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An Analysis on the Effect of the Building Use Types and Physical Properties of Streets on Street Revitalization - Focused on the Building Uses, Land Use Mix, and Street Pedestrian Volume in the Station Influence Areas in Seoul

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ABSTRACT

This study aims to analyze the effect of the building use types and physical properties of the street on street revitalization. This study categorized the types of streets according to the characteristics of land use in the 273 station influence areas in Seoul. A regression analysis was carried out using pedestrian volume as a dependent variable, as a quantitative indicator for street revitalization. The building use and the physical features of the street were also used as independent variables. The result is that the streets need not only physical improvement but also active placement of commercial facilities in the bottom levels of the buildings and connections between public offices and public transit facilities for pedestrian-centered revitalization.

Keywords: Street revitalization; pedestrian volume; street type; index of land use mix; land use type; physical properties of streets; station influence areas; cope of walking range

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AN ANALYSIS ON THE EFFECT OF THE BUILDING USE TYPES AND PHYSICAL PROPERTIES OF STREETS ON STREET REVITALIZATION - FOCUSED ON THE BUILDING USES, LAND USE MIX, AND STREET PEDESTRIAN VOLUME IN THE STATION INFLUENCE AREAS IN SEOUL

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Abstract

This study aims to analyze the effect of the building use types and physical properties of the street on street revitalization. This study categorized the types of streets according to the characteristics of land use in the 273 station influence areas in Seoul. A regression analysis was carried out using pedestrian volume as a dependent variable, as a quantitative indicator for street revitalization. The building use and the physical features of the street were also used as independent variables. The result is that the streets need not only physical improvement but also active placement of commercial facilities in the bottom levels of the buildings and connections between public offices and public transit facilities for pedestrian-centered revitalization.

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1. Introduction

Recently, the pedestrian-centric paradigm shift in urban planning has become one of the main issues of urban regeneration and revitalization in Korea. As the site of various activities related to leisure, culture, commerce and business among other things, streets play a very important role for successful policymaking in this new paradigm.

In particular, the streets in the station influence areas connect other means of transportation and have concentrated land use around the area. As such, the revitalization of such streets through walking has very important urban space functions in order to stimulate local revitalization, including the commercial spheres in the surrounding alleys, and change in the surrounding land uses. However, building uses and the street design elements need to be differentiated according to the street type for pedestrian-friendly street revitalization, as the streets in the station influence areas vary in terms of their types and characteristics depending on the status of the surrounding land uses.

Therefore, this study categorized the types of streets according to the features of land use in the station influence areas, and analyzed the effects of the physical properties by the street types and the use types of the buildings for a street revitalization project. To accomplish this, the study set pedestrian volume as a quantitative indicator of street revitalization in 273 subway station influence areas in Seoul, Korea to specifically and positively analyze the relationship between the building uses and physical properties of streets as the factors affecting this indicator.

2. Literature Review

A number of preceding studies on pedestrians and street revitalization demonstrate “the dynamic relations with the physical environment, including pedestrian volume, frequency of purpose, satisfaction, height, diversity of land use, and activities and density of people such as floating populations in the subway”[1] as the factors affecting street revitalization.

The researchers who studies the relations

between pedestrian volume and the physical properties of streets include Jang Jin-young (2015)[2] who proposed the pedestrian volumes on major streets as the indicator of the level of commercial vitality in the region, and analyzed the population density, the number of employees in each industry, and the number of hospitals and facilities as the factors affecting pedestrian volumes. Jooah Lee (2014)[3] analyzed the effect of the physical environment factors of the streets on street revitalization on three commercial streets in the heart of Seoul and general commercial streets.

Table1. Previous findings on land use mix and pedestrian volumes

Author (Year)	Major findings
Jan Gehl (2010)[4]	Activities on streets in cities are created by the multiple purposes and complex functions, calling for the need for diversification of the street functions according to land use mix
Cervero & Radisch (1996)[5]	The pedestrian-friendly streets and combined uses in the residential areas in large cities increase accesses to public transit and pedestrian volume
Yan Song & Gerrit.J.K (2004)[6]	Land use mix has a positive effect on housing prices in the regions other than the detached housing concentrated areas
Ewing & Cervero (2010)[7]	Walking is closely related to the diversity of land use and the number of destinations within walking distance
Taehyoung Tommy Gim (2016)[8]	More variables should be considered for land use in large cities

Many preceding studies measured pedestrian volumes as the quantitative indicator of street revitalization, and analyzed the relationships among the pedestrian volumes, land use types and street design elements. However, the analytical findings on the relationships between land use mix and pedestrians differed depending on the research subject on the entire city of Seoul, hierarchy of urban spaces, and units of regional scopes, including regional living spheres and areas for a specific use type. According to the studies on the relationship between the diversity of land use and pedestrian volumes, the diversity of land use had the positive

effects on the pedestrian volumes in the scopes of the entire Seoul and regional living spheres, but these effects were either reverse or insignificant on the commercial or residential districts, depending on the researcher or study scope. This result was presumably caused by analyzing various factors on street revitalization, with the streets as one subject in most studies, despite the different factors affecting the pedestrian volumes depending on street type and characteristics.

Therefore, this study intends to analyze the relationships among the diversity of land uses, pedestrian volumes, and physical characteristics of the streets by classifying the streets according to the land use types on the streets in the station influence areas.

3. Research Methods

This study selected 1,316 streets within the scopes of 273 station influence areas in Seoul as its spatial scope. For its temporal scope, the pedestrian volumes according to the “Survey of the Floating Populations in Seoul.”[9] from 2014 to 2015 were used. The consistency of the data was maintained by sampling the number of subway passengers and building use statues from the buildings’ accounting books of taxation in the same period.

This study set the scopes of the station influence areas within 500m, and walking range in these areas within a radius of 50m and 100m through reviewing related legislations and preceding. To analyze the baseline data, this study identified the characteristics of the streets and floating populations in the station influence areas. A cluster analysis was performed on the characteristics of the buildings uses to classify the street types.

To analyze the relationships among the factors affecting street revitalization in the station influence areas, a regression analysis was carried out using pedestrian volume as a dependent variable, as a quantitative indicator for street revitalization. This study identified the variables through a relational analysis on

multicollinearity and a correlation analysis on the factors affecting street revitalization. For the independent variables, the index of land use mix (LUM) and commercial purpose of the first floor were used for the variables for building use, while the street type, fence, bus stops, sidewalk width, slope subway passengers, and distance to subway entrances, etc. were used for the variables of the physical features of the street.

To analyze the effect of these independent variables on the pedestrian volumes, a regression analysis was performed on all streets in the station influence areas, and then another analyses for each street type based on the land use types on the streets. The findings of these regression analyses were compared to verify the variance among the factors affecting the pedestrian volumes on all streets in the station influence area, and also each type of streets. A model for regression analysis was established through analyzing the effects of the building use type and physical properties of the street on the pedestrian volumes, depending on the land use type.

4. Analysis & Results

Based on this scope, the types of streets were categorized, through a cluster analysis on the gross area ratio for each building use, into the residence-centered type, commercial type, and business·public and other mixed types within 50m and 100m of walking range.

Among the variables on the building uses in the 50m and 100m scopes of the pedestrian spheres, increases in the gross area for commercial use on the first floor had the largest positive (+) effect on pedestrian volume. With regard to land use mix, the more singular the uses were, the more pedestrian volume increased, with the largest negative (-) effect.

Regarding the relationship with the physical properties of the streets, it was analyzed that the pedestrian volumes were high on wide streets, safe and flat streets with fences between the sidewalk and roads, streets that

are close to subway entrances, and streets offering convenient transfers to nearby bus stops with a large floating population and public transportation users, as pedestrian-only streets where the sidewalk and road are separated.

These physical characteristics of the streets were significant as the control variables for this study, for their similarity with the findings of the previous studies and general predictions for pedestrian volume increases. Therefore, the physical properties of the streets were excluded as a variable for verification for generalization on the relationship between the building use types and street pedestrian volumes. As a variable on building use type, the analysis on the relationship between the index of land use mix / commerce in first floors and the pedestrian volumes showed the negative influence of the index of land use mix (-) and positive influence of the gross area for commerce on first floors, as shown by the previous analysis.

The pedestrian volumes in the residence-focused streets and commercial streets increased when the index of land use mix was lower and the commercial area in the first floor was wider; i.e. all entire streets in the station influence areas within the 50m and 100m scopes of the pedestrian spheres. Therefore, stimulation of commercial uses in the bottom levels should be considered a more important design element for these types of streets than the diversity of building uses. With regard to the physical properties of the street, segregation between the sidewalk and roads and the width of the sidewalk are important to enhance the stability and convenience of walking.

However, the gross area for the commercial purposes and index of land use mix were not significant or did not have a major impact on the public · business and other mixed types of streets within the 50m and 100m scopes of the pedestrian spheres, unlike all streets in the station influence areas, residence-focused streets, and commercial streets, on which these factors had the largest effect. However, the subway-related factors such as the number of subway passengers and distance to a subway

entrance had the largest impact of the physical properties of the street, probably because purposeful transit is more prevalent among pedestrians on this type of streets. Therefore, public buildings and facilities should be arranged near subway entrances, as the connections to public transit are more important to revitalize the public • business and other mixed types of streets than stimulating a diversity of building uses and commercial uses in the bottom levels.

5. Discussion & Conclusion

Streets in the station influence areas should be studied, considering their segmented design elements by type and characteristic. It is not desirable to revitalize streets in the station influence areas through incentives and planning for mixed uses without considering the distinct characteristics of streets in Korea, which are generally more highly dense than in cities in other countries. Therefore, according to their characteristics, the streets need not only physical improvement but also active placement of commercial facilities in the bottom levels of the buildings and connections between public offices and public transit facilities for pedestrian-centered revitalization. In terms of the physical design of the streets, walking stability should be strengthened by separating the sidewalk and roads and installing fences, while wide and flat sidewalks and a convenient public transit transfer system should be installed for pedestrians to revitalize the street. Planning for the building uses and street design according to the characteristics of each street type will stimulate street revitalization, change the surrounding land uses, and revitalize the local economy by increasing pedestrian volumes for successful urban regeneration.

However, urban planning on the current station influence areas and streets only proposes simple mixed use such as business facilities, commercial facilities, and conference spaces for street revitalization. It is suggested to adopt commercial facilities in the bottom levels of the buildings depending on the characteristics of the street, and to propose a set of guidelines on physical improvements

and specific street design on the sidewalks. This study categorized the street types in the station influence areas in Seoul and positively analyzed the effect of the land use types and physical properties of the streets on street revitalization. It is expected that its findings can be used as baseline data for street revitalization for renewal planning and district unit planning in regions surrounding the station influence areas and existing urban districts.

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