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### MODERN BUILDING SERVICES IMPACT ON HERITAGE SHOPHOUSE FAÇADE IN GEORGE TOWN, PENANG

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#### *Abstract*

This study aims to determine the effects of modern building services on the building's façade of heritage shophouse in George Town, Penang. The study selects shophouse façade as a case study, for the shophouse importance in forming most of the urban fabric in George Town and its façade as it represents the outside part that gives the visual appearance of the building, and therefore, the current streetscape of the area. The focus is on the background of the area and its history, the architectural features of the various types of the shophouse, its categories, the geometrical composition that gives the visual appearance to its façade. The data collected included the building services (traditional and modern) used in shophouse building. The methodology of this research is a comparative analysis of two conditions of heritage buildings. The first one is the original state of the building, as it was built with the authentic architectural features. Secondly, on the current state after the additional features related to the installations of modern building services. The main difference between the two cases is that the original building is built with its traditional methods and passive techniques allow at the time of building, and integrated with the architectural properties of the structure. On the other hand, modern appliances are made with features that dominate and blemish the physical appearance of the building, the façade function, building and finishing materials. The insensitive placements of building services appliances had reduced the authenticity of George Town heritage buildings.

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**Keywords:** Building services, George Town, shophouse, heritage façade, Penang heritage building.



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## 1. Introduction

The year 2008 was a pivotal point for the heritage city of George Town, Penang, as it declared officially a heritage site by UNESCO. George Town World Heritage Site (GTWHS) has been divided into the core zone and the buffer zone (Figure 1). Since then, it has acquired an additional interest by researchers, tourists and any other people who are interested in history, culture, and traditions. This action by UNESCO put a big responsibility on the local authorities and people, towards more preservation and awareness to the increased value of the physical and intangible existing in this area. Moreover, according to the multi-cultural nature in this area, this appears obviously on its architectural morphology. Multiple types of buildings, with various architectural styles, can be seen in George Town streets (Nasution, 1997), which boosts the visual enrichment of the street façade.

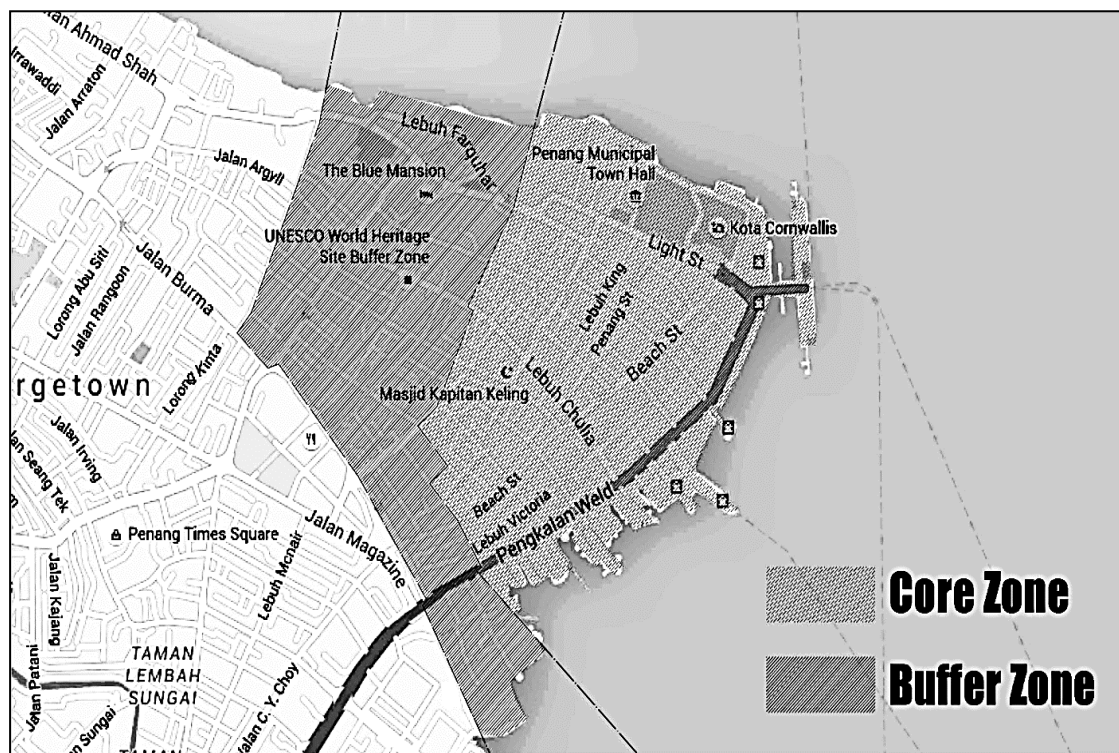


Figure 01. The Core and Buffer Zone of George Town World Heritage Site

The building type of the shophouse is so important for the heritage urban fabric of George Town, according to its ratio of total structures in the area. With a total number of 3771 buildings, the ratio reaches 76.54% of the city components (AJM & Jururancang, 2013). Thus, any preservation effort must consider shophouse as its first focus point. The shophouse types include six basic styles, classified according to the architectural features and the period of constructing.

One of the basic purposes of a building is to be a shelter that provides protection from the outside environment for the occupants inside it (Unwin, 2003), and shophouse is not an exception. The techniques used for achieving the body comfort inside the structure are integrated with the building itself. In other words, they are part of the building process, built with the same materials, techniques, and as a result; they contribute in the final architectural form, as a part of its entity. The information needed for the

research are the main two aspects of it, which are the shophouse itself (the affected aspect), and the building services (the impact system). These will be explored next.

### 1.1. The shophouse

The term (Shop-house) is defined by the Oxford dictionary as ‘...in S.E. Asia, a shop opening onto the pavement and also used as the residence of the proprietor.’ (Oxford, Weiner, & Simpson, 1989). Shophouse was not a recognizable term by the laws like Municipal Ordinance until the 19th century. However, at that time, writers used several alternative terms such as; ‘compartments... single pigeon holes alongside the streets’, ‘long rows of queer little Malay and Chinese cottages’, or ‘shop and house... as belonging to Chee Ean Chinaman’. The last expression used by Captain Francis Light when he firstly settled in Penang in the late 18th century. The name ‘Shophouse’ has become publically used around the 1950s (Wan Ismail & Shamsuddin 2007). Shophouse, as a building type, is determined by its special features of (GTWHI, 2015):

- Facing the street: Shophouse is always having an elevation toward the street.
- Built in rows: A group of shophouses is usually built attached to each other directly. Nevertheless, they are separated by a single party wall between them.
- Low rise building: According to the current building technologies at the time shophouses were built, the shophouse has two to three floors only.
- Longitudinal built area proportion: Shophouse has linear space organization, with narrow street elevation, and long depth.
- Five-foot ways (*kaki lima*): In front of the shophouse façade, there is a covered walkway along the road within the property area, but for public usage.
- Multi-functional: Obviously, from its name, shophouse has a commercial activity zone on the ground floor, while the residential zone is located on the top floor(s) to have the privacy needed.
- Courtyard: Shophouse are designed as a respond to environmental causes, courtyards have a pivotal role in the process of gaining natural light and ventilation. Normally, there are two opening spaces inside shophouse; an air well in the middle depth of the plot area, and another backyard at the rear end of the plan.
- Roofs: Typically, a pitched roof with clay finishing layer of orange tiles is covering the shophouse tops. This technology has developed from the coconut frond thatch (attap) which used earlier in the traditional roofing system.
- Beams and Slabs: The main technique used for carrying slabs and roofs is the structural timber beams. Furthermore, timber planks are used for slabs. However, concrete beams and slabs used in the latest styles.
- Façade decorations and colors: Façade is the most interesting part of the shophouse. Inspired by Malay, Chinese, European and other mixture, it has decorations, ornaments, and drawings, which varied in their complexity, according to shophouse style, location, and owners' prosperity.

Despite their common features, shophouses have been classified into six styles, depending on the time they had been built, façade characteristics, and building techniques and materials. According to Knapp (2010) and Wooi (2015), these styles are (Figure 2):

- Early Penang style (1970s-1850s).
- Southern Chinese Eclectic style (1840s-1900s).
- Early Straits Eclectic Style (1890s-1910s).
- Late Strait Eclectic Style (1910s-1930s).
- Art Deco style (1930s-1960s).
- Early Modern style (1950s-1970s).



**Figure 02.** Penang's shophouse styles

## 1.2. Building Services

Earlier, human learned how to make fire, and when he tried to bring it into his shelter aiming to gain light and heat, turn out that the fire has its problems such as smoke. Also, it needed to maintain fresh air that keeping it burning. Consequently, he made appropriate openings to replace polluted air with an outside fresh one. That idea considered as the first attempt to link thermal comfort and light with a ventilation system, and the concept of building services has been elaborated (Janssen, 1999).

Simply, building services are all systems installed or parts designed into buildings to make them comfortable, functional, efficient and safe. CIBSE defines building Services Engineering as all about making buildings meet the needs of the people who live and work in them (CIBSE, 2016). Building services can be classified according to their category as (Portman, 2014):

- Efficiency: Energy use and supply (gas, electricity and renewable sources such as solar, the wind, geothermal and biomass), and also energy distribution, communications networks, carbon emissions calculations, and reduction, and façade engineering (such as building shading requirements).

- Safety: Includes services like daylight and artificial lighting, escalators and lift, security and alarm systems, lightning protection, and fire safety (detection and protection).
- Comfort: Contains heating, ventilation and air conditioning (HVAC), water (supply, drainage, and plumbing), and refrigeration.
- Others: Some buildings have special types of building services like systems for bacteria and humidity control, emergency power, specialist gas distribution, and for the retail case; it includes advertisement banners and lights.

## **2. Problem Statement**

Some buildings are classified as heritage buildings with a special value, for many cultural, artistic or historical reasons. Those buildings have their building system in the time of their construction, and its building services integrated within it in most cases. However, with new advanced technology, new appliances, and other service parts have been installed in the original structure, which in most cases has a different appearance, material, colour, and any other architectural form feature with the genuine building on both whole and parts levels. Consequently, that unharmonic state has its negative impact on the heritage value of the building.

## **3. Research Questions**

- How is the relation between the shophouse and the building services is changing from its?
- Original state to current one?

## **4. Purpose of the Study**

The purpose of this study aims to diagnose the effects of the new modern building services and their outside parts on the building's façade of heritage shophouse in George Town, Penang.

## **5. Research Methods**

The study uses qualitative methods of comparing building services in shophouse between its original state and explore how they were integrated into the design and current state in which modern parts and appliances are installed. Furthermore, the research elaborates the relationship between shophouse façade and the building services in the two states; their impact on façade design, function, and materials. In other words, viewing their features in comparison with façade characteristics. Each category of building services is clarified in terms of its calibration with shophouse architectural features; integrated with the general design and in which part, the effect on function, correlation with the façade.

Data collection is different between the original and current state. The original building state has been explored through previous studies related to shophouse design, documents, old photos and even postcards, in addition to short interviews with experts. On the other hand, data on the current state is gathered by direct observation, and photo documentary

Case study area is located within George Town World Heritage Site (GTWHS), specifically the shophouse façades in the streets of the inner core area of George Town; which is the initial urban settlement planned by Captain Francis Light himself. This area bounded by Light street from the North, Beach street to the East, Chulia street South, and Pitt street to the West (Figure 3)



**Figure 03.** Case study area (George Town inner core), with samples of streets elevations

## 6. Findings

For each category of building services, a narrative discussion will be done into two sections according to each original and current state. Furthermore, the relation with the shophouse façade will be elaborated.

### 6.1. Original shophouse

Traditional shophouse has been designed with a full response to climatic needs. This can be expected as known that it has been built when no contemporary artificial energy resources were available at the time of constructing. Thus, it is predictable that shophouse design could support every human need of building services. Next, the study shows each category of building services, as it was in traditional methods:

- Efficiency services

Natural resources had been used to gain the necessary energy for daily activities. Cooking was usually done by any available fuel (Hansen, 1987), which had no connection with any physical part of the façade. Mainly, shading has been provided to the entrance area through the Five-Foot-Way, whereas the upper floor(s) are projected to the front to cover the lower area. Besides, wooden louvered shutters are

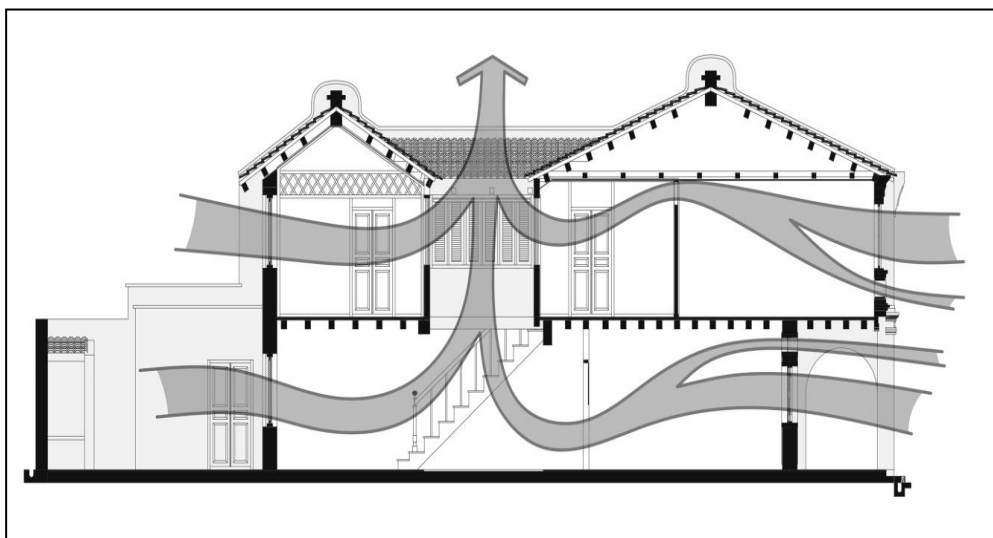
fixed on the windows to control the natural light (Ismail, 2005). These shading techniques were formed the basic elements of Georgetown's shophouse façade.

- Safety services

Shophouse open design is so efficient as related to daylight system. It has an opening to the sky in the middle of the plan known as the air-well, in addition to rear backyard and windows. This system with its elements considered as a basic part of the whole design, and building façade respectively. On the other hand, during night hours, ornamented lanterns, as well as candles in decorative holders, were used. In some cases, lanterns hung from the ceiling of the Five-Foot-Way.

- Comfort services

As a response to the hot/ humid climate, the whole design along with the details are serving the purpose of efficient natural ventilation and air movement (Zakaria, Kubota, & Toe, 2018) (Figure 4). The main elements of the ventilation system in shophouse are Air-well: as well as its importance in natural lighting, it plays a vital role in removing the stale air in the building, with its central position in the long plan area. Air vents: allow the air movement between internal spaces, which normally locates close to ceiling height and from outside too, forming essential elements in façade design. Windows: in order to let the air moves in and out the building, they also locate as an important part of façade elements, in addition to other windows open on the air-well and rear courtyard. Other elements: such as lattice screen separates some interior spaces for better air movement and pitched high roofs which are sometimes designed in jack shape. Fresh water was gained through digging well in the rear backyard (in some cases there were two wells, the other one is in the middle of the plan under the air-well) (Choo, 2015), so it has no effect on façade or general design of the shophouse. Correspondingly, wastewater was treated in different ways according to its type; rainwater was directed outside by the shape of the pitched roof (AJM & Jururancang, 2013), while the heavy water was carried by special workers who collect it into buckets through the rear opening under the toilet (IWK , 2016).



**Figure 04.** Shophouse natural ventilation system

## 6.2. Current shophouse

After electricity was firstly used in Malaysia at the turn of the 20th century, it was not commonly distributed, until the Central Electricity Board (CEB) was established in the middle of that century (TNB 2016). That was a turning point as related to the building services development. Later until the current date, new types of building services and appliances are added to existing structures to replace old methods or to serve new modern needs. Almost all these new types of services are connected to the infrastructure network. These are:

- Efficiency services

The technology of electricity makes it needs cables to transmit through them. These cables connect the national electricity to the main distribution board in each building, and that done from outside to inside the structure, which means, from urban space (the street) penetrating building façade to the interior spaces. After that, it had to be distributed into all building spaces to reach every appliance works by its energy. In other words, cable trajectories are visually appearing on the façade, and their effect varies according to their diameter, length, position, and treatment. Besides, some other related parts are put on façades such as distribution boards and power meters. As related to the shading process, new plastic shades on the metal skeleton are fixed on external walls. Those are mostly cannot be harmonised with other original whole design and details. Other types of networking services such as TV and internet services had the same electricity visual problem as well as some other external parts like receiver dish.

- Safety service

The daylight system almost remains the same, except for some blockage by new system parts. On the other hand, a significant change occurred in artificial lighting, by controlling fixtures shape, light colour, and light direction. That makes it possible to add more aesthetic value to shophouse façade at night, but only if it is used correctly. Alarm systems have been added, along with CCTV networks and fire safety systems in some buildings. The last types of services have a minimum impact on façade according to their relatively small size.

- Comfort services

Firstly, ceiling, wall, and table fans are used to re-direct air movement inside the interior spaces, which have no relation to the external building envelope. Some types of exhausting fans are punching the roof from the façade side affecting the building original skyline. Furthermore, new types of air-conditioners are used, that require indoor and outdoor units, and the last one is forming a big visual problem as their visual design is completely different from the genuine physical character of the building including shape, colour, material, rhythms, ...Etc. Besides, their connecting cables with the indoor units are also ugly if they randomly extended. Furthermore, these types of systems are demanding closed volumes to control air quality, that lead to adding partitions and close spaces, which ruined the process of natural ventilation completely. Water supply is much more efficient nowadays, connected to the water supply network with the small visual cost of external pipes and water meters, while some other parts like water tank are placed inside building's open spaces. Some parts are added to treat rainwater, such as gutter which fixed at the lower end line of the sloped roof, and also the related piping. Plumbing is now perfectly efficient, by wasting heavy water through the network to special places to process.



▪ Other services

As long as the shophouse has commercial activity, it needs to be advertised. New methods of advertising have been used, including printed banners and fluorescent light boards. Varied in size, shape, materials, colours, rhythms and directions, they have their visual features that do not mix fluently with the existing and even affect the visual properties of the whole street façade (Sabah & Samad, 2015). In addition to what mentioned, their big areas cover many façade details, in some cases, they cover all the upper floor(s) area, and even worse, the owner may change the whole façade design to be in line with advertisement concept.

As noticed, some types of modern building services are not compatible with façade design, especially if they not installed properly, with careful consideration to the original composition of the shophouse façade. Figure 5 shows some samples of visual problems caused by the instalments of modern building services.



**Figure 05.** Samples of problems cause by modern building services

Table 1 summarises the results of the relationship between building services and shophouse design in the two conditions of the original building and present state:

**Table 01.** Building services comparison between the original and current state of a shophouse

Shophouse			
Original		Current	
General	Relation with facade	General	Relation with facade
-Energy natural resources. -Wooden shades on windows, upper floors projection.	-No relation. -Part of facade design.	-Electricity from the national network. -Plastic shades with metal frames. -TV, Internet services.	-Harmful without proper treatment. -Not harmonised.  -Minimum impact.
-Natural light system. -Candles and lanterns.	-Windows on street. -Hanging elements.	-Same natural light. -Artificial lighting. -CCTV, alarm systems.	-No change. -Enhancing -Unmentionable effect.
-Natural ventilation. -Wells for water supply -pitched roof for rainwater. -Old methods for Heavy water	- Basic part of design. -No relation. -Basic part of design.  -No relation.	-New air-conditioning. -Water supply network. -Gutters and pipes added to original roofs. -Much more efficient waste water network.	-Bad impact. -Minimum impact. -Not harmonised.  -No relation.
-Advertisement panels carved letters or characters.	-Minimum impact.	-Huge banners and light advertisement.	-Worst impact possibly changes the whole design.

## 7. Conclusion

Building services have witnessed the accelerating development, and still. Aiming to match increasing human needs in more efficient ways. Undoubtedly, infrastructure and their network development have contributed to building service types, in parallel with appliance innovations, higher industry level, and economic power. All these factors lead to increase people prosperity and their willingness to ease of living. On the other hand, heritage values have to be protected. Shophouse as a building type has a special significance in forming the urban fabric in George Town. Its elegant façade, with all the unity of rhythms and repetitions, besides the variety in architectural elements and details, makes it the most important factor in accumulating the mental image of the heritage street façade, and that appears obviously in photos, postcards, and even artistic paintings.

When modern building services entered the area of GTWHS, they made a massive change in the building typology. It is undeniable that their positive contribution is significant. Especially what related to modern infrastructure. For example, the water supply system is now far better, healthier, and more efficient than the traditional method, which made old ways of gaining water disappeared completely. The same could be said of the wastewater system, with its high standards efficient network. Nevertheless, these new methods and their appliances have an unmentionable impact on the physical characteristics of shophouse generally, and its façade specifically. Other new types of modern building services also have an important role in the contemporary daily life of people, like electricity service, CCTV, TV network, and the internet. These types of negative effect are insignificant in most of the cases and can be eliminated by simple treatments and re-positioning. Modern air-conditioning services have improved the air quality noticeably, but their methods and devices require a total change in the previous traditional techniques. Open space system is no longer served the work process of modern technology, so volumes need to be closed to work with full efficiency. Besides, most of the new systems outdoor unit placed arbitrary on the façade, so it affected outside visual appearance. These problems could be avoided only by good planning for the positions of outdoor units, and using transparent partitions in order not to interrupt at least the visual continuity of interior spaces. The worst impact on the visual identity of the shophouse façade is made by advertisement boards, due to the intention of the building's owner advertise their retail activities. In some case, the panels cover all façade area. Hence, it needs to be treated carefully or even could be removed totally to regain the original architectural characteristics beneath it. On the contrary, artificial lights might add another aesthetic value to the elements of the façade, if they used in professional, well-designed feature to amplify the genuine composition of the traditional design.

To conclude, modern types of building services are in the non-stop development process, and using them is inevitable as a response toward perfection, and complying increasing human needs. However, Heritage buildings have their great value, and preserving them has a significant return on the economy, tourism, and many other fields. Indeed, these modern systems could be harmonised with the existing, to maximise their contribution and at the same time, minimise or even eliminate the negative impact. That can only be possible by following the right plans, obeying the legislation related to this matter.

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