Design Engineering

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

The Impact of COVID-19 on the Area and the Capability of Common Components in Public Buildings

Marwa Nossier Hamdan El-Hamaida[1], Shimaa Abdelsalam Mohamed[2], Ahmed Salah Eldin Shiba[3]

[1] Department of Architecture, The Higher Institute of Engineering and Technology in Al-Arish, Egypt.

[2] Department of Arch., Higher Technology Institute in the 10th of Ramadan - 6 October City Branch, Giza, Egypt.

[3]Department of Architecture, Faculty of Engineering, Beni-Suef University, Beni-Suef, Egypt.

E-mail address: archmarwa1@gmail.com

Abstract

The built environment had a major effect on human life and its role in society. But Epidemics have a very important role in Reshaping the built environment. The future of urban design and architecture will be affected by the COVID-19 pandemic. Design standards for public buildings play the main role in the Spread COVID-19 pandemic. So, it is important to change the standers needs of humans inside public spaces to face disasters such as Covid-19 in the future without stopping the use of these buildings. Therefore, the study explains the Design standards for mutual elements in public buildings. Public building mutual of thirteen spaces pedestrian paths, Stairs, Elevators, Service, Administration, Reception, Grandstands, a Table, Twin bedrooms, a computer room, Sales spaces, a Cashier, and a Prayer place. Also, it has been explained the changing in this Design standards to decrease the spread of Epidemics and diseases for each space separately. This paper will study the effect of Covid-19 on public building dimensions, area, and capacity. The finding explains that the thirteen mutual spaces in the public building have been increased in area with a ratio above 40% approximately during Covid-19.

Keywords:

COVID-19 -Mutual Elements in Public Buildings -Public Building Capacity -Social Distancing.

I.Introduction

The main aims of architectural design are to create a sustainable built environment, construct practical spaces for human activities, promote the quality of life and well-being of the people, and improve human life [1]. Architecture plays the main role in preventing the spread of

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

pandemics If spaces are purposefully designed [2]. It can improve physical and mental health by positively designing spaces according to needs [3,4]. A lot of health issues have been reflected in urban planning and architecture. Also, it affects reshaping urban areas and cities [5].

Epidemics significantly affect the built environment in different disciplines [6,7]. One of the worst crises in the covid-19 pandemic. It has been interrupted and affects many aspects of human life[9]. Also, it has been signifying staying away from marketplaces, schools, offices, and where many people congregate to avoid spreading the virus [10]. Covid-19 has affected every industry and, eventually, the overall economy of every country [11,12]. Significant hardship has happened from the COVID-19 pandemic and the resulting economic fallout [13]. COVID-19 has a major impact on building construction [14].

The COVID-19 pandemic has affected the lives of the global community. As a result, it is essential to curb the spread of Coronavirus [15]. It reduces the spread of this global epidemic through social distancing, quarantine, and self-isolation [16-18]. Many studies have discovered a connection between negative health effects and overcrowding [19]. The limited space for human movement in daily activities negatively affected psychological, health, economic, and social impacts. It has also threatened national security and defense [20,21]. Also, decreasing the effect of COVID-19 by closing communal spaces, increasing the cleaning of frequently used spaces, decreasing occupancy of laundry rooms and elevators, and fewer building visitors [22,31]. "Staying home" became a crucial means of survival During the widespread Covid-19 pandemic [23,24]. The essential prevention procedure is social distancing [25-27]. "The Canadian Federal Health guidelines require people to maintain a two-meter distance from others" [28-30]. Additionally, it has been restricting day-to-day activities and closing countries' borders. Social conditions degraded due to functional separation, automobile-based transportation, and the disappearance of places for encounters and the traditional streets [32,33].

COVID-19 saving opportunities for change in the design world [34,39]. In many places has been stopped the live result of the Fear of spreading the COVID-19 pandemic [35,38]. It has been a reassessment of urban spaces. Also, it is essential to move from dealing with the formulation of communities as land subdivision projects to planning projects aimed at creating happy, healthy, sustainable human-friendly communities [36,40]. "The architects should think about how to create and organize multifunctional, flexible, aesthetical, healthy, and clean spaces under the new roles of interaction and social distancing" [37,41].

All previous studies had explained the main role of Epidemics and diseases in the formation of cities. Also, it has been explained especially the effect of the Covid-19 pandemic on the economy and society. The Covid-19 pandemic had a negative effect on all sides of life as a result of the need for social distancing in a public building. All public buildings were not eligible to save social distancing because it has been designed according to special standers in dimensions, area, and capacity. So, it is necessary to study the Design standards for mutual elements in a public building and the changing of these Design standards to decrease the spread of Epidemics and diseases in each space separately.

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

II. Methodology

This paper will study the effect of Covid-19 on public building dimensions, area, and capacity. Public building mutual of thirteen spaces pedestrian paths, Stairs, Elevators, Service, Administration, Reception, Grandstands, a Table, Twin bedrooms, a computer room, Sales spaces, a Cashier, and a Prayer place. This paper includes studying occurrence changes of mutual spaces in a public building for each space separately. Before that, it studied the area per capita in space to know the need of people from space inside the building. The first space is pedestrian paths, it has been studied pedestrian paths, and the study included three cases differing in the number of people. The second space is Stairs, and it has been studied Stairs and divided into two cases. The third space is Elevators, and it has been studied for Elevators area and capacity for five types. The fourth space is Service, and it has been studied the area for the women's and men's bathrooms and the area per capita in the bathroom area. The fifth space is Administration, and the area has been studied for four administration spaces per capita. The sixth space is the reception. It has been studied the area for a person in the reception area in two cases, standing up and sitting, and the capacity for a particular space. The seventh space is Grandstands, and it has been studied the area per capita in grandstands spaces. The eighth space is the table; it has been studying the differences in the table area result of increasing the number of people and the capacity of the public area, including tables and chairs. The ninth space is the Twin bedroom and it has been studied the area per capita in the twin bedroom model. The tenth space is a computer room; it has been studied the capacity of people in the computer room area. The eleventh space is Sales spaces; it has been studied Sales spaces area. The twelfth space is the cashier; it has been studying the capacity of people in the Cashier area. The thirteenth space is prayer's place; it has been studying the person's area needs in prayer's place. All these Thirteenth studies include a period before Covid-19 and during Covid-19. The standard design for mutual spacing in public buildings before appearing Covid-19 has been taken from the neufert book.

Area per capita in space:

The stander space for one person in the space of 60 cm as explained in Figure 1,2. But requires space between people to protect against the virus Covid-19 from a minimum distance of 2 m as explained in Figure 3 [38].

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

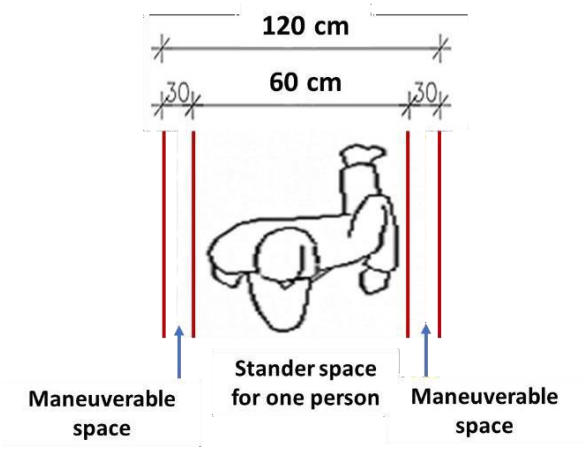


Figure 1 explains the old dimensions of Stander space for one person (before Covid-19)

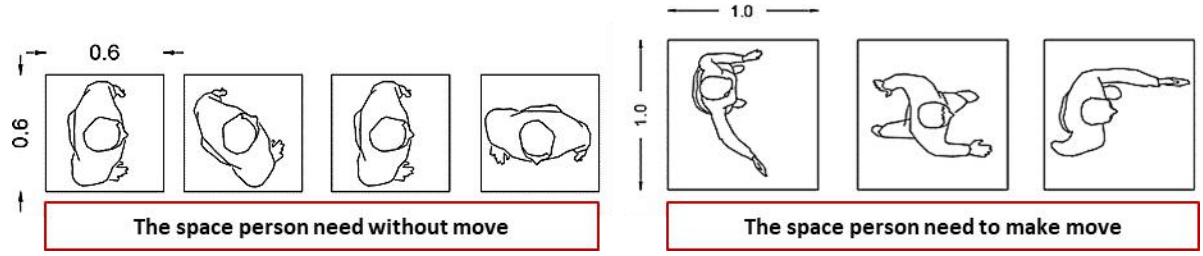


Figure 2 explains the old area of Stander space for one person (before Covid-19)

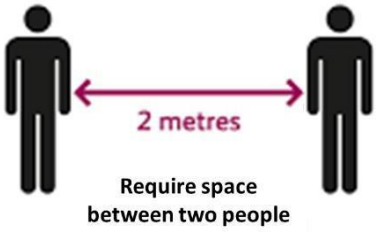


Figure 3 explains Require space between two people (after Covid-19)

pedestrian paths

Pedestrian paths are very important because it found inside and outside buildings. This part has been divided into three cases differing in the number of people as explained in Figure 4. Case 1 includes two persons. Case 2 includes one person and two persons in a group. The case3 includes two groups; every group contains two persons. The Dimensions that two people need before COVID-19 is 115 cm but during COVID-19 is 380 cm. Also, the dimensions of the three people need in case 2 before COVID-19 are 170cm, but during COVID-19 are 450 cm. Additionally, the dimensions of the four people need in case 3 before COVID-19 are 225cm, but during COVID-19 are 540 cm as explained in Figure 5.

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

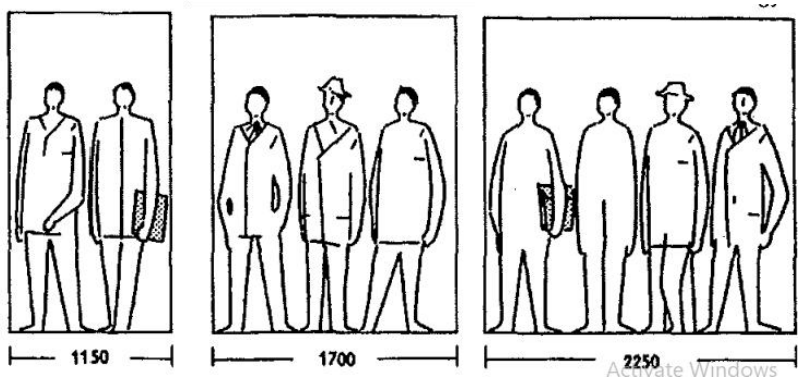


Figure 4 explains old dimensions of pedestrian paths (before COVID-19)

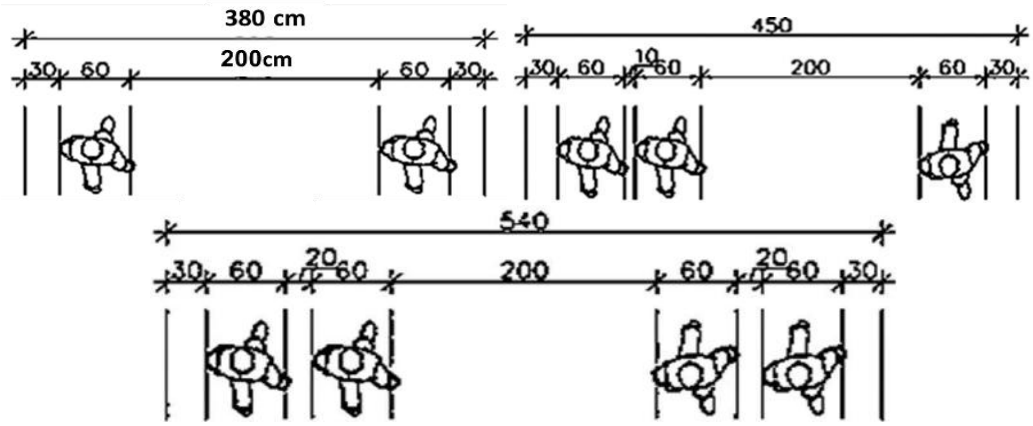


Figure 5 explains the new dimensions of pedestrian paths (during COVID-19)

Stairs

Stairs are found at the entrance of the building, and all buildings have two floors or more, especially public buildings. This part includes two cases as explained in Figure 6. The first case includes two persons, and the second includes three. The dimension for the first case is 125 cm, and the second case is 188 cm before Covid-19. Also, the dimension for the first case is 380 cm and for the second case is 640 cm during Covid-19 as explained in Figure 7.

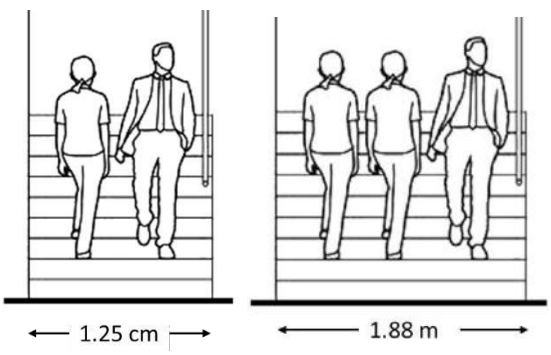


Figure 6 explains the old dimension of Stairs (before Covid-19)

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

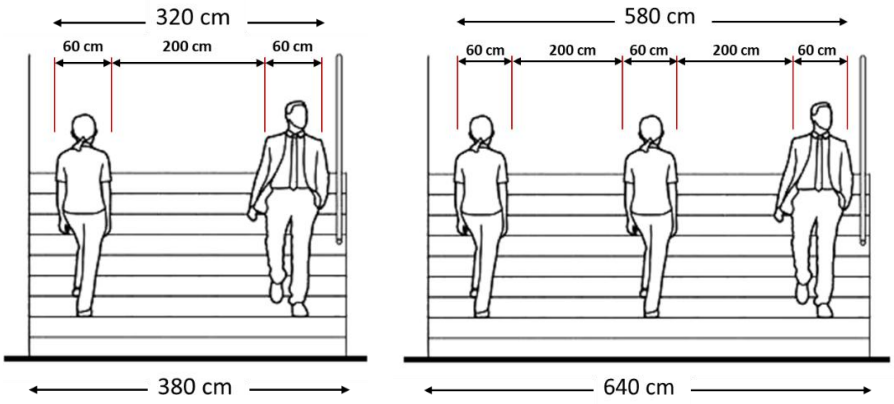


Figure 7 explains the new dimension of Stairs (during Covid-19)

Elevators

Elevators are found in buildings with three floors or more, especially in public buildings. The elevator should include social distancing as explained in Figure 8. This distance ranges from 1m to 2m during COVID-19. This part has studied the capacity of the elevators with different dimensions as explained in Figure 9,10. It has included five models of elevators different in dimensions as explained in Table 1.

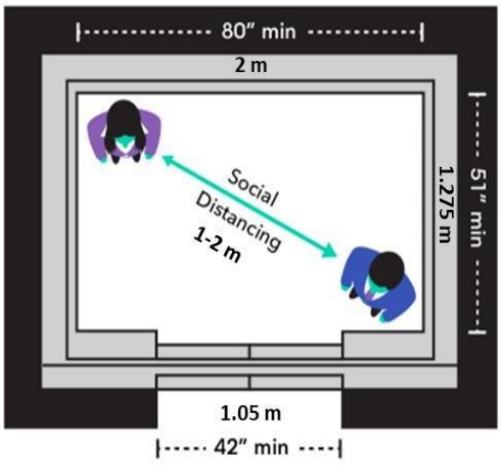


Figure 8 explains new dimensions of social distancing in the elevator (during COVID-19)

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

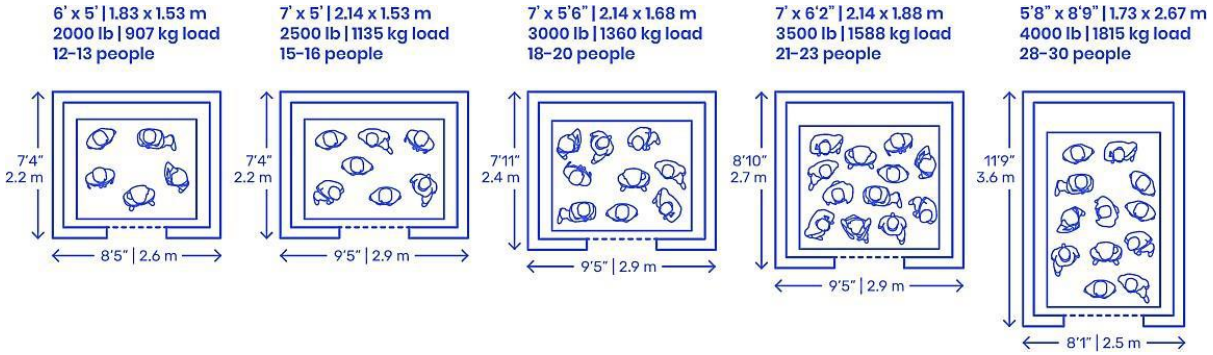


Figure 9 explains the old capacity of Stander space in elevators (before Covid-19) [39].

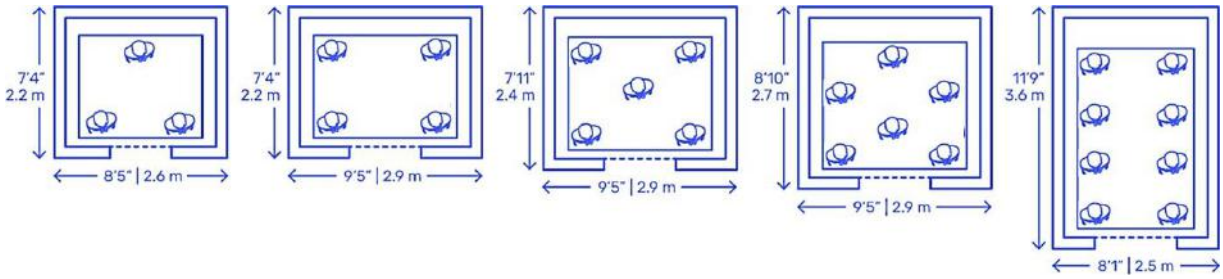


Figure 10 explains the new capacity of Stander space in elevators (during Covid-19)

Model N.	dimension	Area m^2	Capacity	
			before COVID-19	during COVID-19
Model 1	1.83m x 1.53m	2.79	12-13 person	Three persons
Model 2	2.14m x 1.53m	3.27	15-16 person	Four persons
Model 3	2.14m x 1.68m	3.59	18-20 person	Five persons
Model 4	2.14m x 1.88m	4	21-23 person	six persons
Model 5	1.73m x 2.67m	4.61	28-30 person	Eight persons

Table 1 explains the difference between the five models

Service:

The services are found in all public buildings. In this part has been studied the area of the men's bathroom and women's bathroom. Also studied include the area of these bathrooms before Covid-19 and during Covid-19. The men's bathroom includes three toilets, three basins, and two urinals. But the women's bathroom includes three toilets and four basins. According to the component of the bathrooms, the men's bathroom capacity is eight persons, and the women's

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

bathroom capacity is seven persons. People's needs in Men's bathroom is 2.47m^2 before Covid-19 but during Covid-19 is 4.2m^2 as explained in Figure 11. Also, people's needs in women's bathrooms are 2.38m^2 before Covid-19 but during Covid-19 is 4.2m^2 as explained in Figure 12. The men's bathroom area before Covid-19 is 19.7m^2 and during Covid-19 is 34m^2. Also, the women's bathroom area before Covid-19 is 16.7m^2 and during Covid-19 is 30m^2.

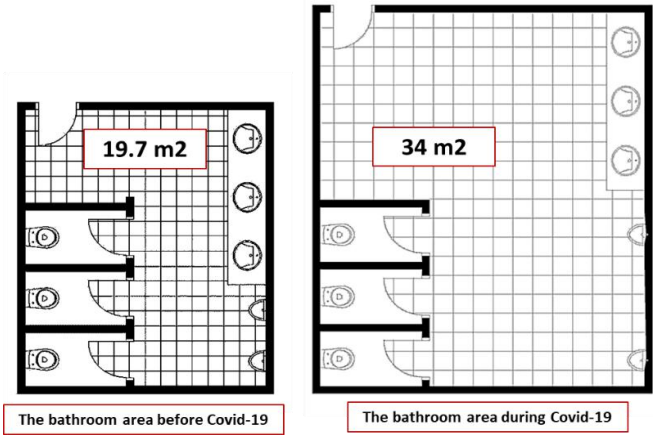


Figure 11 explains the area of the men's bathroom

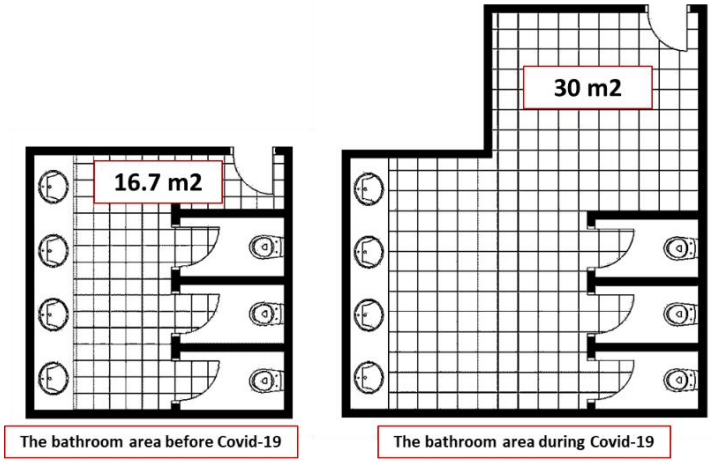


Figure 12 explains the area of the women's bathroom

Administration:

The administration department is found in all public buildings. The administration department includes four models Stander, Medium, large, and Executive as explained in Figure 13. These four models differ in size because of the number of people and components. It has been studied the dimension of these four models of offices. Stander model dimension is a length of 300 cm and a width of 250 cm before Covid-19. The dimension increased in length by 120 cm and width by 180 cm during Covid-19. This model capacity is three persons. Medium model dimension is a length of 375 cm and a width of 300 cm before Covid-19. The dimension has been increased in length by 55 cm and width by 120 cm during Covid-19. This model capacity is three persons. The large model dimension had a length of 375 cm and a width of 375 cm before Covid-19. The

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

dimension has been increased in length by 55 cm and width by 240 cm during Covid-19. This model capacity is six persons. Executive model dimensions a length of 375 cm and a width of 500 cm before Covid-19. The dimension has been increased in length by 405 cm and width by 280 cm during Covid-19. This model capacity is eight persons as explained in Figure 14.

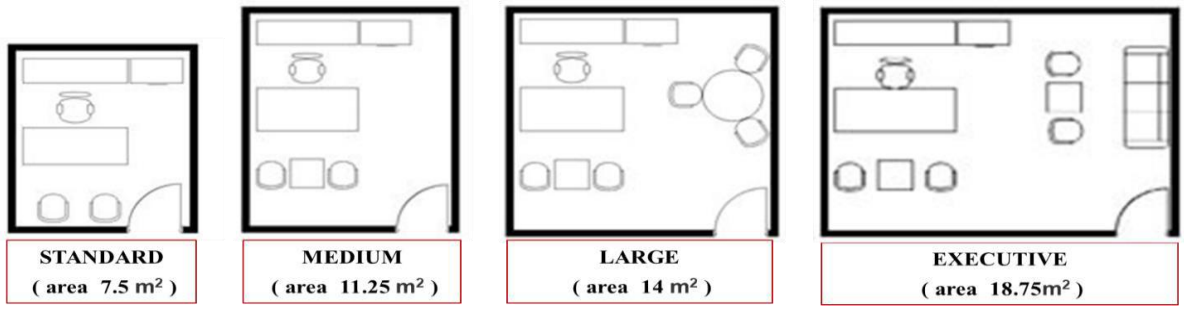


Figure 13 explains the old area of the office (before Covid-19)

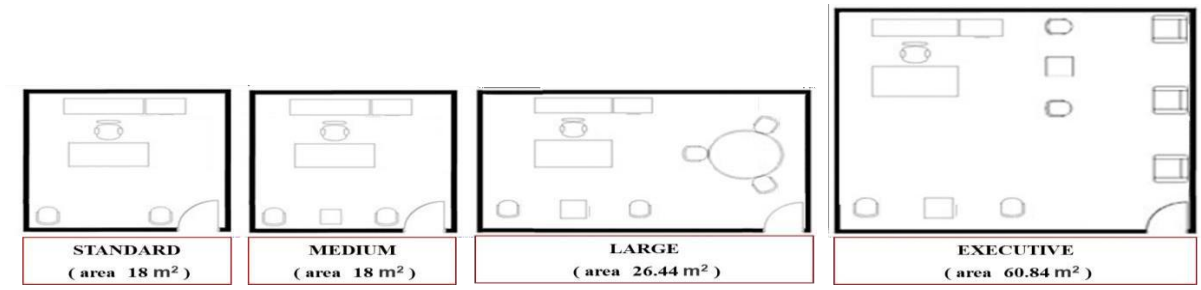


Figure 14 explains the new area of the office (during Covid-19)

Reception

This part includes two phases. The first explains to the people when standing up in reception spaces as explained in Figure 15. The second explains to the people when sitting in reception spaces as explained in Figure 17. It has been determined the area of reception is 25 m^2 with dimensions 5m in length and 5m in width. In phase 1, The area with old dimensions before Covid-19 is 1 m^2. The area with new dimensions during Covid-19 is 5.3 m^2. Also, the capacity of the reception space has been changed in the same area. The capacity in the old area before Covid-19 is 25 persons. The capacity in the new area during Covid-19 is four persons as explained in Figure 16.

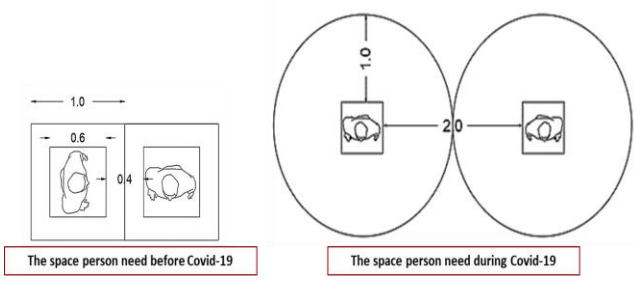


Figure 15 explains the area of space for two persons in the reception space

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

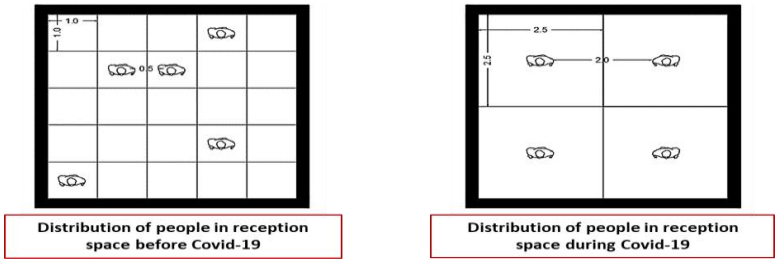


Figure 16 explains the distribution of people in the reception space

In phase 2 The area with old dimensions before Covid-19 is 1.8731 m^2. The area with new dimensions during Covid-19 is 9.7393 m^2. Due to the difference in the space the person needs in the case of sitting, the dimension of space has been changed, but the same area 29m^2. So, the capacity in the reception space has been changed in the same area. The capacity in the old area before Covid-19 is 15 persons. The capacity in the new area during Covid-19 is three persons as explained in Figure 18.

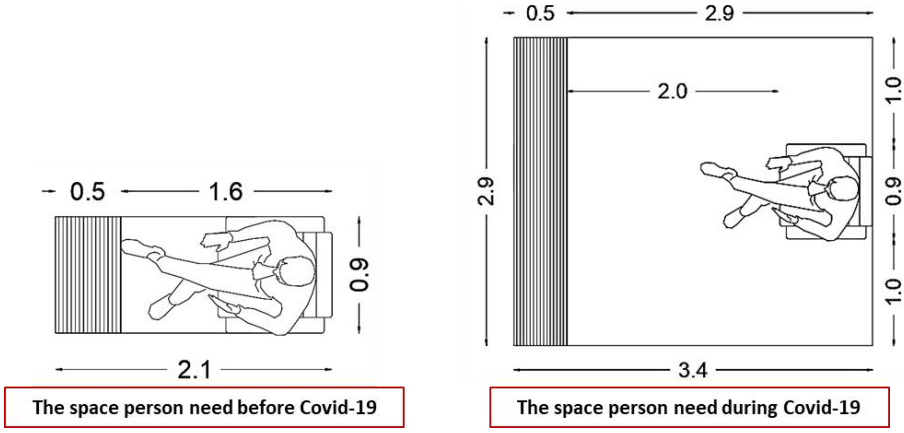


Figure 17 explains the area in which a person needs at sitting in the reception

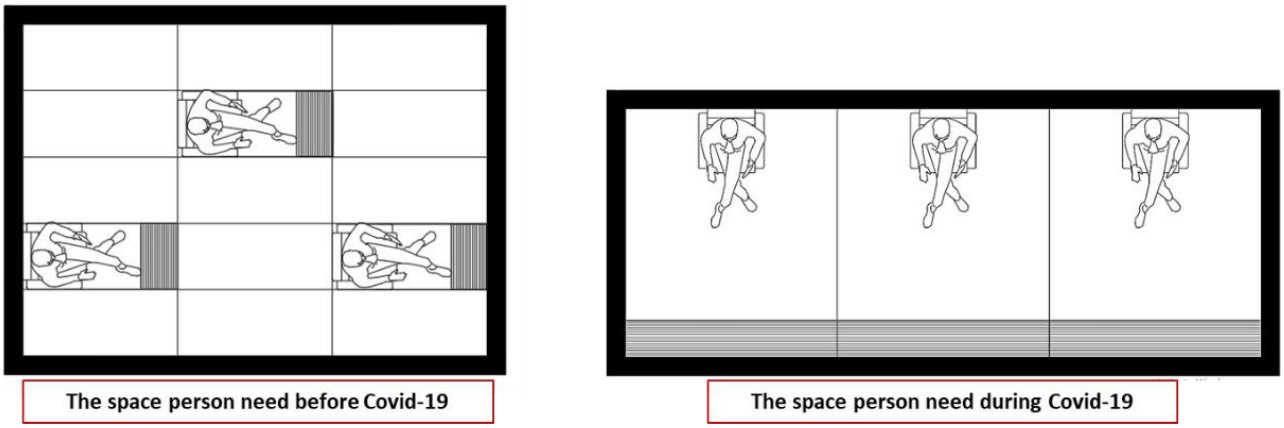


Figure 18 explains the area person needs in reception at siting

Grandstands

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

Grandstands are found in many places, such as stadium amphitheaters, cinema halls, theater halls, opera multi-purpose halls, and Academic halls in universities. The space area for this Grandstand is 257m^2. According to the old dimension before Covid-19 capacity of this area is 232 persons, but during Covid-19, the capacity is 57 persons only as explained in Figure19.

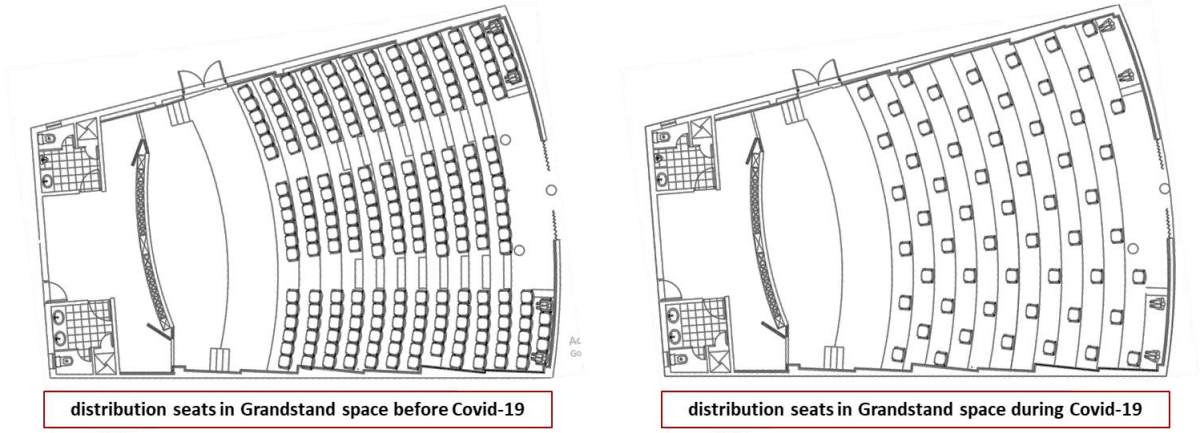


Figure 19 explains the distribution of seats in the Grandstand space.

Table:

The table with chairs has an essential role in public spaces. It uses different functions such as workshops, Meetings, cafeterias, Restaurants, classes, and Universities, as explained in Figure 20. Also, it could be used in the dining hall in the home to save social relationships. This part calculates the area for the table in two cases—the first case before Covid-19 and the second case during Covid-19. The table area that includes two persons was 0.62m^2 before Covid-19, but during Covid-19, the new dimension should be 1.57m^2. The table area, including four persons, was 0.62m^2 before Covid-19, but during Covid-19, the new dimension should be 4m^2. The table area, including six persons, was 0.992m^2 before Covid-19, but during Covid-19, the new dimension should be 10.32m^2. The table area, including eight persons, was 1.302m^2 before Covid-19, but during Covid-19 with, the new dimension should be 14.3m^2 as explained in Figure 21,22.

Figure 20 explains different uses of the table in public spaces

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

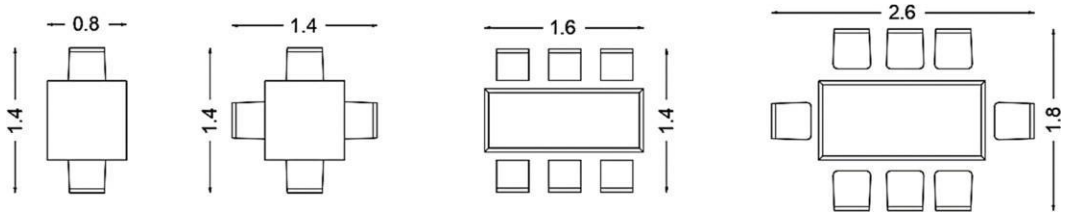


Figure 21 explains the old dimension of tables (before Covid-19)

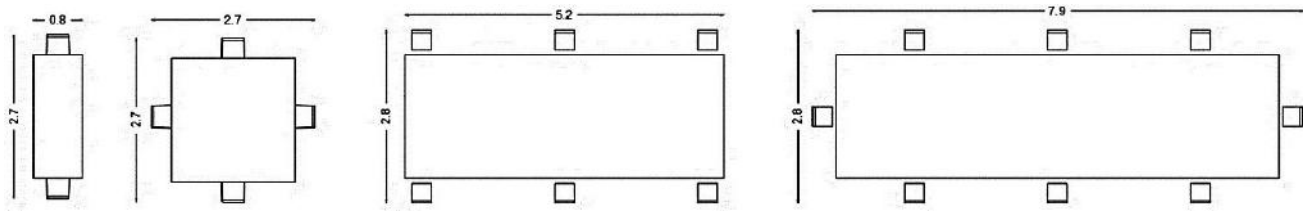


Figure 22 explains the new dimension of tables (during Covid-19)

In this part has been selected the public space with a dimension length of 3.41m and a width of 3.95m. People's capacity in space has been different in the phase before Covid-19 and during Covid-19. Before Covid-19, the number of people is 16 persons, but during Covid-19, there are four persons in the same area as explained in Figure 23.

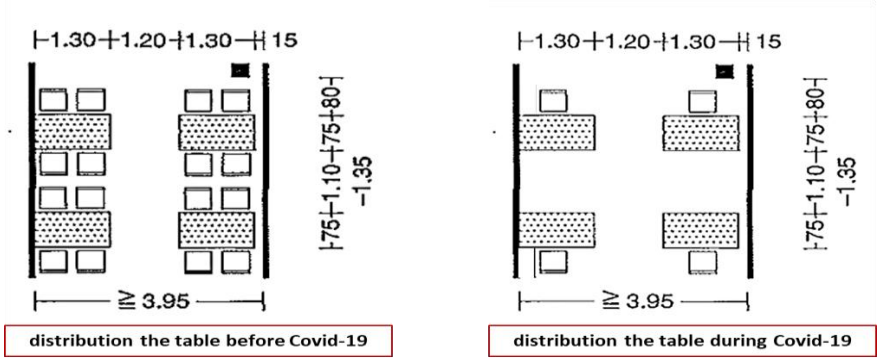


Figure 23 explains the distribution of the table in public space

Twin bedroom

Twin bedrooms are used in many public buildings such as hotels, motels, Youth Hostels, and workers' residents. This part has studied a twin room with a dimension length of 3.1m and a width of 5m. The twin bedroom contains two beds, two closets, and two study desks as explained in Figure 24. Before Covid-19, the area for the twin bedroom was 15.5m^2. But during Covid-19, the area for a twin bedroom is 19.84m^2.

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

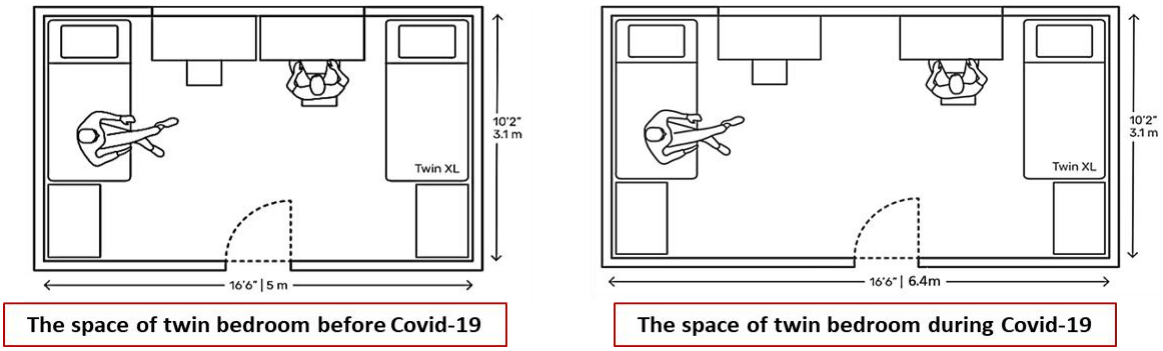


Figure 24 explains the area of twin bedroom

Computer room

Computer rooms are used in many public buildings, such as education buildings, Business buildings, agriculture buildings, Industry buildings, and Entertainment buildings. In this part has been selected the computer room with a dimension length of 12 m and a width of 9.2m. The capacity of people in the space has been different in the phase before Covid-19 and the phase during Covid-19. Before Covid-19, the number of people is 24 persons, but during Covid-19, the number of people was nine persons in the same area as explained in Figure 25.

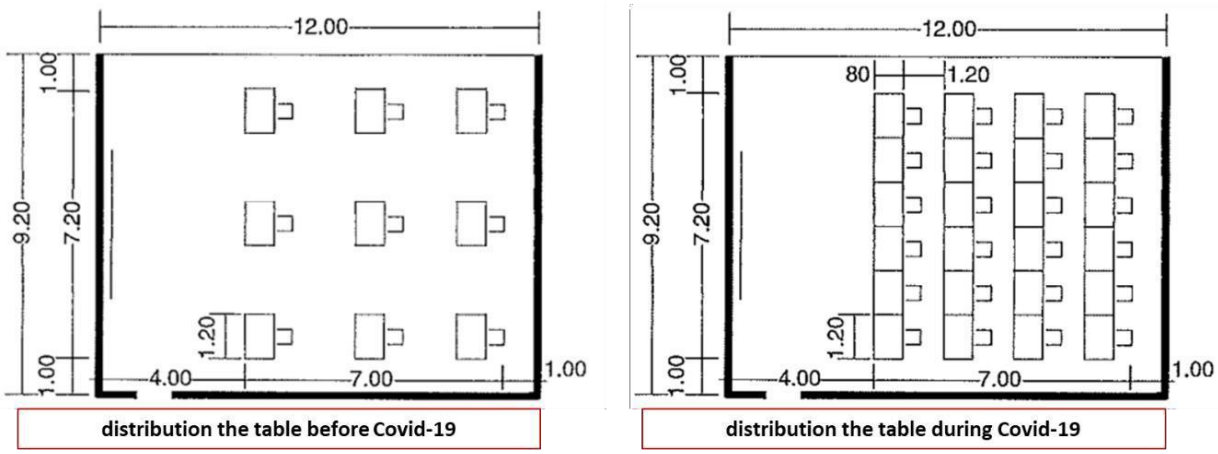
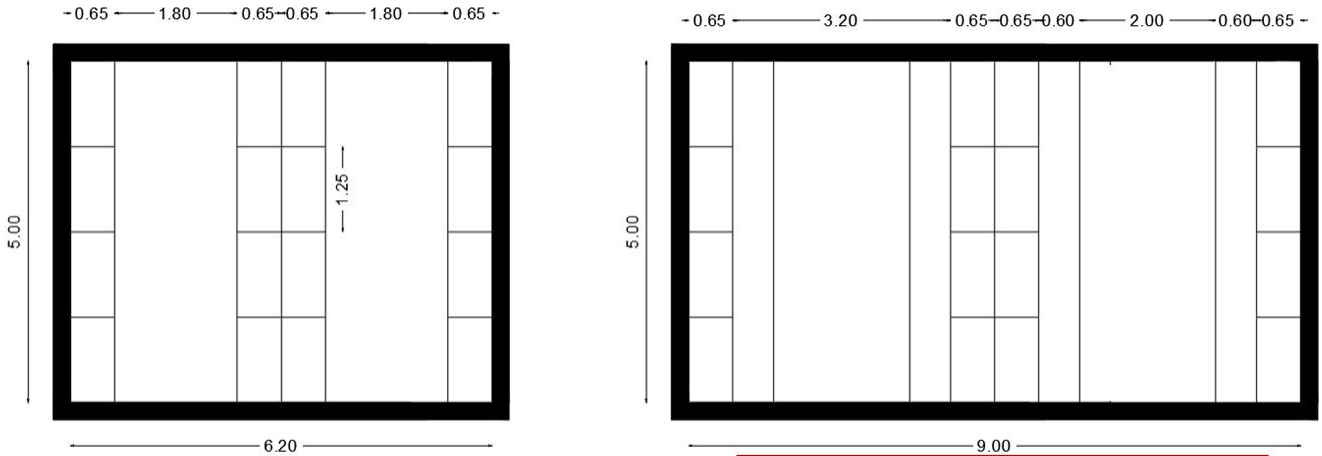


Figure 25 explains the distribution of the table in the computer room

Sales spaces:

Sales spaces are found in malls, shops, supermarkets, and Places to display companies' products. This part has been selected four parts, and the dimension is a width of 0.65m and a length of 5m. Before Covid-19, the dimension of the space is a width of 6.20 m and a length of 5m. Additionally, space dimension during Covid-19 is a width of 9 m and a length of 5m as explained in Figure 26.

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213



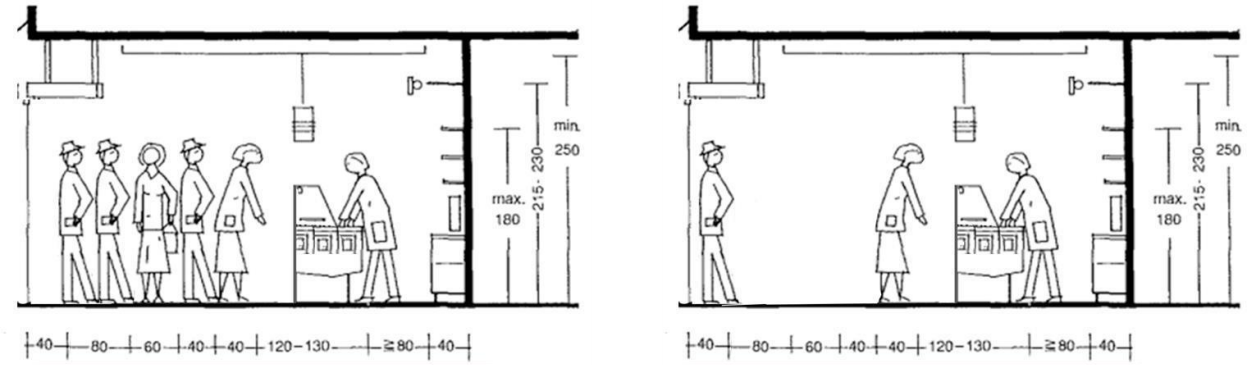
The dimension of Sales space before Covid-19

The dimension of Sales space during Covid-19

Figure 26 explains the dimension of the Sales space

Cashier:

Cashiers are founded in many public spaces, such as sales ticket places for many buildings, shops, malls, supermarkets, banks, Post offices, government buildings, educational buildings, and Entertainment buildings. This part studies the dimension of the line in front of the cashier and the number of people. It has been determined the line length is 5m and the width is 1m. In the case before Covid-19, the number of people is five persons. But the number of people during Covid-19 is two persons as explained in Figure 27.



The dimension in front of cashier before Covid-19

The dimension in front of cashier during Covid-19

Figure 27 explains the dimension in front of the cashier

Prayer's place:

Pray place is found in all public buildings. At this part has been selected space with an area of 48m^2. The space for prayer is 8o cm in width and 120 cm in length before Covid-19, so the capacity of the space is 50 prayers. But during Covid-19, the space for prayer is 260 cm in width and 230cm, so the space's capacity is nine prayers as explained in Figure 28.

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

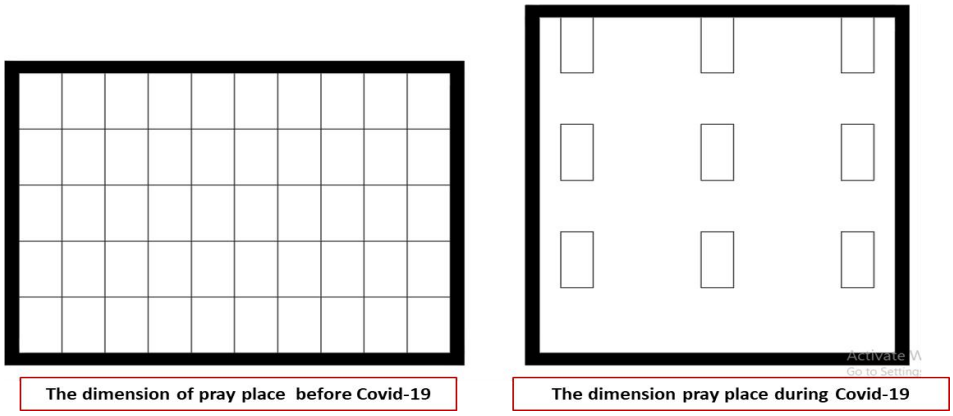


Figure 28 explains the dimension of prayer's place

III. Result and discussion

pedestrian paths

In case 1, Dimension pedestrian paths are increasing during COVID-19 by 70.6% compared with Dimension before COVID-19. In case 2, Dimension pedestrian paths are increasing during COVID-19 by 62% compared with Dimension before COVID-19. In case 3, Dimension pedestrian paths are increasing during COVID-19 by 58.3% compared with Dimension before COVID-19 as explained in Figure 29. According to that, all spaces, including pedestrian paths, will increase with a ratio above 55%.

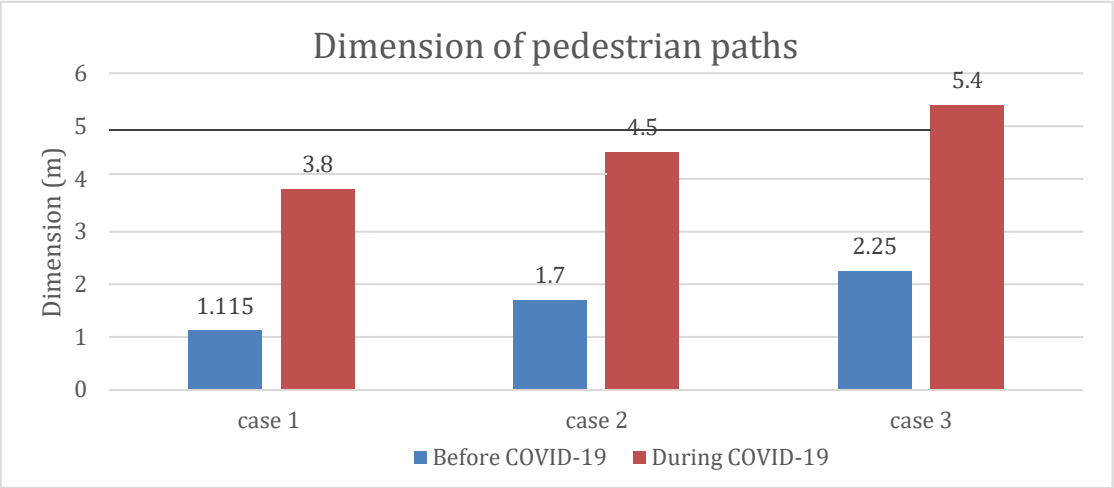


Figure 29 Compare the Dimension of pedestrian paths

Stairs:

In case 1, Stair's dimensions are increasing during COVID-19 by 67.1% compared with Dimensions before COVID-19. In case 2, Stair's dimensions are increasing during COVID-19 by 70.6 % compared with Dimensions before COVID-19 as explained in Figure 30. According to

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

that, all spaces, including Stairs will be increasing with a ratio above 65 %.

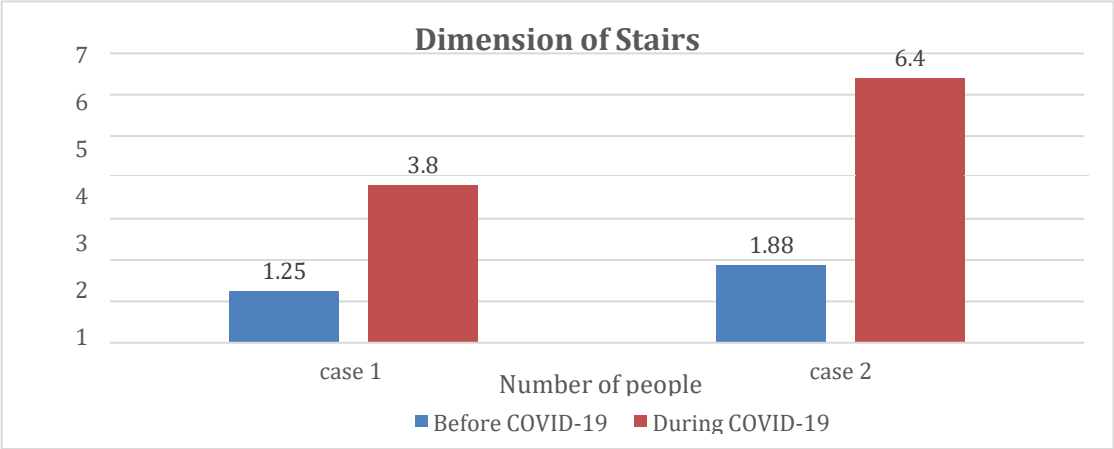


Figure 30 Compare the Dimension of Stairs

Elevators

In the model1 capacity of people inside the elevator is decreasing during COVID-19 by 75% compared with capacity before COVID-19. In model 2 capacity of people inside the elevator is decreasing during COVID-19 by 73.3% compared with capacity before COVID-19. In model 3 capacity of people inside the elevator is decreasing during COVID-19 by 72.2% compared with capacity before COVID-19. In model 4 capacity of people inside the elevator is decreasing during COVID-19 by 71.4% compared with capacity before COVID-19. In model 5, the capacity of people inside the elevator decreased with a ratio of 71.4% during COVID-19 compared with capacity before COVID-19 as explained in Figure 31. According to that, people's capacity inside the elevator is decreasing with a ratio above 70%.

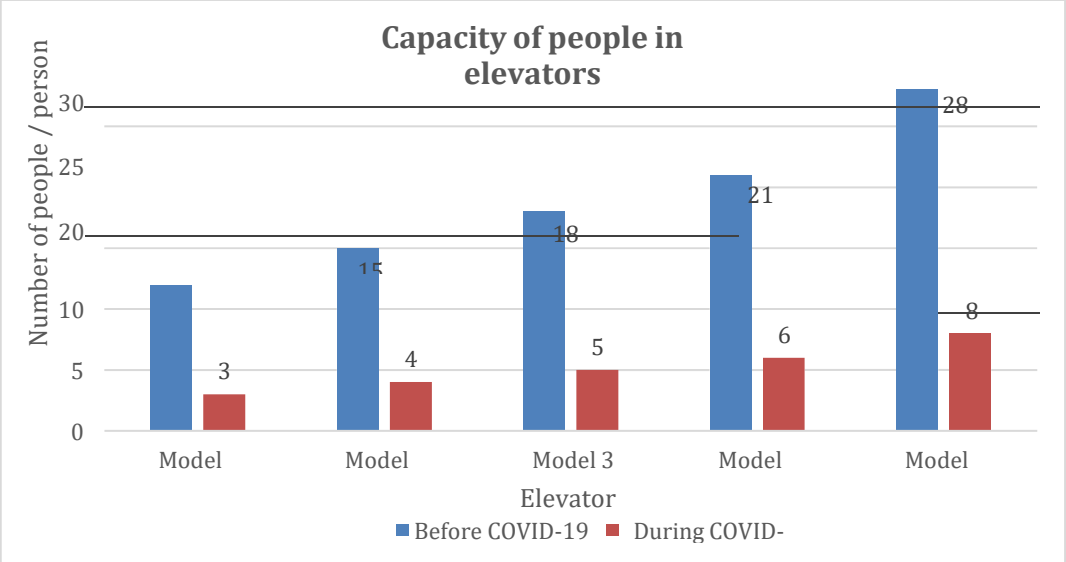


Figure 31 Compare the capacity of people inside elevators

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

Service:

This part discusses two parts 2, The needs of the person from the area and the changing bathroom area. Part 1 study Area per capita in the bathroom area. The area per capita in Men's bathroom area during Covid-19 is higher than before Covid-19, with a ratio of 41%. Also, the area per capita in women's bathroom area during Covid-19 is higher than before Covid-19, with a ratio of 43.3% as explained in Figure 32. Part 2 studies changing areas. Men's bathroom area before Covid-19 is lower than the area during Covid-19, with a ratio of 42%. Also, the women's bathroom area before Covid-19 is lower than the area during Covid-19, with a ratio of 44.3% as explained in Figure 33. According to that, the ratio for increasing capacity is almost identical to the ratio for increasing area.

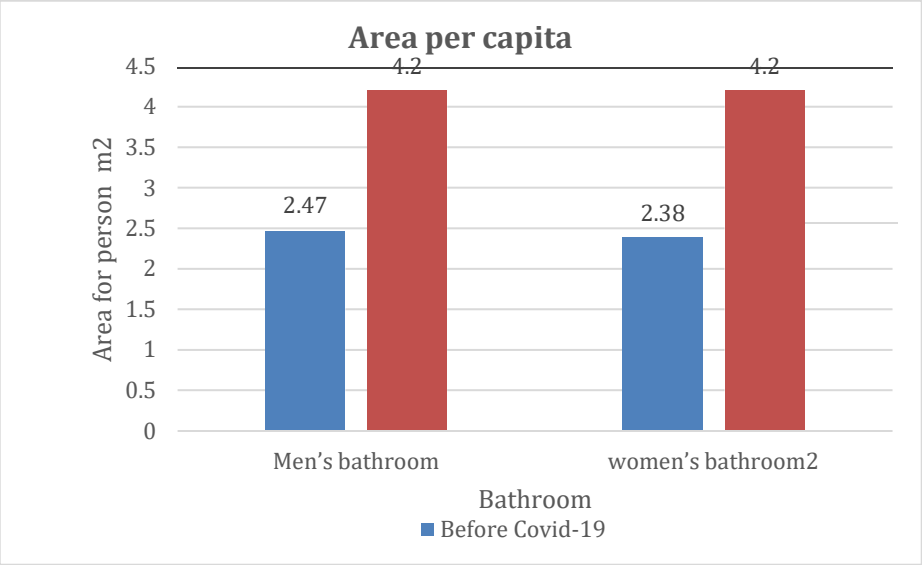


Figure 32 Compare the Area per capita in the bathroom area

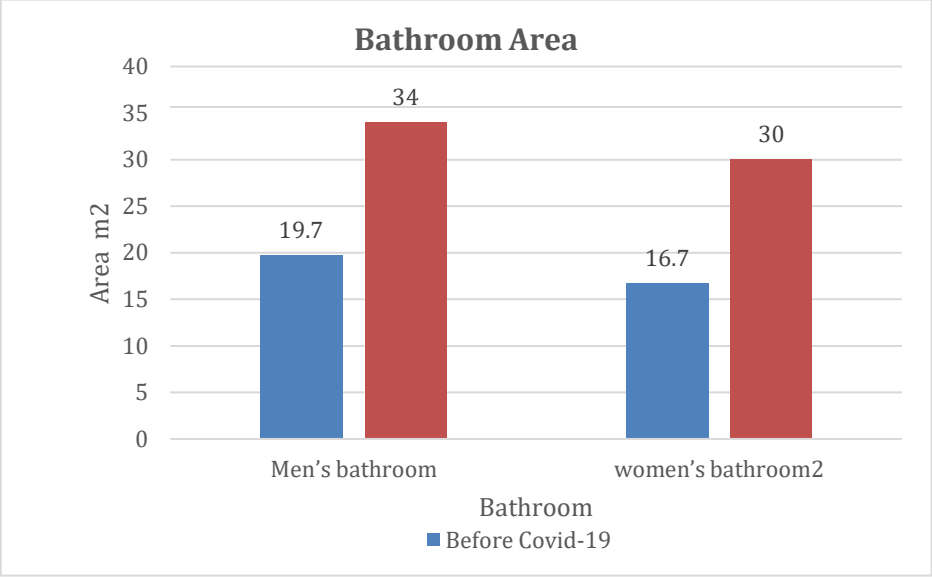


Figure 33 Compare the bathroom area

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

Administration:

This part discusses two parts, The needs of persons from the area and the changing model's area. Part 1 study Area per capita in models. The area per capita in the Stander model during Covid-19 increased with a ratio of 66.6% compared with the area before Covid-19. The area per capita in the medium model during Covid-19 increased with a ratio of 37.5% compared with the area before Covid-19. The area per capita in the large model during Covid-19 increased with a ratioof 47.7% compared with the area before Covid-19. The area per capita in the Executive model during Covid-19 increased with a ratio of 69.7% compared with the area before Covid-19 as explained in Figure34.part 2 study changing area. The Stander model area during Covid-19 increased with a ratio of 58.3% compared with the area before Covid-19. The medium model area during Covid-19 increased with a ratio of 37.5% compared with the area before Covid-19. The large model area during Covid-19 increased by a ratio of 47% compared with the area before Covid-19. Executive model area during Covid-19 increased with a ratio of 34.5% compared with the area before Covid-19 as explained in Figure 35. According to that, the ratio for increasing capacity symmetrical with the ratio for the increasing area in some models.

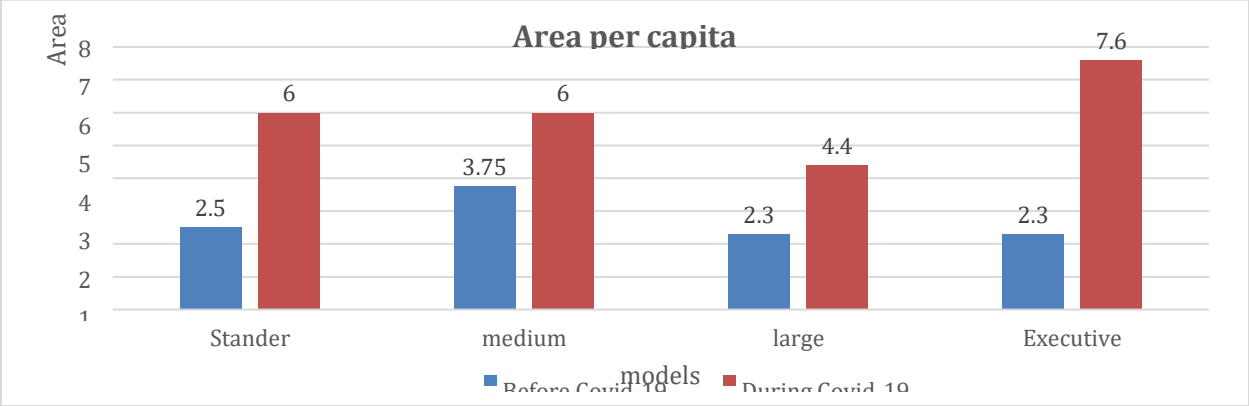


Figure 34 Compare the Area per capita in the Administration area

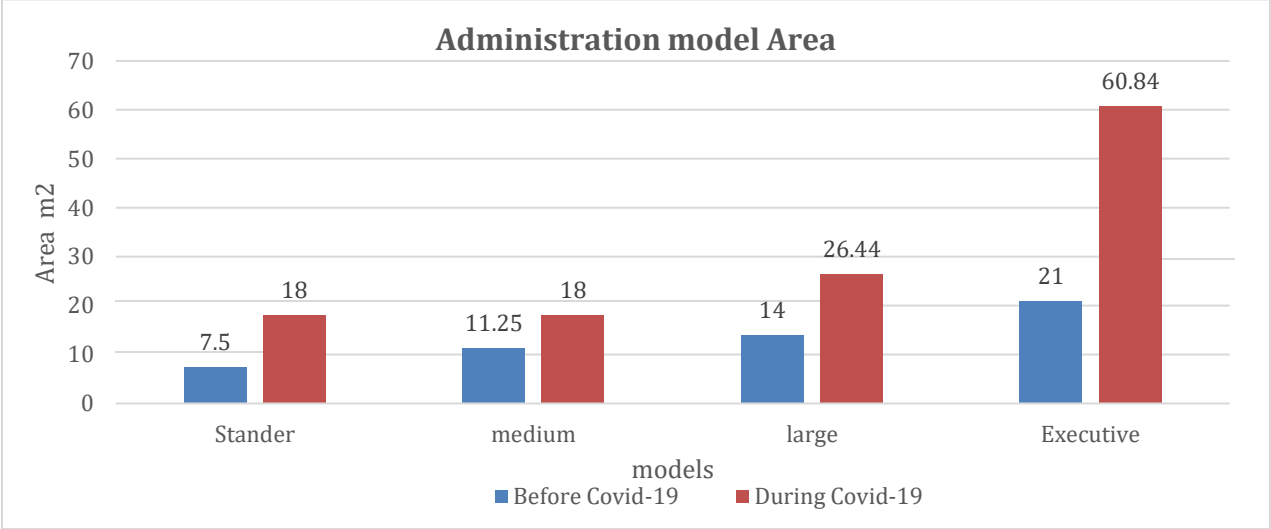


Figure 35 Compare the Administration models Areas

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

Reception

In the case of standing up, the person's area needs before Covid-19 are lower than the area during Covid-19, with a ratio of 81.13% as explained in Figure 36. Additionally, the capacity of people in space before Covid-19 is higher than the capacity during Covid-19, with a ratio of 84% as explained in Figure 37.

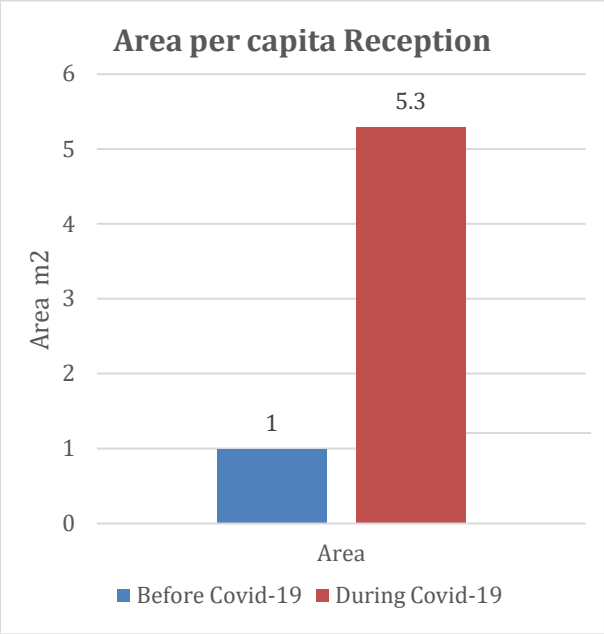


Figure 36 Compare the Area per capita inthe reception area

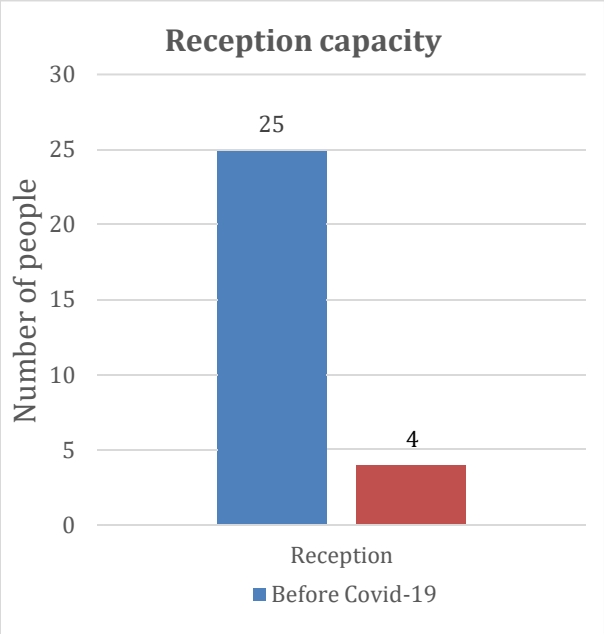


Figure 37 Compare the reception capacity

In the case of sitting, the person's area needs before Covid-19 are lower than the area during Covid-19, with a ratio of 80.7% as explained in Figure 38. Additionally, the capacity of people in space before Covid-19 is higher than the capacity during Covid-19, with a ratio of 80% as explained in Figure 39.

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

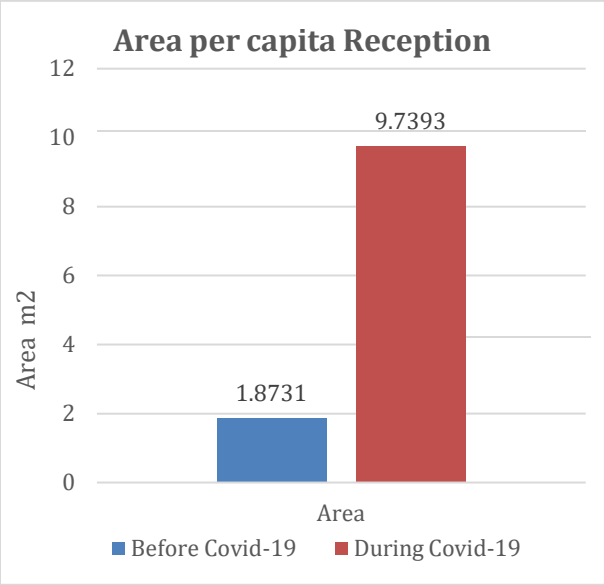


Figure 38 Compare the Area per capita inthe reception area

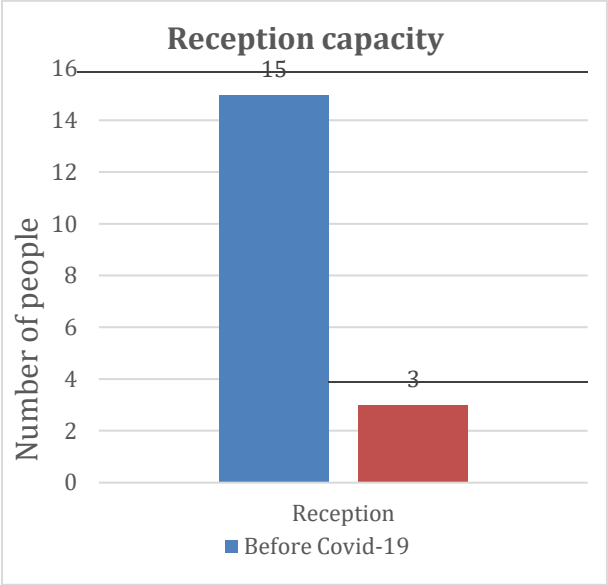


Figure 39 Compare the reception capacity

Grandstands

The area per capita in Grandstands area during Covid-19 decreased by a ratio of 75.5% compared with capacity before Covid-19 as explained in Figure 40.

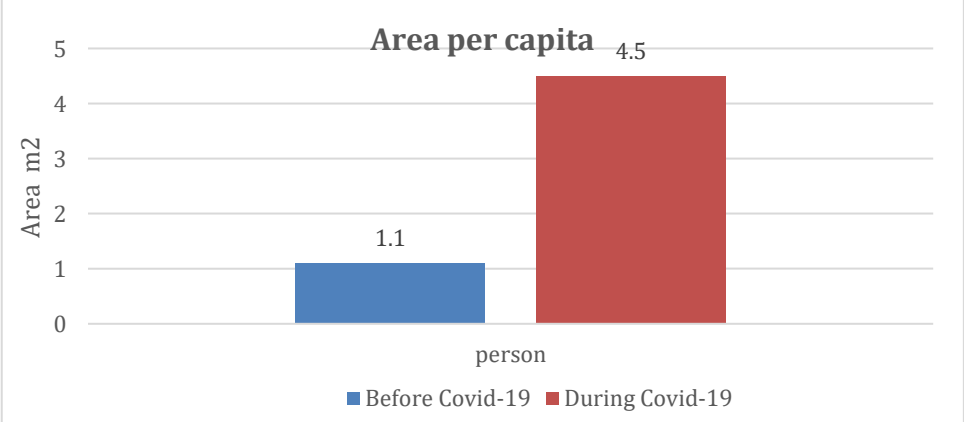


Figure 40 Compare the Area per capita in Grandstands area before Covid-19 and during Covid-19

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

Table:

Also, it has been studying the differences in the table area result of increasing the number of people. The table area for two persons during Covid-19 increased with a ratio of 60.5% compared with the area before Covid-19. The table area for four persons during Covid-19 increased with a ratio of 84.5% compared with the area before Covid-19. The table area for six persons during Covid-19 increased with a ratio of 90.4% compared with the area before Covid-19. The table area for eight persons during Covid-19 increased with a ratio of 90.8% compared with the area before Covid-19 as explained in Figure 41. Additionally, the capacity of people in an area of 13.5m^2 before Covid-19 is higher than capacity during Covid-19 with a ratio of 75% as explained in Figure42.

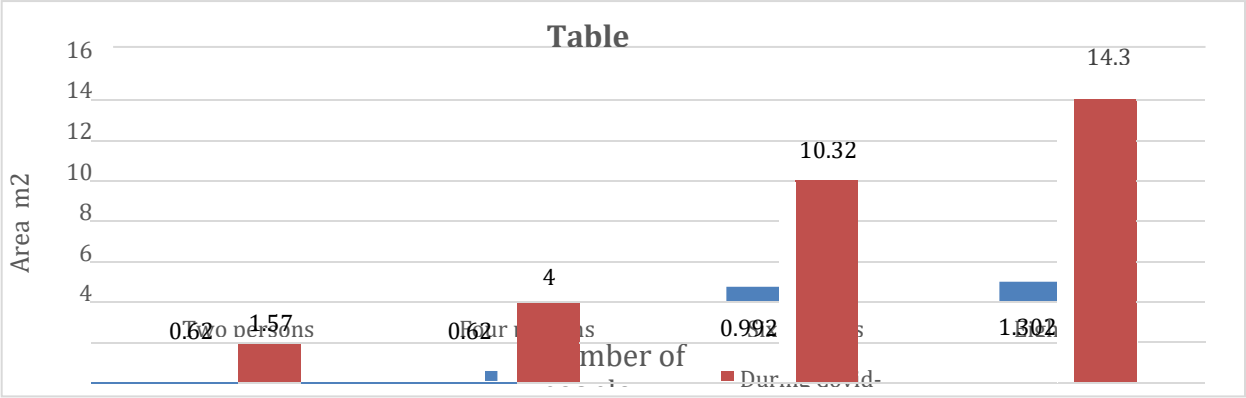


Figure 41 Compare the table Areas in case of an increasing number of people

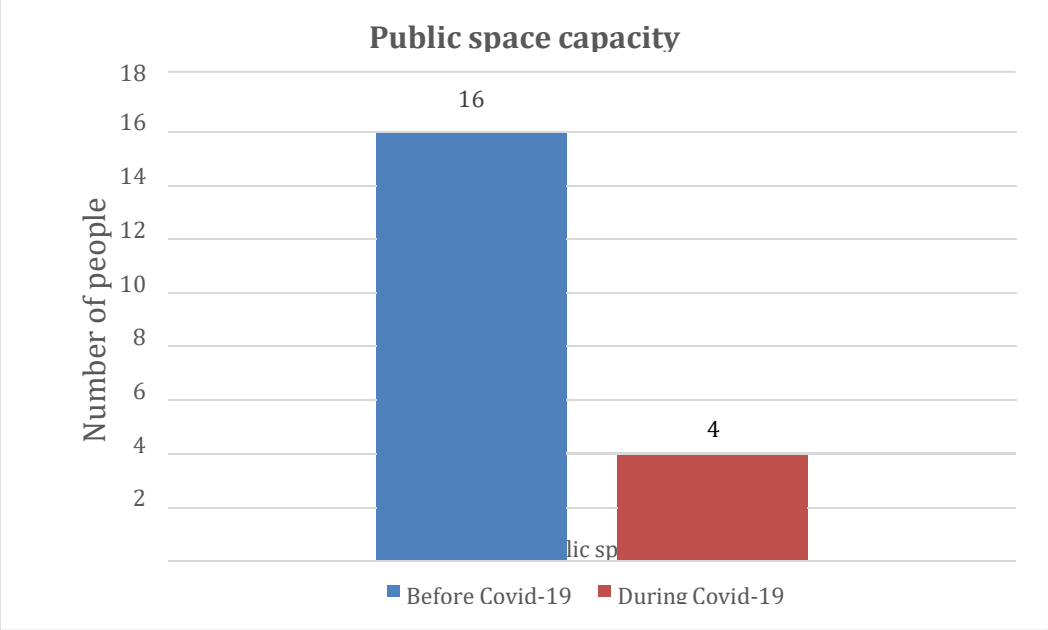


Figure 42 Compare the public space capacity

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

Twin bedroom

The area per capita in the twin bedroom model during Covid-19 increased with a ratio of 21.8% compared with the area before Covid-19 as explained in Figure 43.

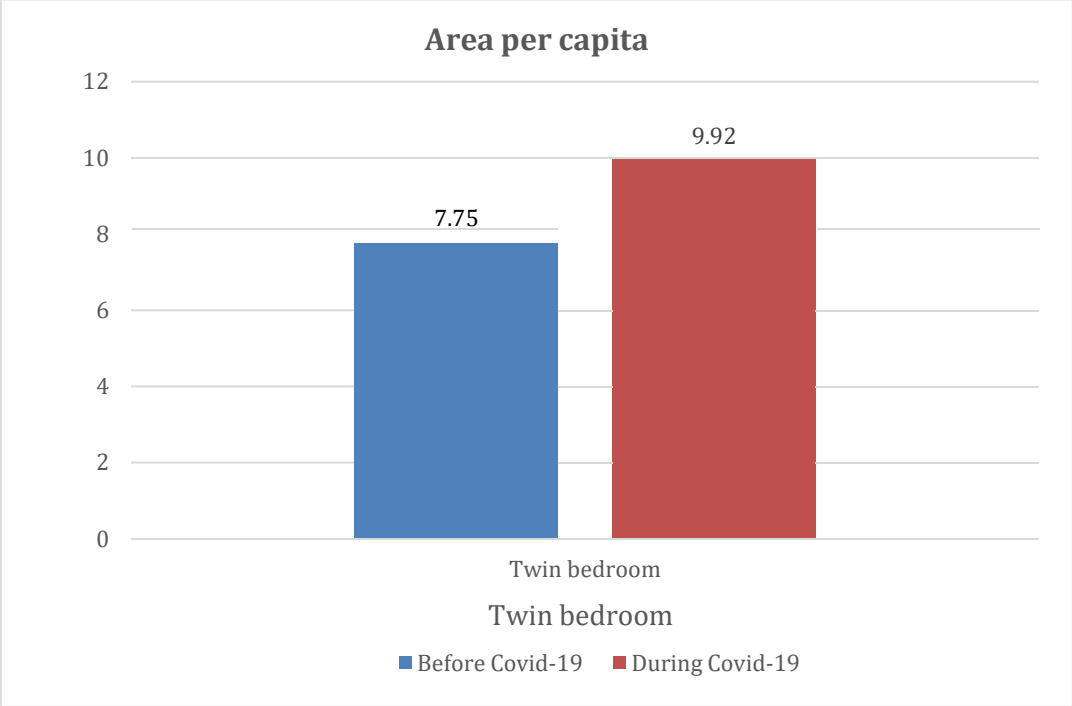


Figure 43 Compare the Area per capita in the Twin bedroom

Computer room

The capacity of people in the computer room area of 110.4m^2 before Covid-19 is higher than the capacity during Covid-19 with a ratio of 80% as explained in Figure 44.

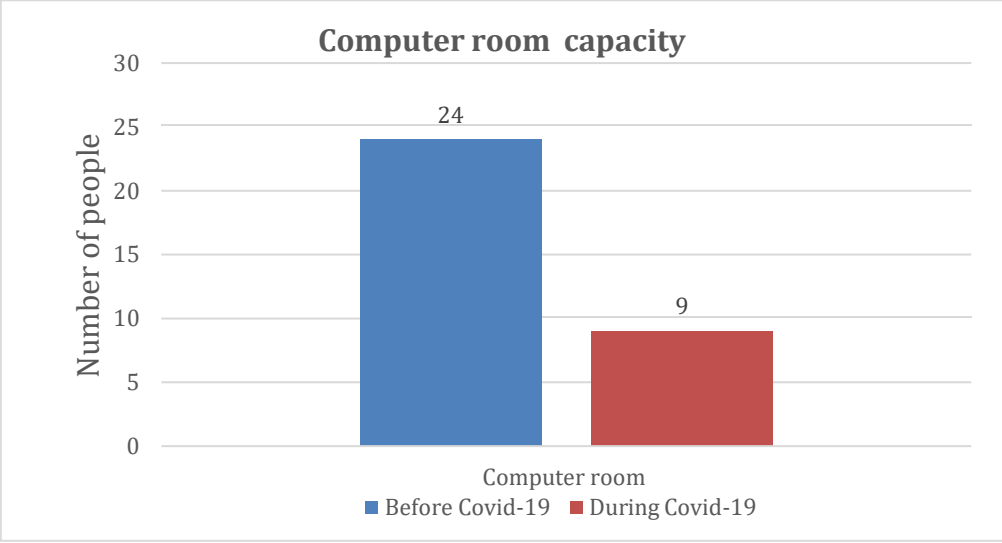


Figure 44 Compare the Computer room capacity

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

Sales spaces:

Sales spaces area during Covid-19 increased with a ratio of 31.1% compared with the area before Covid-19 as explained in Figure 45.

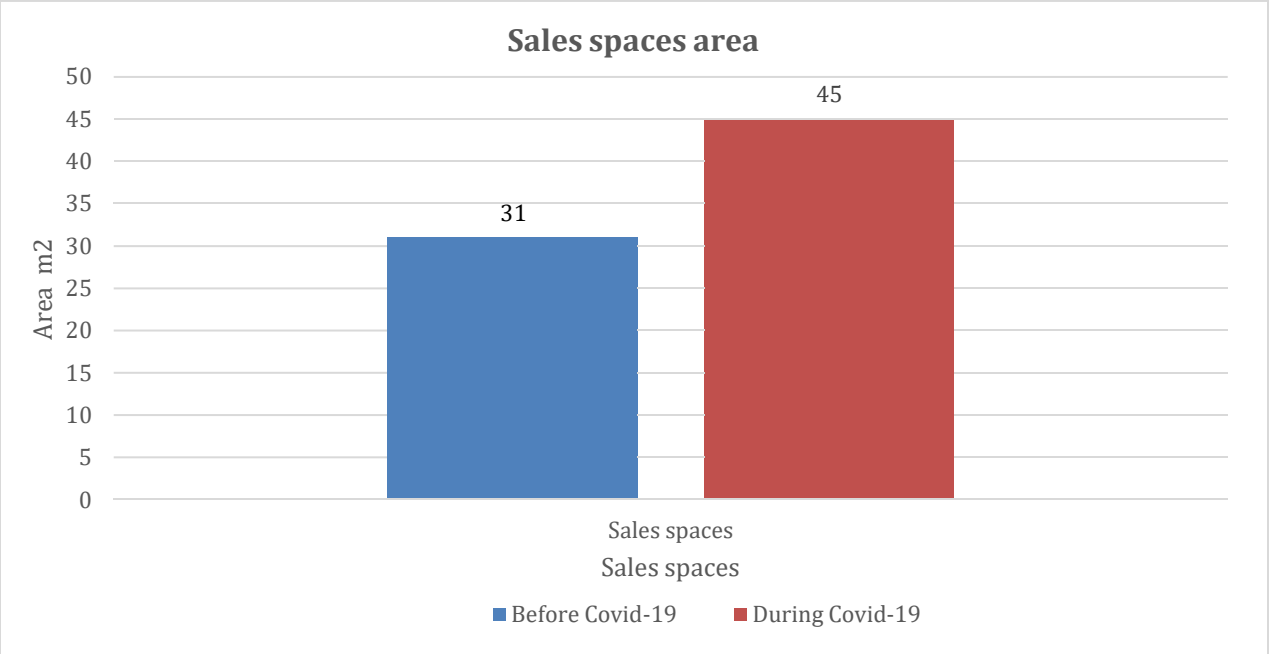


Figure 45 Compare the Administration models Areas

Cashier:

The capacity of people in the Cashier area before Covid-19 is higher than the capacity with a ratio of 40% during Covid-19 as explained in Figure 46.

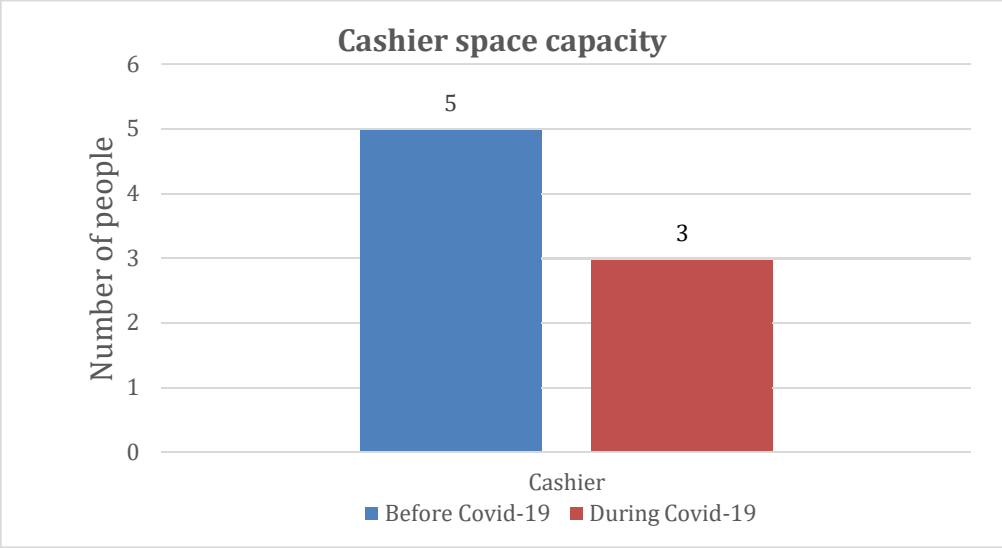


Figure 46 Compare the Cashier capacity

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

Prayer's place:

The person's area needs in prayer place before Covid-19 is lower than the area during Covid-19, with a ratio of 83.9% as explained in Figure 47. Additionally, the capacity of people in space before Covid-19 is higher than the capacity during Covid-19, with a ratio of 82% as explained in Figure 48.

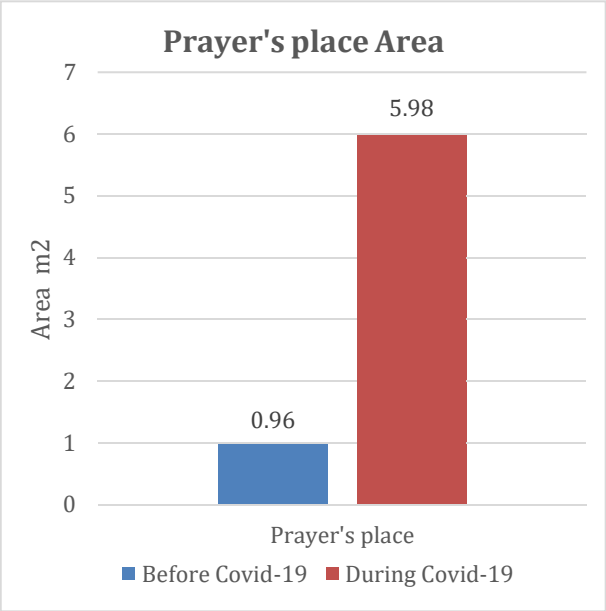


Figure 47 Compare the Prayer's place

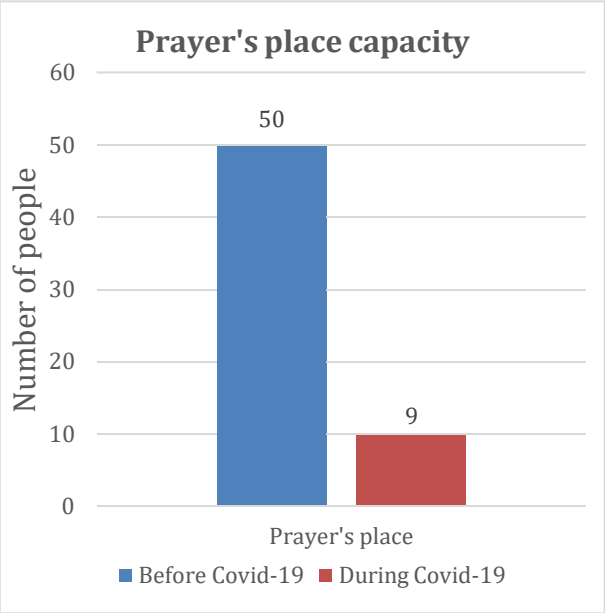


Figure 48 Compare the Prayer's placecapacity

Conclusion:

The thirteen mutual spaces in the public building have been increased in area with a ratio above 40% approximately during Covid-19, as explained later. Pedestrian paths will increase with a ratio above 55%. All spaces, including Stair, will be increasing with a ratio above 65 %. The capacity of people inside the elevator is decreasing with a ratio above 70%. The ratio for increasing capacity is almost identical to the ratio for the increasing area. The area per capita in en's bathroom and women's bathroom area is 4.2 m^2. The average area per capita in Administration spaces is 6m^2. At the reception, in the case of standing up area per capita is 5.3 m^2 and in the case of sitting area per capita is 9.7 m^2. The area per capita in Grandstands is 4.5 m^2. The average area per capita in the table is 1.2 $m^{2.}$ The area per capita in the Twin bedroom is 9.92 m^2. The area per capita in the computer room is 12.2 m^2. Sales spaces area increased with a ratio of 31.1%. The capacity of people in the Cashier area should decrease by a ratio of 40%. The area per capita in prayer's place is 5.98 m^2. Finally, the new ratio of spaces and area per capita in every space will help to fasces disasters in the future. Also, this new stander can be used in the design of new public buildings.

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

Reference

1. Dannenberg, A. L., & Burpee, H. (2018). Architecture for health is not just for healthcare architects. HERD: Health Environments Research & Design Journal, 11(2), 8-12.
2. Murphy, M. (2020). The role of architecture in fighting a pandemic. The Boston Globe, 2020-04.
3. Hercules, W. J., Anderson, D., & Sansom, M. (2020). Architecture Is a Critical Ingredient of Pandemic Medicine. An open letter to policymakers on the essential role of architecture in addressing human health and healthcare facility design during the coronavirus COVID-19 outbreak and for future crises. Hanley Wood Media. Inc. Accessed on 19th April.
4. Gao, S., Mioc, D., Anton, F., Yi, X., & Coleman, D. J. (2008). Online GIS services for mapping and sharing disease information. International Journal of Health Geographics, 7(1), 1-12.
5. Eltarabily, S., & Elghezanwy, D. (2020). Post-pandemic cities-the impact of COVID-19 on cities and urban design. Architecture Research, 10(3), 75-84.
6. Wilcox, B. A., & Colwell, R. R. (2005). Emerging and reemerging infectious diseases: Biocomplexity as an interdisciplinary paradigm. EcoHealth, 2(4), 244–257. https://doi.org/10.1007/s10393-005-8961-3
7. Kadhim, I. J., & Ubaid, W. J. (2021). Perception Of Architectural Output: The Presence Of Architecture In The Presence Of a Pandemic. IOP Conference Series: Materials Science and Engineering, 1067(1), 012025. https://doi.org/10.1088/1757-899x/1067/1/012025
8. Yadav, S. K. S., & Qureshi, M. M. (2021). Impacts of COVID-19 on Indian travel & tourism industry. Int. J. of Trade and Commerce-IIARTC, 9(2), 310-318.
9. Meriam Gaalou, Covid-19ís impact on Architecture, Urbanism and Health, International Journal Water Sciences and Environment Technologies, Vol. (vii), Issue 1, March 2022, pp. 4-17.
10. Mohammed, M. A. (2022). Impact of home-based online classes on residential buildings' use of space during the COVID-19 pandemic school closures in Saudi Arabia. Facilities, (ahead-of-print).
11. Abidi, A. M., & Irshad, D. Q. (2020). Impact of Covid-19 On Architecture Profession. AN INTERNATIONAL BILINGUAL PEER REVIEWED REFEREED RESEARCH JOURNAL, 10(39).
12. Haleem, A., Javaid, M., & Vaishya, R. (2020). Effects of COVID-19 pandemic in daily life. Current medicine research and practice, 10(2), 78.
13. Food, D. G. E. (2020). Tracking the COVID-19 recession's effects on food, housing, and employment hardships. Center on Budget and Policy Priorities.
14. Kim, S., Makhmalbaf, A., & Shahandashti, M. (2022). Diagnosing and quantifying post-COVID-19 fluctuations in the architecture billings indices. Engineering, Construction and Architectural Management, (ahead-of-print).
15. Mulugeta, T., Tadesse, E., Shegute, T., & Desta, T. T. (2021). COVID-19: socio-economic impacts and challenges in the working group. Heliyon, 7(6), e07307.
16. Lunn, P.D., et al., Using Behavioral Science to help fight the Coronavirus. Journal of

Behavioral Public Administration, 2020. 3(1).
17. WHO, Coronavirus disease 2019 (COVID-19) situation report — 44. Reviewed May 4, 2020.
18. Popa, I., Ștefan, S. C., Olariu, A. A., Popa, Ș. C., & Popa, C. F. (2022). Modelling the COVID-19 Pandemic Effects on Employees' Health and Performance: A PLS-SEM Mediation Approach. International Journal of Environmental Research and Public Health, 19(3), 1865.
19. Bethesda, M., Blake, K. S., Kellerson, R. L., & Simic, A. (2007). Measuring overcrowding in housing. Office of Policy Development and Research, 38.
20. Soga, M., Evans, M. J., Cox, D. T., & Gaston, K. J. (2021). Impacts of the COVID-19 pandemic on human–nature interactions: Pathways, evidence and implications. People and Nature, 3(3), 518-527.
21. Amirudin, A., Syamsul, M., Marnani, C. S., Rahmah, N. A., & Wilopo, W. (2021). Positive impacts among the negative impacts of the COVID-19 pandemic for community life. In E3S Web of Conferences (Vol. 331, p. 01008). EDP Sciences.
22. Bruce, S. (2020), "How P.E.I. apartment buildings are keeping tenants apart",CBC, available at: https://www. cbc.ca/news/canada/prince-edward-island/pei-apartment-rules-covid-19-measures-1.5514852.
23. Al-Qaisi, M. O. M. An Overview of Post-Pandemic Housing: Through Stay-at-Home Experience. Arab Journal for Scientific Publishing (AJSP) ISSN, 2663, 5798.
24. Lekić Glavan, O., Nikolić, N., Folić, B., Vitošević, B., Mitrović, A., & Kosanović, S. (2022). COVID-19 and City Space: Impact and Perspectives. Sustainability, 14(3), 1885.
25. El-Husseiny, M. A. (2021). Post-pandemic home design adaptations: Lessons learnt for future theory and practice. Civil Engineering and Architecture, 9(7), 2542-2555.
26. Karpman, M., Zuckerman, S., Gonzalez, D., & Kenney, G. M. (2020). The COVID-19 pandemic is straining families' abilities to afford basic needs. Washington, DC: Urban Institute, 500.
27. Mou, J. (2020, July). Research on the Impact of COVID19 on Global Economy. In IOP Conference Series: Earth and Environmental Science (Vol. 546, No. 3, p. 032043). IOP Publishing.
28. Stueck, W. (2020), "How condo and apartment buildings are encouraging social distancing",The Globe and Mail, available at: https://www.theglobeandmail.com/canada/british-columbia/article-howcondo-and-apartment-buildings-are-encouraging-social-distancing/.
29. Kaushik, M. (2020). Pandemic COVID-19 and its implications on human life. Impact of COVID-19 and Pandemic Lockdown in India, 231-243.
30. Abel, T., & McQueen, D. (2020). The COVID-19 pandemic calls for spatial distancing and social closeness: not for social distancing. International journal of public health, 65(3), 231-231.
31. Bureau, E. E. (2020, 1 September,2020). Minus 23.9 per cent GDP shrinks: slowdown plus Covid plus effect of lockdown, indianexpress.com. Retrieved from

ISSN: 0011-9342 | Year 2021
Issue: 2 | Pages: 1187-1213

https://indianexpress.com/article/business/economy/economy-slowdowngdp contraction-minus-23-9-per-cent-6578116/

32. Fezi, B. A. (2020). Health engaged architecture in the context of COVID-19. Journal of Green Building, 15(2), 185-212.
33. Human Rights Delegation, The impacts of the coronavirus pandemic on the implementation of fundamental and human rights, Human Rights Centre's publications 2020.
34. Peters, T., & Halleran, A. (2020). How our homes impact our health: using a COVID-19 informed approach to examine urban apartment housing. Archnet-IJAR: International journal of architectural research.
35. Varma, A., & Jafri, M. S. (2020). COVID-19 responsive teaching of undergraduate architecture programs in India: learnings for post-pandemic education. Archnet-IJAR: International Journal of Architectural Research.
36. Alraouf, A. A. (2021). The new normal or the forgotten normal: contesting COVID-19 impact on contemporary architecture and urbanism. Archnet-IJAR: International Journal of Architectural Research.
37. Alhusban, A. A., Alhusban, S. A., & Alhusban, M. A. (2021). How the COVID 19 pandemic would change the future of architectural design. Journal of Engineering, Design and Technology.
38. Damjan Balkoski, M.Arch, POST COVID-19 URBANISM: ESTABLISHING MODULAR DIMENSIONS WHEN DESIGNING NEW URBAN SPACES, IBU International Journal of Technical and Natural Sciences 1 (2020) 1-7.
39. Dimensions.com, https://www.dimensions.com/element/one-single-elevator-lift.
40. Shiba, Ahmed Salah Eldin. (2021) " Effects of Climate Changes on Future Architecture and the Contribution of the Developing Countries to Limit and Avoid Harms". Journal of Architecture, Arts and Humanities Science, ISSN: 2357-0342 Vol (6) Issue (26) , P. 1–13. https://doi.org/10.21608/mjaf.2020.26108.1545
41. Shiba, Ahmed Salah Eldin &Sayed, Rasha (2020). “The role of architectural design in raising the efficiency of temporary Infection Isolation to deal with epidemics as an alternative to public hospitals palaces” Journal of Xi'an University of Architecture & Technology. ISSN No: 1006-7930 Volume XII, Issue VII, pp. 993-1008 https://doi.org/10.37896/JXAT12.07/2409