Seventh LACCEI Latin American and Caribbean Conference for Engineering and Technology (LACCEI'2009)
"Energy and Technology for the Americas: Education, Innovation, Technology and Practice"
June 2-5, 2009, San Cristóbal, Venezuela

Preservation of Historic Building Frontages: Problems and General Recommendations for Caribbean Environment

Mwasha, A.; Mwasha, C. and Archers, A.
University of West Indies
St Augustine Campus
Trinidad and Tobago
Email: amwasha@eng.uwi.tt

ABSTRACT

Architectural styles throughout the Caribbean are greatly influenced by three main factors: Environmental, Geological and Colonial factors. The Caribbean, upon being visited by foreign explores has gone through a number of colonial rules such as the Spanish, English, French, and Dutch. Beside colonial rulers slaves from Africans as well as Chinese, Indian workers and Jewish refugees have contributed immensely to architectural and materials used to construct historic building frontage "façade" or "face" of these buildings. In architecture, the frontage of a building is often the most important part of a building from a design standpoint, as it sets the tone for the rest of the building. Throughout the world facades are historic, and local zoning regulations or other laws greatly restrict or even forbid their alteration. The environmental factors are a principal source of deterioration of historic building frontage. For Caribbean Environment, sea water produces expansive pressure dampness in the cement paste or in nondurable aggregates and timber elements. Carbon dioxide and other gases from industries and vehicular contribute another atmospheric component causing deterioration on historic frontage. Fire, to some extent, has destroyed many historic building facades. Faulty repairing of frontage can lead to further damage or safety hazards. In this paper the challenges involved with the preservation of historic sites in Trinidad and Tobago is discussed. The problems and recommendations on preserving historic frontage in Caribbean environment are discussed.

RESUMEN

Los estilos arquitectónicos a lo largo del Caribe están altamente influenciados por tres factores principales: Ambiental, Geológico y Colonial. El Caribe, al ser visitado por exploradores extranjeros ha pasado por un gran número de dominios coloniales tales como el Español, Inglés, Francés y Holandés. Además de gobernantes coloniales esclavos de africanos así como chinos, trabajadores provenientes de la India y refugiados judíos han contribuido en gran medida a la arquitectura y a los materiales utilizados para construir los frentes de edificios históricos, las "fachadas" de estos edificios. En arquitectura, la fachada de un edificio es con frecuencia, la parte más importante de un edificio, desde el punto de vista de diseño, debido a que determina el estilo del resto del edificio. Las fachadas en todo el mundo son históricas, y los reglamentos locales por zonas y otras leyes restringen enormemente o incluso prohíben su alteración. Los factores ambientales constituyen una de las fuentes principales del deterioro de la fachada de un edificio histórico. Por el medio ambiente del Caribe, el agua de mar produce una amplia presión de humedad en el cemento o en el material granular no duradero y en la madera. El dióxido de carbono y otros gases provenientes de las industrias y de los vehículos contribuyen con otros elementos atmosféricos que causan deterioro en las fachadas históricas. El fuego, hasta cierto punto, ha destruido muchas fachadas de edificios históricos. La reparación defectuosa de una fachada puede conducir a un daño mayor o a riesgos de seguridad. En este documento, se habla de los retos relacionados con la conservación

de sitios históricos en Trinidad y Tobago. Asimismo, se habla de los problemas y recomendaciones sobre la conservación de fachadas históricas en el ambiente del Caribe.

1.0 History of Architecture in Trinidad and Tobago

In 1783, due to the gold rush in South America, a significant number of the population had migrated to South America. As such, the Spanish government implored Catholics of all nationalities to settle in Caribbean countries and islands including Trinidad and Tobago. One of the first major buildings to be built in Trinidad was Fort San Andres. This was built by the Spanish in 1785. However after a major fire in 1808, that destroyed the city, only the stone military structures survived. Independence square is one of the few Spanish influenced infrastructures to be found in Trinidad. In 1797 British captured Trinidad and Tobago islands. Under the British rule the Roman Catholic and the Anglican cathedrals were built after the neo-Gothic style (Stanton 1968). The Parliament House, otherwise known as the Red House was built using a neo-Renaissance style. In 1907 the structure had to be rebuilt after two fires. The police headquarters found behind the Red House was built in an Anglicized Italianate neo-Gothic style (Gravette 2000).

Table 1: A brief listing of historic buildings in Port of Spain, Trinidad

Name of Building	Year of Construction	Brief Description
The Botanic Gardens	1818	This former large sugar estate covers an area of 1.6km^2
Queen's Park Savannah Area	-	A 1 km^2, irregular shaped open green space with elegant old and modern buildings around the perimeter.
The Magnificent Seven - Queen's Royal College - Hayes Court - Mille Fleurs - Ambard's House (Rumor) - Archbishop Residence - White Hall - Stollmeyer House/ Castle	 1904 1910 1904 1904 1904 1904 1904	 A building characteristic of German Renaissance design. A Romanesque-Irish style of architecture. A building of French Baroque style having a tower with a spire on it. A typical turn of the century structure with impressive iron fretwork giving rise to an elaborate gingerbread style. The building features a Romanesque-Irish style. An opulent Moorish style mansion, inspired by the Venetian-style Palazzi. A miniature Rhine castle constructed of brick. The building has a characteristic part French and Scottish appearance.
All Saint's Church	1846	A stone wall constructed building.
President's House	1873	A Victorian-styled 'L' shaped structure.

Table 1 reveals that several historic buildings on the island are dating back to the First World War (1914-1918). The geometric patterned layout of Port of Spain center is complemented by parks and squares. Port of Spain constitutes the oldest part of the Trinidad Island. Port of Spain stretches between South Quay to the south, Oxford

Street to the north, St. Ann's River to the east and Richmond Street to the west. The heart of Port of Spain, Woodford Square is the home very important historic buildings i.e. the City Hall, Red House (House of Parliament), the Anglican Holy Trinity Cathedral and the National Library.

The most magnificent of the architectural buildings found in Trinidad can be seen around the Queen's Park Savannah in Port of Spain, fondly known as the magnificent seven. These buildings were built so as to flaunt the wealth of the early 20th century cocoa barons and other notables except for Hayes Court (Bowen 2003). The Queen's Royal College was built in Italianate and mock-German Renaissance style. The college has a double row of broad galleries and clock tower. Its arched fenestration is shaded by top-hinged louvered shutters.

Hayes Court was completed in 1910 and was built to be the residence of the Anglican Bishop. It was built in a mixture of English and French town house styles. Iron fretwork and the Porte Cochere are particular features of this classic mansion.

The Prada House or Mille Fleurs is a French provincial mansion out of the Baroque style. It is known for its delicate wrought-iron filigree and fretwork.

Ambard's House, otherwise known as Roomor or the Gingerbread House, is a Creole-French Second Empire style building. It was built as an imitation of a Paris chateau, with copulas, galleries, dormer windows, towers, spires and pinnacles (Gravette 2000). In terms of the materials used, the tiles used were imported from France and marble from Italy. The renaissance style wrought-iron work was imported from Scotland.

The Archbishop's House is Irish in design, with red granite and marble imported from Ireland. The building contains neo-Romanesque, early Renaissance, Byzantine and semi-Oriental styles. Whitehall follows and is actually an imitation of an Italianate palace in Venetian style.Next is Stollmeyer's castle, which is a stone built, mock-medieval turreted affair in the German Rhinish style and reminiscent of the Balmoral Castle in Scotland.

2.0 General Rview of Historic Building Facade

The building façade is a major component in a building's life cycle. An effective system is essential in contributing to a successful weather tight building envelope and in preventing infiltration of air and water. The signs of deterioration of a building in a hot marine environment can be summarized as represented in Figure 1.

An increasing number of defects on both modern and historic building façades have been studied by (Chew *et. al* 1998, Klieger *et. al* 1994, Manzie 1989 and MPT Construction 1974). Most of these authors found that the common defects are cracking**, s**taining/dis-colouration, sealant failures efflorescence**,** rising dampness/water penetration chemical deterioration/corrosion, buckling/deflection Tile/plaster delaminating and biodegradation. Most of this deterioration is caused by the dampness on the materials.

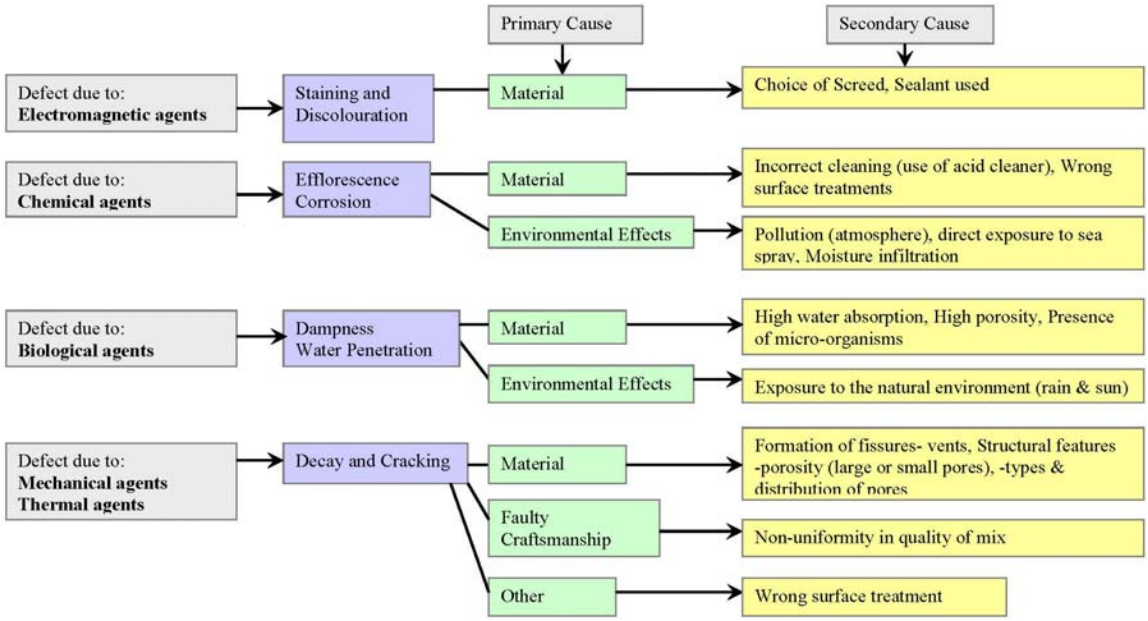

Figure 1: A line diagram of defects and common causes of the deterioration of the building facades in hot marine environments.

Figure 2 shows that the dampness on construction materials reduces thermal resistance leading to condensation of water on the material itself.

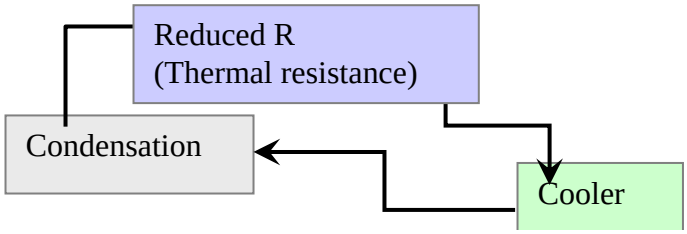

Figure 2: A line diagram of material responses in a hot marine environment

3.0 Assessment of Queen's Royal College building façade in Trinidad and Tobago

The main building of Queen's Royal College was designed by Daniel Hahn and was constructed in 1904 boasting as one of the historic Magnificent Seven landmarks. The majestic clock tower at the front façade is a distinctive landmark in the capital Port of Spain. The building bears resemblance to a place of worship with high arches and stained glass windows. The building façade was constructed of 375mm thick unreinforced concrete walls and lime rendering (Alison 2007)

3.1 Achieving the Aims of Preservation Queen's Royal College Building Frontages

In order to achieve the preservation of Queen's Royal College building frontage, some major assessment were considered such as the flow of water, exposure conditions, surface characteristics and projections and depressions. The major damage to the external façade of the building was due to the reaction of the lime based mortar with acid most likely generated by large amount of vehicular pollution. There was need to acquire knowledge from trained professionals from overseas skilled in restoration historic facades.

According to Alison the sourcing of material for a preservation project were imported including lime for the wall mortar. The preservation project at Queen's Royal College demonstrates that techniques and materials available today can be used in the successful extension of the life of the structure thus preserving a significant cultural resource. On studying the on going project of renovating Queen Royal College Façade the following important conclusion and recommendations were made which could be used on renovation of historic building facades in the Caribbean environment.

4.0 Conclusions

Consideration of the age of the structure, building techniques used, building materials and their locations are important throughout the preservation process.

Complexity of historic building facade could result to high variation of restoration costs.

The lack of maintenance and improper maintenance leads to the critical deterioration of historic building facades.

Techniques and materials available today can be used in the successful extension of the life of the structure thus preserving a significant cultural resource.

4.1 Recommendations

Recommendations for the effective methods of preservation of historic building facades in hot climate zones re:

1) Educating the public about the significance of historic buildings and their reflection as a statement of persons who lived in a particular era.
2) In handing over the restored historic building facades, an outline of the lifecycle of each element such as the timber joists, window frames and wooden floor should be provided. An inventory should be conducted on an annual basis recording information such as of the wear and tear of the elements of the building, exterior façade spot repair for the removal of any visible mould, fungus or bird droppings and the condition of equipment and utilities.
3) Maintenance schedules should be provided to the client inclusive of: the maintenance of the lime wash on the exterior of the building, guarantees and manuals for the lift, air conditioning plant and fixtures and paint specifications for the supplier.
4) The importance of ensuring the final product of the preservation works can be maintained locally, as in upcoming years, the local work force has to be able to apply, replace and maintain materials.
5) The establishment of a curator of historic buildings could facilitate the upkeep of historic buildings in Trinidad. The Ministry should explore the option of providing funds to the National Trust of Trinidad and Tobago in this capacity.
6) There is a need for trained professionals among the local population versed with the knowledge of preservation techniques indigenous to hot marine climatic conditions.
7) The incorporation of distinctive non-destructive methods of evaluating historic concrete building such as the use of thermal imaging to reduce deformation of weak historic materials

References

Archer, A. 2007 Preservation of concrete historic buildings in hot climatic zone. SIP University of West Indies. Trinidad and Tobago

Bowen, W. 2003 "Trinidad's magnificent mansions." *The Jamaica Observer*, 1 5,

Chew, M.; Wong, C. and Kang L. 1998 *Building Facades, A Guide to Common Defects in Tropical Climates,*World Scientific Publishing Co. Pte. Ltd

Gravette, A. 2000 *Architectural Heritage of the Caribbean - An A-Z of Historic Buildings.* Jamaica: Ian Randle Publishers,

Klieger, P. and Joseph, F. 1994 *ASTM: Significance of Tests and Properties of Concrete and Concrete-Making Materials*, 1994, 4th Edition, ASTM Publication Code Number 04-169030-07, American Society for Testing and Materials

Manzie, G. 1989 *Defects in Buildings*, Department of the Environment, Directorate of General Design Services. Her Majesty's Stationery Office

MTP Construction 1974 *Building Defects and Maintenance*, *Essential information from the Building Research Establishment*

Phoebe B S.1968 *The Gothic Revival & American Church Architecture; An Episode in Taste, 1840-1856* Baltimore, Johns Hopkins Press,

Stanton, P. B. 1968 The Gothic Revival and American Church Architecture. Gothic revival. *Columbia Encyclopedia.*