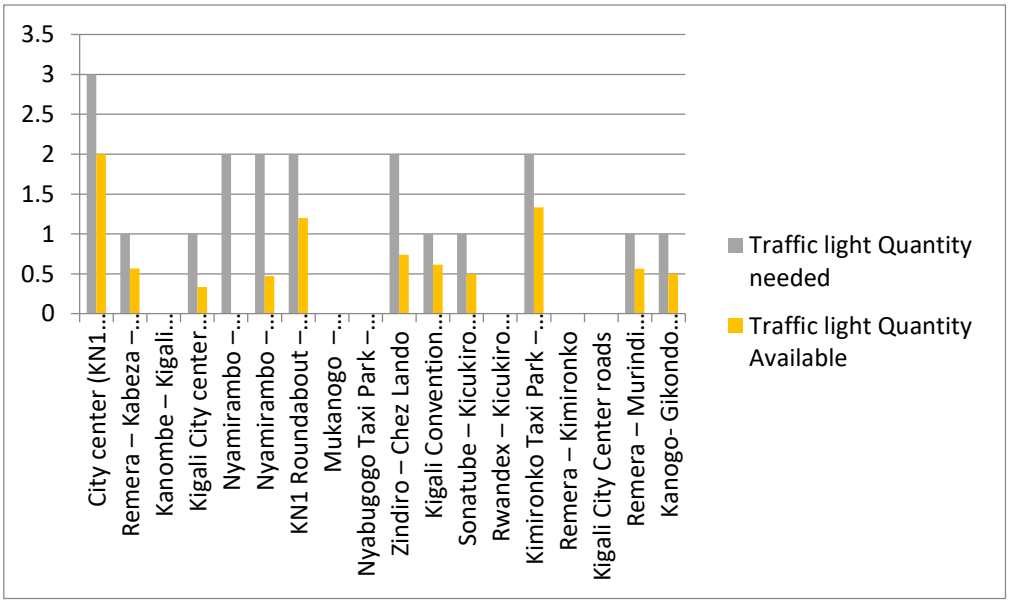

Figure 3: Comparison between Available and Needed Traffic Lighting Facilities

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Pedestrian Bridge Facilities

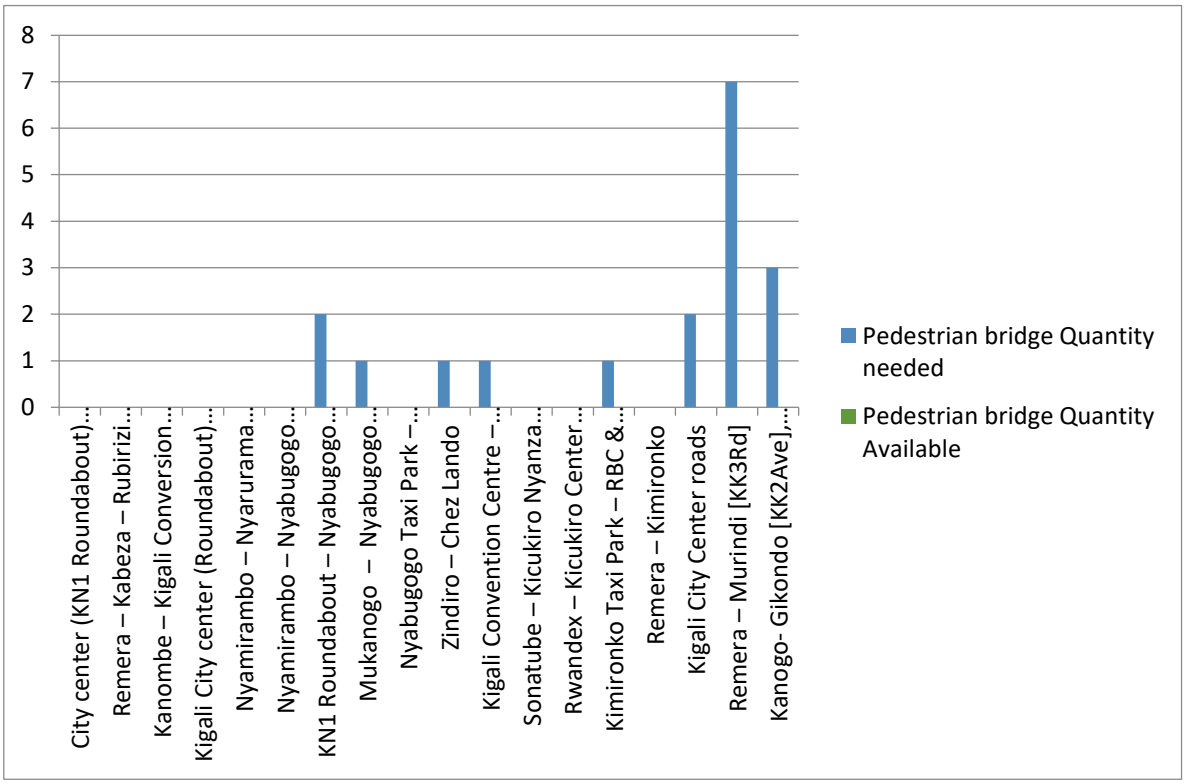

Figure 4: Comparison between Available and Needed Pedestrian Bridge Facilities

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Warning Signs Facilities

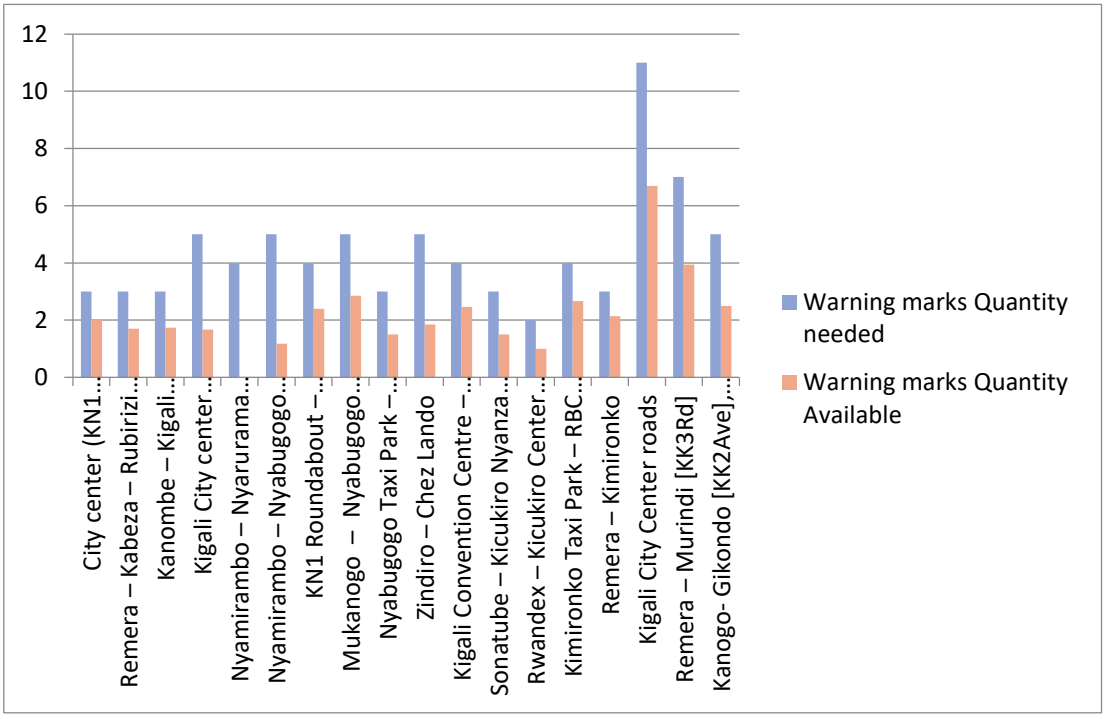

Figure 5: Comparison between Available and Needed Warning signs Facilities

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Pedestrian Buses Shelter Facilities

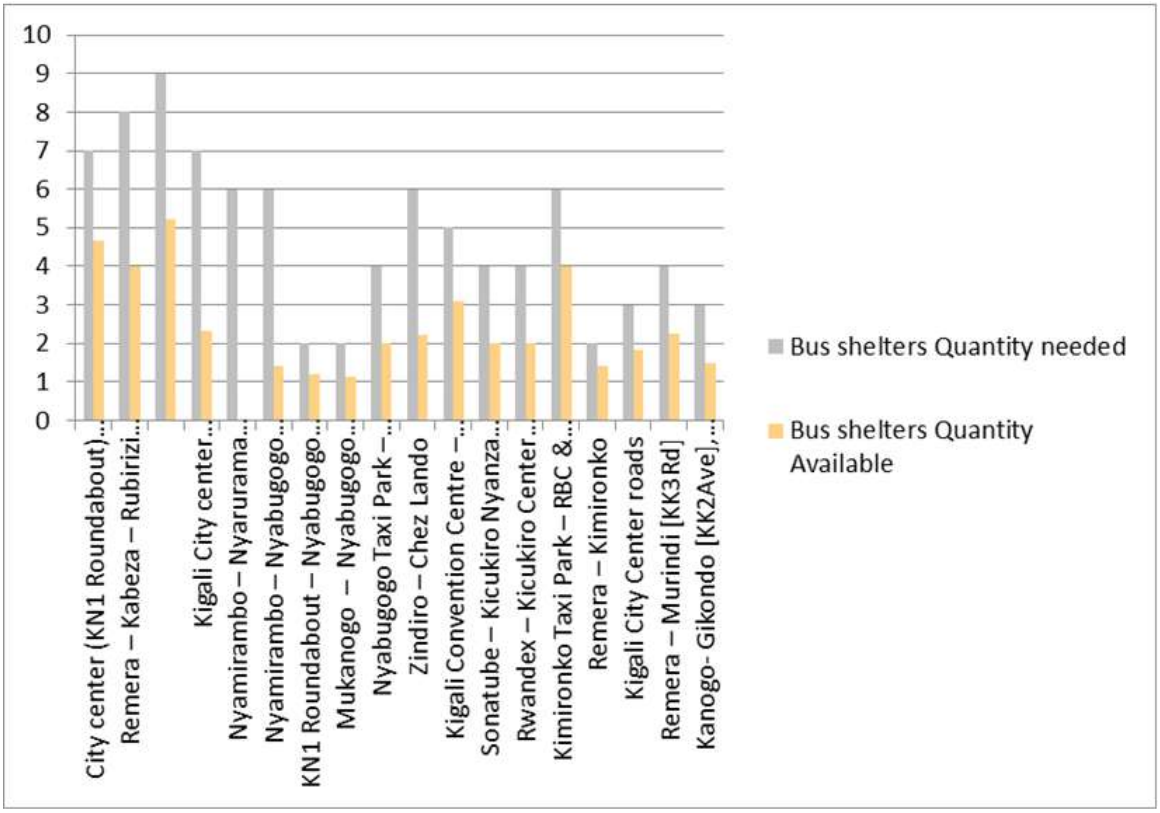

Figure 6: Comparison between Available and Needed pedestrian buses shelter facilities

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Pedestrian Pathways Facilities

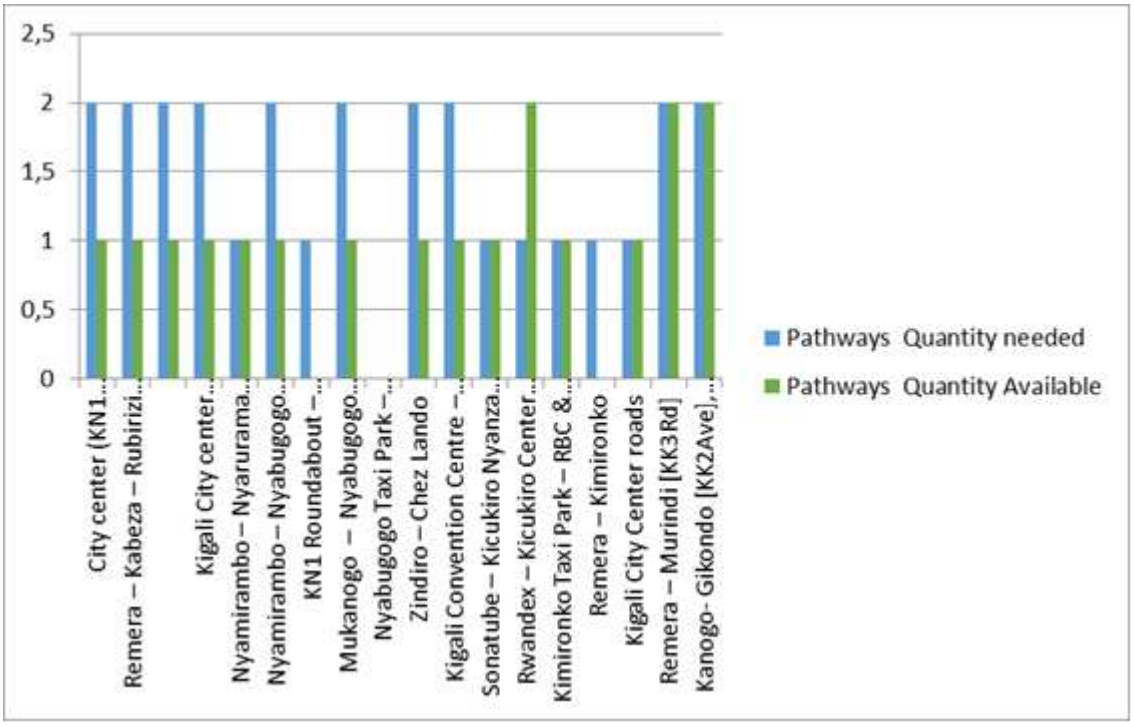

Figure 7: Comparison between Available and Needed Pedestrian Pathways Facilities

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Pedestrian Public Stairs Facilities

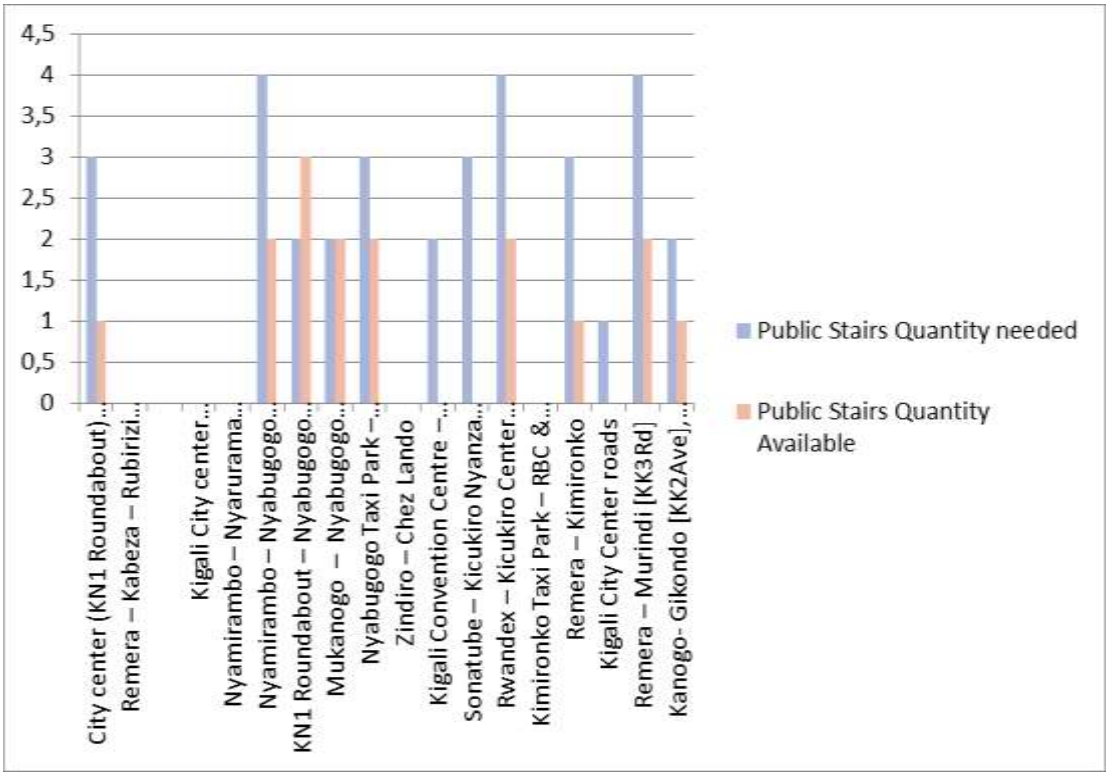

Figure 8: Comparison between Available and Needed Pedestrian Public Stairs Facilities

Discussion

Zebra Crossing Facilities

From the field assessment on 18 visited road network, it was found that almost of the needed crossing for pedestrians are missing and this is dangerous to the crossing people. The figure 9 below shows that only 50% of the required crossing is available.

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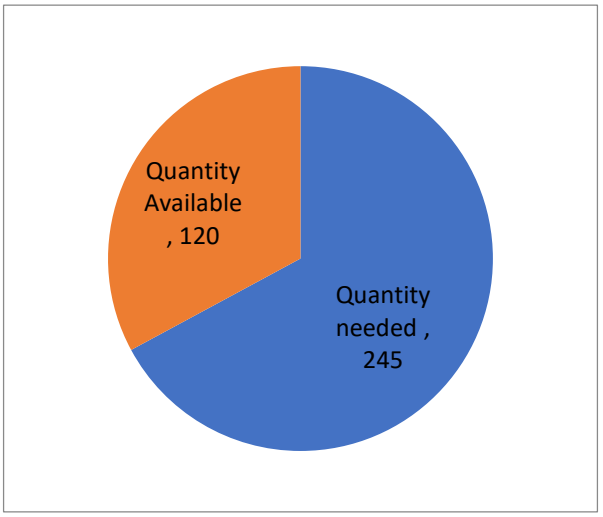

Figure 9: The Available Crossing Vs the Existing

Figure 10: Some of the Existing Crossing without Zebra Painting and Threat to Pedestrians

Traffic Lighting Facilities

Also from the field assessment on 18 visited road network, it was found that almost of the needed traffic lighting to facilitate pedestrians while crossing at junctions only 9 available out of 19 needed were installed and some of them are not functioning and needs repairs. The results found that only 46% of the required lighting is available and this is alarming.

Pedestrian Bridges (Overpass)

During the assessment of pedestrian needs facilities in this paper, it was found that they are needed for some places like at KN1 Round About to Nyabugogo (KN8Ave & KN1Rd) Network as an alternative of Zebra crossings, at KK2Ave & KN68St on the leveled side as an alternative to the zebra crossing for they are located in danger zone.

Warnings Signs Facilities

Warning signs are still very low on the road networks visited and it was found that almost 47% of the required are yet installed and this needs to be a priority so as to help pedestrians to escape from any road danger about their safety.

Figure 11: Zebra Crossing without a Warning Sign (Left Hand Photo) On KG17Ave Road and Difficult/Unsafe Crossing at KN11Ave, Kimironko to Chez Lando (Right Hand Photo).

Pedestrian Bus Shelters

Those facilities are related to the bus stops; they are sometimes ignored during pedestrian facilities designs but they are needed for pedestrians' health for sun radiation and rainfall. Sunrays and rainfalls are the natural phenomena that pedestrians can't escape while he or she is using road for daily base activities or trip. It was found that generally out of the required around 35% are constructed and operational. Still a large number is to be added as soon as possible. The figure below illustrates some of the road networks lacking shelters for pedestrians.

Figure 12: Bus Stop without Pedestrian Shelter on KN501St

Pedestrian Pathways

Those facilities are mostly occurring beside the curved road or near the network from one sidewalk to another. They reduce the density of pedestrians near the networks and provide a comfort passage of pedestrians.

They may be implemented where there is such possibility, but better if they are relatives to the Zebra crossings.

The paper found that around 67% of the required pedestrian pathways are built but still some of the road does not provide them and this is an encouraging indicator that in the near future the coverage is possible. Apart from the pedestrians pathways the escaping island are also useful for lanes separation and also for pedestrians to refresh while waiting for motor drivers to give a free way for him or her. They may be implemented in T-networks or junctions, on a wider crossover networks.

Figure 12 : Escape Island on a Network of KG7Ave & KG544St

Public Stairs Facilities

From the results, it was found that 48.5% of the required stair case facilities are provided and some are missing. Stairs which give pedestrians access to the roads need to have slip but rough staircase with a limited angle of elevation which is adequate to each persons with disability.

Figure 13: A Stair Case on KN1Rd Built Recently in 2019

Other General Mobility Findings

In the City of Kigali specifically the free car zone in Nyarugenge District ,pedestrians are freely to move , doing what they want to do in this zone, and the zone like this are much needed in other districts in of the City.

Grade-separation of crossings is another excellent way to eliminate conflict between vulnerable road users and vehicles, but throughout the City, these infrastructures are not yet thought of and must be encouraged in the near future for vey clouded zones of Nyabugogo, Remera Giporoso and Sonatube round about area.

Lastly, it was observed that many of the pedestrians cross road network facilities by talking on their phone and this can reduce their level of safety control themselves. Every pedestrian should also know more about road safety to reduce the accidents and can be helped by display of road safety notices along and around the city where pedestrians are more likely to cross.

Conclusion

Firstly, the paper looked on major pedestrians' challenges in The City of Kigali and found that according to the chronological order of gravity for facilities, it is the traffic lighting facilities as the first challenge for mobility, secondly it is the inadequate number of and places of zebra crossing facilities, thirdly it is the lack of enough warning signs and fourthly it is the inadequate pathways associated to shelters for pedestrians.

For better sustainability of the safety to add on traffic signs and road markings and signs, there is a need to increase the driver's awareness about the unusual road geometric parameters susceptible to trigger accidents such as sharp curves, locations of a high sequence of curves, high gradients and change of lane widths so as to reduce accidents is to be thought of because Kigali is a mountainous City with hills and Valleys with high gradients.

This paper also suggested maintaining pedestrian's safety by using the traffic lights to warn the drivers to be aware of the pedestrians' safety and to think of how the implementation of the pedestrian overpass can be introduced in the City where more a great number of pedestrians crossing the road reduced to be killed in the accident.

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