

Landscape Elements as Determinants of Pedestrian Movement in Urban Public Spaces: The Case of Dodoma, Tanzania

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Abstract

Provision of landscape elements to promote convenient pedestrian movement especially for cities in the tropics has constituted one of the key design elements. Although the majority of the inter-city trips in these cities are made through walking, basic landscape elements to support this mode of transport have been lacking. This paper attempts to evaluate the potentiality of landscape elements (pavements and shade trees) as key determinants in promoting pedestrian movement in urban centres. Two streets; One Way (with paved surface and pedestrian status) and Tembo (also paved but used by both pedestrians and vehicles) in Dodoma were picked for comparison purpose. Similarly, two sides of Arusha Road, one with and the other without shade trees were selected for comparison. These streets were compared in terms of pedestrian volume based on results from pedestrian counts. The key method that was used to capture empirical evidence was pedestrian count along the lanes of the roads. Pedestrian count was carried out from 08.00 in the morning to 20.00 hours in the night. This was complemented with literature review, field observation, photographing and interview with road users. Findings show that roads which had adequate provisions of landscape elements (pavements or shade trees) accommodated twice as much as the number of pedestrians along roads with limited or no landscape elements. It is recommended that provision of more walking space, provision of continuous, paved and shaded walkways should be encouraged as a strategy of promoting walkability and livability in these cities.

Keywords: Landscape elements; pedestrian movement; Dodoma; Tanzania.

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1. Introduction

Urban areas in cities of the developing world are rapidly urbanizing spatially, demographically and economically. This is resulting into increased pedestrian movement from one place to another. This calls for transport planning to provide infrastructure to facilitate this nature of movement [1]. In the past, more attention was placed on travel modes such as public and private transport at the expense of others including walking [2]. Increasingly, authorities have been switching from motorized to other modes of transport in attempt to reduce traffic congestion in urban areas. Yet solution to reduce congestion has never been achieved. It is argued that walking as a mode of transport is absolutely essential and unavoidable in attaining sustainability from mobility point of view.

All human beings are pedestrians. A pedestrian is anyone on foot [3]. This includes all those aided by equipment like wheelchairs, roller bladder and motorized scooter. A person is considered a pedestrian while jogging, running, hiking or laying down by road side. Every journey starts and ends with walking. Also walking in other case may be used to connect to another mode of transport like bus or train. Walking is the common and basic mode of transport. Walking distances are largely determined by landscape design, climatic condition, topography and land use pattern [4]. Harsh climatic conditions from rainy or sunny seasons may limit people from walking. Many people prefer to walk long distance for leisure but short distance when in hurry like from bus stops to their offices. The level of household incomes determines transport modes to be used by different groups [5]. High and middle income classes tend to use motorized transport as compared to people in the low income group who are highly dependent on walking as a mode transport. However, with the increased traffic congestion in urban areas, the middle and high class people also are compelled to walk to their destinations because walking is less time consuming and relatively cheap.

Increased demand for walking as a mode of transport requires sustainable planning interventions. Travel choices are highly influenced by urban planning because the city spatial structure is somehow influenced by planning [2]. Walking as a mode of transport assist in solving traffic congestions where by short distance within the city can be done by walking. Walking contributes to reducing air pollution, fuel consumption and effects on environment [6]. Walking is the fastest means of moving around and enables the walker to access areas which cannot be accessed by motor vehicles [7]. Unfortunately, this mode of transport is not prioritized in transport planning especially in developing countries irrespective of the fact that it requires inexpensive measures to invest in as compared to other modes of transport [2].

Landscape elements which consist of soft and hard elements include plant materials such as trees, flowers, shrubs, grasses, pavement, street furniture and fixtures. While trees and hedges promote walking by providing shade and directing movement, a pedestrian network can be enhanced by providing a set of continuous public spaces designed to join the main pedestrian generators (*i.e.* facilities, retail areas, offices, transit stations, etc) throughout the entire city, connecting as many streets and people's home as possible. Pedestrians should be provided not only with pedestrian trees, hedges and islands, but with a well-connected network of pathways and well-designed pavement areas so as to promote pedestrian movement.

There are numerous advantages associated with promoting walking within current societies, which surround the notion of “livable cities”. These include benefits to the environment, society and health. According to the International Charter for Walking cited in reference [8], the presence of pedestrians on streets provides a key indicator of a healthy, efficient, socially inclusive and sustainable communities.

Within developed societies, people are facing a series of inter-related problems associated with poor health emanating from use of ineffective transport systems. Increasingly, there has emerged pressure to address these issues [8]. Knowledge of the current situation has fuelled the need for a change in walking culture within these societies. Worldwide, approximately half a million deaths occur each year from motor vehicle accidents and over-reliance on automobile, coupled with the lack of a pedestrian-friendly environment. While promotion of walking requires concerted action in a number of domains including policy, infrastructure, education and promotion, the incentives that can play a role in increasing pedestrian activity needs to be explored, understood and highlighted. Asian cities are generally faced by insufficient pedestrian signage, insufficient and un-maintained sidewalks, poor road design, poor implementation of traffic rules and regulation and personal insecurity [9]. In Tanzania, the situation is similar to many Sub-Saharan and these Asian cities. There is limited consideration and provision of landscape elements in neighborhoods that can promote pedestrian movement and guarantee safety. Citing reference [3], the author in reference [10] noted that more than 270,000 pedestrians lose their lives every year as victims of road accidents.

Despite the fact that landscape elements such as shade trees, paved walkways and hedges are crucial in promoting pedestrian movement in most urban areas these elements are still lacking. Even in places where pedestrian walkways have been provided and paved, supporting landscape elements both hard and soft have not been considered in term of design and implementation. This has resulted into pedestrian over spilling into vehicular routes that has culminated into traffic accident, conflict and people shying away from walking. An important question that is being raised here is: to what extent landscape elements have contributed towards attracting pedestrians in Dodoma City?

2. Conceptual Framework

A conceptual debate on pedestrianism is not new. Way back in 1933 a movement called “New Pedestrianism” was founded by Michael E. Arth, the artist, writer, and urban designer who introduced numerous design techniques to dominate pedestrianism in urban development [11]. This movement was an effort to solve different types of social, health care, energy, economical, aesthetic, and environmental issues with a special emphasis on reducing automobile role in urban space. This movement became more prominent in the 1970s when urban theorists and designers further elaborated on the need to change transportation methods and to consider pedestrianism as one of the main components in urban planning [12-13]. More impetus emerged in the 1980s under the *New Urbanism Movement* that was propounded by the American Architects and Planners; Andres Duany, Elizabeth Plater-Zyberk, Peter Calthorpe, Daniel Solomon, Stefanos Polyzoides, and Elizabeth Moule. New Urbanism puts emphasis on (neo) traditional neighbourhood design, transit-oriented development, and *new pedestrianism*.

Under this paradigm, two main ideas emerge namely; *New Urbanism* that is viewed as the re-invention of the old urbanism that is commonly seen before the advent of the automobile age and; the *New Pedestrianism* that is precipitated by pedestrian-oriented movement with less use of automobiles.

Making reference to new urbanism in the context of American cities in [11], the authors report that citizens have been calling for a city that is more livable, more user-friendly and more tranquil, a place of calm cohabitation with the car and public transport. People have been advocating “walkable communities” with “streetblogs” that are organizing a return to cities on a human scale. The idea is to make use of the best parts of the older approach to urbanism in the interests of sustainable development and social mix: short distances conducive to walking or cycling, housing density sufficient for viable commercial activities, plus social and spatial mix for the residents and for activities. The very notion of “walkability” was invented for the measurement of a “*pedestrian mobility score*” for places and housing and the evaluation of programmes aimed at bringing back the habit of walking. In the United States, a “*walkscore*” is a measure of the availability of local shops and amenities, traffic speed, the configuration of the street network, including the pedestrian pavements. The authors in [11] further report that networks for pedestrians and amenities must be connected, convivial, conspicuous, comfortable and convenient.

Other authors in [14] view *pedestrianism* as a move towards reducing the car traffic as much as possible and giving more priority to walking. In fact the main goal in this theory is the cooperation between the pedestrians and the drivers, giving priority to pedestrians’ safety against the moving vehicles. *Pedestrianism* is limiting the vehicles access to a street or a neighborhood for exclusive use of pedestrians. The motive behind *pedestrianism* include; reducing the environmental and noise pollution, reducing use of fossil and consequently helping to achieve sustainable development. Other motives behind *pedestrianism* include the opportunity to leave greater area for planting trees and flowers in public spaces and when combined with improved public interactions, social life, and security, will encourage people to show up in public places, which in turn will improve stores’ sales and flourish economical conditions in cities.

In addition, the authors in reference [14] argue that the needs and characteristics of the pedestrians can be classified into two categories namely; the physical that deals with the body and quantitative aspects of the human, and psychological that focuses on the qualitative and conceptual aspects of the human. Making reference to [14], the authors articulate the psychological needs of pedestrians in five items as follow: *continuity*; where pedestrians are psychologically inclined towards the continuous networks that connect any two points without interruption, *shortness*; where pedestrians are more sensitive to distance compared to drivers and they generally pick the shortest route, *beauty and attractiveness*; based on the fact that if the walkway is attractive, more people will use it. *Security and Safety*; referring to vulnerable during quiet times and; *accessibility and comfort*; referring to the condition that an accessible and comfortable route usually encourages walking. In reference [14], the authors further argue that for an acceptable urban walkway, the organizing elements (fundamental), identity improving elements, and persisting elements have significant influence on its level of utility. Consistent with these observations the following questions may be raised: to what extent design for continuous pedestrian movement has been taken into account in Dodoma Municipality? How convenience, safety and security issues have been perceived by pedestrians in Dodoma?

The level of street use has been also linked to debates cited in reference [12] whereby the author postulated that the number of outdoor activities shall depend on quality of outdoor spaces and entertainment activities form a considerable amount of social activities. According to reference [12] quality of physical environment in public space will affect the occurrence of those activities. These interesting activities diminish when outdoor situations are weak and prosper when the outdoor conditions are improved (Figure 1).







Type of Activity	High quality of physical environment	Low quality of physical environment
Necessary activities		
Optional activities		
Social activities		

Figure 1: Relationship between Outdoor Activities and Quality of Physical Environment [12]

The author in reference [12] further argued that the importance of improving the daily activities becomes more evident when we consider walkways or areas with free transportation. Making reference to [15] further described how the three activities are related to each other. Necessary activities and optional activities are prerequisites for social activities. Social activities happen spontaneously because people are in the same place, meet, and make contacts. Hence, better condition for necessary and optional activities to take place must be presented through design and policy intervention to provide a lot of opportunities for social exchange in public spaces. In addition, the author in reference [15] pointed out on the opportunity for walking as the starting point for all these activities. Activities taking place in public spaces like walking, short stops, longer stays, window shopping, conversation and meetings, exercise, dancing, street trading, children’s play, and street entertainment are highly affected by walking opportunities given to people. Therefore, according to reference [12], it is true to say that the best pedestrian street, is one that offers greater opportunities for optional and social activities.

Based on his extensive works on public spaces in the Scandinavian countries he observed that by enhancing the physical conditions, pedestrians volumes doubled with elongated time spent on these spaces. Pertinent questions worth raising in this paper are: to what extent physical conditions (elements supporting walking) have contributed towards people choosing certain streets to walk through in Dodoma? How urban design has facilitated or hindered pedestrian movement in Dodoma? What is the degree of utilization when the two situations are compared? What can be done so as to improve walkability in other streets in Dodoma?

3. Methods

This study was conducted in Dodoma, the new National Capital of Tanzania. Apart from the rapid population growth, the selection of Dodoma was also motivated by its capital administrative status with designs that were developed to support pedestrian movement. Since the study focus was about applicability of landscape elements in promoting pedestrian movement, the selection of study streets was based on areas with or without landscape elements. Three streets were selected for detailed studies. Two from the inner city (One Way) that was paved and designed as pedestrian commercial street and an adjacent (Tembo Street) that was being used for both pedestrians and vehicles. The third was Arusha Road that had two distinct features; one side that was provided with shade trees and the other side that was less covered with trees (Figure 2). The main methods that were employed to collect evidence included counting of pedestrians who were walking along the streets. The count was continuous starting from 08.00 to 20.00 hours. The counting was done at the end points of the streets with the understanding that not all pedestrians who went through the entrance would come to the other end for both streets. The numbers of pedestrians who were using the identified streets should therefore be considered as proximal as exact figures. The counting was recorded in pedestrian count form. Pedestrian counting was complemented with physical observations that were facilitated by photograph taking. In addition to these methods, a total of 200 pedestrians were interviewed (100 pedestrians in the city centre and 100 along the Dodoma- Arusha Road) to gather their views on the condition of the roads and issues of safety. The interview was conducted to pedestrian who were willing to be interviewed after stopping and asking them. These methods were further complemented with official interviews namely the physical planner and an environment engineer from the Capital Development Authority.

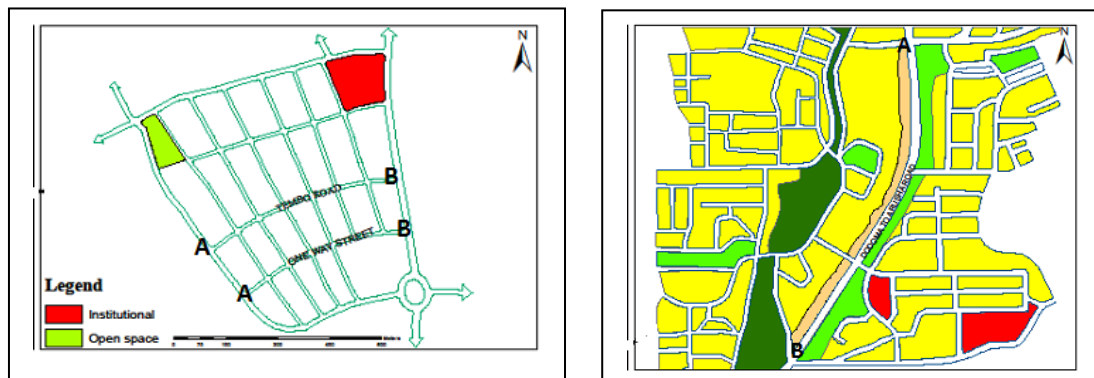


Figure 2: Location of One Way, Tembo and Arusha Roads in Dodoma



Photo 1: One Way Street Accommodate many Petty Trading Activities



Photo 2: Tembo Street Paved for both Pedestrians and Vehicles

4. Results

4.1 Planning Concept for Dodoma Residential Communities

The planning for residential communities for Dodoma National Capital was based on modules of communities that were circular in shape (Figure 3). The idea was to achieve population thresholds that could sustain facilities that were located at the community centre. Apart from the provision for curvilinear road network pattern, the concept provides for continuous open space systems providing a link of the four neighbourhoods that constitute a community. This planning concept was replicated for overall city of Dodoma. Although actual implementation has somehow deviated in some areas by invasion of informal developments, the overall structure has remained as indicated in this plan (Figure 4). Even in the urbanized parts of the city, attempts to provide pedestrian links were made. These included the one way street, the National Capital Centre Link, pedestrian free walkways along Arusha Road, Chamwino, Chinangali, Nkuhungu, Mlimwa West and East, Area D, E, F and Medeli communities.

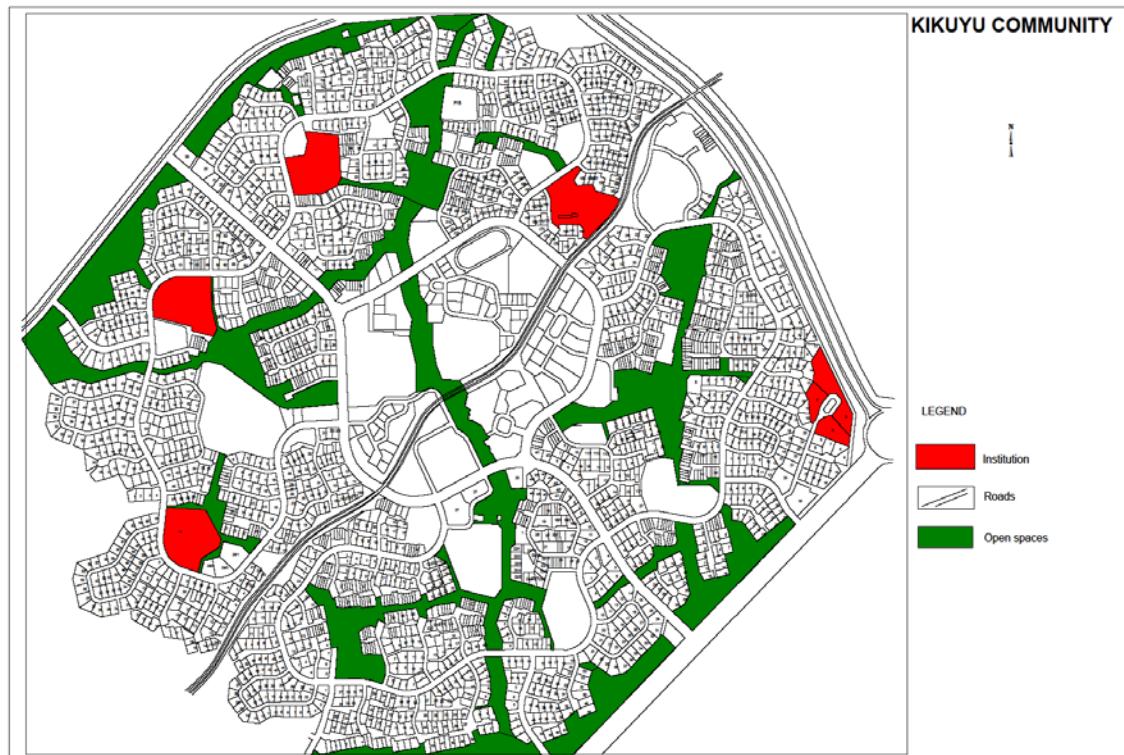


Figure 3: Planning Concept for Residential Communities in Dodoma National Capital

4.2 Pedestrian Flow along One Way and Tembo Streets (At points A)

Empirical evidence indicated that One Way hosted more pedestrian flow (almost twice) as much as that of Tembo Road for the whole counting period that lasted between 08 to 20 hours (Figure 5). This difference is attributed to the better physical condition of One Way that was designated as a pedestrian street but also provided with paved surface for pedestrians. Even though both Tembo and One Way were predominantly

commercial streets in terms of use, more business units were found along One Way as compared to Tembo.

The peak period seems to be 09-10 hours in the morning with a total of 800 and 350 and 17-18 hours in the evening for One Way and Tembo respectively. While 09-10 hours is period where people flock to the city for such activities as business, the evening period is largely characterized by employees who go back to their home places.



Figure 4: Proposed land use Plan for Dodoma (1976-1996)

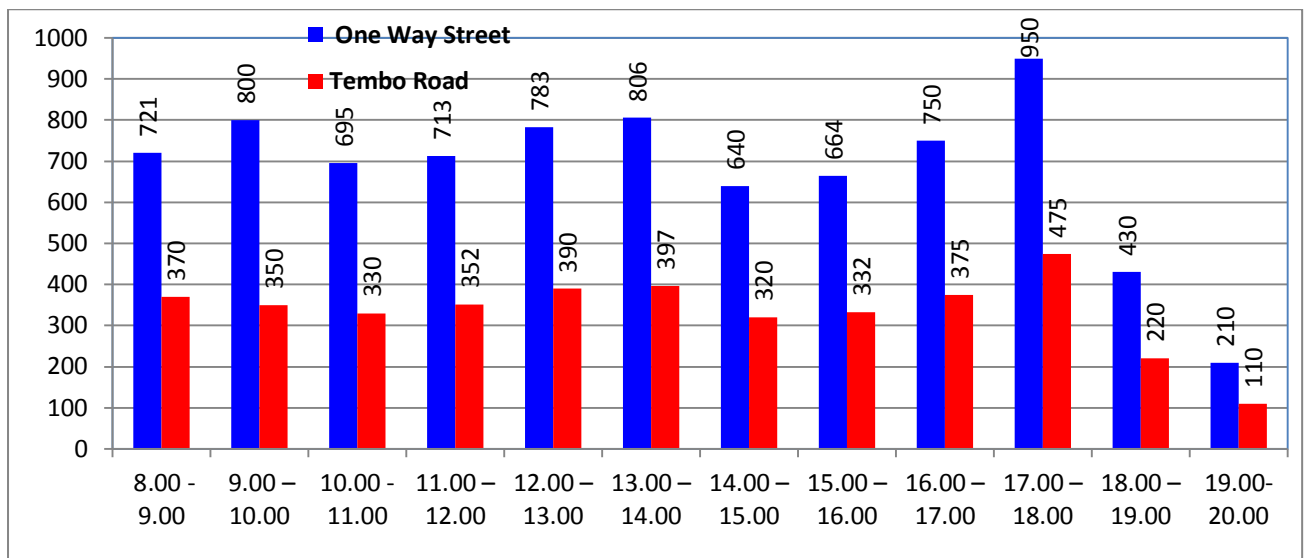


Figure 5: Pedestrian Flow for One way and Tembo Streets at Point A

4.3 Pedestrian Flow along One Way and Tembo Streets (at points B)

Similar pattern of pedestrian volumes were recorded at point B for One Way and Tembo Roads. The morning peak period was observed to be 09.00 to 10.00 hours with 700 and 400 pedestrians respectively. A similar pattern was recorded for the afternoon period between 13.00 and 14.00 hours for One Way and Tembo Streets respectively. More pedestrians were recorded in the evening peak period accounting for 959 for One Way and 470 for Tembo Street between 17.00 and 18.00 hours (Figure 6). The restriction of vehicular movement along One Way was also contributed by peoples’ feeling of safety against accidents. According to the interview with 50 pedestrians, 45 reported that One Way was located in the area with the mixed uses and therefore it was attractive to walk along. On the issue of safety, 37 pedestrian reported to feel safe while walking along One Way as compared to other streets because there were no threat of traffic accidents. On the contrary, the opposite prevailed for Tembo Street where the majority (37) respondents felt unsafe walking along the street (Table 1) because the street also accommodated motor vehicles.

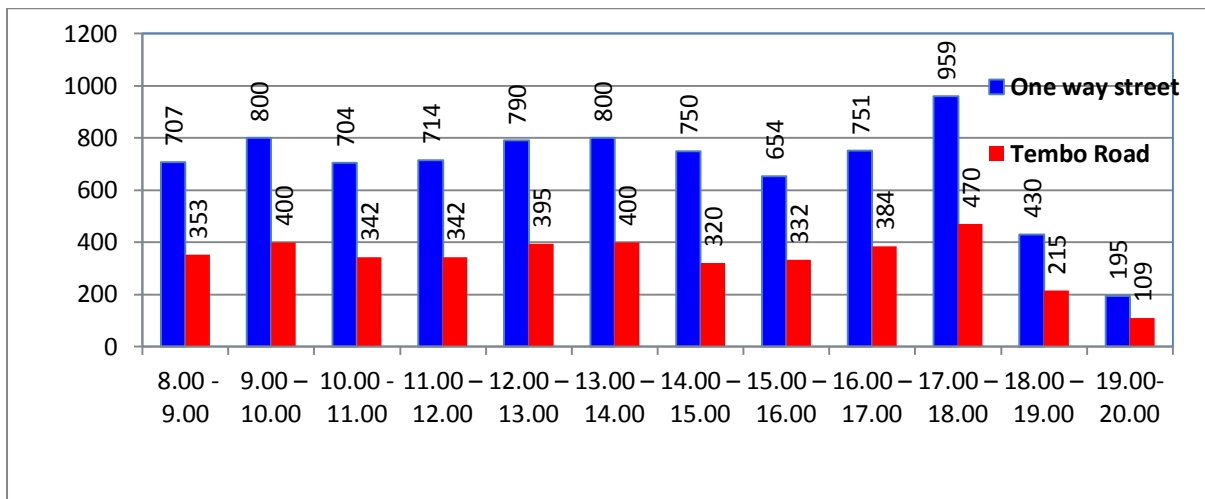


Figure 6: Pedestrian Flow for One Way and Tembo Streets at Point B

Table 1: Degree of Safety as Expressed by Pedestrians

Degree of safety	One way		Tembo Street	
	Number	Percent	Number	Percent
Safe	37	74	5	10
Fair	10	20	8	16
Unsafe	3	6	37	74
TOTAL	50	100	50	100

4.4 Pedestrian Flow Density

Pedestrian flow density refers to the number of pedestrian crossing a section of the road in a specified period of

time. Although this study focuses on improved landscape to promote pedestrians movement along the streets, it was also noticed that too many pedestrians and activities in particular street can also bring negative impression for the street. While busy streets bring vitality in cities, in fact some pedestrians feel insecure because the street is too busy. This implies that there must be an optimum density in utilizing street spaces either for walking or other outdoor activities. For instance, while the street traders and groups of people sitting and talking in the sidewalks can stimulate social interactions on the street, in fact some pedestrians feel that they are obstructed from walking activities. This means that the presence of pedestrians on the street can only bring positive effect when the density is appropriate. Similar notion is applied for other activities as well. When the street is overcrowded, comfortability of walking can be reduced. Some studies have indicated optimal densities for walking. For example the proposed pedestrian flow in New York indicates 23 pedestrians per minute per metre for a side walk of three feet [16]. In Copenhagen, the proposed density of 13 pedestrians per minute per metre for a three feet side walk has been noted; and 25 to 30 pedestrians per minute per square metre [17]. The approximate length and width of One Way and Tembo Street were measured to be approximately 400 and 11.5 metres respectively. This gives a total surface area for each road to be 4600 square metres. When pedestrian volumes are translated into space density per road (for both points A and B directional movements), it was revealed that a flow density of 26 persons per minute for One Way for morning peak period for the whole stretch of 400 metres and 31 persons per minute for the evening peak period. For Tembo Road, the morning peak period density was 13 per minute while the evening peak was 16 persons per minute. If these figures are divided over the total length of the roads/streets, the flow density becomes too small as compared to those noted for New York and Copenhagen. This is apparently because of the low population thresholds in Dodoma compared to larger metropolis.

4.5 Pedestrian Flow along Arusha Road

Pedestrian volume count was also administered along Arusha Road that had two sides with contrasting landscape elements. While one of the sides was well provided with shade trees, the other side had limited number of trees. This provided a limitation for pedestrian use of the side with limited number of shade trees (Photos 3 and 4).



Photo 3: Arusha Road Side Walks with Shade Trees



Photo 4: Arusha Road Side with no Trees

Pedestrian volume was counted at both points (A and B) along both sides. A similar pattern in terms of volume emerged like the one for One Way and Tembo Roads even though the total volume was slightly on the lower side. The shaded side had more than twice the volume observed on the un-shaded sides and with two notable peak periods in the morning and evening. While the morning peak period (08-09 hours) for point A for the shaded side accounted for 353 pedestrians, the un-shaded side registered 172 pedestrians. At point B, the morning peak period registered a total of 348 and 185 pedestrians for the shaded and non-shaded sides. The evening peak periods (17.00-18.00 hours) were relatively lower compared to the morning periods. At Point A the total pedestrian volume was recorded to be 360 and 190 for the sides with shade and without shade trees respectively (Figure 7). At point B the total volumes accounted for 360 and 198 for the sides with shade and without shade trees respectively (Figure 8). These volumes are lower compared to those noted for One Way and Tembo Roads apparently because the latter are located in the central business District of Dodoma with commercial functions that attract more pedestrian movement almost the whole period of the day. An important observation is however, the contrast between shaded and un-shaded pedestrian routes which play as decisive factors for pedestrian flow. The results correspond well with responses from pedestrians as summarized in Table 2.

Table 2: Reasons for More Pedestrian Movement along Arusha Road

Respondent	Reason for attracting movement
Pedestrians	<ul style="list-style-type: none"> • The area is safe no any motorized means of transport allowed since police make sure only pedestrian use the walkway • The area have shading trees which obstruct the sun to heat pedestrian directly • The area is comfortable to walk around • The wideness of the walkway • The area characterized by hedges which direct pedestrian movement.

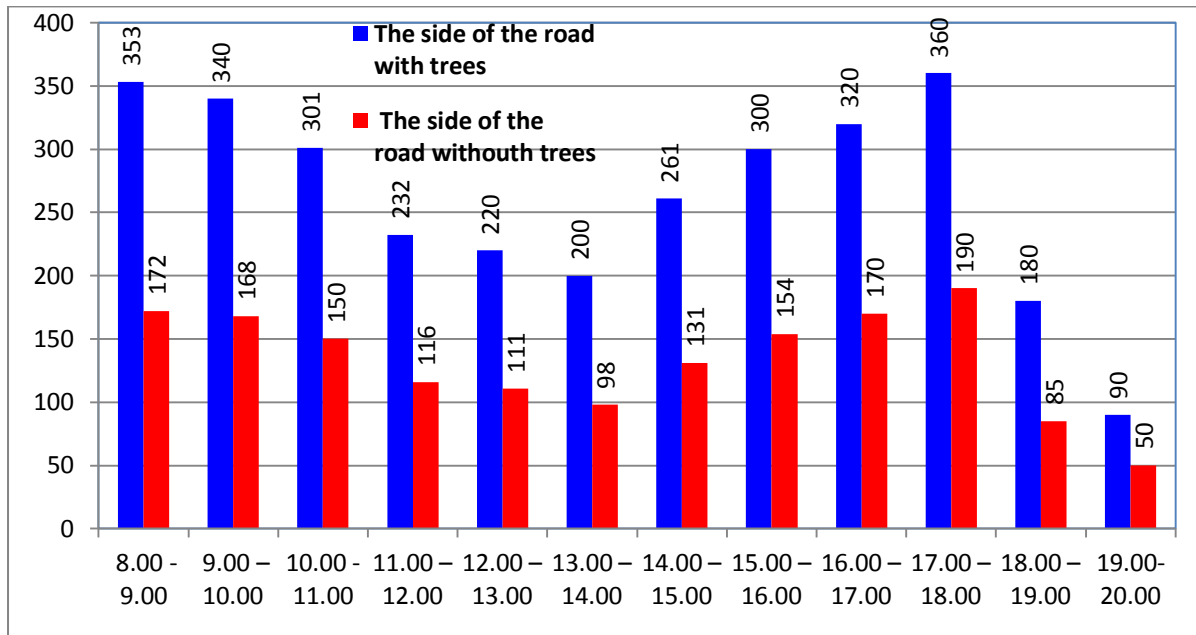


Figure 7: Pedestrian Flow along Arusha Road at Point A

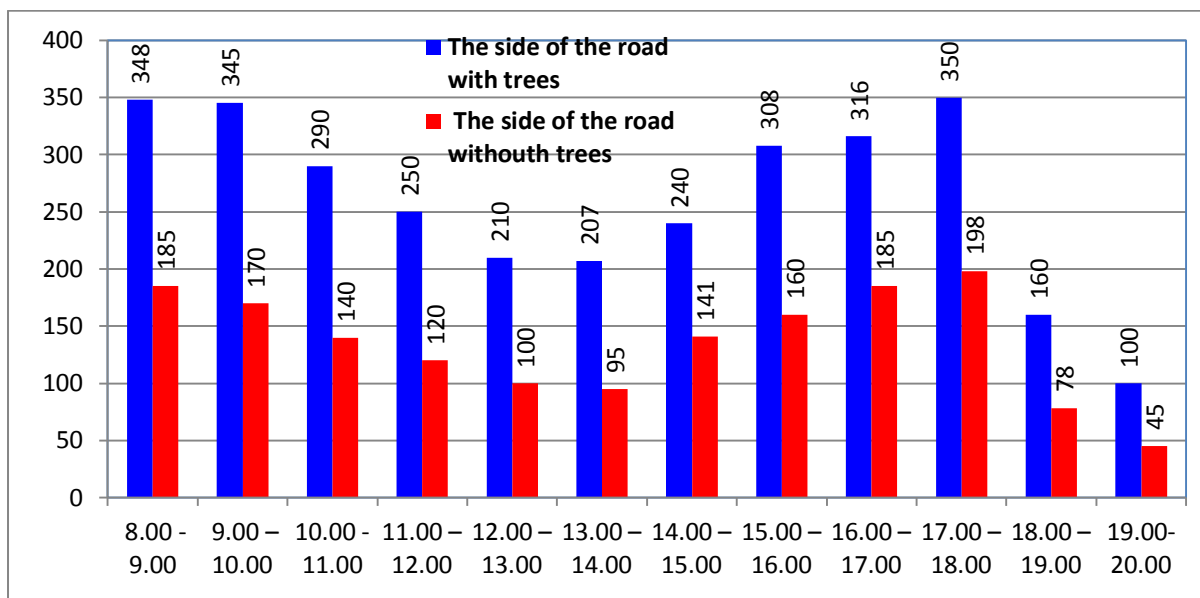


Figure 8: Pedestrian Flow along Arusha Road at Point B

5. Discussion

Although the intention of this paper was not to explore the various types of outdoor activities, the central observation that becomes explicit is the fact that the quality of landscape elements determines the level of usability of such spaces. The observations revealed above augurs very well with prepositions put forward by the author in reference [12]; that the quality of the physical environment plays a key role in determining the level of optional, necessary and social activities. This has been empirically shown by the provision of paved surface (hard

landscape elements) for One Way Road that registered more pedestrian movement compared to Tembo Road.

It has been also revealed along Arusha Road where the roadside with shaded trees (soft landscape elements) registered more pedestrians than the un-shaded side of the same street. Although pedestrianism as a design paradigm is yet to reach the high levels with only few neighbourhoods provided with pedestrian streets in Dodoma National Capital, the design concept seems to capture the key ideas propounded in this concept. One can speculate that if the design concept that has been proposed in the Dodoma Master Plan will be adhered to and pursued, there is a possibility of realizing *pedestrianism* and “*walkable communities*” in Dodoma as suggested by the theory of new urbanism and pedestrianism.

From policy perspective, section 5.1.2.5 of the Tanzania National Transport Policy (2003) emphasis that security, safety, and comfortability of pedestrian and bicyclist must be ensured in the design of residential areas by providing for dedicated pedestrian and cyclist lane. It should also consider planting of flora including trees and flowers along urban roads to provide for both attractive road scenery and shading to pedestrian from overhead sun [18]. Section 5.3.2.5 further provides for the need to promote non-motorized transport and public transport and discourage private transport especially in the Central Business District (CBD) at peak hours to decongest the city centre. Complementing this policy, the second schedule of section 16(4) of the Urban Planning Act (2007) puts emphasis on providing special spaces for pedestrian and facilitates segregation of vehicles from pedestrians. These provisions have been captured well in the Dodoma Master Plans of 1976, 1988 and 2010 by putting guidelines to be followed during the design of new areas and redevelopment of inner city neighborhoods.

In another study that was done in the City of Dar es Salaam focusing on *pedestrianization* as a tool to promote business and social interaction, responses from people indicated that the majority of them (92 percent) were feeling safer along the street because of the pedestrian character of the Street [19]. One can therefore argue that apart from improving the vitality, walkability and livability in cities, *pedestrianization* also amounts to increased feeling of safety for the road users. It should however be remembered that pedestrian movement will increase once the conditions that call for people to walk are improved.

6. Conclusion and Recommendations

This paper has empirically shown that provision of landscape elements both soft and hard promotes pedestrian movement. This observation is supported by the fact that the presence of landscape elements (paved surface and provision of shade trees) culminated into twice the volume of pedestrian’s movement that was noted in other streets without these elements. Responses from pedestrians also revealed that by improving the landscape qualities along these streets, safety and security was also guaranteed. Landscape elements and pedestrian movement are also spatially related. Through pedestrian volume count it was revealed that pedestrians prefer to walk in areas where landscape elements have been provided. This was more important especially during morning peak periods when the majority of the people were moving towards work places and evening peak periods when they were moving back home. In terms of flow density, the estimated figures seem to be relatively low. However, this low density is likely to increase due to rapid urbanization that is taking in Dodoma will

culminate into crowding if measures are not put in place to distribute pedestrian traffic to other streets. Dodoma municipality being located in the semi-arid and hot climatic zone of Tanzania, outdoor walking would only be conducive if landscape elements such as shade trees are provided.

As a way forward towards improved landscape elements in Dodoma and other cities in Tanzania it is recommended that guidelines for pedestrian design should be developed and implemented as part of the city-specific master plans and detailed planning schemes. For the case of Dodoma where continuous open space systems have been designed, they should be protected from encroachment by other land uses. Along walkways of continuous open space systems, hard and soft landscape elements should be provided with a view to promoting pedestrian movement. Tree nursery should be established so as to have reliable supply of seedlings for shading trees and hedges for the city.

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