Analysis on Maha Myat Muni Pagoda Complex from the Aspects of Fire Safety

Aye Thandar Phyo Wai¹, Theingi Shwe²

¹Researcher, Master of Architecture, Department of Architecture, Yangon Technological University, Insein, Yangon, Myanmar
²Associate Professor, Deputy Head, Department of Architecture, Yangon Technological University, Insein, Yangon, Myanmar

Abstract— The ancient city, Mandalay has many historical relics such as pagodas and monasteries and other religious buildings. Mandalay city and most of heritage relics are founded by King Mindon in 1857. But, Maha Myat Muni Pagoda is founded by King Bodawphaya in October 1784, which is the most famous Buddhist statue in Myanmar. Mandalay city is suffered from urban fire all the time mostly in spring and summer. Urban fire is threatening the whole citizens and other natural resources. And due to hot and dry weather condition, the fire outbreak can happen easily and the fire can spread easily to the environment. So, the historical relics are needed to preserve from these hazards. Urban fire safety plays a prominent role for this city. For the cultural heritage and historical religious buildings, conservation and prevention from fire case are major consideration. The paper presents about fire risk assessment for historical heritage buildings and detail study and analysis on Maha Myat Muni pagoda complex. The research work includes the analysis with six types of criteria from the aspects of fire safety. All the required considerations have been proposed by upgrading the compound and that will be of great support not only for heritage conservation but also for urban fire safety.

Keywords—urban fire, fire safety, Maha Myat Muni, Mandalay, heritage building

I. INTRODUCTION

Maha Myat Muni Pagoda complex is a famous Buddhist shrine and the best known place of pilgrimage in Upper Myanmar. This ancient Statue of the Buddha or the Maha Myat Muni Image is historic and most sacred to Buddhists due to its religious and historical significance. Hence, pilgrims and devotees, travelers and tourists from all walks of life visit this remarkable Maha Myat Muni Image all the year round. This site is located in the ancient site zone which is protected and preserved now. It is cultural heritage region and these are Myanmar cultural heritages that are worth preservation because the Maha Myat Muni complex represents unique architectural, sculptural and aesthetic achievements highly respect of our religious identity. Therefore, it should be taken the preservation regularly and prevention for the fire case.

II. HERITAGE BUILDINGS AND IMPORTANCE OF CONSERVATION IN MANDALAY

There were many religious complex or precincts and buildings in Mandalay founded by King Mindon. He made the plans of religious buildings and precincts systematically and conserved them in order to promote and enhance religion.

Historic buildings and areas are the reflection of the social and cultural life of their time, and their retention transmits to this to the present and future generations as an essential element in the recognition of cultural identity. Therefore, many boasting historic sites and buildings of religion express its identity and culture.

In Mandalay, the religious condition is more outstanding than any other cities. But, the ancient historical handiworks in religious buildings and sites were destroyed by Second World War. Therefore, heritage conservation efforts were carried out and enhanced in present day. In 1998, the national government have been determined the Protection and Preservation of Cultural Heritage Regions Law and protected and preserved the cultural heritage. Also people started to recognize the importance of heritage and cultural properties as a resource for tourism, commerce and industries.

Therefore, the public has become increasingly aware of the importance of heritage conservation, and governments are undertaking various measures to protect not only the heritage sites but also buffer zones.

The majority of the remains of Mandalay are religious monuments and complex with variety of forms and
composition. All religious complexes and monuments were used such as timber, brick and occasionally stones as construction materials. Almost all the structures and compounds had been destroyed, decayed, burnt and only the brick structures and few stone masonry works remained. [1] There are (30) famous pagodas and (2424) number of monasteries left in Mandalay now. Some of the remained heritage buildings in Mandalay are listed below;

a. Maha Myat Muni temple
b. Sanda muni stupa
c. Maha law ka ma ra jin stupa (which is recorded as memory of the world now)
d. Mahatthakyatmarajin kyauttawgyi temple
e. Shwkeyimyin temple
f. Maha Satkyatthiha temple
g. Mahalawkaranthi Eaindawya stupa
h. Aung taw mu stupa
i. Shwe kyaung monastery
j. A tu ma shi kyaung taw and so on.

III. FIRE RISK ASSESSMENT FOR HERITAGE BUILDINGS

The six types of criteria are important in conserving and preserving historical heritage building and from the fire risk assessment, it can observe for all the conditions of heritage buildings from the aspects of fire safety. For the fire risk assessment, it can be specified with six types of criteria, which are fire apparatus access, emergency escape, distance from fire station, exterior wall building materials, fire buffer area and fire fighting water supply. These are mainly important for extinguishing fire and protection from spreading of fire. Fire apparatus access route, distance from fire station and fire fighting water supply plays a vital role in extinguishing fire. Fire buffer area is a prominent case for protection of spreading fire. Emergency escape and building materials are major case for protection of lives and properties of people. [2]

A. Evaluation for Marking

Firstly, it can be determined for the mark of each criterion, Mark 1 is for good condition, 2 is for moderate and 3 is bad condition. [2]

<table>
<thead>
<tr>
<th>Fire Apparatus Access</th>
<th>Emergency Escape</th>
<th>Building Materials</th>
<th>Fire Buffer Area</th>
<th>Distance from Fire Station</th>
<th>Fire Fighting Water Supply</th>
<th>Total</th>
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Secondly, the total marks can be identified as; 6-9 marks are good condition, 10-12 marks are moderate condition and 13-18 marks and/or one of bad in six criteria is bad condition. [2]

B. Findings from Fire Risk Assessment

In Mandalay urban areas, almost all of heritage buildings are existed in urban areas, mainly in four townships. The paper presents about fire risk assessment for heritage building area in these townships.

The blocks which are not in detail study area has widen road but the building materials have less fire resistance. So, it can be presumed as a moderate condition.

Most of heritage building areas have open space within the compound, so it can be regarded as good condition and some in moderate condition. But, some of heritage
building areas are bad condition because of timber buildings and lack of open space.

For all the area of assessment, most of areas are bad because of lack of fire buffer area. But in Mandalay, the water supply is suitable because of river, creeks, and canals are surrounding the residential area. And the distance from fire station is also suitable for all urban areas. But, in Chan Aye Thar San Township, there is no fire station at the east. So, it should be more station at there.

As an overview, Mandalay city urban areas are in great anxiety from the aspects of fire safety. By studying fire risk assessment, the bad one should be upgraded for new planning and the moderate one should be maintained to become better. And the good one is also need to keep the ability for protection of fire hazard. [2]

IV. BRIEF HISTORY OF MAHA MYAT MUNI PAGODA

The Maha Muni Pagoda, popularly known as the Great pagoda or Phayargyi in Myanmar, is a famous Buddhist shrine and the best known place of pilgrimage in Upper Myanmar. The bronze image of the Buddha enshrined in the Pagoda has a long history stretching back to more than 25 centuries. The ancient Statue of the Buddha or the Maha Muni Image is historic and most sacred to Buddhists due to its religious and historical significance. Hence pilgrims and devotees, travelers and tourists from all walks of life visit this remarkable Maha Muni Image all the year round.

The Maha Muni Image looked magnificent in repose on Thrigoke Hill in Rakhine. Its fame spread far and wide. The chronicles mention King Alaungsithu, one of the kings of Bagan, as one of the reigning monarchs who went on a pilgrimage to Rakhine to pay homage to the Great Maha Muni Image in the year 1096 A.D. It is also said that King Alaungsithu carried out the construction of annexes to the shrine and renovated old structures within the sacred precincts.

In October 1784, King Bodawphaya of Amarapura, also known as Badone Min, sent his son the Crown Prince at the head of a large regiment to convey the Maha Muni Image from Dinnyawadi. The Prince was victorious, and marched back with the huge Maha Muni Image and several bronze figures as spoils of war in January 1785. The Maha Muni Image was conveyed up the Ayeyarwadi River from Padaung to Amarapura and finally came to a stop near its landing-place at the foot of Sagaing Hills in May 1785.

In June 1785, the design for the Old Shrine was drafted and in July, the foundation stone was laid. In October, the Old Shrine was completed in Mandalay. The shrine measured a height of 176 feet and the Maha Muni Image enshrined within is 12 feet 7 inches high. Thus the Great Maha Muni Image was initially installed in Mandalay for public veneration.

A century later, on April 8, 1884, during the region of King Thibaw, a great fire broke out in Mandalay. The flames consumed hundreds of houses but the Maha Muni Image miraculously escaped damage. Only a small portion of the Sacred Image was affected. Even then, the fire melted down the solid gold crown and the gold regalia.

The new structure over the Great Image was completed on May 17, 1884 and the overall restoration was finished on July 5, 1884. The Shrine was restored to its former splendor mainly through the meritorious deeds of King Thibaw.

Every day, crowds gather round the Maha Muni Image to offer prayers and do meritorious deeds. The Shrine is especially overcrowded on sabbath days, full moon days and during religious festivals with devotees and pilgrims reciting prayers, telling their beads or meditating. We also find people gilding the Great Image with fine gold leaves or offering flowers, candles, fragrant incense-sticks, etc. or making cash donations for the maintenance of the Shrine. Monks, nuns and hermits also visit the Shrine to carry out their religious practices. [3]

V. EXISTING CONDITIONS OF MAHA MYAT MUNI PAGODA COMPLEX

It is located between 81º and 84º road and the north of Athawkyayama Kyaung Taik and the south of 45º road. It is in Kyun Lone Oke Shaung ward of Chan Mya Thar Si Township.

The area of the pagoda complex is 82.9 acres in 1973 and 58 acres in present without Athawkyayama monastery compound and Armandar pagoda. The total population in this complex or pagoda compound is approximately 2500-3000 numbers. And the pilgrims and devotees, travelers and tourists arrived in Maha Myat Muni Pagoda are approximately 200 population at dawn, 250 population at morning, approximately more than 200 population at afternoon, and at the evening is approximately 300 population, but at the Sabbath day, there may be more than 400 pilgrims and at the full moon day of every month, the pilgrims and devotees in Maha Muni Pagoda are more than 500-1000 population.
A. Land Use in Maha Muni Pagoda Complex

The existing land use of Maha Muni pagoda area is not only religious buildings, mixed with others. The land use can be classified as religious buildings (pagodas), residential buildings (shop houses and apartments), fire station, ponds, monastery compound and open space as shown in Fig. 7. In the innermost compound, perfumed chamber is existed and surrounding with various types of museum. In the middle enclosure compound, some of small museum are existed at the south. At the outer enclosure compound, two ponds and recreation parks are existed at the east. And Buddhist museum is existed at the south outer enclosure compound. Monastery compound is existed at the west part of outer enclosure compound. Most of shop houses and residential buildings are existed along main road and fire station is existed near the Buddhist museum.

B. Types of Construction in Maha Muni Pagoda Complex

Depending on fire resistance rating of building elements such as structural frame, exterior and interior walls, floor and roof, five types of construction can be classified as described in I.B.C. Type I and II are built with non-combustible materials, Type III a is R.C and III b is brick nogging, Type IV is built with heavy timber and Type V are of others. These types of construction can be seen in this complex shown in the following Fig. 5 as an exterior wall building materials within the complex.

C. Environmental Conditions around Maha Myat Muni Pagoda Complex

By studying environmental conditions around Maha Myat Muni pagoda complex, it is found that there are Mahanandithaynayama Kyaung Taik monastery and Taung Htilin Taik monastery are existed at the east and some shop houses are existed along the east main roads. At the west, there is Than Hlat Hmaw South Ward and Kan Daw Gyi Lake is existed at there. The building near Maha Muni area is mostly R.C and brick nogging building from this ward. At the south, there is Shwe Phone Shein Ward, Myin wun Kyaung Taik monastery and Phayagyi market is existed. The buildings from this ward are also safe from flame spread because of R.C and brick nogging building. But, there may also be dangerous from Phayagyi market because all the shops are set closely each other and there are also transient sellers on the middle road. Because of these, it should consider about fire emergency case. At the north, there existed Athawkayama Kyaung Taik monastery and apartment buildings from Maha Muni Pagoda. There also do not need to be considered for fire emergency case, because these has many private and public open space at the Athawkayama monastery and all the apartment buildings are R.C buildings.
VI. ANALYSIS ON MAHA MYAT MUNI PAGODA COMPLEX

The pagoda complex is analyzed with six types of criteria and as a result the sample upgraded plan has been proposed for this compound.

A. Analysis with six types of criteria

1) Exterior Wall Building Materials: Except from religious buildings, all the buildings are brick nogging. But, the most anxiety thing is walkway along to image. All the walkways are timber and this can cause spreading of fire. The environmental buildings around pagoda complex are mostly R.C and brick nogging buildings. That will be in good condition to prevent from spreading of fire.

2) Fire Buffer Area: There is not much buffer area in the compound whether it has much open space. Most of open spaces are mixed with residential and religious building, so it can’t perform for defensible fire. But recreation space can act as buffer area existed at the north east part. When a fire outbreak happen, Mandalay city gets mostly south wind and these open spaces can’t perform as fire barrier because most of these are existed at north part.

3) Emergency Escape: When the entrance is calculated with population volume, it can see that 625 population volume per entrance. And the route to escape is very narrow for all people to escape within a few minutes, the inner walkway is 20 ft wide but the side shops take 4 ft each side and the route left is about 12 ft only for 6 people to walk at the same time. So, people will block in the compound.

4) Distance from Fire Station: There is fire station within the compound. And the fire engine can arrive in time quickly.

5) Fire Apparatus Access: The entire road in the compound can make accessible for fire engine. They are 15 ft and more than 15 ft wide and some are unpaved lane. But the bad thing for fire engine access is there is fire lane to the inner compound although it has entrance.

6) Fire Fighting Water Supply System: There is one fire hydrant at the north road and the pagoda area is suitable for firefighting water supply. Because the compound is close to natural water body (Kan Daw Gyi Lake) at the west and the water from two ponds existed at the east can also use as a fire fighting water. So, the water supply is the convenient thing in this area.

When this area is analyzed by micro climate there has highest temperature from March to May which are the hottest month in Mandalay. And the temperature and the wind area the two forces for fire to big and spread quickly. The wind speed is around 1.9 to 4.9 knot at these months but there is south wind almost all the year round. So, it needs to prevent the south part than other parts.

When the wind blows from south direction, the fire will spread all the area, mostly to residential and walk ways areas. Although it has open space, they are existed at north part, so they can’t perform well for defensible fire. When the wind blows from south-east and south-west direction, the fire spread exactly the same as the above. So, the south parts and the walk ways are needed to prevent form spreading of fire in this area.

The inner portion needs fire lane and emergency escape for people. This part need to be upgraded for fire safety. And all the existing land uses must be clearly defined. The compound needs more parking space than the present conditions to prevent from traffic problems. Public and private open spaces are needed to be suitable buffer are for defensible of flame and fire spread.

For the occupant load more than 1000 person per storey needs minimum 4 escapes. The area has 2500-3000 people, so it needs more emergency escapes in the inner compound. There must be one exit at every travel distance 145 ft. And the last things need to provide is suitable fire lane only for fire engine to enter and all these lanes must be
at least 10 ft wide. And there also must be one fire hydrant at every 500 ft within the compound.

B. Proposed Upgraded Plan for Maha Myat Muni Pagoda Complex

By analyzing above criteria, the paper presents the upgraded plan for the compound. All the issues have been systematically upgraded in this proposal. The land use has been clearly defined and no other residential buildings in this religious site. Due to this affect, the area has much open space and parking space for visitors which can act as defensible space for fire. All the inner compound needs to give one emergency exit at every travel distance of 145 ft without sprinkler systems according to the requirements for emergency escape for fire safety. In this compound, all of the roads are at least 12 ft to 15 ft wide which can be accessible and suitable for existing fire engine of Mandalay. There has provided the lane which can only pass through for fire engine called fire lane to the inner compound shown in the following fig. And for the fire fighting water supply, it has provided one fire hydrant at every 500 ft, and which can be suitable for this supply and the compound has two ponds and it is closed to natural water body (Kan Daw Gyi Lake), so there is no emergency case for requirement of water supply.

Fig. 13 Upgraded plan of Maha Myat Muni pagoda complex

VII. CONCLUSION

Historic buildings and areas are the reflection of the social and cultural life for future generations as an essential element in the recognition of cultural identity. Therefore, many boasting historic sites and buildings of our religion express our identity and culture. And this is our responsibility to preserve these relics and religious buildings and areas from various deteriorations. Natural hazards are major destroyer of our historical relics. In Mandalay, urban fire is more common than any other natural hazards. So, fire safety is a predominant requirement for this city. The historic sites are needed to conserve properly and the only and the most famous statue, Maha Myat Muni pagoda complex also needs to prevent from urban fire. There are many possible ways to make fire safety for this complex. The paper is presented and discussed about the way for fire safety from urban planning point of view and the proposed plan will be a useful and suitable way for conserving this historical site from the danger of urban fire. That will be reduced fire to a moderate limit and may be of great help in heritage conservation.

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