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Actual Conditions of Lighting Environment of Kitchen and Washroom Spaces in Houses between China and Korea

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Abstract

To compare the lighting environment of kitchen and bathrooms in the apartments in China and Korea, this research conducted a study of the current status, targeting 68 households in China and 79 households in Korea. The results are as follows.

First, the Korean kitchen space is a little bigger than China's, but the height of the sink and table show no difference. China does not use local lighting in the kitchen. And Korea 40.2[%], China 65.6[%] is sink's KS based was below. In the case of the dining table, KS criteria satisfy both Korean and Chinese standards. 20[%] appear to be very feeble; urgent improvements are required. Secondly, regarding the size of the bathroom, Korea and China show similar sizes; the average height of the vanities and toilet is higher in Korea than in China by 2[cm]. China does not use local lighting in the bathroom. The levels of illumination were measured; lighting is higher in China's bathrooms compared to Korea's.

Key Words : Kitchen, Washroom, Korea And China, Lighting Environment

1. Research Purpose

Lighting, which is one of the most important elements that determines the quality of a residential area, determines the characteristic of a space and affects much of the efficacy of work, as well as the stability and mental status of the residents. Also, according to the purpose of a space, there is a difference in necessary lighting systems to be installed. However, because research on lighting plans focus on major areas such as living rooms and bedrooms, research on other spaces is still insufficient.

Kitchen space in modern society, compared to the past which used to be limited solely to preparing meals, now consists of a variety of facilities and lights and has been transforming into the center of living as a place not only for meals, but also for family circles and guest reception. In particular, this has led diets to be improved, important relationship between work and light to be generated, and demands on efficient lighting environment to become increased. Also, washrooms, which used to be only for hygiene in the past, have recently become connected with the roles of a dressing room

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and make-up room; their cultural aspects are becoming more and more important. Kitchens and washrooms are both places where people use water. Therefore, for space plans, they commonly need a facility core plan and waterproof lighting facilities. Hence, this research examined lighting environments of Korea and China by focusing on kitchens and washrooms-the places where water is mainly used in a house. The results from this research will be able to supply basic data for correct lighting environment plans for kitchen and washroom spaces by comprehending the current state of the lighting environment in Korea and China according to life-culture and environment.

2. Research Method

Table 1. Outline of Actual Conditions

Survey Subjects	68 households at apartments in Shenyang, China 79 households at apartments in Daegu, Korea
Survey Time	After sunset (after 6PM)
Measuring Instruments	Minolta digital illuminometer T-1, Tape measure
Survey Items	① Dimensions of kitchen and washroom space
	② Variety and numbers of light sources
	③ Dominant color
	④ Brightness and satisfaction level of kitchen / washroom lighting
	⑤ Kitchen and washroom lighting usage method
	⑥ Interior work plane height and illumination level
	⑦ Problems in interior lighting environment
Survey Method	Visiting experimental study
Survey Period	China: January 18, 2009 - February 20, 2009
	Korea: May 2, 2008 - June15, 2008

The outline of research on the actual conditions of the lighting environment of kitchen and washroom spaces is shown in Table 1, and general particulars are shown in Table 2. The results of the research were analyzed by utilizing the frequency of SPSS 14.0 program, multiple response method, cross-tab analysis and descriptive statistics.

Table 2. General Aspects of the Surveyed

Variables	Classification	Korea	China
Gender N ([%])	Male	20 (25.3)	36 (52.9)
	Female	59 (74.7)	32 (47.1)
Age (years old)	M (SD)	47.78 (24.48)	37.54 (10.65)
Residence Years (years)	M (SD)	3.33 (1.30)	3.91 (1.34)

3. Research Results and Analysis

3.1 Surveyed Space

The results of the survey on the size of the spaces of the subjects (Table 3) show that most Korean homes (50.3[%]) have 10~15[㎡] kitchens, and most Chinese homes (38.6[%]) have 5~10[㎡] kitchens. Also, the average size of the kitchen space in Korea was 11.72[㎡] and in China, 8.38[㎡]. Thus, Korean homes have larger kitchen spaces than Chinese homes. This is because Koreans tend to consider kitchen space not only as a place for cooking but also as a place for communicating with family as well as personal space of the housewife. Meanwhile, the average sizes of washroom space in Korea and China were 3.4[㎡] and 3.8[㎡], respectively, showing almost no difference.

The working surface heights of kitchen and washroom spaces in Korea and China (Table 4) show that the average height of Korean sinks is approximately 3[cm] higher than the height of Chinese sinks. This means that there is almost no difference between the two countries. Meanwhile, the average heights of basins and toilets in Korean

washrooms are approximately 2[cm] higher than the ones in Chinese washroom. Overall, although Koreans have slightly higher working surfaces than the Chinese, considering they are both Asian culture, not much difference is shown.

Table 3. Kitchen and Washroom Dimensions in Korea & China N([%])

Variables	Classification	Korea	China
Kitchen	Less than 5	6 (6.0)	12 (17.1)
	5~10	28 (28.0)	27 (38.6)
	10~15	50 (50.3)	12 (17.2)
	15 or more	15 (15.0)	6 (8.6)
	M (SD)	11.72 (5.33)	8.38 (4.61)
Washroom	Less than 3	9 (21.9)	26 (46.9)
	3~4	31 (75.6)	18 (32.4)
	4 or more	1 (2.4)	11 (19.8)
	M (SD)	3.4 (.55)	3.8 (2.0)

Table 4. Kitchen and Washroom Working Plane Height in Korea & China M(SD)

Variables		Korea	China
Kitchen	Sync	83.2 (3.72)	80.8 (4.65)
	Dining Table	72.4 (3.22)	72.5 (2.62)
Washroom	Basin	76.2 (3.54)	74.3 (4.24)
	Toilet	41.1 (1.85)	38.7 (3.81)

3.2 Recommended Illumination Level

1) Types and Number of Light Sources

The types and number of light sources in kitchen and washroom spaces in Korea and China are shown in Table 5. Kitchens in both Korea and China primarily use one fluorescent light. However, the percentages of the two countries (Korea: 47.4[%]; China: 77.9[%]) show significant differences. Sorting through the results in detail, they show that the percentages of each type and number of light sources used in Korea (47.4[%] - one fluorescent light > 37.2[%] - one light bulb > 34.6[%] - two fluorescent lights) are similar. However, the percentage of the primary light source in China is three times greater than the percentages of second and third light sources in China (77.9[%] - one fluorescent light > 20.6[%] - one light bulb > 17.7[%] - halogen). Thus, although Korea and China both primarily use fluorescent lights, the percentage of not using fluorescent lights in Korea is only 2.6[%], but in China it reaches up to 20.6[%]. Also, the results imply that Korea is using general lighting and local illumination by using multiple fluorescent lights or combining a light bulb and a fluorescent light; China is not using local illumination and uses only one light source. Therefore, considering that the kitchen is a working area, because fluorescent light is the most effective light source, China ought to increase the use of fluorescent lights in kitchen spaces as well as

Table 5. Variety and Numbers of Light Sources of Kitchens/Washrooms N([%])

Classification			Korea	China
Kitchen	Incandescent Lamp	None	36 (46.2)	52 (76.5)
		1	29 (37.2)	14 (20.6)
		2 or more	13 (16.7)	2 (2.9)
		M (SD)	0.88 (1.23)	0.26 (0.51)
	Fluorescent Lamp	None	2 (2.6)	14 (20.6)
		1	37 (47.4)	53 (77.9)
		2	27 (34.6)	1 (1.5)
		2 or more	12 (15.4)	-
		M (SD)	1.74 (1.03)	0.81 (0.43)
	Halogen	None	74 (94.9)	56 (82.4)
		1 or more	4 (5.2)	12 (17.7)
		M (SD)	0.14 (0.83)	0.47 (1.39)
Wash room	Incandescent Lamp	None	15 (19.5)	45 (66.2)
		1	55 (71.4)	23 (33.8)
		2 or more	7 (9.1)	-
		M (SD)	0.92 (0.62)	0.34 (0.48)
	Fluorescent Lamp	None	61 (78.2)	49 (72.1)
		1	14 (17.9)	19 (27.9)
		2 or more	3 (3.8)	-
		M (SD)	0.26 (0.52)	0.32 (0.45)
	Halogen	None	76 (97.4)	58 (85.3)
		1 or more	2 (2.6)	10 (14.8)
		M (SD)	0.03 (0.16)	0.29 (0.73)

* Multiple choice

the use of local illumination. Korea primarily uses one light bulb for washrooms. However, the percentage of all the types and number of light sources in China does not reach 100[%] when added up. This implies that some washrooms in China do not have artificial illumination installed at all.

2) Lighting Usage Method

The lighting usage method in kitchen and washroom spaces in Korea and China (Table 6) shows that for kitchens, Korea is primarily using general lighting and local illumination together (97.2[%]), but only 17.7[%] in China use local illumination. This is the same with the implications made from the results of types and number of light sources mentioned above. Although local illumination must be used in working areas such as kitchens where fire and tools are used, it is indicated as a problem for China to have an overwhelmingly high percentage (82.3[%]) of not using local illumination. For washrooms, Korea primarily uses only general lighting (58.3[%]), and China mostly uses only general lighting (85.7[%]). For washrooms, because mirrors are installed with the basin and can increase the efficiency of light, various lighting installation methods need to be studied.

Table 6. The Kitchen/Washroom Space Lighting Usage Method N([%])

Classification		Korea	China
Kitchen	General Lighting	2 (2.8)	51 (82.3)
	General + Local	70 (97.2)	11 (17.7)
Washroom	General Lighting	42 (58.3)	54 (85.7)
	General + Local	30 (41.7)	9 (14.3)

3) Illumination Level Measurements

The result from the illumination level measurement survey of kitchen and washroom spaces in Korea and China is shown in Table 7. For kitchens, illumination levels of the sink, which is the working area, and the dining table are measured. The average illumination level of sinks in Korea is 266.6[lx] and is 143.2[lx] in China. Neither of them reach their illumination level standard. In particular, for Korea, the illumination level is not even close to the lowest illumination level (300[lx]) of KS standards for dining tables. For kitchens, the illumination level of sinks satisfies the illumination level standard, but the illumination level of dining tables in Korea is very low. For washrooms, illumination levels of the basin and toilet are measured.

Table 7. Measured Value of Luminance([lx])

N([%])

Variables		Classification	Korea	China
Kitchen	Sync	Less than 100	4 (6.0)	16 (22.6)
		101 - 200	23 (34.2)	29 (43.0)
		201 - 300	13 (19.5)	6 (9.0)
		301 - 400	16 (23.7)	9 (13.5)
		401 - 500	9 (13.4)	7 (10.5)
		500 or more	3 (4.5)	1 (1.5)
		M (SD)	266.6 (156.40)	198.9 (134.44)
	Dining Table	Less than 100	21 (31.5)	35 (49.5)
		101 - 200	22 (33.0)	20 (31.2)
		201 - 300	10 (15.0)	4 (5.9)
		301 - 400	11 (16.5)	4 (6.0)
		401 - 500	2 (3.0)	3 (4.5)
		500 or more	1 (1.5)	2 (3.0)
		M (SD)	187.9 (120.34)	143.2 (110.84)
Washroom	Basin	Less than 100	36 (53.6)	16 (23.7)
		100 - 200	25 (37.1)	28 (41.5)
		201 - 300	4 (6.0)	7 (10.5)
		300 or more	3 (4.5)	3 (4.5)
		M (SD)	120.5 (76)	123.9 (71.52)
	Toilet	Less than 100	53 (79.0)	43 (63.9)
		100 - 200	10 (14.8)	21 (31.2)
		201 - 300	4 (6.0)	4 (5.9)
		300 or more	1 (1.5)	-
		M (SD)	92.9 (111.42)	99.7 (45.36)

Regarding illumination level standards (Table 8), both Korea and China suggest standards for general lighting of washrooms. After applying the

measurements of illumination levels of basin and toilet to these standards, it can be shown that the actual conditions of illumination levels of basins for both Korea and China satisfy the illumination level standards. However, although illumination levels of toilets for both countries fall short of the standard, not much difference was shown. Therefore, the actual conditions of illumination levels of washrooms in Korea and China both meet the standard.

The illumination level standards of Korea suggest different standards for different stages – low, average and high. However, the standards of China only suggest an average illumination level. When the average illumination levels of Korea and China are compared, the general lighting standards of kitchens and washrooms are 100[lx] and the same. However, the standards of sinks and dining tables in China are much lower than those of Korea. Thus, illumination level standards are established by considering each country's natural environment, socio-cultural environment, and economic standards; thus, the standards for Korea and China do not need to be the same. However, in order to effectively plan lighting, different illumination level standards for different stages need to be suggested. Also, illumination level standards that aid in performing various activities need to be suggested. Therefore, the illumination level standards of China need to be raised; in particular, the illumination level standards in working area need to be improved as soon as possible. Meanwhile, the illumination level standards of Korea set the height of a dining table to 40[cm] based on the sedentary lifestyle of Koreans. However, the actual condition survey tells that most Koreans are using Western-style dining tables, and their average height is 72.4[cm]. Therefore, the height and categorization of illumination measurement of Korean illumination level standards need to be revised according to the current reality.

Table 8. Recommended Illumination Level

Space		Korea	China
Kitchen	General	60-100-150	100
	Working Space (Sync)	150-200-300	150
	Dining Table, Counter	300-400-600	150
Washroom		60-100-150	100

Note: Reference plane height of China: 0.75[m]
Korea: Dining Table-0.4[m];
Kitchen/Washroom-0.85[m]

3.3 Awareness of the Living Room's Lighting Environment

The survey results on brightness and satisfaction levels of kitchen and washroom lighting in Korea and China is shown in Table 9. Measured by Likert Scales, considering 'very bright' to be 5 points and 'very dark' to be 1 point, people in China and Korea both felt that their kitchens are brighter than normal, and the satisfaction level of the lighting environment was above average. Meanwhile, people in both Korea and China felt that the brightness of washrooms was a little dark, and the satisfaction level in China was slightly higher than in Korea.

Table 9. Brightness/Satisfaction Level of Kitchen/ Washroom Lighting in Korea & China

M(SD)

Variables		Korea	China
Kitchen	Brightness Level	3.13 (0.77)	3.14 (0.72)
	Satisfaction Level	3.28 (0.86)	3.06 (0.83)
Washroom	Brightness Level	2.97 (0.67)	2.99 (0.84)
	Satisfaction Level	3.16 (0.98)	3.34 (0.90)

4. Conclusion

This research surveyed 79 Korean and 68 Chinese households in order to compare and analyze the

actual conditions of the lighting environment of kitchens and washrooms, locations where water is being used the most in a house, in Korea and China. The results show that Korea is using slightly larger kitchens than China and that the heights of sinks and dining tables are similar. Most Chinese households do not use local illumination, and general lighting seems to be used insufficiently. The illumination levels of sinks in both Korea and China satisfy their respective illumination level standards. However, the illumination levels for both Korea and China do not reach their standards; in particular, the illumination level of dining tables in Korea is very low. Average sizes of washrooms in both countries are similar. China uses inadequate local illumination. Basins do satisfy the illumination level standards for either country. However, toilets for both countries fall short of the standards.

Based on the results above, proposals about lighting environments of kitchens and washrooms in Korea and China would be, first, that China's illumination level standards be raised, and, especially, that illumination level standards for working area be revised as soon as possible. Moreover, illumination measurement heights and categorizations in Korea need to be revised according to current reality.

Because China inadequately uses local illumination, it must be planned to use local illumination where it is needed. The need to choose and use various light sources for Korea was raised. Because, currently, many energy-saving light sources are being developed, saving energy and securing illumination need to be simultaneously satisfied by choosing various light sources according to the features of a space and by utilizing the rheostat well.

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References

[1] THE IESNA LIGHTING HANDBOOK 9TH EDITION, IESNA, 2000.
[2] "Korean Industrial Standards," KS A 3011.
[3] "China Industrial Standards," GB 50034-2004.
[4] Cheng YanSheng, Lighting & Electric Industry in China, Journal of the Japanese Illuminating, 92(1), pp.19-24, 2008.
[5] Ren Jianping, Watanabe Kaoru, Lighting Regulations in China, Journal of the Japanese Illuminating, 92(1), pp.29-31, 2008.

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