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Analyzing the Change in Built Environment of World Heritage Site: Case of Luang Prabang, Lao P.D.R

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1. Introduction

The World Heritage title in the recent years has attracted tourism growth and becomes the main source of income for local community. Although the inscription benefits the World Heritage Site economically and socially, unplanned and rapid development can impact the World Heritage Site negatively and causes the site to deteriorate. In addition, the philosophy of heritage conservation has evolved to a broader scope. Venice Charter drawn in 1964 is universal guideline to carry out conservation in a holistic manner. The charter recognized that conservation of World Heritage Site needs to expand beyond individual historical monuments and archaeological sites to include the surrounding environment and landscape [1]. Thus, the preservation of entire landscape is significant. However, the landscape can deteriorate under the pressure of development.

Luang Prabang is inscribed in 1995 for its unique landscape integrated from Lao and French urban characteristics, diverse architectures, and rich nature of river network and mountainous terrain. The town has received sharp influx of visitors and led to increasing touristic related buildings constructed. World Heritage Committee reported excessive concentration of tourists is degrading landscape, putting the heritage site at risk [2].

This paper aims to study the change of Luang Prabang built environment in from three aspects considered important for the landscape, namely 1) skyline of landscape, 2) condition of buildings, and 3) level of land use. The changes were derived from the comparison of data captured in 1999 and 2009 using GIS. GIS is software instrumental in investigating changes in term of spatial and time using thematic maps. The skyline of the landscape analysis illustrates on how the overall building heights have changed. The condition of buildings is analysed to find out the state of buildings. Finally, the level of land use analysis shows the changes in total building size and density.

2. Methodology

A GIS prototype is designed to study and visualize changes in building attributes. The prototype considered sustainable usage of GIS has been developed to adapt to the local environment and challenges. The prototype components consist of; 1) data collection, 2) development of base map, 3) development of database, 4) spatial analysis of landscape, and 5) development of local human resource [3].

The study of change is carried out in a pilot site of six villages located in the core of the heritage area. Base map dated 1999 and 2009 developed through the implementation of GIS prototype were utilized. The building attributes analyzed are derived from indicator of changes identified by Heritage Preservation and Development Master Plan (PSMV). PSMV provides comprehensive guidelines and regulations on building constructions and modifications, land use and soil occupation [5]. Eight building attributes subjected to change as time pass are 1) building usage, 2) building architecture, 3) building material, 4) building roof material, 5) building height, 6) building condition, 7) percentage of land use, and 8) co-efficient of soil occupation. This paper focuses on three building attributes of height, condition and land use.

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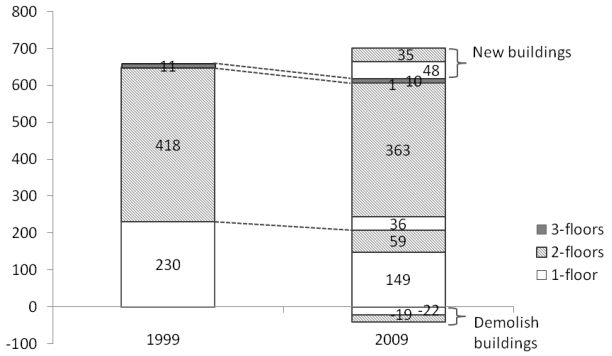
3. Data analysis and major findings

Three major findings are derived from data analysis carried out to investigate the trend of changes in building height[2], building condition[3], and land use[4]. The pilot site covers six villages and analysis uses sample size of 700 in 1999 and 745 in 2009 except for building height (659 in 1999, 742 in 2009).

3.1 Number of building floors is changing within height limit and maintaining skyline of landscape

The purpose of analysis is to observe the change in livable building height by looking at the number of building floors. Buildings investigated has number of floors ranging from 1 to 3 floors. The analysis exclude the religious offering structures in temples such as stupas and buddha house because the structures did not have no floors. A total of 659 buildings was analysed in 1999 of which 618 buildings continue to exist till 2009. While 41 buildings were demolished in 2009. By 2009, 83 buildings were added.

Fig 1. Change in height of buildings (1999-2009)



Source: Data analysis of building attributes, Luang Prabang, 2010

Visual comparison of buildings height between 1999 and 2009 finds no significant change in saptial pattern of building floors due to conversion of 1-floor to 2-floors buildings and 2-floors to 1-floor in six villages. Buildings with one floor located mainly along the middle of the peninsula and concentrated in monastery areas. This pattern did not change during 10 years. More than half of original 1-floor buildings remained the same in 2009 (n=149, 64.8%), while 59 were converted to 2-floors buildings (25.7%), and 22 were demolished (9.6%). As for 2-floors builidngs, a total of 363 maintained the same height (86.8%) while 36 decreased height to 1-floor (8.6%), and 19 were demolished (4.5%). Almost all 3-floors buildings remained the same height (N=11) except for one building reverted to 2-floors. There are 48 new buildings constructed with 1-floor and 35 with 2-floors. As a result, in 2009, there are 233 1-floor building (increased by 3), 458 of 2-floors (increased by 40), and 10 of 3-floors (decreased by 1).

The 2-floors buildings dominated the landscape of six villages in the 10 years. Majority of the buildings maintained the height of 1 to2-floors. A high percentage of buildings maintained 2-floors height and more 1-floor building was converted to 2-floor buildings. There is slight reduction of 3-floors buildings. The PSMV regulation stipulated that building height is restricted to maximum 2-floors, 6m except for buildings located along commercial road. The commercial road is designated as business and trading spaces. Buildings on commercial road are allowed up to 7m [4]. The 3-floors buildings built before inscription are considered too high, blocking the view and affecting the landscape. The 3-floors buildings are required to be reduced at the time of restoration or modification. This means the number of floors are kept following the regulations and the skyline of six villages is preserved.

3.2 Building condition are improving with the significant increase of buildings with good condition and decrease of buildings with bad condition

The analysis is conducted with the purpose, 1) to find out the condition of all buildings; and 2) to identify which building usage is dominant in contributing to maintain building good condition. The building condition were assessed during field survey and categorized into good, moderate and bad condition. A total of 700

[2] Total number of floors in livable buildings, exclude stupa and Buddha house structures

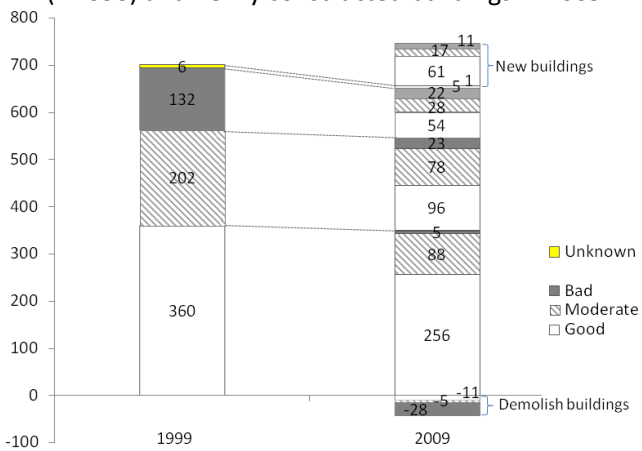
[3] State of building condition evaluated as good, moderate or bad according to criteria defined by UNESCO and Lao Ministry of Culture and Information, Chaiyong et.al (1996), *An Urban Conservation Pilot Planning Project for Luang Prabang, Part One: Conservation Study,* p. 60.

[4] Percentage of land use for built land and free land

buildings analyzed in 1999. 656 buildings continued to exist till 2009. However, 6 buildings condition were unknown due to poor documentation in 1999 and could not be compared. During 10 years, 44 buildings were demolished and 89 new buildings were added.

Visual comparison of GIS map of building condition attribute in 1999 and 2009 found buildings with good condition is increasing in every village with no particular pattern. Small buildings with bad condition scattered throughout six villages has reduced. Moderate condition buildings is found to be increasing and concentrated in Phone Heuang village located in the middle of peninsula compared to other villages.Out of 360 buildings with good condition in 1999, two third of the buildings maintained good condition (n=256, 73.3%) while 88 buildings degraded to moderate condition (24.4%) and 5 to bad condition (1.4%). As for buildings with moderate condition, 96 buildings improved to good condition (47.5%) and 78 buildings remained the same (38.6%). However, 23 buildings deteriorated to bad condition (11.4%) and 5 were demolished (2.5%). For bad condition buildings, more than half improved to good (n=54, 40.9%) and to moderate condition (n=28, 21.2%), while 22 remained the same (16.7%) and 28 were demolished (21.2%). Most of the new buildings built are in good condition (61) while 17 are in moderate condition and 11 are found in bad condition. Overall, buildings with good condition increased significantly while buildings with bad condition decreased. The increase of buildings with good condition is derived mostly from maintenance of good condition buildings from 1999, improvement of buildings from moderate and bad condition, new buildings, as well as demolition of bad buildings condition.

Fig 2. Change in original building condition in 1999 (N=650) and newly constructed buildings in 2009



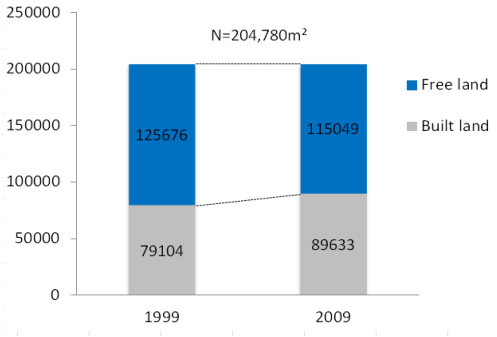
Source: Data analysis of building attributes, Luang Prabang, 2010

During survey, it was found that there is increasing buildings with good condition used for touristic and religious purposes. Buildings with good condition used for touristic purpose increased from 55 to 214 of which 24 are new buildings. Religious buildings with good condition increased from 74 to 103 of which one is new building. The owners of touristic buildings are motivated maintained the buildings to attract tourists and the monks of religious buildings have the capacity and motivation to restore the monasteries.

3.3 Building density is growing with the increase of land use for buildings in six villages

The aim of analysis is to investigate the change in area of built land which buildings occupied, and area of free land space. The built land has increased from 79, 104m^2 to 89, 633m^2 by 10, 529m^2 (5.2%). Free land space has decreased from 125, 676m^2 to 115, 049m^2 by 10, 627m^2 (5.2%) as shown in Figure 3. Visual comparison of built land and free land between 1999 and 2009 in Figure 4 shows the land use increases in every block of village with no particular pattern with roads or river banks. There are 89 newly constructed buildings, 12 buildings have been extended. Increased number of new buildings and buildings' size contributed to the increase of built land as shown in Figure 4.

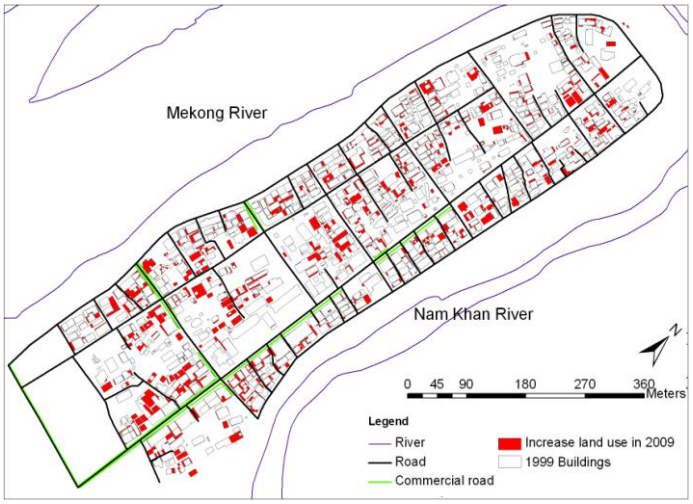
Fig 3. Comparing land use in 1999 and 2009



Source: Data analysis of building attributes between 1999 and 2009

The 5% increase in built land area represents more occupation of land which increases the land use and consequently the density. The six villages are located at core heritage site which was already dense with residences, monasteries, government offices and school buildings compared to other areas at the time of inscription. Moreover, the land use is regulated with maximum 40% of its land except for the buildings along commercial road which can occupy 75% [4]. The local residences optimized the land use by demolishing and rebuilding the houses or increasing building height from 1-floor to 2-floors. According to discussion with local architects of Department of Luang Prabang World Heritage, there are bigger buildings advised to be rebuilt in smaller size but with higher height in order to maintain the percentage of land use. The buildings reduced in size but increased land use with height. Non-historical buildings are allowed to be demolished and rebuilt. A total of 20 buildings were demolished and rebuilt on the same land during the 10 years. The rebuilding and increased of building height are not reflected in the total area of built land. However, the land use is increasing with rebuilding, conversion to higher height, 2-floors buildings, and increased number of buildings which in return increases the building density.

Fig. 4 Increased land use in ten years



Source: Data analysis of building attributes, Luang Prabang, 2010

4. Conclusion

Luang Prabang World Heritage Site is renowned for its beautiful landscape and rich heritage. The inscription is beneficial to the heritage site by attracting tourists. However, currently the town faces an increasing need to cope up with increased tourists. The paper illustrated and analyzed the changes in built environment from 1999 to 2009 in six villages in the core heritage area using building attributes such as building height, building condition and level of land use with GIS analysis. Overall, the six villages still maintains the skyline, has improved buildings condition and increased building density over 10 years duration. The height of buildings is changing mainly to 2 floors, controlled well within the height limit permitted and thereby, preserving the original skyline of heritage landscape of six villages. There is significant increase of buildings with good condition and decrease of buildings with bad condition, showing that over all buildings conditions in the areas are improving. The built land which refers to land use for buildings has increased by 5.2% indicating the increases of building density in core heritage area. The trend of building attributes in six villages serve as demonstration to derive important information of how the heritage site is changing with development which is vital for developing sound urban planning strategies.

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