

IV-303

THEORETICAL STUDY OF EFFECT OF SQUARE SHAPE ON VISUAL ACCESSIBILITY OF RAILWAY STATION BUILDINGS

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1) INTRODUCTION

Arrangement of outdoor spaces around railway station buildings has a great effect on people's accessibility and ease of use. On the other hand, vision is the mode through which human acquire most of their knowledge about the environment. Therefore, studying the effect of outdoor space structure on the degree of visual accessibility was found to be of great importance. Many factors were found to affect the degree of visual accessibility. The study objective is to clarify the effect of different square shapes on the degree of visual accessibility of the station building. Accordingly, a parametric study of theoretical cases was conducted representing main space structure patterns around stations in Tokyo metropolitan area, considering square shape as the main parameter. A quantitative analysis method was proposed, where "visual exposure" was used for expressing the degree of visual accessibility.

2) OUTLINES AND METHODOLOGY

The visual accessibility is defined herein as "the degree of visibility or the possibility of vision provided through different space structure patterns around railway station buildings." Visual accessibility can express the effect of different spatial characteristics on passenger's perception of the station building. Method of "Visibility Contour Lines Distribution" was proposed for measuring quantitatively the degree of visual accessibility from different viewpoints around station buildings. Fig. 1 represents the procedures of the proposed method, which can be described in the following steps:

Step 1: The first contour circle can be constructed (diameter = station length). Every point on this circle has a view angle of 90° and can see 100% of the station.

Step 2: Successive contour circles can be drawn having view angles ranging from 0° up to 180° .

Step 3: Intersection of the contour circles and radial lines drawn at 20° intervals define locations of the viewpoints around the station building.

Step 4: Effective contour lines can be obtained by joining points with similar degree of visual accessibility according to different spatial characteristics of cases.

In this study, "visual exposure" was used for expressing the visual accessibility, implying the portion of vision provided from station building proportional to distance. Accordingly, relationship between distance from the station building and percentage of visible length can be used for expressing the results of different cases. The percentage of visible length is defined as the ratio between visible length from any viewpoint (L1) to initial length of station (L) as shown in Fig. 2.

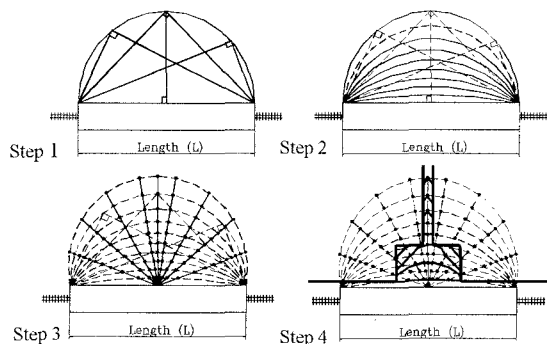


Fig. 1: Steps of Visibility Contour Lines method.

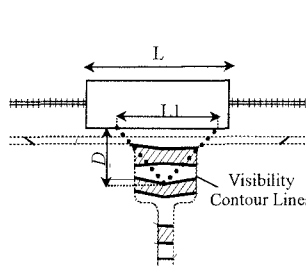
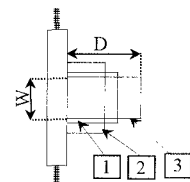


Fig. 2: Variables of analysis.



1. Square ($W/D = 1$)
2. Rectangular ($W/D = 2$)
3. Rectangular ($W/D = 0.5$)

Fig. 3: Assumptions of square shape.

3) THEORETICAL ANALYSIS

Theoretical cases of study representing common space structure patterns in Tokyo metropolitan area were constructed. The common patterns were concluded from analyzing 116 cases of study. In order to construct the theoretical cases, design guidelines of railway station buildings and basic theories of urban space design were implemented. The cases of stations were classified mainly according to the number of passengers daily commute to the station and were categorized from very small up to large size stations. Relatively, different outdoor space elements such as square area size, streets width and square area size could be estimated. Many factors of outdoor spaces elements were found to affect the degree of visual accessibility of the station building. Accordingly, a parametric study of the theoretical cases was conducted.

The perception of the area of geometric figures having the same area varies according to their shape. Also, it was found previously that the area of a room was perceived as larger as the length/width ratio increased [1]. The station square is basically considered to play the role of a multi-functional node [2] where, providing best square dimensions is of great importance. Consequently, "square shape" was considered as the main parameter in the present study. The method of Visibility Contour Lines was applied on the theoretical cases and the degree of visual accessibility was measured for the different cases by varying the square shape.

4) EFFECT OF SQUARE SHAPE ON THE DEGREE OF VISUAL ACCESSIBILITY

Three types of square shapes were proposed, based on varying the ratio between the square width to depth (W/D) as shown in Fig. 3. The assumed differences were found to affect the distribution of visibility contour lines within square limits (Fig. 4). The degree of visual exposure and consequently the degree of visual accessibility were also found to be different for each shape as can be seen in Fig. 5. "Rectangular shape" square having $W/D = 0.5$ was found to provide low degree of visual accessibility. Squares with large depth constrain the degree of visual accessibility as well as restrict traffic control and function distribution. On the other hand, "square shape" was observed to provide better results. "Rectangular shape" square with $W/D = 2$ were found to provide best degree of visual accessibility among the different types of stations especially in cases of large size stations as observed in Fig. 5(e, f). By increasing the square width, larger amount of station frontage could be seen, thus, increasing the degree of visual exposure. In addition, it can provides good arrangement of traffic functions and square elements as well as creates gathering spaces and pedestrian accommodations.

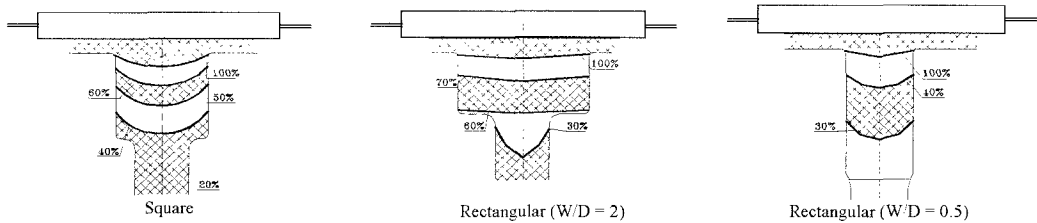


Fig. 4: Contour lines distribution of different shapes for cases of large stations.

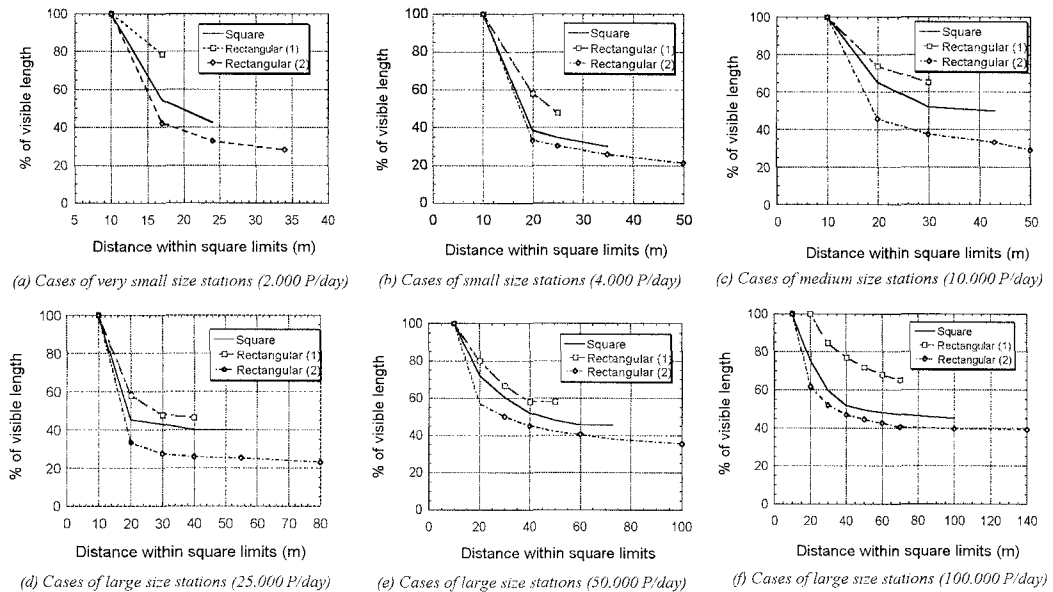


Fig. 5: Relationships between distance and percentage of visible length for different types of square shape

5) CONCLUSIONS

Outdoor space structure patterns around railway stations have a great effect on the degree of visual accessibility. Many factors around station spaces were observed to affect the visual accessibility. Therefore, a parametric study of theoretical cases expressing common patterns around stations in Tokyo metropolitan area was conducted, considering square shape as the main parameter. It was concluded that by increasing width/depth ratio of the square, the degree of visual accessibility increases. Additionally, better arrangement of different square functions can be provided. The results are suggestive for future development in determining square shape in order to provide better degree of visual accessibility as well as controlling function distribution that might be of great importance in the overall improvement of outdoor spaces.

REFERENCES

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