1. INTRODUCTION

In consideration of facilities used by general public, the environment that incorporates the idea of universal design (hereinafter referred to as UD) is being promoted. With the progress of UD, the facilities are becoming easier to use for users with children, but on the other hand, there also come out some problems.

Recent years, commercial facilities such as department stores and shopping malls, where are many customers with children, have begun to provide services and facilities for children and their companions with the aim of attracting customers with children.

From paper The demand of customers with children on shopping facilities [1], we learn that adequate services and facilities for childcare is a very important reason for customers with children to choose the shopping place. Among the services and equipments that have been used, diaper changing sheet is the most common, followed by baby chair and rental stroller. There are many opinions requesting the increase of services and equipments for fathers with children, such as installing diaper changing sheets for men’s toilet.

In many shopping malls, except the baby room and kids’ toilet which are exclusive for customers with children, they also set up equipments for childcare in men’s toilet, women’s toilet and multipurpose toilet. So the public service facilities for customers with children can be divided into exclusive use and common use as Figure 1 shows.

The arrangement of public service facilities for customers with children is very different in shopping malls. Some are only set up in one place, and some are set up on each floor. The types and amount of children’s equipments installed in men’s toilet, women’s toilet and multipurpose toilets are also very different.

There are some previous studies about childcare in public service facilities. Tasai conducted a survey about the space composition and users’ evaluation of 43 family rooms in Sapporo from the viewpoint of gender equality and pointed out the considerations about space layout to improve the gender equality usage of family room [2]. Ishida conducted a survey about the space composition and users’ evaluation of 28 nursing rooms in Kitakyushu and summarized the types and the user needs of the nursing rooms [3]. Kawano conducted a survey about

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Figure 1: Two types of public service facilities for customers with children

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Abstract: This study focuses on the public service facility (men’s toilet, women’s toilet, multipurpose toilet, baby room, kids’ toilet) zone arrangement in the shopping malls. The purpose is to find out the problem between the arrangement of public service facilities and the customer needs that can be fed back to the planning of public service facilities in shopping malls. In this study, we analyzed the function distribution for customers with children and customer behaviors by field survey in Ario-kameari, Aeonmall-hinode and LaLaport-tachikawa tachihi to make the current situation clear. And based on the results of quantitative analysis on the equipments of the service facilities and the user behavior observation, we conducted interview investigation and found out the correlation between the distribution of facilities, equipments and user needs. And finally, it provides several directions for further improvement of public service facilities for customers with children in shopping malls.

Keywords: Shopping mall, Service facility, Arrangement, Childcare
the space composition and furniture arrangement of 44 nursing rooms in Tokyo area and extracted the issues about the appropriate space and personal zoning [4]. Naka conducted observation surveys on user behavior in diaper changing zones of baby rooms in three commercial facilities to formulate architectural guidelines on the planning and designing of diaper changing zones in baby rooms mainly focused on the proper number and layout of changing stations [5]. Yatogo made some studies about the child use in public rest room and discussed the proper space and layout planning for equipment with child use in general toilet and multipurpose toilet [6]. Numajiri conducted a research to identify difficulties involved in the use of multipurpose toilet by questionnaire survey carried out on individuals accompanying children and found out the difficulty experienced by wheelchair users in the use of multipurpose toilets was largely due to the unavailability of such toilets when they needed to use them, in particular, such toilets were often occupied by individuals accompanying a child [7].

The previous studies are mostly concentrated on the space composition layout in one kind of facilities. But as mentioned above, there are always various kinds of facilities for child use in one commercial building. Although Kanki conducted a study on the demand of customers with children on shopping facilities by questionnaire survey, the function distribution and user behavior, needs were not discussed much in the report [1]. The facilities distribution on different floors, the equipments distribution in different facilities, and how it affects the behaviors of the users, how the users feel about are not clear yet. This study focus on the arrangement of different public service facilities related to the users with children and try to make the above clear. By quantitative survey about the equipments, user behavior observation and interview investigation to find out the direction for further improvement about the public service facilities in shopping malls.

The shopping malls are more sensitive to the arrangement of public service facilities in order to attract customers. Especially in some large-scale shopping malls, consumers always stay for a long time and even spend one day in these huge commercial facilities on weekends. Their requirements for public service facilities are higher than other public facilities (such as stations and parks). Time-consuming is becoming a trend for commercial facilities. So we focused on the large-scale time-consuming commercial facilities. Among the 339 commercial facilities in Tokyo listed by Japan Council of Shopping Centers [8], we selected the proper investigation objects according to the following conditions: i) The commercial area is above 35,000 square meters. ii) Low-rise buildings (2-5 floors) with relatively high mobility, and independent buildings not complex with apartment or office. As a result, three shopping mall brands, Ario, Aeonmall, LaLaport came out. We chose one facility in each of the three brands, and their design concepts all include community, family and children. The target customers are mainly family. And their tenant composition is also multifarious, including restaurants, miscellaneous goods, services, fashion, and entertainment. They all have large food court and plenty of parking spaces, and they are all close to the station. They are well placed for easy access by car or public transportation. They are good choices for parents to have a good time with their children on weekends or holiday.

In this study, we investigated the distribution of public service facilities related to customers with children in three shopping malls, and the types and amount of equipments related to customers with children in men’s toilet, women’s toilet, multipurpose toilet, baby room and kids’ toilet. Then we conducted a behavior observation, focusing on the usage of public service facilities on each floor by customers with children. And based on the result of field survey, we made the interview investigation to learn more about the needs of the users and their viewpoints about the current situation. By analyzing the function distribution, user behavior and user needs, the purpose is to find out the problem between the arrangement of public service facilities and the customer needs that can be fed back to the planning of public service facilities in shopping malls.

2. THE DISTRIBUTION OF THE PUBLIC SERVICE FACILITIES AND THE EQUIPMENTS

There are three public service facility zones on each floor of the three shopping malls. There is an extra one in the part of Aeon’s market of Aeonmall-hinode, divided into tenant service facility. So, it is defined that there are also three public service facility zones on each floor of Aeonmall-hinode. In order to distinguish the three facility zones on each floor, the locations of the three public service facility zones on the same floor are named A, B and C from left to right on the front side view of the shopping mall.

2.1 The distribution of the public service facilities and the equipments in Ario-kameari

Figure 2 shows that the public service facility zones in Ario-kameari are located at place A, B and C of each floor.
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Figure 2: Zone A, B, C of Ario-kameari

Table 1: The distribution of the public service facilities in Ario-kameari

|   | A | B | C |
|---|---|---|---|
| 1F | Fashion, Ito Yokado’s supermarket, restaurants and food court |   |   |
| 2F | Fashion, miscellaneous goods, service, and Ito Yokado’s fashion market |   |   |
| 3F | Cinema and Ito Yokado’s household goods, children’s goods and amusement |   |   |

Table 2: Equipments distribution on the first floor of Ario-kameari

|   | Men's toilet | Women's toilet | Multipurpose toilet | Baby room |
|---|-------------|---------------|---------------------|-----------|
| A | 1 1 1 | 3 1 1 1 1 |   |   |
| B | 2 1 1 | 3 1 4 1 1 | 2 2 2 3 3 |   |
| C | 1 1 1 | 3 1 2 |   | 1 1 1 |

Amount: 4 3 1 9 3 7 2 2 3 3 3 3

Table 3: Equipments distribution on the second floor of Ario-kameari

|   | Men's toilet | Women's toilet | Multipurpose toilet |
|---|-------------|---------------|---------------------|
| A | 2 1 1 | 4 1 1 1 1 1 1 1 |   |
| B | 1 1 1 | 2 1 2 1 1 1 1 1 |   |
| C | 1 1 1 | 3 1 2 |   |

Amount: 4 3 2 9 2 1 5 2 2 2 2 2

Table 4: Equipments distribution on the third floor of Ario-kameari

|   | Men's toilet | Women's toilet | Multipurpose toilet |
|---|-------------|---------------|---------------------|
| A | 2 2 5 1 | 3 1 1 1 1 1 1 1 |   |
| B | 1 1 1 | 2 1 2 1 1 1 1 |   |
| C | 1 1 1 | 3 1 2 |   |

Amount: 4 4 1 10 2 1 7 2 2 2 2 2 1

From Table 1 we can learn that the tenant types on the first floor of Ario-kameari are mainly fashion, Ito Yokado’s supermarket, restaurants and food court. It can be speculated that there is a wider range of public service facility users on the first floor, especially around food court, the more elderly, children, families and other users, and the residence time is also longer. They use the service facilities more frequently. Through the investigation we can learn that on the first floor, there are three multipurpose toilets, and one baby room. Around zone A, the main tenant type is fashion and there are general toilets only. Around zone B, the main tenant types are restaurant and food court. There are two multipurpose toilets and one baby room. Around zone C, the main tenant types are Ito Yokado’s supermarket and pet shop. There is one multipurpose toilet.

There are two multipurpose toilets on the second floor. Around zone A, the main tenant types are fashion and miscellaneous goods. There is one multipurpose toilet. Around zone B, the main tenant types are fashion and miscellaneous goods. There is one multipurpose toilet. Around zone C, the main tenant types are children goods and children service. There are general toilets only. Tables 2, 3, 4 show the equipment distribution on each floor of Ario-kameari. We count the number of the equipments related to the childcare in each facility.
Table 5: Correlation of the proportions of the equipments in Ario-kameari

|                              | Diaper in men’s toilet | Baby chair in men’s toilet | Diaper in women’s toilet | Baby chair in women’s toilet | Kids urinal in men’s toilet | Diaper in multipurpose toilet | Baby stroller booth in multipurpose toilet | Diaper in baby room |
|------------------------------|------------------------|----------------------------|--------------------------|----------------------------|----------------------------|--------------------------------|-------------------------------------------|---------------------|
| Diaper in men’s toilet       | 1                      | -0.158                     | 0.632                    | -0.112                     | 0.632                      | -0.040                        | -0.040                                    | -0.316              |
| Baby chair in men’s toilet   | -0.158                 | 1                          | 0.500                    | 0.707*                     | 0.500                      | 0.625                          | 0.625                                     | 0.500               |
| Diaper in women’s toilet     | 0.632                  | 0.500                      | 1                        | 0.354                      | 1.000**                    | 0.500                          | 0.500                                     | 0.250               |
| Baby chair in women’s toilet | -0.112                 | 0.707*                     | 0.354                    | 1                          | 0.354                      | 0.177                          | 0.177                                     | -0.177              |
| Kids urinal in women’s toilet| 0.632                  | 0.500                      | 1.000**                  | 0.354                      | 1                          | 0.500                          | 0.500                                     | 0.250               |
| Diaper in multipurpose toilet| -0.040                 | 0.625                      | 0.500                    | 0.177                      | 0.500                      | 1                              | 1.000**                                   | 0.688*              |
| Baby stroller booth in multipurpose toilet | -0.040 | 0.625 | 0.500 | 0.177 | 0.500 | 1.000** | 1 | 0.688* |
| Diaper in baby room          | -0.316                 | 0.500                      | 0.250                    | -0.177                     | 0.250                      | 0.688*                         | 0.688*                                     | 1                   |

From the proportion of the equipments, we conduct a SPSS correlation analysis as Table 5 shows. We can learn that baby chair in general toilets are positively correlated. The more baby chairs in men’s toilet, and the more baby chairs in women’s toilet in the same facility zone. Kids urinal in women’s toilet and diaper equipments in women’s toilet are positively correlated. Kids urinal and the diaper changing sheet outside the booth are set up together in women’s toilet on zone A, B on each floor. Baby stroller booth in multipurpose toilet, diaper equipments in multipurpose toilet and diaper equipments in baby room are positively correlated. Because there is one diaper changing sheet in each multipurpose toilet, and there is only one baby room on zone B of the first floor, where there are two multipurpose toilets. On zone B of the first floor, there are more facilities and equipments for childcare. Multipurpose toilet is also an important support facility for childcare.

2.2 The distribution of the public service facilities and the equipments in Aeonmall-hinode

Figure 3 shows that the public service facility zones in Aeonmall-hinode are located at place A, B and C of each floor.

From Table 6, for Aeonmall-hinode, we can learn that the multipurpose toilets are evenly distributed in the three zones on each floor. Then we focus on the analysis of the location of baby rooms, and kids’ toilets. Around zone B on the first floor, the main tenant type is restaurant. As mentioned above, the customer stays for a longer time, and the service facilities are used more frequently. There is one kids’ toilet. The tenant types around zone C are restaurants and food supermarket. There is one baby room. It can be speculated that kids’ toilet and baby room are arranged separately to avoid crowding. They are relatively close to the restaurants.

Figure 3: Zone A, B, C of Aeonmall-hinode

Table 6: The distribution of the public service facilities in Aeonmall-hinode

|             | A                | B                | C                | Tenant composition                      |
|-------------|------------------|------------------|------------------|----------------------------------------|
| 1F          | ![image of zone A](Image 333x318 to 344x330) | ![image of zone B](Image 333x354 to 344x365) | ![image of zone C](Image 333x384 to 344x395) | Fashion, Aeon's supermarket, restaurants and book store |
| 2F          | ![image of zone A](Image 333x318 to 344x330) | ![image of zone B](Image 333x354 to 344x365) | ![image of zone C](Image 333x384 to 344x395) | Fashion, miscellaneous goods, and Aeon's fashion market |
| 3F          | ![image of zone A](Image 333x318 to 344x330) | ![image of zone B](Image 333x354 to 344x365) | ![image of zone C](Image 333x384 to 344x395) | Cinema, Aeon's household goods, children's goods, miscellaneous goods, amusement and food court |

Around zone B on the second floor, the main tenant types are fashion and miscellaneous goods. There is one kids’ toilet. Around zone C, the main tenant types are fashion and beauty salons. There is one baby room, which is located at the same location as the first floor to avoid the concentration of people in the same location as the kids’ toilet. And at the same place on the upper and lower floors, it is easier to be found out.

The kids’ toilet and baby room on the third floor are all located at zone C. We can learn that around zone C, there are children playground, children goods stores, and food court which is not far away. Therefore, service facilities related to childcare are arranged there.

Tables 7, 8, 9 show the equipment distribution on each floor of Aeonmall-hinode. We count the number of the equipments related to the childcare in each facility.
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Table 7: Equipments distribution on the first floor of Aeonmall-hinode

| Men's toilet | Women's toilet | Multipurpose toilet | Kids' toilet | Baby room |
|--------------|----------------|---------------------|--------------|-----------|
| A            |                |                     |              |           |
| B            |                |                     |              |           |
| C            |                |                     |              |           |
| Source       |                |                     |              |           |

Table 8: Equipments distribution on the second floor of Aeonmall-hinode

| Men's toilet | Women's toilet | Multipurpose toilet | Kids' toilet | Baby room |
|--------------|----------------|---------------------|--------------|-----------|
| A            |                |                     |              |           |
| B            |                |                     |              |           |
| C            |                |                     |              |           |
| Source       |                |                     |              |           |

Table 9: Equipments distribution on the third floor of Aeonmall-hinode

| Men's toilet | Women's toilet | Multipurpose toilet | Kids' toilet | Baby room |
|--------------|----------------|---------------------|--------------|-----------|
| A            |                |                     |              |           |
| B            |                |                     |              |           |
| C            |                |                     |              |           |
| Source       |                |                     |              |           |

From the proportion of the equipments, we conduct a SPSS correlation analysis as Table 10 shows. We can learn that kids urinal in women’s toilet and diaper equipments in women’s toilet are positively correlated. Kids closestool in multipurpose toilet, diaper equipments in women’s toilet, kids urinal in women’s toilet, diaper equipments in multipurpose toilet, baby chair in multipurpose toilet are positively correlated. On zone B of first floor and second floor where the kids’ toilet is set up, the equipments for childcare in multipurpose toilet and women’s toilet are less then other zones. The proportion of the equipments for childcare in kids’ toilet and the proportion of the equipments for childcare in women’s toilet, multipurpose toilet are negatively correlated. We can learn that if there is a kids’ toilet, the equipments for childcare in women’s toilet and multipurpose toilet are reduced on purpose.

2.3 The distribution of the public service facilities and the equipments in LaLaport-tachikawa tachihi

Figure 4 shows that the public service facility zones in LaLaport-tachikawa tachihi are located at place A, B and C of each floor.

From Table 11, for LaLaport-tachikawa tachihi, we can learn that multipurpose toilets and baby rooms are evenly distributed in three zones on each floor. But one thing to note is that there are two baby rooms at zone C on the second floor. Around zone C, the main tenant type is fashion. Considering that the second floor of LaLaport-tachikawa tachihi is directly connected to the station tachihi, the flow of people is relatively large. More baby rooms would be necessary.

Table 10: Correlation of the proportions of the equipments in Aeonmall-hinode

|                              | Diaper in women’s toilet | Baby chair in women’s toilet | Kids urinal in women’s toilet | Diaper in multipurpose toilet | Baby chair in multipurpose toilet | Kids closestool in multipurpose toilet | Diaper in baby room | Diaper in kids’ toilet | Baby chair in kids’ toilet | Kids urinal and closestool in kids’ toilet |
|------------------------------|--------------------------|------------------------------|-------------------------------|-------------------------------|----------------------------------|----------------------------------------|---------------------|-------------------------|-------------------------------------------|---------------------------------------------|
| Diaper in women’s toilet     | 1                        | -0.286                       | 1.000**                      | 0.357                        | 0.598                            | 0.756*                                 | 0.369                | -1.000**                | -0.756*                                   | -1.000**                                    |
| Baby chair in women’s toilet| -0.286                   | 1                           | -0.286                       | 0.357                        | 0.598                            | 0.756*                                 | 0.369                | -1.000**                | -0.756*                                   | -1.000**                                    |
| Kids urinal in women’s toilet| 1.000**                  | -0.286                      | 1                             | 0.357                        | 0.598                            | 0.756*                                 | 0.369                | -1.000**                | -0.756*                                   | -1.000**                                    |
| Diaper in multipurpose toilet| 0.357                    | 0.357                       | 0.357                        | 1                            | 0.598                            | 0.756*                                 | 0.369                | -0.286                  | -0.357                                   | -0.756*                                    |
| Baby chair in multipurpose toilet| 0.598                    | 0.598                       | 0.598                        | 1                            | 0.791*                            | -0.251                                 | -0.598               | -0.791*                 | -0.598                                   | -0.791*                                    |
| Kids closestool in multipurpose toilet| 0.756*                  | 0.189                       | 0.756*                       | 0.756*                       | 0.756*                            | 1                                     | 0.122                | -0.756*                 | -0.756*                                   | -1.000**                                    |
| Diaper in baby room          | 0.369                    | -0.0670**                   | 0.369                        | -0.064                       | -0.251                           | 0.122                                 | 1                    | -0.369                  | -0.369                                   | -0.122                                     |
| Diaper in kids’ toilet       | -1.000**                 | 0.286                       | -1.000**                     | -0.357                       | -0.598                            | -0.756*                               | -0.369               | 1                       | 1.000**                                  | 0.756*                                     |
| Baby chair in kids’ toilet   | -1.000**                 | 0.286                       | -1.000**                     | -0.357                       | -0.598                            | -0.756*                               | -0.369               | 1                       | 0.756*                                   |                                           |
| Kids urinal and closestool in kids’ toilet| -0.756*                 | -0.189                     | -0.756*                      | -0.756*                      | -0.791*                           | -1.000**                              | -0.122              | 0.756*                  | 0.756*                                   | 1                                           |
In the multipurpose toilets on the first floor and second floor, equipments in women’s toilet are positively correlated. Diaper equipments in multipurpose toilet and diaper number of the equipments related to the childcare in each baby room.

From the proportion of the equipments, we conduct a SPSS correlation analysis as Table 15 shows. We can learn that baby stroller booth in women’s toilet and baby chair in women’s toilet are positively correlated. On zone B, C of first floor and third floor and zone B of second floor, there are more baby stroller booths and baby chairs in women’s toilet. Diaper equipments in multipurpose toilet and diaper equipments in women’s toilet are positively correlated. In the multipurpose toilets on first floor and second floor,

| Table 11: The distribution of the public service facilities in LaLaport-tachikawa tachihii |

|     | A       | B       | C       | Tenant composition                                                                 |
|-----|---------|---------|---------|-------------------------------------------------------------------------------------|
| 1F  | ![Image](image1) | ![Image](image2) | ![Image](image3) | Fashion, service, restaurants and miscellaneous goods                                 |
| 2F  | ![Image](image4) | ![Image](image5) | ![Image](image6) | Fashion                                                                               |
| 3F  | ![Image](image7) | ![Image](image8) | ![Image](image9) | Fashion, children’s goods, miscellaneous goods and food court                        |

Tables 12, 13, 14 show the equipment distribution on each floor of LaLaport-tachikawa tachiihi. We count the number of the equipments related to the childcare in each facility.

| Table 12: Equipments distribution on the first floor of LaLaport-tachikawa tachiihi |

|     | Men’s toilet | Women’s toilet | Multipurpose toilet | Baby room |
|-----|--------------|----------------|---------------------|-----------|
| A   | ![Image](image10) | ![Image](image11) | ![Image](image12) | ![Image](image13) |
| B   | ![Image](image14) | ![Image](image15) | ![Image](image16) | ![Image](image17) |
| C   | ![Image](image18) | ![Image](image19) | ![Image](image20) | ![Image](image21) |

| Table 13: Equipments distribution on the second floor of LaLaport-tachikawa tachiihi |

|     | Men’s toilet | Women’s toilet | Multipurpose toilet | Baby room |
|-----|--------------|----------------|---------------------|-----------|
| A   | ![Image](image22) | ![Image](image23) | ![Image](image24) | ![Image](image25) |
| B   | ![Image](image26) | ![Image](image27) | ![Image](image28) | ![Image](image29) |
| C   | ![Image](image30) | ![Image](image31) | ![Image](image32) | ![Image](image33) |

| Table 14: Equipments distribution on the third floor of LaLaport-tachikawa tachiihi |

|     | Men’s toilet | Women’s toilet | Multipurpose toilet | Baby room |
|-----|--------------|----------------|---------------------|-----------|
| A   | ![Image](image34) | ![Image](image35) | ![Image](image36) | ![Image](image37) |
| B   | ![Image](image38) | ![Image](image39) | ![Image](image40) | ![Image](image41) |
| C   | ![Image](image42) | ![Image](image43) | ![Image](image44) | ![Image](image45) |

| Table 15: Correlation of the proportions of the equipments in LaLaport-tachikawa tachiihi |

|                          | Baby chair in men’s toilet | Diaper in women’s toilet | Baby chair in women’s toilet | Baby stroller booth in women’s toilet | Diaper in multipurpose toilet | Diaper in baby room |
|--------------------------|---------------------------|--------------------------|-----------------------------|--------------------------------------|-------------------------------|---------------------|
| Baby chair in men’s toilet | 1                         | 0.000                    | -0.352                      | 0.000                                | -0.500                        | 0.000               |
| Diaper in women’s toilet  | 0.000                     | 1                        | 0.414                       | 0.470                                | 0.756*                        | -0.189              |
| Baby chair in women’s toilet | -0.352                  | 0.414                    | -0.352                      | 0.789*                               | 0.196                         | -0.255              |
| Baby stroller booth in women’s toilet | 0.000              | 0.470                    | 0.789*                      | -0.500                               | 0.222                         | -0.488              |
| Diaper in multipurpose toilet | -0.500                  | 0.756*                   | 0.196                       | 0.222                                | 1                             | -0.250              |
| Diaper in baby room       | 0.000                     | -0.189                   | -0.255                      | -0.488                               | -0.250                        | 1                   |
there is no diaper equipment. On third floor, there is diaper equipment in every multipurpose toilet. And in the women’s toilets on zone B, C of third floor, there are extra diaper equipments outside the booth. It is supposed that is because the tenants of third floor mostly are children’s goods. So more equipments for childcare are arranged.

2.4 The characteristic of distribution of the public service facilities and the equipments in the three shopping malls

From the survey above, we can learn that:

(1) For Ario-kameari, the amount of public service facilities is small and the distribution is concentrated in zone B on first floor.

(2) For Aeonmall-hinode, there is kids’ toilet while other two hasn’t. At the zone where set up kids’ toilet, the equipments for childcare in women’s toilet and multipurpose toilet are reduced on purpose.

(3) For LaLaport-tachikawa tachihi, the amount of public service facilities is large. Multipurpose toilet and baby room are set up at every zone. But in the multipurpose toilet on first and second floor, there are no childcare equipments. There are extra diaper changing sheets in the multipurpose toilet and women’s toilet on the third floor. It is supposed that is because the the tenants of third floor mostly are children’s goods.

(4) From the SPSS correlation analysis, we can learn that, among common use facilities, the childcare equipments distribution in men’s toilet dose not change much by different zones. In women’s toilet and multipurpose toilet, the equipments distribution tends to be positively correlated. Among the exclusive use facilities, at the zone where set up kids’ toilet, the equipments for childcare in women’s toilet and multipurpose toilet are reduced on purpose. Women’s toilet and multipurpose toilet share the function of kids’ toilet.

3. USER BEHAVIOUR OBSERVATION

In order to learn about how the customers use the public service facilities, user behaviour observation was conducted in the three shopping malls.

• Observation place: Zone A, B, C on each floor of the three shopping malls.
• Observation time: Ario-kameari at 2020.7.5,
  Aeonmall-hinode at 2020.10.4,
  LaLaport-tachikawa tachihi at 2020.7.12.
• Observation method: There are 9 zones in every shopping mall. 9 investigators are assigned to every zone to record the usage status outside the doors of public service facilities. From 11:00 am to 18:00 pm, every first 15 minutes per hour is the record time.
• Observation target: We focused on two group of users, adults with pre-school children (without strollers), adults with children using strollers. We recorded the amount of the two kinds of users by every facility.

We use P to stand for the user group without strollers, S to stand for the user group using strollers below.

3.1 The user behaviour observation result of Ario-kameari

As Figure 5 shows, the facility used mostly for customers with pre-school children (without strollers) is women’s toilet. The second is men’s toilet. The facilities used mostly for customers with children (with strollers) are women’s toilet and baby room. The second is multipurpose toilet. For men’s toilet, user with strollers is not captured.

There are 9 public facility zones in Ario-kameari. The 3 zones on first floor are named A1, B1, C1. On second floor are named A2, B2, C2. One third floor are named A3, B3, C3. Figure 6 shows the user proportion of every zone. We can learn that at zone B1 where located the only baby room, users with strollers using baby room, women’s toilet, multipurpose toilet are the most. The usage is concentrated at zone B1.
3.2 The user behaviour observation result of Aeonmall-hinode

As Figure 7 shows, the facility used mostly for customers with pre-school children (without strollers) is women’s toilet. The second is men’s toilet and kids’ toilet. The facility used mostly for customers with children (with strollers) is women’s toilet. The second is kids’ toilet. For men’s toilet, user with strollers is not be captured.

Figure 8 shows the user proportion of every zone. We can learn that at zone B1 and C1, users with strollers using women’s toilet have a large proportion. Compare to Ario-kameari, the usage of public service facilities is not so concentrated.

3.3 The user behaviour observation result of LaLaport-tachikawa tachihi

As Figure 9 shows, the facility used mostly for customers with pre-school children (without strollers) is women’s toilet. The second is men’s toilet and the third is baby room. The facility used mostly for customers with children (with strollers) is baby room. The second is women’s toilet.

The third are men’s toilet and multipurpose toilet. There are 12% of customers with children (with strollers) used men’s toilet. Men’s toilet in LaLaport-tachikawa tachihi has the booth with baby stroller space, while the other two hasn’t. It is supposed this is a big reason why male customers didn’t used the men’s toilet in the other two shopping malls.

Figure 10 shows the user proportion of every zone. We can learn that at zone B1, users with strollers using baby room have a large proportion. While, the proportions of users with strollers using baby room are not low at zone A2, C2, A3. At zone C2, with pre-school children (without strollers) using women’s toilet have a large proportion. From the tenant composition, on the second floor of LaLaport-tachikawa tachihi, there are many popular fashion shops. And the second floor of LaLaport-tachikawa tachihi is directly connected to the station tachihi, the flow of people is relatively large. We can learn that the usage proportion of public facilities on second floor is very high from Figure 10. For the other two shopping malls, the usage of public facilities on first floor is higher.
3.4 The characteristic of user behaviour

From the survey above, we can learn that:

(1) For customers with pre-school children (without strollers), the user proportion of women’s toilet is the largest. It is more than half in Ario-kameari and LaLaport-tachikawa tachihi. In Aeonmall-hinode, kids’ toilet shares the usage of women’s toilet. User proportion in women’s toilet is smaller than other two shopping malls.

(2) For customers with strollers, in Ario-kameari, user proportions of women’s toilet and baby room are the largest. Multipurpose toilet is larger than the other two shopping malls. From Table 16, although there is only one baby room in Ario-kameari the amount of diaper equipments in baby room is close to that in women’s toilet. And there are diaper changing sheet in every multipurpose toilet. Multipurpose toilet is also an important support facility for baby care. In Aeonmall-hinode, user proportion in women’s toilet is the largest, more than half. From Table 16, women’s toilet has much more childcare equipments than other facilities. In LaLaport-tachikawa tachihi, user proportion of baby room is the largest. Women’s toilet is only 20%, much smaller then other two shopping malls. Baby room is set up at every zone of each floor. And from Table 16, there is not many diaper equipments in women’s toilet. The diaper equipments are mostly set up in baby room. It is supposed that the customers with strollers tend to use the diaper equipments frequently, so the user proportion is larger in the facility with more diaper equipments.

(3) In Ario-kameari and Aeonmall-hinode, there are diaper changing sheet and baby chair in men’s toilet. But from the observation, they are not so accessible for fathers with strollers. In LaLaport-tachikawa tachihi, there are no diaper equipments in men’s toilet as Table 16 shows. But there are booths with strollers space. From Figure 9, the user with strollers proportion in men’s toilet is 12%, almost the same with multipurpose toilet. It is supposed that it is not common for males to change diaper for babies by themselves. They carry strollers to men’s toilet to solve their own physiological need problems. Booth with stroller space is a very important element for males to decide if carry strollers to men’s toilet or not.

(4) Although the distribution of the public service facilities and the equipments is very different among the three shopping malls, at zone B on the first floor, customers with strollers gathered more easily. At other zones, the amount of the customers with children is influenced by the tenant composition and the connection to other buildings.

4. INTERVIEW INVESTIGATION

In order to learn the needs for public service facilities from the users, between 2021.1 – 2021.4, we interviewed 15 couples lived in Tokyo online. Among them, eight couples each has one child under age 2, four couples each has one child between 3–6 years old, three couples each has two children, one is under age 2, the other is between 3–6 years old. The interview content is about the experience of the usage of public service facilities when they went to the shopping malls with their children, based on the result of field survey of three shopping malls. Such as the difficulties encountered when they used the equipments in the public service facilities and the improvement they expected.

Table 16: The equipments distribution in three shopping malls
4.1 The result of the interview investigation

According to the interview investigation, we sorted out some points related to the arrangement of public service facilities as below:

(1) When they need to change diaper for their children, most of them gave preference to baby room, because they thought it was cleaner and more spacious than other public service facilities.

(2) If there was no baby room, most of them tended to use multipurpose toilet to change diaper for children, because it had a bigger space than the general toilet, and they didn’t need to worry about that the crying of children would bother others. But the long-time occupation of multipurpose toilet (because changing diaper need a longer time) always increased their psychological burden at the thought of the disabled people or elderly who need to use multipurpose toilet, especially when they met the people waiting outside.

(3) If the mothers changed diaper in women’s toilet, most of them preferred the diaper changing sheet in the booth rather than the one outside the booth. Because they felt embarrassed to change diaper in front of many people (it was not so clean) or worried about the crying of children.

(4) Fathers rarely changed diaper in men’s toilet except there was no available diaper changing equipments in other public service facilities (such as, it was too crowded in women’s toilet). The reason why fathers rarely changed diaper in men’s toilet was mainly that fathers seldom did that at home. Not because the equipment was not enough.

(5) When the fathers changed diaper in men’s toilet, most of them preferred the diaper changing sheet outside the booth rather than the one in the booth. Because it was close to the entrance.

(6) Most of them had the experience to use the baby chair in the booth, but they didn’t use the baby chair outside the booth.

(7) Most of them thought that the baby chair in kids’ toilet was not so necessary. Because they used baby chair when they solve their own physiological need problems with children in the booth.

(8) Because the kids’ toilet was insufficient and children couldn’t hold their own physiological need, most of them thought it was a big problem that they had to stand in a queue in women’s toilet when their children wanted to go to the toilet. So they would rather use diaper.

(9) Most of them thought baby stroller space, fitting board and kids closestool were insufficient in general toilet.

Table 17: The correlation between the distribution of facilities, equipments and the points of interview investigation result

| Facility     | Equipment                        | Issues                                                                 |
|--------------|----------------------------------|----------------------------------------------------------------------|
| Men's toilet | ![image](image1.png) | Seldom be used. (4) Users prefer the diaper changing sheet outside the booth. (5) Fitting board is insufficient. (9) |
| Women's toilet | ![image](image2.png) | Users prefer the diaper changing sheet in the booth. (3) Babby chair outside the booth is seldom used. (6) |
| Multipurpose toilet | ![image](image3.png) | Because of the big and private space, users prefer to use multipurpose toilet. But the usage may bring some psychological burden. (2) |
| Baby room | ![image](image4.png) | Cleaner and more spacious than other public service facilities. So users prefer to use it. (1) |
| Kids' toilet | ![image](image5.png) | Kids toilet is insufficient. Usually the general toilet and multipurpose toilet undertake the function of Kids' toilet. But children can't wait for a long time to go to toilet. The exclusive toilet is necessary. (8) |

Number (X) is the point number of interview investigation result

4.2 The correlation between the distribution of facilities, equipments and the points of interview investigation result

Combined with the field survey, we sorted out the correlation between the distribution of facilities, equipments and the points of interview investigation result as Table 17 shows.

4.3 The characteristic of user needs

From the user interview, we can classify the user needs into the items as below:

(1) Cleanliness

Baby room is thought cleaner than other public service facilities, so it is the preferred choice for the users. Cleanliness is a very important index for users to choose the public service facilities.

(2) Big space

Users tend to use baby room and multipurpose toilet because of the bigger space. The equipments space for childcare in general toilet can’t meet the user’s satisfaction.

(3) Privacy

Because of the crying of children, private space is a
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good choice for users to avoid embarrassing. Among the public service facilities, multipurpose toilet is preferred with this characteristic. The arrangement of the equipments should also take this into consideration.

(4) Sufficiency
For the public service facilities, kids’ toilet is insufficient. For the equipments, baby stroller space, fitting board and kids closestool are insufficient in general toilet.

(5) Pressureless
Children can’t hold their own physiological need. But in the common use facilities, children don’t have the priority to use the equipments. Although there are many equipments for childcare in the common use facilities, they can’t undertake the function of exclusive use facilities completely. Users prefer to use the multipurpose toilet. But, they feel psychological pressure when use it. While, it doesn’t mean that we encourage the users to use multipurpose toilet without pressure. It can be used as a reference to planning pressureless and private space for users with children.

5. CONCLUSION

From the field survey, we can learn that, some users go to the common use facilities, men’s toilet, women’s toilet, multipurpose toilet to solve their own physiological need problems with children. So the equipments to keep children are important. Baby chair is set up generally in men’s toilet, women’s toilet. But booth with stroller space is insufficient in Ario-kameari and Aeonmall-hinode. And the lack of stroller space have a great influence on the usage of men’s toilet for males with strollers. Even though there are no booth with stroller space in women’s toilet of Ario-kameari and Aeonmall-hinode, the user with stroller proportions are also very large. For LaLaport-tachikawa tachih, the user with stroller proportion in women’s toilet is small, although there are many booths with stroller space. It is supposed that the behaviour of males with strollers and females with strollers in toilet is very different. It is not common for males to change diaper for babies by themselves. Most of them carry strollers to men’s toilet to solve their own physiological need problems. But for females, changing diaper for baby is common behaviour when they carry strollers to women’s toilet. So the equipment distribution arrangement should take the difference of user behaviour into consideration. And from the interview investigation, we found it is true that fathers rarely changed diaper in men’s toilet.

For multipurpose toilet, too many users with children will have a bad influence on the normal usage for wheelchair users and other disabled. So it is not expected to set up too many equipments for childcare in multipurpose toilet. In Ario-kameari, two multipurpose toilets are set up at zone B on first floor where the users are more then other zones. In Aeonmall-hinode, where there is kids’ toilet or baby room nearby, the amount of the equipment for childcare is reduced. In LaLaport-tachikawa tachih, there is no diaper equipment in the multipurpose toilets on first floor and second floor. On third floor, there is diaper equipment in every multipurpose toilet because of that the tenants of third floor mostly are children’s goods. Although multipurpose toilet is not the point space for childcare, it dose play a support role among the public service facilities.

For exclusive use facilities, kids’ toilet, baby room, baby room is more general than kids’ toilet. Among the three shopping malls, only in Aeonmall-hinode, there is kids’ toilet. Their existence reduced the usage of common use facilities for users with children. But it should be taken into consideration that many customers go to the common use facilities to solve their own physiological need problems and have to take the children with them. So the equipments for keeping child are always necessary for common use facilities no matter there are exclusive use facilities nearby or not.

From the interview investigation, we can learn that the user needs mainly include cleanliness, big space, privacy, sufficiency and pressureless. For men’s toilet, it is not so easy to encourage fathers to change diaper just by increasing the equipments for childcare. For women’s toilet, although there are many equipments for childcare than other service facilities, the lay out and the crowded may make them difficult to use. For multipurpose toilet, the bigger space is preferred by the users with children. But the usage may bring some psychological burden. For kids’ toilet, it is insufficient. Through the field survey, women’s toilet and multipurpose toilet sometimes undertake the function of kids’ toilet. But because children can’t hold their own physiological need, kids’ toilet can not be replaced by common use facilities easily. For baby room, it is thought cleaner than other public service facilities, so it is the preferred choice for the users. That is why in LaLaport-tachikawa tachih where baby room is set up at every zone of each floor, the user (with strollers) proportion is more than half, much higher than other two shopping malls.

In view of the above-mentioned fact, the arrangement of public service facility in shopping mall should pay attention to the following points:
(1) Increase the amount of the exclusive use facilities.
(2) Guarantee sufficient quantity of equipments for keeping children in common use facilities.
(3) It is not common for males to change diaper for babies by themselves. Most of them carry strollers to men’s toilet to solve their own physiological need problems. But for females, changing diaper for baby is common behaviour when they carry strollers to women’s toilet. The equipment distribution arrangement should take the difference of user behaviour into consideration.
(4) Zone B on first floor is a place where more users with children gather. More facilities and equipments are necessary. And the zone nearby children’s goods tenants should be arranged more facilities and equipments.
(5) The user needs, cleanliness, big space, privacy, sufficiency and pressureless should be taken into consideration.

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