

Importation of Le Corbusier's 'Roof Garden' to Japanese Modern Architecture

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Abstract

The purpose of this paper is to clarify how the "Roof Garden" concept of Le Corbusier (1887-1965) has been imported to Japanese Modernism architecture. Our research objects are the buildings by the architects extracted from *Japanese Modern Architecture* (1993). Classifying the Modernism architects as the "Bauhaus School" and the "Le Corbusier School" based on the *Japanese Modern Architecture*, we analyze the chronological tendency from the viewpoint of "Flat roof (structure)", "Plant (material)", and "Function". As a result, we can say that the material control for the World War II has been one big turning point. That is, the "Bauhaus School" always made full use of the structure for the flat roof. On the other hand, the "Le Corbusier School" once gave up at the time of the material control, but they planned the roof garden again at the postwar period and gave a new positive meaning. In conclusion, we suggest that such an aspect of the importation of Le Corbusier's "roof garden" concerns not only the physical problem of the difference of climate, but also the "Controversies on Tradition" in Modernism architecture at that period.

Keywords: Le Corbusier; roof garden; Japanese modernism; Controversies on Tradition; garden

1. Introduction

1.1. Purpose

Le Corbusier (1887-1965) is known for summarizing the Modern architectural language by advocating "5 points of a new architecture" (Les 5 points d'une architecture nouvelle, 1927)⁴. Certainly, 5 points of a new architecture, "Piloti", "Roof Garden", "Free Plan", "Free Facade", and "Strip Window", in Japanese Modern architecture, can be pointed out as an element of a building. However, the "Roof Garden" (toit jardin) as negation of the traditional vocabulary on roof is the most ambiguous concept: Is it synonymous with a flat roof? Is it indispensable to plant? What is the exact definition of garden at all?

About these questions, Le Corbusier's statements are sometimes contradictory or sometimes mute. So, the form of acceptance of the "Roof Garden" in Japanese Modernism architecture must contain yet

more various interpretations. Therefore, this paper aims to clarify how the "Roof Garden" concept of Le Corbusier has been imported to Japanese Modernism architecture.

1.2. Method

The roof garden can be observed not only in Le Corbusier's work but in the buildings of De Stijl or Bauhaus, and there are also many formal similarities among them.

However, Le Corbusier was the one who stipulated about the "Roof Garden". That is, in his books^{5, 6}, a terrestrial garden is indicated to be the "Released Land (le sol libéré)". Le Corbusier divided a garden into two kinds according to the distance from the ground, and sketched it to indicate the garden of the non-ground as the "Gained Land (le sol conquis)". So, in this paper, outdoor space which functions in the non-ground is set as the analytic object as a "Roof Garden".

We classify the Japanese Modernism architects as "Bauhaus School" or "Le Corbusier School" based on the *Japanese Modern Architecture* (1993)². And we analyze the chronological tendency from the viewpoint of "Flat Roof (structure)", "Plant (material)", and "Function"⁴. And finally, we discuss and compare the difference between compare the two schools.

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1.3. Reviews

Many researches analyze the influence from the Western European architecture in the Japanese Modernism Architecture. The typical researches on the acceptance of Le Corbusier point out the morphological influence^{1, 2, 11}.

Moreover, from a viewpoint of the form composition some researches analyze each building by Kunio Mayekawa, Junzo Sakakura, and Kenzo Tange who are considered as those strongly influenced by Le Corbusier himself^{7, 14, 15}.

In general, these conventional researches demonstrate the idea or the form by Modern Japanese architects. Compared with these analyses, this paper particularly focuses on the roof garden which is demi-constructive and demi-natural in the Modern Japanese architect's buildings.

2. Roof Garden of "Bauhaus School"

Table 1. Roof garden of "Bauhaus School"

year	architect	work	Flat Roof (structure)	Plant (material)	Function
1923	Antonin Raymond	Architect's Residence	○	○	rest
1924	Seigo Motono	Seigo Motono Residence	○	○	rest
1927	Bunzo Yamaguchi	Shop Yamazaki	○		rest
	Seigo Motono	Tsurumaki Residence (old)	○	○	rest
1929	Mamoru Yamada	Senju Post Office (old)	○		rest
	Antonin Raymond	Saint Luke's International Medical Center in Tokyo	○		rest
1930	Sutemi Horiguchi	Tokugawa Residence	○		rest
	Antonin Raymond	French Embassy	○		rest
1931	Kameki Tsuchiura	Tnii Residence	○		rest
		J Residence	○		rest
	Kameki Tsuchiura	Twara Residence	○		rest
		Hirabayashi Residence	○		rest
1932	Antonin Raymond	Tokyo Golf Club	○	○	rest
	Antonin Raymond	Project for Viscount S Residence	○	○	rest
		Residence of Kisuke Akaboshi	○		rest
1933	Kameki Tsuchiura	Ishii Residence	○		rest
	Sutemi Horiguchi	Nagai Residence	○		rest
1934	Kameki Tsuchiura	Imamura Residence	○		rest
		Tkeuchi Residence	○		rest
	Antonin Raymond	Residence of Morinosuke Kawasaki	○	○	rest
		Mr. K. Fukui's Villa	○		rest dry area
	Sutemi Horiguchi	Arao Residence	○		
1935	Kameki Tsuchiura	Kameki Tsuchiura Residence	○		rest
		Mishima Residence	○		rest
		Itou Residence	○		rest
	Bunzo Yamaguchi	Tomojiro Yamada Residence	○	○	rest
1936	Sutemi Horiguchi	Small Residence in Ginza	○		rest dry area
	Kameki Tsuchiura	Nakanishi Residence	○		rest
	Bunzo Yamaguchi	Kadoya Residence	○		rest
		Baigetsudou	○	○	rest
1937	Sutemi Horiguchi	Naitou Residence	○		rest
1938	Kameki Tsuchiura	Miyaguchi Residence	○		rest
	Sutemi Horiguchi	Yamakawa Residence			rest
	Sutemi Horiguchi	Wakasa Residence (old)	○		rest
1939	Kameki Tsuchiura	Miura Residence	○		rest
		Suzuki Residence	○		rest
1957	Sutemi Horiguchi	Iwanami Residence	○		rest
1958	Kameki Tsuchiura	Doi Residence	○		rest
1964	Sutemi Horiguchi	Shirakawa Residence	○	○	rest dry area

Architects: Antonin Raymond (1888-1976), Sutemi Horiguchi (1895-1984), Seigo Motono (1882-1944), Kameki Tsuchiura (1897-1996), Bunzo Yamaguchi (1902-1978), Iwao Yamawaki (1898-1987), Michiko Yamawaki (1910-2000) and Mamoru Yamada (1894-1966) who are classified into the "Bauhaus School" in *Japanese Modern Architecture*² (Table 1).

2. 1. "Flat roof (structure)"

From the 1920s to the 1930s, the Architects of the "Bauhaus School" have tried to establish various roof gardens by the flat roof by reinforced concrete. However, the Sino-Japanese War in 1937 has brought the control for the material shortage, architectural planning other than by wood has become impossible. It was very difficult to solve the leakage-of-water problem of a wooden flat roof under the climate condition of heat and high humidity in Japan, and Antonin Raymond, Seigo Motono, the Bunzo Yamaguchi and Mamoru Yamada have given up the roof garden.

On the other hand, only Sutemi Horiguchi and the Kameki Tsuchiura tried the roof garden by a wooden flat roof, replacing the Western reinforced concrete flat roof with woods. In the *Wakasa Residence (old)* (Sutemi Horiguchi, 1939) or *Miyaguchi Residence* (Kameki Tsuchiura, 1938) which are representative cases, the leakage-of-water problem of a wooden flat roof is coped with the asphalt waterproofing (Figure 1).



Figure 1. *Miyaguchi Residence* by Kameki Tsuchiura (1938)³

Even after the postwar period, in spite of the currency of the materials, the architects of the "Bauhaus School" continued to pursue Japanese Modernism, without returning to a Western roof garden. Antonin Raymond, Seigo Motono, Bunzo Yamaguchi and Mamoru Yamada used the inclined roof, not flat roof. Moreover, Sutemi Horiguchi and Kameki Tsuchiura could not solve the problem of the weight or the degradation of asphalt waterproofing, and gave up gradually the wooden flat roof.

However, Sutemi Horiguchi and Kameki Tsuchiura planned the roof garden by a reinforced concrete flat roof again. And then, they exposed the pillars and the beams on elevation surface. Besides, Sutemi Horiguchi combined a flat roof and a hipped roof in the *Yamakawa Residence* (Sutemi Horiguchi, 1938), and expressed the roof garden with a wooden Japanese style.

2.2. "Plant (material)"

Antonin Raymond and Seigo Motono planned the roof garden with the domestic plants on the flat roof by reinforced concrete in the first stage of the 1920's. (ex. *Architect's Residence* (Antonin Raymond, 1923))

In 1930s, in addition to Antonin Raymond and Seigo Motono, Bunzo Yamaguchi planned the roof garden with plants (Figure 2). On the other hand, Sutemi Horiguchi and Kameki Tsuchiura planned the roof garden of the simple geometric composition by only artificial materials (ex., ceramic tile, cement, etc.).



Figure 2. *Residence of Kisuke Akaboshi* by Antonin Raymond (1932)¹⁰

However, when the material control started in 1937, it was technically impossible to plan the rich green garden with no leakage of water in a wooden roof without eaves or an inclination of roof, and it was forced to give up the plants on the roof garden.

While Sutemi Horiguchi and Kameki Tsuchiura continued to plan the roof garden of simple geometric composition by only the artificial materials, Antonin Raymond, Seigo Motono, Bunzo Yamaguchi, and Mamoru Yamada who had used plants abundantly on the roof garden were studying a new garden on the ground as a patio or a courtyard.

Even after the end of the World War II, Antonin Raymond, Seigo Motono, Bunzo Yamaguchi and Mamoru Yamada tried the natural garden on the ground, without a roof garden. On the other hand, although plants are exceptionally used by Sutemi Horiguchi and Kameki Tsuchiura in part in the *Shirakawa Residence* (Sutemi Horiguchi, 1964), they continued to plan the roof garden of the simple geometric composition only using artificial materials.

2.3. "Function"

The architects of the "Bauhaus School" planned a roof garden having the simple function as a terrace of the highest floor.

The view from the roof garden was one of the themes, and neither the bench nor the monument were planned but the roof garden was

comparatively used for a short-time rest (Figure 3). Moreover, as *Shirakawa Residence* (Sutemi Horiguchi, 1964), the roof garden functioned also as a dry area after laundry in the residences.

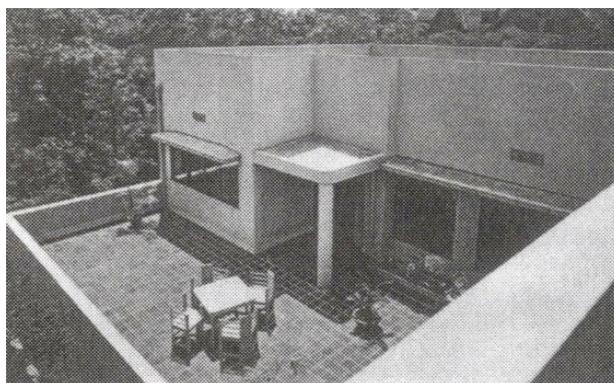


Figure 3. *Ito Residence* by Kameki Tsuchiura (1935)³

3. Roof Garden of "Le Corbusier School"

Table 2. Roof garden of "Le Corbusier School"

year	architect	work	Flat Roof (structure)	Plant (material)	Function
1929	Kunio Mayekawa	Nagoya City Hall	○		rest
1931	Kunio Mayekawa	Meiji Seika, Ginza Bakery Shop	○		rest
1932	Kunio Mayekawa	Kimura Industrial Laboratory	○		rest
1951	Junzo Sakakura	L'Institut Franco-Japonais de Tokyo	○		rest
1952	Kunio Mayekawa	Nippon Sogo Bank	○	○	rest
1954	Kenzo Tange	Shimizu City Hall	○		rest
1955	Kunio Mayekawa Junzo Sakakura	The International House of Japan	○	○	rest
1956	Junzo Sakakura	Tokyu Bunka Kaikan	○		rest
1957	Kunio Mayekawa	Silk Center	○	○	rest
	Junzo Sakakura	Residenc Ma	○	○	rest
	Kenzo Tange	Tokyo Metropolitan Government Office	○		rest
1958	Kunio Mayekawa	Kurashiki City Hall	○		rest outdoor-theater
		Harumi Apartments	○		rest
	Kenzo Tange	Kagawa Prefectural Government Building	○	○	rest
1959	Junzo Sakakura	Imabari City Hall Complex	○		rest
		Silk Center, International Trading and Tourist Building	○	○	rest
1960	Kunio Mayekawa	Hashima City Hall	○		rest
		Gakushuin University	○		rest
	Junzo Sakakura	Residenc Mi	○	○	rest
	Kenzo Tange	Dentsu Osaka Branch	○		rest
1961	Kunio Mayekawa	Imabari Credit Bank	○		rest outdoor-theater
		Tokyo Metropolitan Festival Hall	○	○	rest
	Junzo Sakakura	Urban Planning for Hashima City	○	○	rest
1962	Kunio Mayekawa	Atami Garden Hotel	○		rest
		Kanagawa Prefectural Youth Center	○		rest
	Junzo Sakakura	Okayama Prefectural Culture Center	○		rest
1963	Kunio Mayekawa	Gakushuin University Library	○	○	rest
1964	Junzo Sakakura	Ueno City Hall	○	○	appreciate
		Hiraoka City Hall	○	○	outdoor-theater
		Ashiya Civic Center	○		rest
1968	Junzo Sakakura	Residenc Ue	○	○	rest
		Residenc Ha	○	○	rest
1971	Kunio Mayekawa	Kunio Mayekawa Residence (new)	○	○	rest amusement
	Junzo Sakakura	Hotel Pacific Tokyo	○	○	appreciate
1975	Kunio Mayekawa	Tokyo Metropolitan Art Museum	○	○	rest

Architects: Kunio Mayekawa (1905-1986, Le Corbusier office enrollment period 1928.4.17-1930.4), Junzo Sakakura (1901-1969, Le Corbusier office enrollment period 1931-1936,1938-1939), and Kenzo Tange (1913-2005) who are classified into the "Le Corbusier School" in *Japanese Modern Architecture*² (Table 2).

3.1. "Flat roof (structure)"

As *Kimura Industrial Laboratory* (Kunio Mayekawa, 1932), the roof garden was the flat roof by reinforced concrete in the 1930s. However, when the material control for construction started in 1937, the architects of the "Le Corbusier School" planned the wooden inclined roof as the *Ibashi Residence* (Junzo Sakakura, 1941), or *Kunio Mayekawa Residence* (Kunio Mayekawa, 1942), and gave up the roof garden because the wooden flat roof accompanied the problem of leak for their architects (Figure 4).

On the other hand, when it was able to obtain construction materials constantly in the postwar period, the architects of the "Le Corbusier School" planned again the roof garden by the flat roof by reinforced concrete or steel reinforced concrete, as *Residence Ma* (Junzo Sakakura, 1957), or *Kurashiki City Hall* (Kenzo Tange, 1957). In addition, after the 1970s, an architect of the "Le Corbusier School" planned the roof garden also on the vault roof, as *Tokyo Metropolitan Art Museum* (Kunio Mayekawa, 1975) or the *Kunio Mayekawa New Residence* (Kunio Mayekawa, 1971).



Figure 4. *Kunio Mayekawa Residence* by Kunio Mayekawa (1942)¹⁸

3.2. "Plant (material)"

The architects of the "Le Corbusier School" used only the simple artificial materials, such as concrete finishing, stone pitching, monochrome paint, almost without plants for a roof garden from the 1930s to the 1940s. In the 1950s, they studied the geometrical composition by using the natural materials; grass, pebbles or Oyaishi stone represented in *The International House of Japan*

(Kunio Mayekawa, Junzo Sakakura, Junzo Yoshimura, 1955).

After the 1960s, each architect from the "Le Corbusier School" has read and reinterpreted the Le Corbusier's "Roof Garden". Kunio Mayekawa and Kenzo Tange were greatly influenced by *Unité d'Habitation* (Le Corbusier, 1945)¹⁸, and have realized the plastic garden without plants as *Gakushuin University* (Kunio Mayekawa, 1960) (Figure 5).

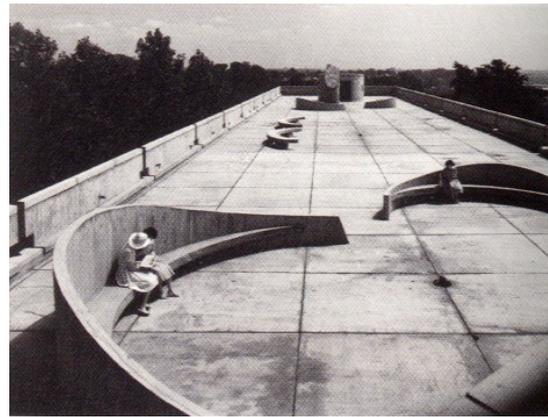


Figure 5. *Gakushuin University* by Kunio Mayekawa (1960)¹⁸

Moreover, Kunio Mayekawa came to use many "cast in place tile". This "cast in place tile" became distinct character of Kunio Mayekawa's building after the 1960s, as *Kunio Mayekawa New Residence* (Kunio Mayekawa, 1971), and the feature of the soil, the style of burning, the style of glazing and the size of the tile for every buildings were often searched for the roof garden by Kunio Mayekawa.

Junzo Sakakura realized three-dimensional and organic composition, making sometime water yard in a large portion in the roof garden as *Hotel Pacific Tokyo* (Junzo Sakakura, 1971) his intentions were described as "I would like to be united with nature" regarding a garden as a life space¹². Furthermore, Junzo Sakakura tied up a terrestrial garden with a roof garden and built environment were one organism for him¹³.

3.3. "Function"

From 1930s to 1940s, the architects of the "Le Corbusier School" did not provide special function to a roof garden and planned the very simple roof garden with only tiles. However, in the 1950s, the architects of the "Le Corbusier School" arranged fixed benches and plastic monuments, and came to use the roof garden for rest. Furthermore, after the end of 1950s, Junzo Sakakura designed a traditional Japanese garden for the appreciation of the view from the roof.



Figure 6. *Kurashiki City Hall* by Kenzo Tange (1957)¹⁶

In addition, Kunio Mayekawa and Kenzo Tange added various functions, such as amusement or outdoor theater represented in the roof garden of the *Imabari Credit Bank* (Kenzo Tange, 1960) or the *Kurashiki City Hall* (Kenzo Tange, 1957), and gave a new meaning to the roof garden (Figure 6).

4. Result

Table 3. Comparison of roof garden in the "Bauhaus School" and the "Le Corbusier School"

		-1936	1937-1945	1946-
"Bauhaus School"	Flat Roof (structure)	flat roof by reinforced concrete	flat roof by wood	flat roof by reinforced concrete
	Plant (material)	plants	artificial materials	artificial materials
	Function	[rest] dry area	[rest] dry area	[rest] dry area
"Le Corbusier School"	Flat Roof (structure)	flat roof by reinforced concrete	-	flat roof by reinforced concrete vault roof by reinforced concrete
	Plant (material)	artificial materials	-	artificial materials plants
	Function	[rest]	-	[rest], [amusement] [outdoor theater], [appreciate]

The result of analysis on the roof garden in the "Bauhaus School" and the "Le Corbusier school" from the viewpoint of "Flat Roof (structure)", "Plant (material)" and "Function" can be described in the table 3.

Chronologically, it is certain that the material control for the World War II has been one big turning point.

That is, the "Bauhaus school" always made the flat roof with possible materials or structures. On the other hand, the "Le Corbusier School" has given up at the time of the material control. However, the "Le Corbusier School" planned the roof garden again at the postwar period and gave a new positive meaning.

5. Discussion

The difference between the "Bauhaus School" and the "Le Corbusier School" above is not a simple problem of the acceptance or the abandonment of a roof garden.

In fact, despite of the high temperature and the humid climate condition in Japan, the "Bauhaus

School" was attached to a formal roof garden even during the material control, and on the other hand, at the same time, the "Le Corbusier School" gave up the roof garden. However, after the World War II, the "Le Corbusier School" has reinterpreted Le Corbusier's roof garden using the plants or the natural materials.

In spite of such a difference, the chronological process of each School contains the "Controversies of Tradition" caused by the acceptance process of European Modernism architecture. That is, traditional Japanese garden and domestic wooden framework were referred when Le Corbusier's modernistic "Roof Garden" was interpreted by Japanese Architects.

In fact, concerning the "Controversies on Tradition" in Modernism architects, Kunio Mayekawa made reference to the nature of a material⁸. Kenzo Tange interpreted and referred the "Japanese Style" in Japanese garden ("Niwa")¹⁷.

6. Conclusion

The acceptance of the "Roof Garden" inspired by Le Corbusier is not a problem of the ideology. As a physical problem, the form of a roof garden does not necessarily fits in the climatic and spiritual characteristic of Japan. However, the Japanese Modernism architects generated unprecedented various "Roof Garden" and synthesized the "Le Corbusier Style" into the soil of "Japanese Style". In this meaning, the acceptance of the "Roof Garden" by Le Corbusier is an ecological "importation" in a sense.

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