

Analysis of Heritage Footprint in Towns along the Kenya Railway

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Abstract

The origins of urban development and the colonial railroad in Kenya's hinterland are inseparable. As a consequence of their history, the urban areas encompass important heritage areas that can be methodologically determined, quantified and conserved for posterity. Despite its historic significance, townscape heritage around railway stations is at threat of loss since it remains unidentified, unmapped and without a common methodological conservation approach. This paper aims to identify and map out townscape heritage along the Kenya Railway. A mixed methods approach and a cross-sectional research design were adopted. Three towns; Limuru, Naivasha and Molo with larger precinct areas were selected through homogenous sampling. A precinct around the railway station was delimited for each of the towns and data was collected through observation guides and interview schedules. A spatial analysis was done for the townscapes to provide a visual illustration of the footprints of the different towns. A combined inventory of 28 townscape heritage areas; nine for Limuru, nine for Naivasha and ten for Molo were identified by a survey. The values cited directly during the identification of significant places of heritage in the order of importance are economic, age, historic, function and identity. Findings revealed a combined heritage inventory of 28; nine in Limuru, nine in Naivasha and ten in Molo, with a heritage footprint of 10.3%, 8.4% and 19.4% respectively. Buildings are the most predominant townscape heritage. It was concluded that there is indeed heritage that is considered significant by residents. Recommendations include: mainstreaming heritage surveys and conservation planning as well as documenting townscape heritage through inventories.

Keywords

Conservation, Heritage Footprint, Heritage Values, Historic, Railway, Townscape

1. Introduction

The historic meter gauge Kenya Railway line was developed over 120 years ago between 1896 and 1901. Having played a central role in the establishment of numerous towns along it, its impact is still evident through the urban fabric. The railway line facilitated the colonial conquest of the hinterland by Britain and made it possible to do business across great distances, creating the conditions for towns to grow (Eliot, 1905). There was also a major contribution by Indians who migrated to East Africa as imported labour from Punjab to work on the railway; those who settled were predominantly involved in trade and craftsmanship (Gadgil, 2019; Beri, 2014). They set up near railway stations and along the railway line helping grow market centres and towns to create a historic backdrop. More than a century later, the historic backdrop in the form of the townscape heritage is facing a constant threat of loss from various challenges ranging from environmental, social, and technological, to economic. Townscape heritage in this context includes immovable heritage, such as historic buildings, monuments, open spaces and landmarks that make up the townscape scene.

The series of towns established along the Kenya Railway line grew and expanded, to colonise the linear territory of the railway. The towns exhibit peculiar urban fabric which is important to the history of Kenya yet it is under threat of loss. The townscape heritage around the railway stations today remains unidentified and without conservation action in the face of change. The practical process of identifying urban heritage and identifying its significance is not established.

In other instances, the fabric in the railway precincts has long been ignored. Current development is detached from the old in scale, form, and material of the British colonial and Indian influence. The loss of the original townscape's distinctive atmosphere is taking place in various ways; changes in built environment densities; variations of building scale; and destruction and demolition of the townscape heritage. Owing to the changes in the original townscape character, there is a loss of *genius loci*, orientation, and identity.

The towns exhibit heritage that can be traced back to the period of their establishment with railway stations as the nuclei of their spatial growth. Even as the different towns grow, the townscape heritage has always given identity since they were the origins of growth. The heritage areas benefit towns along the railway line in that they are places with a rich legacy. Economically, heritage in the towns has the potential of being magnets for tourism based on the historic background that it represents and the association with key historic events. In addition, the reuse of older buildings, as opposed to the construction of new structures, offers savings.

Sustainable Development Goal (SDG) No. 11. on making cities and human settlements inclusive, safe, resilient, and sustainable advocates for strengthening efforts to protect and safeguard the world's cultural and natural heritage (United Nations, 2015). In Kenya, the Physical and Land Use Planning Act under section 47 also recognises the preservation of buildings of Special Architectural values or historic interest together with the National Museums and Heritage Act (Republic of Kenya, 2012).

Previous studies have not exclusively addressed the need to account for heritage in urban areas in Kenya. Attempts at the preservation of this heritage stop at the documentation of the old railway stations while studies focused on the conservation of heritage in urban areas are limited to the coastal cities and towns, cultural sites, and the capital city of Nairobi. As pointed out by Audefroy (2022) in the ICOMOS Heritage at Risk report of 2020, approximately 65% of the world's buildings with artistic and/or cultural interest currently present a lack of maintenance. Additionally, they are in a poor state of conservation, which leads to a constant loss of cultural, artistic, and economic value (Otero, 2022). Concerns have been expressed, that attempts to preserve historic cities and cultural heritage are very few compared to the historic richness of the world (Hmood, 2019). It, therefore, calls for the upscaling of urban conservation to give attention to much more heritage in towns and cities. It is also a response to the gap in the planning approach in Kenya where many heritage areas are without conservation action since there is no laid-out method for such an undertaking.

This study focused on the identification and establishment of a townscape heritage footprint along the Kenya railway to enable targeted conservation. The idea of Heritage footprint (HF) as an accounting method is adopted. It appropriates the ecological footprint theory in reverse to account for the coverage space of heritage in an urban environment. The two research questions addressed in this paper are: what constitutes the heritage in towns along the Kenya Railway? and what is the heritage footprint of towns along the Kenya Railway?

1.1. Urban Heritage and Historic Planning

As early as 170 years ago, Ruskin (1849) argued, that without architecture, we cannot remember. Today, more than ever, towns and their heritage are valuable not just for their architectural or historic value, but also because they are tangible and visible examples of a people's social history and have great educational value.

While there is a unanimous consensus internationally on the need to conserve monuments and other important tangible heritage assets for future generations, less relevant heritage assets such as historic urban patterns and features are not adequately acknowledged and protected (Trillo et al., 2020). This is supported by the Historic Urban Landscape (HUL) recommendation which addresses the need to better integrate and frame urban heritage conservation strategies within the larger goals of overall sustainable development, to support public and private actions aimed at preserving and enhancing the quality of the human environment (UNESCO, 2011). The recommendation suggests a landscape approach for identifying, assessing, conserving, and managing historic areas within their urban contexts, by considering the interrelationships of their physical forms, spatial organization and connection, natural features and settings, and social, cultural, and economic values. Further support is provided through the contemporary theory of conservation that calls for the consideration of various heritage values and sensible actions towards conservation (Muñoz-Viñas, 2012). Moreover, heritage conservation promotes sustainable development by conserving the embodied energy in the existing buildings (Sodangi et al., 2014).

Tangible heritage can be classified into movable and immovable heritage (Wan Isa et al., 2018). The immovable heritage such as historic buildings, monuments, open spaces and landmarks make up the townscape perspective. The intangible cultural heritage related to the immovable heritage within a town as held by people, provides meaning and therefore the heritage value. Heritage values also relate to the concepts of authenticity and integrity. The credibility and truthfulness of heritage information sources determine authenticity. Heritage may be considered to meet the conditions of authenticity if their cultural values are truthfully and credibly expressed through a variety of attributes that include form; materials; function; setting; and other internal and external factors (UNESCO, 2020). Urban heritage reflects the local community's identity, memories, and authenticity (Shehata, 2022). On the other hand, integrity measures the wholeness and intactness of the heritage and its attributes. According to van Saaze (2013), a central principle of conservation theory is that all conservation activities should be faithful to the "integrity" of the heritage object.

A significant challenge to urban heritage in contemporary society is the economic desire for urban growth and urban areas' densification (Phetsuriya and Heath, 2021). Railway towns in their different formats must be understood as a part of the internationalisation of the economy and railway business that developed from the second half of the 19th century onwards (Cuéllar, 2018). As pointed out by Muhoro, Munala, and Njuguna (2016) in Kenya, most listed buildings are privately owned and well cared for, bearing in mind the often-disproportionate costs of repair and maintenance. However, there are instances where owners are not able, or decline, to repair listed properties with the consequence that the buildings' condition deteriorates exposing the buildings' notable qualities to the risk of being lost (Muhoro, Munala, & Njuguna, 2016). It is the position of this study, therefore, that in the very process of social and economic change, is important to ensure continuity with the past, thus preserving the national heritage and presenting future generations with the townscape heritage through its conservation.

1.2. Establishment of Towns along the Railway Line

The development of the first railway system in Kenya from Mombasa to Kisumu and beyond is significant to the existence and development of Kenya as a country since when its construction commenced in 1896. The Railway system was instrumental in exploring and developing the hinterlands of Kenya and further into Uganda from the Indian Ocean by the British colonisers. The decrease in internal trade costs had a strong and unexpected effect on the settlement of British farmers, who established cities and towns from where they could manage their coffee farms and specialize in urban production activities (Jedwab, Kerby, and Moradi, 2013).

A study on how colonial railroads defined Africa's economic geography showed that the railway had a strong impact on European settlement, establishing towns from where the European settlers managed their commercial farms and specialised in urban activities (Jedwab, Kerby, and Moradi, 2017). The settlement happened in high-potential areas for farming along the railway. This gave rise to numerous new urban centres whose main functions included administrative centres, caravan towns, and mission stations. Many of these urban areas have continued to exist and function as small towns even in the face of the decline of the railway system. The landscape that the railway passes through from Nairobi to Kisumu mainly consists of the Kikuyu escarpment, the rift valley, and the lake basin which are agriculturally fertile zones.

1.3. The Idea of Heritage Footprint

This study borrows directly from the foundation of the theory of Ecological Footprint (EF) which is the area of land that is needed to provide for a population to represent the area within an urban area that is occupied by townscape heritage. For this paper, the adapted approach to be referred to as "Heritage Footprint" aims to establish densities of the townscape heritage in the urban space. EF is aimed at accounting for land that is needed to sustain the production of energy and material needed to support a population and absorb all waste produced. On the other hand, the proposed Heritage Footprint (HF) in this study can be thought of as an accounting index for the area of land occupied by townscape heritage within an urban precinct. The idea of heritage footprint therefore works in reverse of the ecological footprint concept in that the ideal state for the former is to have more area under heritage while the latter ideal is to have a reduced supporting area of land.

Measurements take into account the various types of heritage that include, buildings, monuments, streets, and sites. The information is then be represented graphically and spatially taking the form of a figure-ground map to communicate the distribution, densities, types, and relationships. Productive land is equated to the area of land occupied by townscape heritage of cultural significance within the urban space. Heritage footprint is expressed in the form of a ratio of the area occupied by the identified heritage to the total area of land of the delimited precinct. For this study, the heritage footprint involved the following stages of calculations:

1) Delimit the precinct of interest within a developed area and identify the heritage objects.

2) Calculate the total area (ta) in hectares of the delimited precinct.

3) Calculate areas of the identified heritage objects (ha) singularly "i" within the delimited precinct that includes buildings, monuments, streets, and sites to in-

clude associated spaces.

4) Compute the total heritage footprint of a precinct ("hf") *i.e.*, the heritage footprint by summing all heritage areas (ha_i) by all identified heritage areas (n) in the precinct.

a) $hf = \Sigma ha_i$

5) Calculate the heritage footprint ratio (hf_r) by dividing the heritage footprint obtained by the total area of the precinct of interest.

$$hf_r = hf:ta$$

where:

- **hf**_r is the heritage footprint ratio;
- **hf** is the heritage footprint in the precinct; and
- **ta** is the total area of the precinct.

After the quantification of the townscape heritage in ratio form and thereafter expressed as a percentage, can then be considered as a historic planning decision-making tool in conservation.

In a related study, Said, Latif, and Safiee (2016) did a quantitative assessment to evaluate the physical changes for the conservation initiatives in the historic city of Melaka, Malaysia between 2010 and 2013. Subsequent townscape value topography maps of townscape heritage value footprint in the urban space were created. The result suggested an increase in the townscape value of areas, as a product of the implementation of a conservation management plan. This study however did not identify or quantify the physical townscape heritage. Consequently, this paper explores the idea of quantifying identified townscape heritage as a physical footprint.

2. Methodology

A cross-sectional research design was applied since it involved more than one case of town along the Kenya Railway. The aim was to identify the urban heritage, quantify the heritage footprint and uncover associated heritage values. The study took place in three selected towns along the Kenya Railway line between Nairobi to Kisumu as shown in Figure 1. The choice of this section of the railway line is based on two main reasons: the stations between the two cities are vibrant in rich agricultural zones, and more towns are located between the two cities than any other section of the railway in Kenya. 19 towns exist along the railway between Nairobi and Kisumu. Three Cities; Nairobi, Nakuru and Kisumu were excluded in consideration that, over time, development layers could have erased the integrity of the original nexus of the railway and the urban fabric. From the 19 towns listed in the sampling frame, three towns that were 16% of the towns lined along the railway line in the study area were selected. A homogeneous sampling method was used to select three towns: Limuru, Naivasha and Molo. The three towns selected, notably, were municipalities and therefore homogeneous in terms of the Kenyan classification of urban areas based on population size (Republic of Kenya,

2019).



Source: Adapted from Gunston (2004); McCrow (2022); and Molesworth (1899).

Figure 1. Map of sampled towns.

To identify heritage places, a total of 360 respondents were interviewed in all three towns. Using respective ratios for representativeness, each town was allocated its sample size from the total sample size based on KNBS's, 2019 report on the distribution of the population by urban centre (KNBS, 2019). Limuru had a population of 81,316, Naivasha had 198,444, and Molo had 156,732. Interviews were conducted with 70 respondents in Limuru, 160 in Naivasha, and 130 in Molo. Residents were sampled from an average walkable radius of 400 to 800 meters from the centre of the railway station in the selected towns. For each sampled town, the walkable radius area was divided into smaller spatial units bounded by streets and using the respective town maps to ensure samples drawn were evenly distributed in the urban space. Thereafter samples of residents were drawn conveniently from each of the spatial zones. The interviewees targeted were adults who lived in the selected towns and acknowledged familiarity with it.

The spatial focus was the urban area around the railway station called "precinct" in this study where the basis was that the railway station and its operations influenced the establishment of the town. The precinct areas around railway stations were defined on a case-to-case basis based on the subjection of the preset spatial delimitation method; where the periphery of a precinct is defined by the urban districts fronting the first street next to and around the railway stations. Therefore, the preparation for a field survey involved delimiting precincts for each of the sampled towns, and the preparation of their figure-ground maps. Then, transect walks were carried out within the precincts and their immediate context to familiarise them with the townscape layout.

To identify townscape heritage, using interview schedules respondents were each asked to identify three important places in the town that they considered important to be conserved for future generations. For each of the identified places, respondents were asked to give reasons for their choices. The identified places were then spatially located on the maps. Data on floor areas covered by each of the identified heritage was then collected through observation guides.

Thereafter, data was analysed and interpreted qualitatively; by interpreting responses on reasons for identifying specific heritage places into heritage value words established through analysis of literature. Quantitatively, heritage footprint was expressed in the form of a ratio of the area occupied by the identified heritage to the total area of land of the delimited precinct. The Heritage footprint was also represented spatially using figure-ground maps for visual appreciation. Figureground analyses were especially useful in revealing the relationships of solids and voids that make up the fabric of the towns and establishing the physical sequences and visual orientation between places.

3. Results

3.1. Delimiting Townscape Precents around Railway Stations

The townscape perspectives for Limuru, Naivasha and Molo showing the precinct areas around the railway stations to enable three-dimensional townscape visual appreciation are presented in **Figure 2**, **Figure 3**, and **Figure 4**. The influence of the railway stations as the original urban nucleus of settlements and commercial areas is demonstrated in the evidence of idiosyncrasies of historic sectors adjacent to the core.



Figure 2. Townscape perspective model of Limuru.



Figure 3. Townscape perspective model of Naivasha.



Figure 4. Townscape perspective model of Molo.

The townscape scene is mainly characterized by buildings and the spaces between them, streets, squares, vegetation and topography. Limuru and Molo townscapes exhibit a dynamic topography causing organic townscape layouts, while Naivasha is plane allowing for a grid townscape layout.

The sense of enclosure is present in various instances within the townscapes, in the streets and spaces between buildings. With average heights of buildings between seven and ten meters and street widths of between 12 and 16 meters, the sense of enclosure in the towns is considerable. The primary roads are the main axes of the organisation of townscape fabric. The different functions and land use needs have dictated the varied types, sizes and forms of buildings and features. For example, large industrial warehouses and factories in Limuru and Naivasha, small compact buildings for trade, spread out places such as markets and tall commercial structures for commerce. This variety gives a desirable mix of townscape forms.

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

3.2. Objects of Townscape Heritage

The identified townscape heritage places within the precinct area around the railway stations were listed for the three towns: Limiru, Naivasha and Molo. Within the railway precincts of the three towns, places of heritage significance were identified by the respondents and all of them were listed. However, these lists were filtered further to only those that were identified by three or more respondents. These identified places that fell within the delimited precinct around the railway station are listed with their respective photographs presented in **Table 1**, **Table 2**, and **Table 3**. They were identified based on varied reasons and translated into heritage values that include; historicity, economic benefits, Identity, rarity, aesthetics, uniqueness, functionality, and age. There are also similarities in the kind of heritage identified in the three towns such as the post office, Kenya Famers Association (KFA) offices, and warehouses.

Table 1. Significant places Limuru town railway precinct.



Continued					
Heritage Values	Economic Historic Age	Identity Historic Function	Age Economic		
Identified Heritage	7. Jua Kali	8. Njegi Plaza	9. Hope Medical Clinic Limuru General Store Building		
Heritage	Age	Economic	Age		
Values	Economic	Identity	Rarity/Oddness		

Table 2. Significant places Naivasha town railway precinct.

Identified Heritage	1. La Bell Inn Restaurant	2. Ivory Salama Building/Lake View Villa	3. Post Office		
Heritage Values	Economic Age Historic	Aesthetic Age Historic Economic Function Identity	Function Age Historic		
Identified Heritage	4. Family Bank/Bawani Store Ltd Building	5. Mahaver Store Building	6. Kenya Farmers Association (KFA)		
Heritage Values	Economic Age Identity Aesthetic	Age	Economic Historic		
Identified Heritage	7. Wambuku Hote	8. Four Seasons Building	9. Gitegenye Building		
Heritage Values	Economic Function Historic Age	Economic Aesthetic	Function Historic Age		

Identified	1. Agricultural Development	2. Kenya Breweries/Kenya	3. Kenya Cooperative
Heritage	Corporation (ADC)	Malting Ltd.	Creameries (KCC)
Heritage Values	Economic Function	Economic Rarity/Oddness Function	Function Economic
Identified Heritage	4. Posta Area	5. Post Office	6. Cornermix Godown/ ADC Warehouse/Molo Stores
	UHURU BAR BAR BAR BAR BAR BAR BAR BAR BAR BAR BAR BAR BAR BAR		NOLO CORRESSIONES CONTRACTOR DE LA FERTURA EST
Heritage Values	Historic Age Identity Function Economic	Economic Uniqueness Identity Historic Age	Function Economic Identity Historic
Identified Heritage	7. Molo Township School	8. Kenya Farmers Association (KFA)	9. Family Bank
Heritage Values	Historic Function Age Rarity/Oddness	Function Historic Age Economic	Economic
Identified Heritage	10. Sub-County Offices		
Heritage Values	Function		

Table 3. Significant places Molo town railway precinct.

3.3. Heritage Values

The values translated from reasons given for the identified heritage for each of the three towns are shown in **Table 4** and illustrated in **Figure 5**. Economic, age, and

historic values were highly cited as reasons for the significance of important areas for the three towns. In addition, the values, function and Economics, were cited as a high value in Molo Town. Therefore, the key values identified by respondents in all three towns in order of significance are 1. economic, 2. age, 3. historic, and 4. Function, and 5. Identity.

	Aesthetic	Age	Economic	Function	Historic	Identity	Rarity/ Oddness	Uniqueness
Limuru	0	5	6	1	4	2	1	0
Naivasha	3	6	6	3	5	2	0	0
Molo	0	5	8	8	6	3	2	1
Total	3	16	20	12	15	7	3	1





Figure 5. Frequencies of derived heritage values.

3.4. Townscape Heritage Footprint

The establishment of the heritage footprint in each of the selected towns as defined by the delimited precinct areas was done through the analysis of the figure-ground maps. In the analysis of the townscape heritage footprint, it is important to note that the railway station is regarded as a heritage area in itself, as observed from responses on significant places of towns.

3.4.1. Core and Precinct Sizes

For Limuru, the area of the delimited precinct and the core occupies an area of 31.56 ha, where the core is 8.27 ha or 26.2% of the delimited area, while the remaining area of the precinct is 23.29 ha or 73.8%. In Naivasha, the area of the delimited precinct and the core occupies an area of 21.09 ha, where the core is 6.34 ha or 30.1% of the delimited area, while the remaining area of the precinct is 14.75 ha or 69.9%. In Molo town, the area of the delimited precinct and the core occupies an area of 33.5% of the delimited area, while the remaining area of 26.24 ha, where the core is 8.79 ha or 33.5% of the delimited area, while the remaining area of 26.5%. The data on core and precinct sizes is shown in **Table 5**.

Town		Calculation	Aroo	% of the delimited
TOWI		Calculation	Alea	area
	1.	The area of the delimited precinct and the core	31.56 ha	100%
Limuru	2.	Area of the core (railway station area)	8.27 ha	26.2%
	3.	Total area (ta) of the precinct	23.29 ha	73.8%
	1.	The area of the delimited precinct and the core	21.09 ha	100%
Naivasha	2.	Area of the core (railway station area)	6.34 ha	30.1%
	3.	Total area (ta) of the precinct	14.75 ha	69.9%
	1.	The area of the delimited precinct and the core	26.24 ha	100%
Molo	2.	Area of the core (railway station area)	8.79 ha	33.5%
	3.	Total area (ta) of the precinct	17.45 ha	66.5%

Table 5. Core and precinct sizes.

3.4.2. Heritage Footprints of Three Towns

Table 6 presents the calculated areas in hectares of the various zones, solids and voids according to the maps in **Figure 6**, **Figure 7**, and **Figure 8** that enabled the calculation of the heritage footprint ratio in the delimited precinct of Limuru, Naivasha and Molo towns.

 Table 6. Townscape heritage footprint.

Town		Calculation	Area	% of precinct				
Limuru	1.	Area of all solids in the precinct area	5.02 ha	21.6%				
	2.	Area of all voids in the precinct area	18.27 ha	78.4%				
	3.	Area covered by solids of identified places of heritage significance	2.39 ha	10.3%				
	4.	Area covered by voids of identified heritage open spaces in the precinct area	0.00 ha	0%				
	5.	Total heritage area (solids and voids of identified places of heritage significance) in the precinct area (hf).	2.39 ha	10.3%				
	6.	The heritage footprint ratio, $hf_r = hf$: ta 2.4:23.3 = 1:10 or 10.3%						
	1.	Area of all solids in the precinct area	4.7 ha	31.9%				
	2.	Area of all voids in the precinct area	10.05 ha	68.1%				
a	3.	Area covered by solids of identified places of heritage significance	1.24 ha	8.4%				
Naivash	4.	Area covered by voids of identified heritage open spaces in the precinct area	0.00 ha	0.0%				
	5.	Total heritage area (solids and voids of identified places of heritage significance) in the precinct area (hf).	1.24 ha	8.4%				
	6.	The heritage footprint ratio, $hf_r = hf$: ta 1.24:14.75 or 1:12 or 8.4%						
	1.	Area of all solids in the precinct area	4.82 ha	27.6%				
	2.	Area of all voids in the precinct area	12.63 ha	72.4%				
	3.	Area covered by solids of identified places of heritage significance	3.30 ha	18.9%				
Molo	4.	Area covered by voids of identified heritage open spaces in the precinct area	0.09 ha	0.5%				
	5.	Total heritage area (solids and voids of identified places of heritage significance) in the precinct area (hf).	3.39 ha	19.4%				
	6.	The heritage footprint ratio, $hf_r = hf$: ta 3.39:17.45 or 1:	5 or 19.4%					

Limuru Town. All solids in the precinct area occupy an area of 5.02 ha or 21.6% of the precinct area while the voids cover 18.27 ha or 78.4% of the precinct area.

The area covered by solids and voids of identified places of heritage significance occupies 2.39 ha or 10.3% and 0.00 ha or 0.0% of the precinct area respectively. The total heritage area of solids and voids of identified places of heritage significance is therefore 2.39 ha or 10.3% of the precinct area. The heritage footprint ratio for Limuru town railway station precinct is therefore 1:10 or 10.3%. **Figure 6** provides a visual illustration of the heritage footprint within the precinct area in Limuru town.



Figure 6. Heritage footprint in Limuru town.

Naivasha Town. All solids in the precinct area occupy an area of 4.7 ha or 31.9% of the precinct area while the voids cover 10.5 ha or 68.1% of the precinct area. The area covered by solids and voids of identified places of heritage signifi-

cance occupies 1.24 or 8.4% and 0.00 ha or 0.0% of the precinct area respectively. The total heritage area of solids and voids of identified places of heritage significance is therefore 1.24 ha or 8.4% of the precinct area. The heritage footprint ratio for Naivasha town railway station precinct is therefore 1:12 or 8.4%. Figure 7 provides a visual illustration of the heritage footprint within the precinct area in Naivasha town.



Figure 7. Heritage footprint in Naivasha town.

Molo Town. All solids in the precinct area occupy an area of 4.82 ha or 27.6% of the precinct area while the voids cover 12.63 ha or 72.4% of the precinct area. The area covered by solids and voids of identified places of heritage significance occupies 3.30 or 18.9% and 0.09 ha or 0.5% of the precinct area respectively. The

total heritage area of solids and voids of identified places of heritage significance is therefore 3.39 ha or 19.4% of the precinct area. The heritage footprint ratio for the Molo town railway station precinct is therefore 1:5 or 19.4%. **Figure 8** provides a visual illustration of the heritage footprint within the precinct area in Molo town.



Figure 8. Heritage footprint in Molo town.

4. Discussion

The first research question, aimed to reveal what constitutes the heritage in towns along the Kenya Railway. The survey in the three towns identified a combined inventory of 28 townscape heritage areas: nine for Limuru, nine for Naivasha and ten for Molo. The significance expressed directly by respondents caused the derivation of heritage values associated with the identified townscape heritage. The values given in the order of importance are economic, age, historic, function and identity. These values give meaning to the townscape heritage as advocated for by the Historic Urban Landscape (HUL) approach and the contemporary theory of conservation (Muñoz-Viñas, 2012; UNESCO, 2011). There were also notable similarities in the type of heritage across the three towns. This could be due to the original need to replicate service facilities near the railway station for transport logistics, storage, service provision and communication when the towns enjoyed full operations of railway services. Examples of the replicated facilities include the post offices, Kenya Farmers Association (KFA) offices and warehouses. The identified heritage areas also serve as landmarks due to their unique physical character, form, size or even their historic nature.

The second research question was: what is the heritage footprint of towns along the Kenya Railway? To start with the railway stations themselves at the core of the townscape precincts are regarded as townscape heritage. The railway stations for the towns averaged one-third of the delimited precinct area. The townscape as perceived from the figure-ground is only in the form of solids. Heritage in the form of voids is not represented except in an isolated case in Molo town. The heritage footprint (HF) ratio for Limuru is 10.3%, for Naivasha is 8.4% and for Molo is 19.4%. The lower ratios in Limuru and Naivasha could have been due to physical and memory loss of potentially significant areas in the past as an effect of continued urban redevelopment. **Figure 9** of the Naivasha townscape scene shows the potential danger of loss posed by the need for urban renewal.



Figure 9. New developments abutting townscape heritage in Naivasha.

Molo town has the highest heritage footprint ratio of 19.4% which could be attributed to the intactness of the older built environment and also preserved clusters of historic zones wholly considered as places of significance. The primary reason for the intactness could be attributed to the continuity in the functions of such palaces. Figure 10 shows a heritage cluster in Molo town, marked in yellow, known as the Posta area. Compared to the study by Said, Latif, and Safiee (2016) where there was an improvement in townscape heritage value, the results in this



study suggest that the low value of townscape heritage in the three towns can be improved with the application of appropriate conservation plans.

Figure 10. Heritage cluster in Molo town.

The identified heritage is part of the character of the townscape where the railway station is the core of the precinct area as conceptualised in **Figure 11**.



Figure 11. Conceptualisation of core and townscape heritage.

5. Conclusion

The railway stations were the cause of the establishment and urban areas' eventual growth. The historic structures next to the train stations, many of which still serve their original purposes, provide evidence of this. The railway and its territory form a combination that interacts inevitably (Llano-Castresana, Azkarate, and Sánchez-Beitia, 2013; Cuéllar, 2018). The link between the core and town in the three towns exists. However, it is weak due to the decline in Kenya Railways operations. Even

though there is a relationship between the railway stations and the immediate urban fabric, the link is weak due to the decline in Kenya Railways operations.

The findings show that residents hold varied heritage values associated with the identified townscape heritage. These heritage values are important in providing meaning to the heritage in their continued conservation. The key values identified by respondents when identifying heritage areas in the three urban areas are: 1. economic, 2. age, 3. historic, and 4. Function, and 5. Identity. The Heritage footprint (HF) ratios in Limuru at 10.3%, Naivasha at 8.4%, and Molo at 19.4% indicate the variation and extent of the urban fabric in each of the towns that there is indeed heritage that is significant to residents.

The study also adds value to theory by the adapting the theory of ecological Footprint and simplifying it to achieve the measurement of heritage footprint. Heritage footprint is a concept that is useful to measure the area of land covered by heritage to bring knowledge on its size compared to the area of focus. For analysis and effective visual communication, the figure-ground theory is suitable when considering the relationship of the core as the source of historic places, which are a heritage unto themselves and the surrounding townscape heritage. The figure-ground theory therefore accounts for the spatial distribution of townscape heritage. It is therefore practical to fuse the accounting concept of the theory of ecological footprint and the figure-ground theory to explain the density of the town-scape heritage in the urban space.

Procedures of townscape analysis and heritage survey provide a practical approach beyond the expert-driven heritage documentation. The townscape analysis on figure-ground maps provides a visual appreciation while figure-ground calculations give an arithmetic appreciation of the measure of heritage in space. Additionally, it may raise a methodological curiosity to extend the heritage footprint to the measurement vertically into the third dimension. On the other hand, the accounting of heritage footprint in space is informative to practitioners, and figure-ground maps are effective tools for visual communication to highlight the spread of heritage in an area.

6. Recommendations

The study provides evidence of a potentially rich townscape heritage inventory along the Kenya railway. Consequently, an extensive survey should be done to identify and protect these areas of interest to document, make inventories, and conserve and also expand heritage urban heritage inventory in Kenya. In addition, a heritage survey of all the towns along the Kenya railway line should be carried out. Heritage surveys can be done periodically to update the inventories so that these are also not frozen in time. This form of documentation can thus provide material for future urban conservation research and to popularise tourism for the towns. The documentation of the identified places through heritage inventories would also cover cases of unforeseeable future loss of heritage and similarly be the basis for continuous maintenance. In addition, the application of Geographic Information Systems (GIS) in mapping heritage areas is necessary for georeferencing. The application of GIS will therefore enable future manipulation of such heritage data with ease whether for research or practical needs.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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