Current Status and Issues Regarding the Number of Sanitary Fixtures Installed in Japan

H. Kose (1)

(1) hkose@toyo.jp
(1) Professor, Faculty of Information Sciences and Arts, Toyo University, Japan

Abstract

In Japan, the Society of Air Conditioning and Sanitary Engineers standard “SHASE-S 206-2019” stipulates the technical requirements “Determination of the number of sanitary fixtures to be installed,” and is used in the architectural field. This is based on the report compiled by this society in 1983. After 40 years have passed and the situation regarding toilets in Japan has changed significantly.

First, in 2021, the country's office hygiene standards regulations were revised, and it was allowed to install separate toilets for both men and women in offices with a small number of people. In 2023, the Supreme Court ruled that the government's restriction on transgender servants from using women's toilet at work was illegal. All-gender toilets are being installed in Japan. However, there are opinions that this will take away women's rights and that there is a risk of voyeurism.

Next, the barrier-free design guidelines set by the Ministry of Land, Infrastructure, Transport and Tourism, “Architectural design standards that take into account the smooth movement of elderly people, people with disabilities, etc.,” were revised in 2021, indicating a direction toward decentralizing the functions of multifunctional toilets. This has created a need to appropriately install sanitary fixtures according to the people who need each function, but the appropriate number has not been clearly indicated.

Furthermore, Japan is facing challenges such as earthquakes that can cause buildings to be destroyed, water supply and drainage system to malfunction, and water and sewage infrastructure to be disrupted for long periods of time. In 2016, the Cabinet Office established the “Guidelines for securing and managing toilets in evacuation centers,” which set guidelines for the number of sanitary fixtures to be installed. However, there are challenges in securing and maintaining sanitary fixtures, functionality, and hygiene that will allow victims to defecate within hours after a disaster.

Keywords

Review paper, Number of sanitary fixtures, Gender, Barrier-free design, Emergency toilet

1 Introduction

This is a review paper of the current situation and issues regarding the number of sanitary fixtures installed in Japan, related to water supply and drainage system planning.

In Japan, the Society of Air Conditioning and Sanitary Engineers standard "SHASE-S 206-2019" stipulates the technical requirements "Determination of the number of sanitary fixtures to be installed," and is widely used in the architectural field. This is based on the contents of a report compiled by this society in 1983. The characteristics of buildings are divided into arbitrary usage formats such as offices and intensive usage formats such as theaters, and the appropriate number of fixtures is calculated for the former based on queuing theory and for the latter based on simulations using the Monte Carlo method. Three service levels are set depending on the user's allowable waiting time: level 1 (sufficient number of fixtures), level 2 (standard number of fixtures), and level 3 (minimum number of fixtures) (Figure 1).

To explain the concept of this diagram in more detail, the number of sanitary fixtures that can provide a "standard level" of service with no or short waiting times at the "upper limit" load, which is the highest number of users, is a "sufficient value." Similarly, the number of sanitary fixtures that can provide a "low level", the maximum acceptable waiting time, at the "upper limit" load is the "minimum value." The number of sanitary fixtures that can provide a "standard level" of service at an "average" load is the "standard value." If the "upper limit" load occurs with this number of sanitary fixtures, waiting times will increase and the service level will decline. If sanitary fixtures with a "low level" service are installed at the "average" load, they will not be able to handle users at the "upper limit" load, and the value will be an "undervalue."

For each sanitary fixture (men's water closet, men's urinal, men's washbasin, women's water closet, women's washbasin), the appropriate number of fixtures for the number of people using the toilet is determined (Table 1) based on the set arrival rate at the toilet and the time spent using sanitary fixture (Figure 2).

40 years have passed since the creation of the report on which these technical guidelines were based, and the situation regarding toilets in Japan has changed significantly. The amenities of public restrooms have improved, and most water closets have changed from Japanese-style (squat type) to Western-style (seated type) (Figure 3). In 2015, Japanese-style water closets were excluded from JIS (Japanese Industrial Standards) standards. Additionally, the overall environment of the room has been improved, including the installation of a bidet Seat (Figure 4), dry flooring, ventilation and antibacterial water closet, improved sealing of the booth, and the installation of sound imitation devices. Waiting lines have changed from queuing in parallel for each booth or fixture to queuing in a single line at the entrance to the toilet. Research results show that due to these circumstances, there are changes in the arrival rate at the toilet and the time spent using sanitary fixture.

There are also research results regarding the calculation of the number of fixtures at railway stations [4), 5), 6)] and expressway rest areas (service areas and parking areas) [7)], where the technical guidelines do not specify how to determine the number of fixtures to be installed.

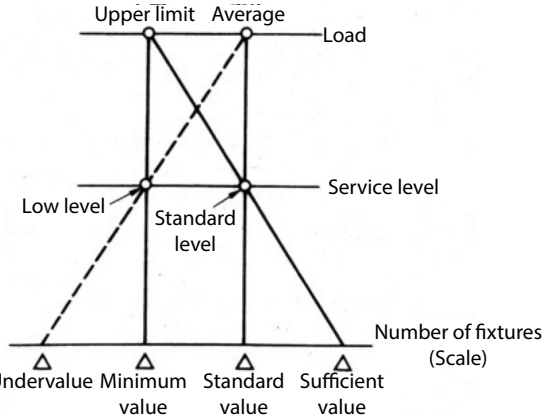

Figure 1 - Concept for number of sanitary fixtures multi-step calculation method Translated of 1)

Table 1 - Conditions for calculating the appropriate number of fixtures Translated of 1)

		Arrival rate	Occupancy time	Latency evaluation [a]		
		(people/(min* 100 people))	(sec)	Level 1	Level 2	Level 3
Office	Men's water closet	0.130	300	P(>10)<0.05	P(>60)<0.05	P(>120)<0.05
	Men's urinal	0.600	30	P(>0)<0.01	P(>10)<0.01	P(>30)<0.01
	Men's lavatory	0.700	20	P(>0)<0.01	P(>10)<0.01	P(>20)<0.01
	Women's water closet	0.600	90	P(>10)<0.01	P(>40)<0.01	P(>90)<0.01
	Women's lavatory	1.000	30	P(>0)<0.01	P(>10)<0.01	P(>30)<0.01
Department stores / Mass retailers	Men's water closet	0.080	240	P(>10)<0.05	P(>60)<0.05	P(>120)<0.05
	Men's urinal	0.300	30	P(>0)<0.01	P(>10)<0.01	P(>30)<0.01
	Men's lavatory	0.250	20	P(>0)<0.01	P(>10)<0.01	P(>20)<0.01
	Women's water closet	0.300	90	P(>10)<0.01	P(>40)<0.01	P(>90)<0.01
	Women's lavatory	0.350	30	P(>0)<0.01	P(>10)<0.01	P(>30)<0.01
Dormitory	Men's water closet	0.650	300	P(>10)<0.05	P(>60)<0.05	P(>120)<0.05
	Men's urinal	0.800	30	P(>0)<0.01	P(>10)<0.01	P(>30)<0.01
	Men's lavatory	1.700	150	P(>0)<0.01	P(>60)<0.01	P(>120)<0.01
	Women's water closet	1.000	120	P(>10)<0.01	P(>60)<0.01	P(>120)<0.01
	Women's lavatory	1.700	210	P(>10)<0.01	P(>60)<0.01	P(>120)<0.01
Hospital (Ward)	Men's water closet	0.600	360	P(>10)<0.05	P(>60)<0.05	P(>120)<0.05
	Men's urinal	0.800	45	P(>0)<0.01	P(>10)<0.01	P(>45)<0.01
	Women's water closet	1.000	180	P(>10)<0.01	P(>60)<0.01	P(>120)<0.01

Note a) The value in parentheses represents the waiting time (sec), and the value on the right represents the probability.

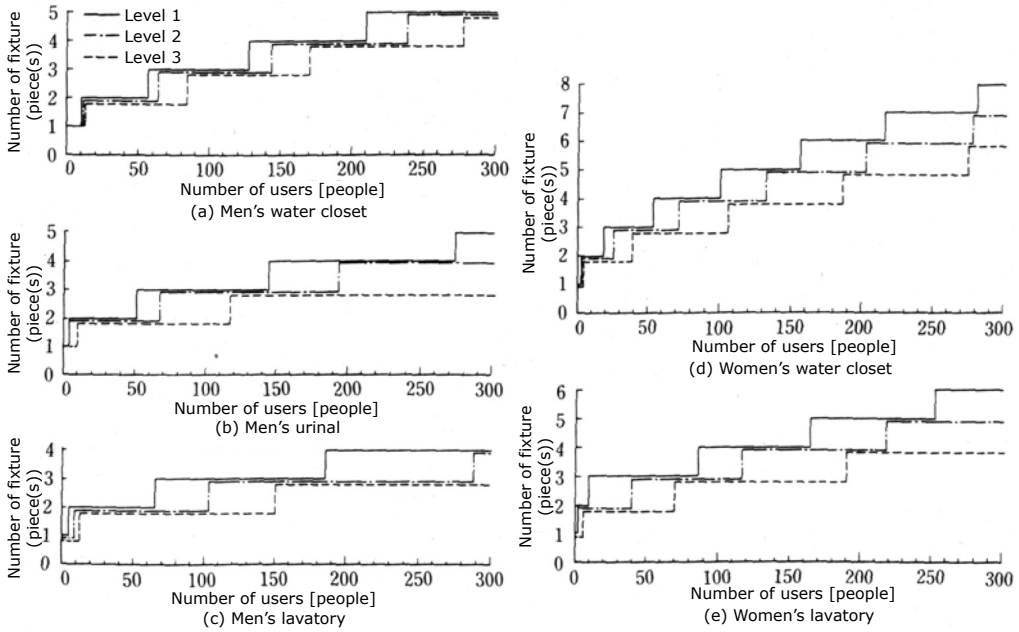

Figure 2 – Appropriate number of fixtures in the office Translated of 1)

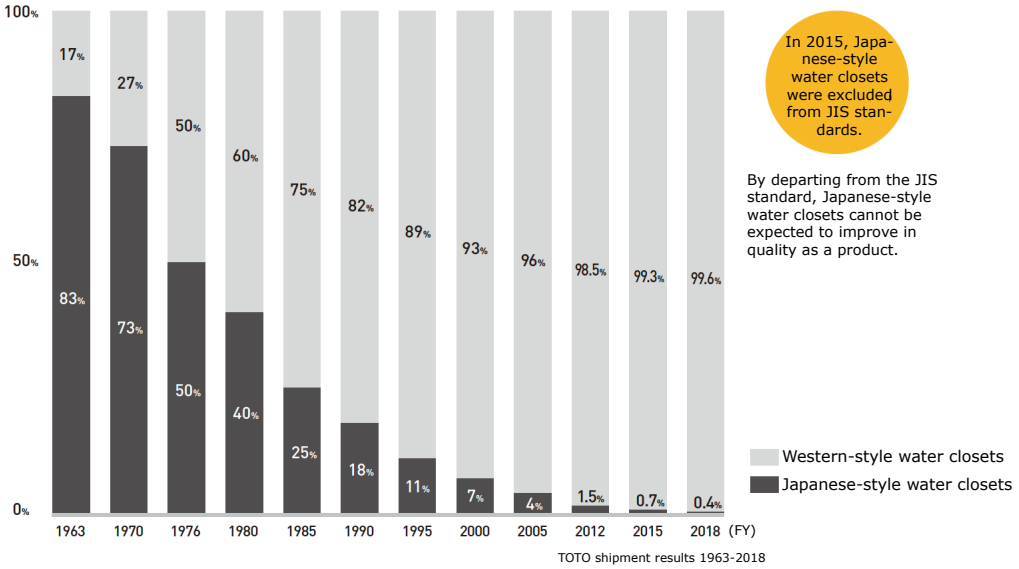

Figure 3 – Changes in the shipping ratio of Western-style toilets and Japanese-style toilets at TOTO Translated of 2)

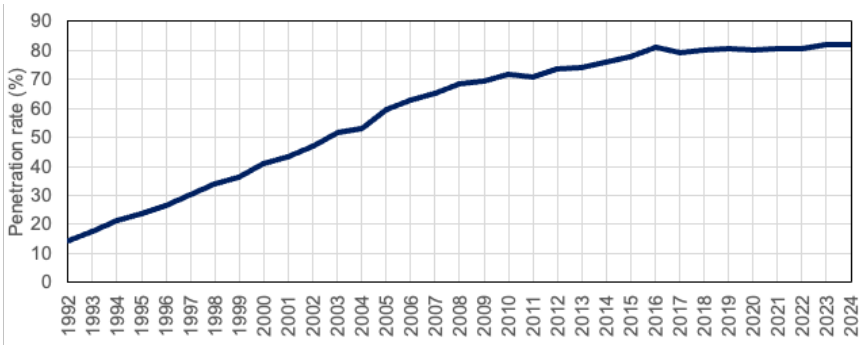

Figure 4 – Trends in penetration rate of bidet seats (households of two or more people) Created from 3)

2 Currently major issues

Next, 3 points are presented that are currently major issues.

2.1 Gender responsive

First, there are issues regarding gender. In 2021, the country's office hygiene standards regulations were revised, and as an exception, it was allowed to install separate toilets for both men and women in offices with a small number of people (Figure 5) [8]. In 2023, the Supreme Court ruled that the government's restriction on transgender national civil servants from using women's toilet at work was illegal [9]. Japan has been slow to understand LGBT issues, but progress has been made in recent years, including the installation of all-gender toilets. However, there are opinions that this will take away women's rights and that there is a risk of voyeurism, and some are moving to return from all-gender toilets to separate toilets for men and women [10]. Meanwhile, progress is being made in installing all-gender toilets in outdoor public restrooms [11].

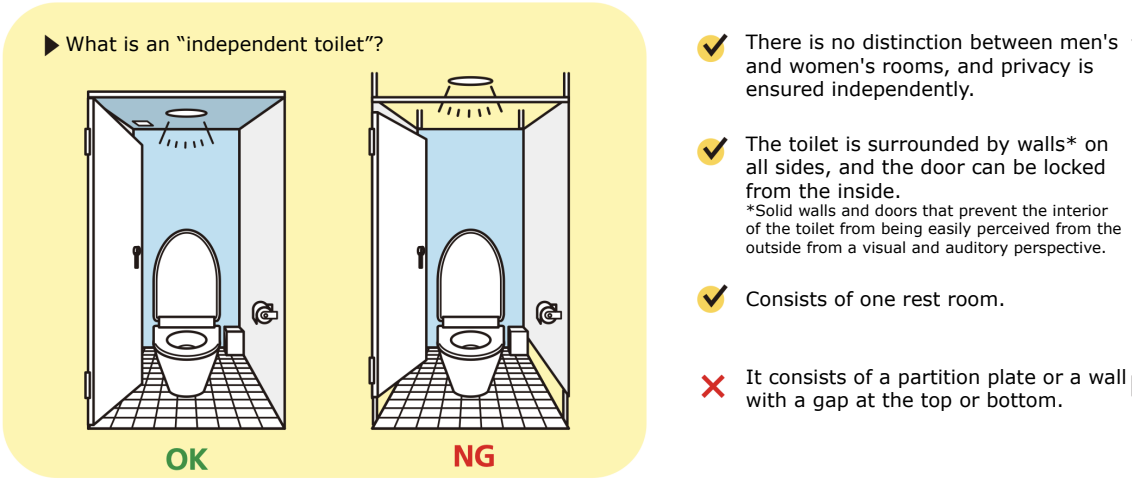

Figure 5 - "Independent private toilet" has been newly established by law [8]

2.2 Functional distribution of multifunctional toilets

Next, there is a high concentration of multifunctional toilets used by people with disabilities. The barrier-free design guidelines set by the Ministry of Land, Infrastructure, Transport and Tourism, "Architectural design standards that take into account the smooth movement of elderly people, people with disabilities, etc.," were revised in 2021, indicating a direction toward decentralizing the functions of multifunctional toilets [12), 13)]. This has created a need to appropriately install sanitary fixtures according to the people who need each function, but the appropriate number has not been clearly indicated.

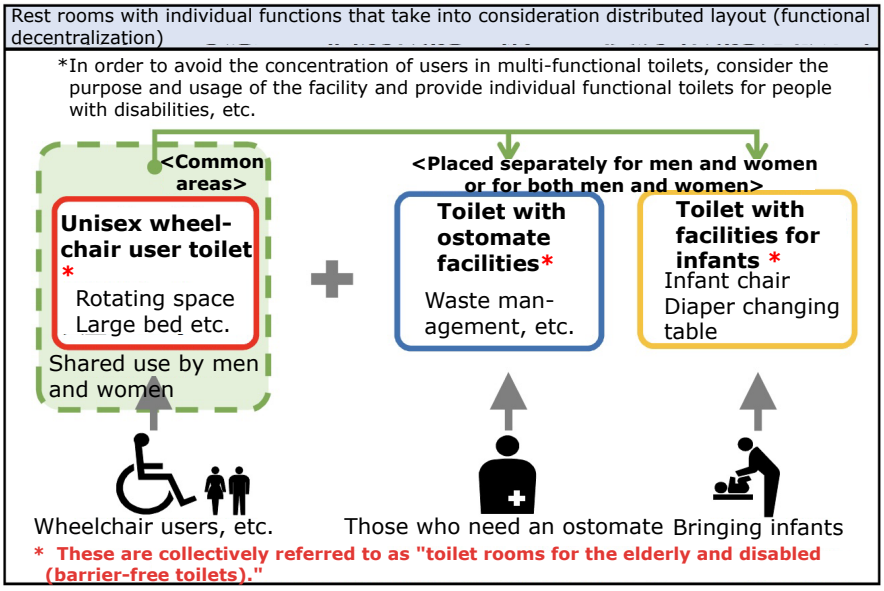

Figure 6 - Rest rooms with individual functions that take into consideration distributed layout (functional decentralization) [13)]

Table 2 - Number of toilets (estimate)

Municipalities should take into account the installation status of temporary toilets in past disasters and standards set by the United Nations, etc.
* At the beginning of the disaster, one unit per approximately 50 evacuees
* After that, if the evacuation is prolonged, one unit will be installed per approximately 20 people.
* The average number of times a person uses the toilet is 5 times a day.

It is desirable to create a plan for stockpiling and securing toilets for emergencies using this as a guideline.

The number of toilets is divided into private toilets at the facility (portable toilets with Western-style toilets) and emergency toilets.
In addition, barrier-free toilets are not included in the number above, but should be confirmed according to the number and needs of evacuees.
However, these are guidelines, and the number of toilets needed at an evacuation center will vary depending on the situation of evacuees, the degree of damage, etc
The number required varies depending on the degree of damage, etc.
At each evacuation center, it is important to pay attention to the waiting time for toilets and to ensure the number of toilets and treatment/storage capacity commensurate with the number of evacuees (including men and women).

In addition, the following points need to be kept in mind while taking into account the situation of evacuees, etc.

1. Since toilets are needed immediately after a disaster occurs, the minimum number of toilets required should be stocked, and the number should be secured according to future needs to ensure comfort.
2. As a general rule, toilets will be separated into those for men and women, and more toilets will be installed for women, and efforts will be made to give priority to toilets in buildings for use by the disabled, the elderly, women, and children.

Please note that it is not realistic to supply all the toilets in evacuation centers with stockpiles. In order to be able to quickly procure emergency toilets in the event of a disaster, it is important to strengthen collaborative systems, such as by signing agreements in advance with related organizations and businesses, and to ensure smooth operation in the event of a disaster.

2.3 Response to natural disasters

Furthermore, Japan is facing challenges such as earthquakes and floods that can cause buildings to be destroyed, water supply and drainage system to malfunction, and water and sewage infrastructure to be disrupted for long periods of time. In 2016, the Cabinet Office established the "Guidelines for securing and managing toilets in evacuation centers," [14] which set guidelines for the number of sanitary fixtures to be installed (Table 2). Additionally, efforts are being made to secure emergency toilets at designated evacuation centers, and local governments are also working to install movable toilet trailers [15]. However, there are challenges in securing and maintaining sanitary fixtures, functionality, and hygiene that will allow victims to defecate within hours after a disaster.

3 Conclusion

As a review paper, this study summarized the standards and social situation regarding the number of sanitary fixtures installed in Japan and pointed out future issues.

This paper only indicates future issues but does not provide any surveys or analytical results. In the future, field surveys, simulation-based analysis, and discussions will be required to set academic standards for the number of sanitary fixtures to be installed to address these issues.

The SDGs include the idea of realizing a society in which "no one is left behind." Public toilets with the necessary functions for those who need them are necessary so that various people have equal opportunities to go out. It is also essential to secure toilets in times of disasters that affect survival. We need to continue responding to this issue while responding to changes in social conditions.

4 References

1) The Society of Heating, Air-Conditioning and Sanitary Engineers of Japan, "SHASE -S206-2019 Plumbing Code", 2019
2) TOYO Co., Ltd., "Explained with data, Future public toilet, Westernization book, 20 19, https://www.catalabo.org/iportal/cv.do?c=57111490000&pg=1&v=CATALABO &d=link
3) Cabinet Office, Government of Japan, "Consumer Trend Survey", viewed on 27 Ma y 2024, https://www.e-stat.go.jp/stat-search/files?tclass=000001213562&cycle=0
4) Saburo Murakawa et al., "Analysis of the Toilet Users and the Passengers in Railway Stations: A Study on the Calculating Method of Fixture Requirements for Railway S tations Part 1", Journal of Architecture and Planning (Transactions of AIJ), No.522, pp.91-96, 1999, https://doi.org/10.3130/aija.64.91_3
5) Yasuo Koshikawa et al., "Analysis of the Toilet Users and Their Behaviors in Railw ay Stations: A Study on the Calculating Method of Fixture Requirements for Railwa y Stations Part 2", Journal of Architecture and Planning (Transactions of AIJ), No.52 8, pp.59-65, 2000, https://doi.org/10.3130/aija.65.59_1
6) Saburo Murakawa et al., "A Proposal for the New Calculating Method of Fixture Re quirements in Railway Station Toilets: A study on the calculating method of fixture r

equirements for railway stations Part 3", Journal of Architecture and Planning (Trans actions of AIJ), No.545, pp.59-64, 2001, https://doi.org/10.3130/aija.66.59_3
7) Jixing Zhang and Kyosuke Sakaue, "Studies on The Calculating Methods for the Sui table Number of Fixtures Restroom of Highway Service Area", Technical Papers of Annual Meeting the Society of Heating, Air-Conditioning and Sanitary Engineers of Japan, G-38, pp.149-152, 2018, https://doi.org/10.18948/shasetaikai.2018.1.0_149
8) Ministry of Health, Labour and Welfare, "Do you know? Occupational health standa rds in the workplace have changed", 2022, https://www.mhlw.go.jp/content/1130000 0/000905329.pdf
9) Courts in Japan, "|Judgments of the Supreme Court, Details of 2021 (Gyo-Hi) 285", 2023, https://www.courts.go.jp/app/hanrei_en/detail?id=1951
10) Japan Today, "Tokyu Kabukicho Tower backtracks on its gender-neutral toilets, reji gging them to appease public", 22 May 2023, https://japantoday.com/category/natio nal/tokyu-kabukicho-tower-backtracks-on-its-gender-neutral-toilets-rejigging-them-t o-appease-public-1
11) Shibuya City, "Hatagaya – The Tokyo Toilet", Viewed on 27 May 2024, https://toky otoilet.jp/en/htagaya/
12) Ministry of Land, Infrastructure, Transport and Tourism, "Press release: "Architectu ral design standards that consider the smooth movement of the elderly, people with d isabilities, etc." have been revised ~ Decision to hold an online seminar on the revise d contents - Applications for participation will begin today ~", 16 March 2021, https: //www.mlit.go.jp/report/press/house05_hh_000868.html
13) Ministry of Land, Infrastructure, Transport and Tourism, "Outline of revisions to ar chitectural design standards that take into account smooth movement of the elderly, people with disabilities, etc.", March 2021, https://www.mlit.go.jp/common/001391 184.pdf
14) Cabinet Office, Government of Japan, "Guidelines for securing and managing toilets in evacuation centers", 2016, https://www.bousai.go.jp/taisaku/hinanjo/pdf/1604hin anjo_toilet_guideline.pdf
15) Tasukeai Japan, "Disaster Dispatch Toilet Network Project: A toilet that makes ever yone feel better", Viewed 27 May 2024, http://corp.tasukeaijapan.jp/toilet/

5 Presentation of Author

Hiroyuki Kose is the Professor at Toyo University, Faculty of Information sciences and arts from 2009. Special fields of study are water supply and drainage for buildings, water environment, reproduction of the agricultural and forestry industries by collaboration of citizens and an organization and community design for regional vitalization.