For the development of pedestrian spaces to respond to diversified types of pedestrians

SHINGAI Hiroyasu, Head
YOSHIDA Jundo, Senior Researcher
Urban Facilities Division, Urban Planning Department

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1. Introduction

There are a variety of types of pedestrians in large cities in terms of attributes (e.g. gender and age), purpose of walking (e.g. commuting to work or school, shopping, and sightseeing), and things they are carrying (e.g. suitcase and baby stroller). Various types of actions (e.g. walking fast and staying at one spot) are intermingled at a significant level in cities. Meanwhile, past studies argued that walking speed and pedestrian density could be expressed using a certain relational expression depending on nearby conditions.[1] Since the volume of pedestrian traffic can be computed from speed and density, the traffic volume can be found if only the speed is known. This can be used for designing the capacity of pedestrian walks. Under such circumstances, National Institute for Land and Infrastructure Management is seeking an ideal development of comfortable pedestrian spaces where various types of pedestrians are walking at various speeds.

As a preliminary step in this study, the team identified conditions and compared pedestrian spaces in large cities using a case in which pedestrians with various attributes are intermingled (case 1) and a case in which pedestrian attributes are relatively homogeneous (case 2). This paper introduces the result of this preliminary investigation.

2. Overview and outcome of the investigation

For case 1, the team selected Roppongi, Ueno, and Nihonbashi subway stations on weekdays from 15:00 to 18:00, when the subway stations were crowded with people on shopping. For case 2, the team selected the sidewalk of Sotobori-dori Street near Shinbashi Station on weekdays from 8:45 to 9:00, during which most people walk in the same direction to go to work. The team observed pedestrians using video cameras and collected walking speed and other conditions.

Photo: Sidewalk near Shinbashi Station

The team then categorized pedestrian attributes based on gender, age, whether they were forming groups, and any baggage they were carrying for each case and organized average speeds for each of the categories. In addition, the team conducted F-test and t-test for sets of attributes. The team categorized multiple attributes into the same group if no significant difference was seen between them. The team then organized the attributes in the table below. The team found that the average walking speed of case 2, mainly consisting of the traffic of commuters, was generally faster than case 1, consisting of intermingled people on shopping. The team also found that the difference between elderly people and non-elderly people was small, and that difference between male and female was small in case 2.

Table. Average walking speed (m/s)

Group	Baggage	Case 1				Case 2			
		Non-elderly		Elderly		Non-elderly		Elderly	
		Male	Female	Male	Female	Male	Female	Male	Female
Solo	None	**1.41**	1.29	**1.13**		1.59	1.53	1.45	1.42
Solo	Suitcase	1.37	1.25	1.07		1.63	-	-	-
Solo	Baby stroller	1.19				-	-	-	-
Two people	None	1.33	1.17		1.04	1.38	1.48	-	-
With a child	None	1.03				-	-	-	-
Three or more	None	1.16	1.05	**0.88**		-	1.37	-	-

*Elderly: Pedestrians who appears to be age 65 or older based on the judgment of an inspector
- mark: No data

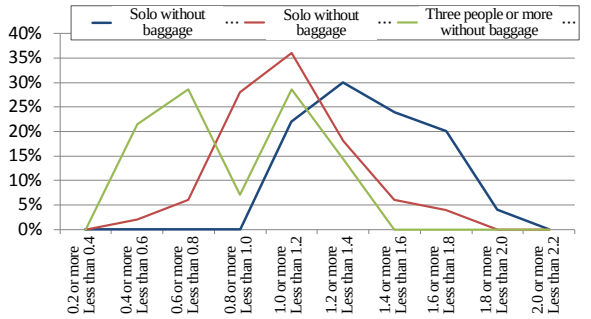

Figure. Frequency distribution of speed by attribute

3. Future studies

The team will add more areas to be investigated in the future to analyze how differences in nearby conditions and attributes of walking will affect walking speed and pedestrian density. The team will also obtain the relational expression of walking speed and pedestrian density based on current conditions of large cities in which the composition of pedestrian attributes is changing to find ideal pedestrian spaces.

1) *Traffic Engineering Handbook* (in Japanese) (2005 edition)