Data Article

Construction time, cost and testing data of a prefabricated isolation medical unit for COVID-19

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**A B S T R A C T**

Coronavirus Disease 2019 (COVID-19) has been identified as a global pandemic by the World Health Organization (WHO). The breakout of COVID-19 in various countries and regions brings a great threat to people's life and adds an unprecedented high pressure on healthcare systems. Due to the high infectivity of COVID-19, high standard negative pressure isolation units are required to accommodate the patients with COVID-19 and protect health workers. A novel prefabricated negative pressure isolation medical unit was designed and constructed in Shenzhen, China to help to accommodate the patients with COVID-19. This article provides detailed construction cost, time and testing data for this isolation medical unit. Considering the construction happened during the lockdown in Shenzhen (and in China), the construction cost and time can provide precious and rare information as well as guidelines to construct or expand appropriate medical facilities to accommodate the patients with COVID-19.

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Specifications table

| Subject | Civil and Structural Engineering |
|---------|----------------------------------|
| Specific subject area | a novel prefabricated negative pressure isolation medical unit. |
| Type of data | Tables. |
| How data were acquired | The data about construction cost and time were collected during the construction. Performance data were collected during a test operation of a HVAC system for the medical unit. Brand and model of the testing equipment are listed as follows: TSI Incorporated: AccuBalance Air Capture Hood 8375. TSI Incorporated: VelocAir Velocity Meter 9545. Kimo MP 120 Manometer Pressure Sensor Monitor Meter. |
| Data format | Raw. Analysed. |
| Parameters for data collection | During the construction, the cost data were collected and categorized as various major components, including the containers, windows & doors, sanitation, indoor equipment, heating, ventilation and air conditioning. During the test operation of a HVAC system, the performance data, including the pressure difference between rooms, pressure difference against atmosphere pressure and ventilation rate for the clean (fresh) air fans, were collected. |
| Description of data collection | Construction cost data of the prefabricated isolation medical unit for the COVID-19, available in an associated Excel spreadsheet, and the construction time, testing and evaluation data of the prefabricated isolation medical unit for the COVID-19, available in tables within the main text. |
| Data source location | Institution: China Construction Science and Technology Cooperation City/Town/Region: Shenzhen Country: China Latitude and longitude (and GPS coordinates) for collected samples/data: 114.357712 E, 22.693763 N |
| Data accessibility | With the article. |

Value of the data

- These data provide precious and rare information and guidelines to expand high standard medical facilities to accommodate the patients with COVID-19.
- Medical and engineering professionals currently combat COVID-19 or consider expanding medical facilities due to COVID-19.
- The detailed construction time and cost breakdown of a negative pressure medical unit are presented, which will enable a cost analysis and comparison with the other medical applications and construction methods.

1. Data description

The data presented in this article have been collected under the construction of a high cleanliness negative pressure prefabricated isolation medical unit constructed for the patients with COVID-19, located at Pingshan People’s Hospital, Shenzhen, China. In this project, this medical unit was constructed within five working days via prefabricated modular construction. Table 1 shows the daily construction progress during this period. The information includes the number of workers engaged each day, the working hours as well as the progress. As the construction happened via the lockdown in Shenzhen (and China), the cost of installation can be unique. Shown in the attached spreadsheet, the collected installation cost data were categorized as various major components, including the containers, windows & doors, sanitation, indoor equipment, heating, ventilation and air conditioning. All the costs listed are in CNY (Chinese Yuan). The last but not the least, testing and evaluation regarding the pressure and air flow rates in
Table 1
Construction time and progress.

| Date          | No. of labors | Working hours | Progress of the day                                                                 |
|---------------|---------------|---------------|-----------------------------------------------------------------------------------|
| Feb. 04, 2020 | 3             | 12            | Containers arrived and assembling was started                                      |
|               |               |               | Building envelopes were assembled                                                  |
|               |               |               | Interior declaration/installation was completed                                     |
| Feb. 05, 2020 | 7             | 12            | Heating, cooling and ducting systems were installed                                 |
|               |               |               | Ventilation fans were installed and air purifiers were installed                   |
|               |               |               | Control panels were installed and connected                                         |
| Feb. 06, 2020 | 10            | 12            | Heating, cooling and ducting systems were installed                                 |
|               |               |               | Ventilation fans were installed and air purifiers were installed                   |
| Feb. 07, 2020 | 10            | 12            | Heating, cooling and ducting systems were installed                                 |
|               |               |               | Ventilation fans were installed and air purifiers were installed                   |
| Feb. 08, 2020 | 8             | 12            | Heating, cooling and ducting systems were installed                                 |
|               |               |               | Ventilation fans were installed and air purifiers were installed                   |

Table 2
Measured pressure difference between rooms.

| Pressure Difference between Rooms | Measured Pressure Difference (Pa) | Design Requirement | Requirement Met |
|-----------------------------------|-----------------------------------|--------------------|-----------------|
| Ward 1 and Restroom 1            | 5                                 | ≥ 5 Pa             | Yes             |
| Patient Corridor and Ward 1      | 8                                 | ≥ 5 Pa             | Yes             |
| Ward 2 and Restroom 2            | 8                                 | ≥ 5 Pa             | Yes             |
| Patient Corridor and Ward 2      | 9                                 | ≥ 5 Pa             | Yes             |
| Buffer Room and Ward 1           | 9                                 | ≥ 5 Pa             | Yes             |
| Buffer Room and Ward 2           | 10                                | ≥ 5 Pa             | Yes             |
| Medical Corridor and Buffer Room | 6                                 | ≥ 5 Pa             | Yes             |

Table 3
Measured pressure difference against atmosphere pressure.

| Pressure Difference Against Atmosphere Pressure | Measured Pressure Difference (Pa) | Design Requirement | Requirement Met |
|-------------------------------------------------|-----------------------------------|--------------------|-----------------|
| Restroom 1                                       | −19                               | ≤ −15 Pa           | Yes             |
| Ward 1                                           | −14                               | ≤ −10 Pa           | Yes             |
| Restroom 2                                       | −23                               | ≤ −15 Pa           | Yes             |
| Ward 2                                           | −15                               | ≤ −10 Pa           | Yes             |
| Patient Corridor                                 | −6                                | ≤ −5 Pa            | Yes             |
| Buffer Room                                      | −5                                | ≤ −5 Pa            | Yes             |
| Medical Corridor                                 | 1                                 | ≥ 0 Pa             | Yes             |

Each room has been conducted. Table 2 shows the details of the measured pressure difference between rooms, and the room with higher pressure is shown first (As an example, Ward 1 has a higher pressure than Restroom 1). Table 3 then presents the measured pressure difference between each room and the atmosphere pressure (Note: the negative value means that the pressure in the room is lower than atmosphere pressure). Lastly, Table 4 shows the results of the measured ventilation rates for the clean (fresh) air fans in each room. The locations of the fans are shown in Fig. 1. The experimental design and methods will then be discussed in the next section.
Table 4
Measured ventilation rate for the clean (Fresh) air fans.

| Room/Fan       | Designed Ventilation Rate ($m^3/h$) | Measured Ventilation Rate ($m^3/h$) |
|----------------|-------------------------------------|------------------------------------|
|                |                                     | Level 10  | Level 7  | Level 5  | Level 3  |
| Ward 1 Fan No.1| 350                                 | 635       | 555       | 335       | N/A      |
| Ward 1 Fan No.2| 350                                 | 675       | 507       | 313       | N/A      |
| Ward 2 Fan No.1| 350                                 | 530       | 400       | 275       | N/A      |
| Ward 2 Fan No.2| 350                                 | 500       | 454       | 270       | N/A      |
| Buffer Room    | 150                                 | 353       | 320       | 300       | 150      |
| Medical Corridor | 450                               | 510       | N/A       | N/A       | N/A      |

Fig. 1. Medical unit layout and locations of the ventilation fans for fresh air.

2. Experimental design, materials, and methods

An appropriate indoor environment can be essential to the isolation wards to form effective protections for the patients and medical workers [1-3]. The parameters need to be considered including indoor air temperature, relative humidity [4], ventilation and differential pressure control [5]. While indoor air temperature and relative humidity can be easily satisfied with the air conditioning system, the ventilation and differential pressure control can be critical and chal-
loungeable for isolation medical units [6]. In this practice, according to the cleanliness and functions, the medical unit is divided into five zones, such as the patient corridor, the patient room, the patient restroom, the buffer room and the medical corridor, and each with an independent fresh air conditioning system. Gradient pressure air distribution is adopted to achieve this aim, where different levels of negative pressure are distributed in different zones (Fig. 2). In this project, the isolation wards where patients are located are designed to have the $-10 \text{ Pa}$ comparing with the atmosphere and the restroom is kept as $-15 \text{ Pa}$. This is to ensure that the clean air continues flowing into the patient rooms and the exhausted air can be pulled out without leaking to the health care workers’ working area.

To achieve the design mentioned above, it took five continuous days during the construction period. The daily construction progress is organised and presented in this article (Table 1). The
associated installation cost is also reported to reflect the price under the unprecedented challenges (due to lockdown) in the supply chain of equipment as well as the labor and workers (shown in the attached spreadsheet). The evaluation and testing were then conducted before handing over to the hospital. The testing includes the pressure differences and air flow rates in each room. The locations of the fans tested are shown in Fig. 1. The top view of the medical unit constructed is shown in Fig. 3.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships which have, or could be perceived to have, influenced the work reported in this article.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.dib.2020.106068.

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