COMPOSITION OF EXTERIOR SLANTED SPACE
IN JAPANESE CONTEMPORARY ARCHITECTURE
現代日本の建築作品における外部傾斜空間の構成

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The aim of this study is to clarify the composition of exterior slanted space in Japanese contemporary architecture. “Exterior slanted space” is seen as an inclined open space within public facilities which affords a good view of the vicinity and provides a place where people may congregate. The structure of the exterior slanted space is seen as a composition between the slanted element with attachments, such as buildings or open spaces. First, the exterior slanted elements and attachments were defined. Second, exterior slanted elements were examined according to the organization of the connection between top(s), bottom(s), and side(s). Third, applied connections of attachments to the exterior slanted element were observed, leading to the distinguishment of typologies. By comparing these typologies, five characteristics were clarified as Axis, Deviation, Cul-de-Sac, Concentration, and Dispersion. The restriction of the circulation sequence varies these characteristics as Axis surrounded with volumes, Concentration surrounded with volumes, and Dispersion mounted on volume.

Keywords: Japanese Contemporary architecture, Exterior Slanted space, Composition, Slanted element, Attachment, Typology

1 Introduction

1.1 Background and purpose

The structure of large-scale cities or small villages deals with a number of urban elements that make up its environment. Within it, exterior spaces such as squares or parks can be seen as public spaces; in light of the fact that these exterior spaces are open and accessible to all, which enable people to gather and socialize comfortably. Some of these spaces are inclined and possess the potential to provide people a good view of the vicinity, and a place where people may congregate and sit to watch the surrounding activities; this paper focuses on this type of exterior space calling it an “exterior slanted space”.

In the city of Rome, a multitude of examples of “exterior slanted space” from ancient times can be observed. Nowadays, these are dedicated for social and commercial activities. In the case of the Spanish Steps, for example, several buildings enclose a stairway where on the top a church stands and at the bottom a fountain is situated. This stairway shows a link between a sacred place at the top and a public plaza at the bottom, giving monumentality to the destination atop. The orientation of the rising stairway, reinforced by the surrounding volumes, can be seen as an expression of a path towards another reality which may be higher than daily life.

The stairway gives the adjacent elements different characters according to the positions at different levels. At the same time the stairway unifies these elements by grouping them together. The structure of the exterior slanted space is seen as the architectural composition between the stair or slope as exterior slanted elements and adjacent buildings or open spaces as attachments.

Public facilities especially for education or culture, carry an important role to promote public space where citizens can access and gather. The exterior slanted space is not only utilized for the movement of people, but is also occupied by the social behaviors of the people; such as resting, watching, and chatting. It permits the visitors to pass through gathering spots, to stay and to contem-
plate surroundings, or to engage in social activities. It creates a “mise-en-scene”, for the coexistence of different people and their behaviors, which is the basic condition of public space even in a territory of a single building. Contemporary Japanese architecture attempts to introduce various characteristics of exterior slanted space as a device to promote social behaviors within public facilities. It is important to establish a theoretical framework in order to make the role of the composition of exterior slanted space more understandable.

The purpose of this study is to investigate the exterior slanted spaces in contemporary Japanese architecture, built in the post-war period in Japan (1950-2012) and to clarify the characteristics of their compositions.

1.2 Intrinsic structure of exterior slanted space

Intrinsic structure of the exterior slanted space can be explained by comparing it to the horizontal exterior open space. If cardinal orientation (ex:south-north) is not counted, a horizontal exterior open space has equal relationship with its surroundings. If an open space is inclined, the difference between the upside and downside emerges. The connection between different heights at top and bottom produce an axial direction, and the perpendicular direction of this axis divides two sides. In consequence, the slanted element, which is arranged by top, bottom and sides, introduce spatial difference as bottom for the lower part, top for the upper part and sides for the perpendicular adjacent area to the axis between bottom and top. In addition, under for the part underneath, above for what is overhead and on for placement on the inclined surface also become distinguishable. These positions give relative characters. The additional consideration of the approach level and entrance attaching elements, tells the itinerary of the visitors within the exterior slanted space. Based on these facts, the intrinsic structure of the exterior slanted space is established as the composition of exterior slanted elements with attachments, where the exterior slanted element unifies them together and gives various characters to the attachments based on different positions.

Each sample is examined and diagramed by how the exterior slanted element is arranged by top, bottom and sides, and the position, number, and kind of attachments applied (Fig. 1).

1.3 Overview of samples

90 samples (Table 1) were gathered through a research of Japanese contemporary architecture that includes an exterior slanted space. They were selected where an exterior slanted element has a minimum height difference of 1.6 meters, higher than the line of sight of an average Japanese adult (1.5 m) and a width of 4 meters, the minimum width of a public street. The study focuses on the period when contemporary architecture has been published after the Second World War. These samples are published in the periodical Shinkenchiku from 1950 to present, due to its consistent review oriented approach and the precision of its data. The information was based on the pictures, plans and sections.

As an overview, most of the works have been published during the 1990s (41) and the 2000s with the beginning of 2010s (31);
followed by a smaller proportion in the 1970s (8), 1980s (7) and 1990s (3) (Table 2). The purposes of the buildings are Cultural facilities (34) such as museums, and public centres, Educational institutions (32), like schools and universities and Others (24), like hotels, gymnasiums, etc (Table 3). The majority of height differences of the works were 3m<h<6m (38), and others were found as 6m<h<12m (24), 1.6m<h<3m (17), h>12m (11) (Table 4). The widths were found as 5m<h<20m (26), w=40m (25), 20m<h<30m (21), 30m<h<40m (18) (Table 5).

### 1.4 Relevancy

There are several studies that show correlation with this paper. From the viewpoint of architectural composition, the compositional role of exterior elements in the arrangement of exterior space 10, the emphasis of the facade and the extension of public space with the approach space 17, and the formation of approach space by continuous and noncontinuous parts 16 were studied. These studies give architectural composition relevancy for the study of exterior space. From the viewpoint of social environment, the influence of slanted conditions and cover surfaces on resting behavior in public space 20 and the available distances around the sitting spots concerning the intimacy and behavior of people 20 have been studied. These studies give exterior slanted spaces relevancy as fields for resting and socializing.

This study is based on 90 samples of exterior slanted space found in Japanese contemporary architecture. It investigates various typologies of exterior slanted space achieved from their intrinsic structures; composition of exterior slanted elements with attachments, where exterior slanted elements unifies them together, and gives characters to the attachments based on different positions.

### 1.5 Methodology

Based on the definition of the intrinsic structure of exterior slanted space, this study is developed as follows:

- Definition of the element of exterior slanted space (Ch. 2).
- Diagrammation of the entire sample. Investigation of the arrangement of the exterior slanted element (Ch. 3)
- Establishment of typologies by comparison of the diagrams, considering applied connections of attachments to the exterior slanted elements. Clarification of the characteristics of exterior slanted space from the comparison between these typologies (Ch. 4).

### 2 Elements of exterior slanted space

The exterior slanted space is composed of the exterior slanted element and attachments. Various examples of exterior slanted elements are identified as a series of steps; flights of steps or slope that enable passing from one level to another. Several configurations are conceivable according to the organization of the connection between top(s), bottom(s) and side(s). The attachments are identified as elements which are connected to the exterior slanted element such as: building volume, wall, a main entrance or a sub-entrance with volumes, a subentrance without volume (Building), and open space elements such as street or open spaces made of pavement, sand, trees, grass or water (Open Space) (Fig. 2).

For example, the exterior slanted element of sample 29 is arranged with a single top and bottom with two sides open. It connects an open space in pavement with a main entrance at top and a street in pavement adjacent to open spaces made of water and trees at bottom, plus a volume at under/at on. There are no attachments at both sides (Fig. 3). In the same manner, the exterior slanted element of sample 5 is arranged with three tops and two bottoms connected by three sides, plus two open sides. It connects an open space of water with a volume at bottoms and an open space in pavement separate from the main entrance, wall, street at three tops, plus the volume or wall at two open sides (Fig. 4).
3 Arrangement of exterior slanted element

In order to investigate the exterior slanted elements, all samples are diagrammed, and the organization of the connection between top(s), bottom(s) and side(s) are observed. The connections of different slanted elements are also observed in one exterior slanted space. These slanted elements are connected at top, at bottom or at side. In the case of connection by side, the number of slanted elements are counted when turned at 90°. In this manner, the arrangement of exterior slanted elements are examined (Fig. 5).

In the case of one set of slanted elements, one top and one bottom with two sides open (a1) forms Single Linear. Regarding Linear arrangements with many tops and/or bottoms; one top is connecting two bottoms with two sides open (a2), one bottom is connecting two tops with four sides open (a7), and two tops is connecting two bottoms with six sides open (a8), which forms Multiple Linear. Regarding arrangements with one top and many bottoms; one top and two bottoms connected by one side with two sides open (a3), one top and three bottoms connected by two sides with one side open (a4), one top and four bottoms connected by four sides (a5), which forms Bottoms Branching. Regarding arrangements with one bottom and many tops; two tops and one bottom connected by one side with two sides open (a6), three tops and one bottom connected by two sides with two sides open (a9), four tops and one bottom connected by four sides (a12), which forms Tops Branching. Regarding arrangements with many tops and bottoms; three tops and two bottoms connected by three sides with two sides open (a10), three tops and three bottoms connected by four sides with two sides open (a11), which forms Multiple Branching. A multitude of tops and bottoms connected by several sides (a13), which forms Networking.

In the case of several sets of slanted elements connected via an attachment, it is understood as combinations of a few slanted elements. Two Single Linear are connected at side by an attachment (a14), a Single Linear and a Tops Branching are connected at bottom by an attachment (a16), the top of a Single Linear and the bottom of a Bottoms Branching are connected by an attachment (a15), a Single Linear and a Bottoms Branching are connected at side via an attachment (a17), the top of a Multiple Branching and the bottom of Bottoms Branching are connected via an attachment (a19), the top of a Single Linear and the bottom of a second and third Single Linear are connected via an attachment, plus the top of these second and third Single Linear and the bottom of a Multiple Branching are connected via an attachment (a20).

4 Typologies and characteristics of exterior slanted space

Each arrangement of the exterior slanted elements potentially connects various attachments (Ch. 3). For example, the Spanish steps; Single Linear connects an open space in pavement with water at bottom as approach level and an open space in pavement with a volume including a main entrance at top; plus volumes at sides. It produces a circulation sequence in the form of a top/bottom axis, reinforced in perspective by volumes at both sides (Fig. 6). In the same manner, from the diagrams of the exterior slanted element (Ch. 3), applied connections of attachments are drawn. The potential of connections are observed as not being entirely fulfilled. This chapter examines how much this potential is applied with attachments in the composition of exterior slanted space of each sample. Based on the observation of these diagrams, similar sets of composition (minimum of 3 samples) are distinguished as typologies. Description of the typologies is centered on the arrangement of the exterior slanted element, the consideration of the positions of the attachments, and the attachments...
### Fig. 5 Arrangement of exterior slanted elements

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>Top</td>
<td>Single Linear</td>
<td><img src="image" alt="Diagram" /></td>
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<tr>
<td>Top</td>
<td>Tops Branching</td>
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<tr>
<td>Bottoms</td>
<td>Bottoms Branching</td>
<td><img src="image" alt="Diagram" /></td>
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<tr>
<td>Top</td>
<td>Multiple Linear</td>
<td><img src="image" alt="Diagram" /></td>
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<tr>
<td>Bottoms</td>
<td>Networking</td>
<td><img src="image" alt="Diagram" /></td>
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Note: examples of different shapes with one side connected, and a diagram.
Fig. 7 Typologies of exterior slanted space
as Building, Open Space with/without approach level (Fig. 7). Single Linear connects an open space in pavement with a volume including a subentrance at top and an open space in pavement at bottom as approach level without attachment at sides (typology I). Single Linear connects a volume including a main entrance at top and an open space in pavement at bottom as an approach level, plus volumes at sides and above (typology II). Single Linear connects a subentrance at top and a path in pavement adjacent to an open space in grass, pavement at bottom as an approach level, plus a volume at under (typology III). They produce a circulation sequence in the form of a top/bottom axis, without volume at sides (I), and volume at top (II) and with volumes at sides; at above (III). Single Linear connects a path made in pavement or sand adjacent to water, grass at top and bottom as two approach levels, plus a volume including a sub entrance at side. It connects open spaces from different approach levels at top and at bottom, producing a deviation of the circulation sequence to the entrance at side (typology IV). Single Linear connects a path in pavement at bottom as an approach level, plus a volume under, without an attachment at top. It produces a Cul-de-Sac sequence (typology V). Single Linear connects an open space with a volume at bottom and enclosing volumes at top plus sides, without an entrance and approach level. It results in the restriction of the circulation sequence of Axis, by being surrounded with volumes (typology VI).

Bottoms Branching connects a volume including a main entrance at top and streets in pavement at three bottoms as approach levels, plus volumes at sides (typology VII). Tops Branching connects a volume including a main entrance at bottom and an open space in pavement as approach levels at three tops, plus volume at sides (typology VIII). One forms a convex shape (VII) and the other a concave shape (VIII). With an entrance in the opposite position of the open spaces, it produces a concentration of the circulation sequence from several approach levels to the entrance. Tops Branching connects an open space in pavement with volume at both bottoms and two tops, plus enclosing volumes at sides, without an entrance and an approach level. It results in the restriction of the circulation sequence of Concentration, by being surrounded with volumes (typology IX).

Regarding Multiple Linear and Multiple Branching, typologies cannot be distinguished. Networking connects a path in sand or pavement adjacent to open space in grass at some bottoms and subentrances at on, plus a volume at under, without an attachment at top (typology X). Networking connects a street in pavement at some bottoms and volumes including sub entrances at on, plus volume at under, without an attachment at top (typology XI). Network connects several approach levels and several entrances, where the intinary can differ. They produce a Dispersion of the circulation sequence. Networking connects a volume at under, plus another volume at one bottom, without an approach level and an entrance. It results in the restriction of the circulation sequence of Dispersion, by being mounted on volume (typology XII). Regarding several sets of slanted element via attachment, typologies cannot be distinguished.

All these typologies are compared, and the characteristics of exterior slanted space are clarified (Fig. 8). Three different characteristics are emerging from Single Linear as Axis (I, II, III), Deviation (IV), and Cul-de-Sac (V). One characteristic is emerging from Tops and Bottoms Branching as Concentration (VII, VIII). Another characteristic is emerging from Networking as Dispersion (X, XI). While all of these characteristics include a circulation sequence, the restriction of the circulation sequence varies these characteristics, since the exterior slanted element is surrounded with volumes (Axis surrounded with volumes (VI) and Concentration surrounded with volumes (IX)), or is being mounted on

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**Fig. 8**

Characteristics of exterior slanted space
volume (Dispersion mounted on volume (XII)).

In Ch. 1, exterior slanted space was seen as “public space”. It afford a person to sit, defines directions of his/her body, influences certain postures, and organizes his/her ways of watching the surrounding activities or vicinity. As the exterior slanted spaces have enough width to gather people, many persons might use it at the same time, and groups of people might sit. The exterior slanted spaces arranges a certain distance and position between the people. This might afford certain behaviors of people as a collective subject. For example, Typology VIII where the directions of the bodies are converging might afford a theatrical behavior of people, or Typology X where the body directions and postures are unsystematic, might let people behave independently.

5 Conclusion
The characteristics of exterior slanted space were examined in contemporary Japanese architecture. The intrinsic structure of the exterior slanted space was defined as the composition of exterior slanted elements with attachments, where the exterior slanted element unifies them together and gives various characters to the attachments based on different positions (Ch. 1). First, the exterior slanted elements and attachments as Building or Open Spaces were defined (Ch. 2). Second, exterior slanted elements were examined according to the organization of the connections between top(s), bottom(s) and side(s), observing twenty different arrangements (Ch. 3). Third, applied connections of attachments to the exterior slanted element were observed, which led to the distinction of typologies. Five characteristics of the exterior slanted space were clarified through the comparison of these typologies as Axis, Deviation, Cul-de-Sac, Concentration, and Dispersion. The restriction of the circulation sequence varies these characteristics as Axis surrounded with volumes, Concentration surrounded with volumes, and Dispersion mounted on volume (Ch. 4). These characteristics of exterior slanted space affect behaviors of people, whether circulating or resting, and enable public space in the framework of designing public facilities.

Notes
1)  Consult reference ii.  
2)  Consult reference iii. : for example, piazza da Camplidigio, on the top of the Capitoline hill, including the palazzo Senatorio. 
3)  Consult reference iii. : the Spanish Steps are a set of steps in Rome, Italy, between the Piazza di Spagna at the base and Piazza Trinità dei Monti, dominated by Trinità dei Monti church at the top. 
4)  Consult reference iv.  
5)  Consult reference v. : For example the Pompidou Center in Paris, where the volume of the museum is setback, creating an inclined square for social activities. 
6)  Consult reference vi. : Parent analyzed “the dynamism and interaction of human body with slanted space”. The body reacts to the slanted line scientifically, and opens possibilities of free route, movements and postures. 
7)  Consult reference vi. : Certeau explains public space as namelessness space that integrates the private space through daily use of the human.

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和文要約
現代日本の建築作品における外部傾斜空間の構成を明らかにすることが本研究の目的である。公共建築に付随したオープンスペースでは、傾斜した床面や大きな階段は、人が動くだけではなく、座って会話をしたり、眺めを楽しむ場所となっている。こうした外部傾斜空間の構成を外部傾斜要素（階段、スロープなど）と隣接要素（建物、オープンスペースなど）の組み合わせとその配置によって捉えることにより外部傾斜空間の類型を抽出した。それら類型の比較から外部傾斜空間の性格は、潜在的な結合性の形態を前提にアプローチレベルとエントランスの配置から、Axis, Deviation, Cui-de-Sac, Concentration, Dispersion の 5 つのアプローチ動線として位置づく場合の性格に加えて、ボリュームによる包囲や居上に用いられることで、アプローチ動線から切り離されることによる展開型があることを明らかにした。

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