Proceedings of the 2023 International Conference on Functional Materials and Civil Engineering
DOI: 10.54254/2755-2721/23/20230620

The impact of COVID-19 on civil engineering

Yushan Xie

Sichuan University, Shuangliu County, Chuanda road, Chengdu, 610207

598086281@qq.com

Abstract. This passage is mainly about analyzing the civil engineering which has been hugely affected and forced to slow down during COVID-19 under Chinese government strict restriction and quarantine policy. It focusses on the impact of COVID-19 and the Chinese policy to civil engineering and construction and try to find some solutions for future same situation. It includes several essential parts in civil engineering, such as cost management, need assessment, design of the system, monitoring of users of civil system and End-of-Life Phase. It also uses the data and information during COVID-19 to find some solutions for the lack of labor force and difficulty in operations. Also, in this passage, it analyzes all this important phase's availability and efficiency in the civil engineering one by one under the strict policy of COVID-19 in China. Moreover, it also includes some solutions to the current situation of civil engineering design in order to improve the efficiency and quality of the civil engineering.

Keywords: COVID-19, civil Engineering, construction.

1. Introduction

Civil engineering is one of the most important things when China is developing so fast. But due to the COVID-19 and the strict policy restrictions in China, civil engineering has been to a difficult time. Currently, it gets temporarily control. Huo mentions that, The core experience of China is: first, the testing of the novel coronavirus pneumonia is free, the testing speed is fast and the testing time is short, and the insufficient medical insurance payment of confirmed patients is borne by the government; Second, timely control and contain the spread of the novel coronavirus pneumonia; Third, efforts have been made not only at the local level but also at the national level to control and contain the spread of the novel coronavirus pneumonia. The difficulty can be summarized as seven categories: lack of work force, difficulty in operation, impact on cost management, influence on the need assessment, impact to the design of system, impact to the monitoring of users of civil systems and the increased use of temporary plans for civil systems. In this essay, I will analyze the impact of COVID-19 on civil engineering in China.

2. Lack of work force

Owing to the COVID-19 and the strict policy restrictions in China, the labor force in civil engineering are facing shortage badly. The first reason is Chinese government ask anybody whose health code or travel code is in exception to quarantine for seven days. Under those circumstances, people who work in civil engineering are unwilling to face the risk of quarantine. As a result, they are more willing to do the same work in their hometown which allows them to get quarantine in their home or they just quit the job.

DOI: 10.54254/2755-2721/23/20230620

The second reason is that the civil engineering company are facing economic shortage mostly during the COVID-19. Consequently, these company will reduce the hired employee and reduce their salary to balance the company expenditures. Due to the reduced salary, the civil engineering workers may choose to work in other fields instead of doing the construction works.

According to the regulation in Hangzhou, the expenses of accommodation, food, management and epidemic prevention measures incurred by the workers during the quarantine period shall be reasonably shared by the contracting parties through consultation. For the project invested by the municipal government, the owner shall provide appropriate subsidies according to the number of quarantined persons (excluding those quarantined by the government). The subsidy standard shall be 100 yuan per person per day, and the maximum for each person shall not exceed 1000 yuan. The contractor shall provide the registration list of quarantined people and be confirmed by the owner [1]. For construction company, they will face the expenditure on quarantined workers. As a result, they will cut the nonlocal workers to control the cost. Moreover, they will subtract the salary of workers to balance the expenditure.

Accordingly, these reasons lead to the lack of labor force.

3. Difficulty in operation

The difficulty in operation mainly comes from the strict restrictions of COVID-19 from Chinese government. The first step in the civil engineering is need assessment. In this step, people will propose the prospects of the civil infrastructure and the outcome. Specifically, people must agree with each other to start next step. Then, they need to check the site's availability and feasibility. Chinese government's strict restrictions which can be summarized as People will get nuclear test after they travel from one place to another place. People are asked to wear mask in public place such as cinemas. People are asked to scan place code before they enter public place. People will be quarantined if they come from somewhere abroad. People will be quarantine if they are diagnosed with COVID-19. People must stay at home if the community where they live has somebody be diagnosed with COVID-19.

Obviously, these restrictions will affect the process of civil engineering to a huge extent. Different departments can only have met online, and the lack of labor force will slow down the operations. Some of the operations could be paused for a long time if this city has some COVID-19 patients or this region is in high risk [2].

4. Specific impact on civil engineering

4.1. Impact on cost management

Cost management includes the control and the plan of the budget in civil engineering. Specifically, it contains planning, estimating, budgeting, financing, funding, managing, and controlling costs [3]. These all process is aimed to make the cost of the project such as a bridge or a road to meets the budget and measure the project's feasibility and economic effects. As shown above, these steps all are infected due to the restriction policy of COVID-19. For example, in the planning and estimating stage, civil engineers would go to the field for accurate estimation of cost. However, restricted by the quarantine policy in China, they are not able to go to the field in person if this city has one confirmed COVID-19 case. As a result, this will slow the whole process of planning and estimating and add the total cost finally because of the delayed work process.

Take Hangzhou civil engineering regulation during COVID-19 as an example. According to the regulation, for projects under construction contract, property losses and cost increases caused by work stoppage due to epidemic prevention and control shall be implemented in accordance with the contract. If the contract is not agreed or the agreement is unclear, the contracting parties shall reasonably share the corresponding losses and sign a supplementary agreement based on the principle of risk sharing, and the compensation fee for work stoppage loss shall be applied to the construction industry VAT. The specific treatment method is: During the period of shutdown caused by epidemic prevention and control, the contractor's necessary personnel (labor and management personnel) remaining at the construction site shall be borne by the Employer, and the necessary construction machinery stop shift expense and

DOI: 10.54254/2755-2721/23/20230620

turnover material usage fee shall be reasonably shared by the contracting parties through negotiation. The contractor shall collect and save necessary written materials or video data, such as the list of left-behind personnel, expense vouchers, idle site construction machinery and equipment, as the measurement basis for fee settlement. The owner shall do a good job in relevant visa work [4].

Related expenses sharing during the shutdown period of Hangzhou government investment projects shall be carried out according to the following standards and regulations: The compensation standard for the left-behind personnel at the construction site during the shutdown period: 140 yuan/person/day for workers and 240 yuan/person/day for managers (including project managers) during the first-level response period for epidemic prevention and control; Workers and managers (including project managers) were 115 yuan per person per day and 215 yuan per person per day during the second-level response period. Workers and managers (including project managers) are 105 yuan per person per day and 205 yuan per person per day during the level 3 response period. The above cost standards include the additional cost of epidemic prevention management and epidemic prevention materials for those left behind due to epidemic prevention and control [5].

The cost increases caused by work stoppage due to epidemic prevention and control shall be implemented in accordance with the contract. Consequently, the unit cost increase dramatically.

4.2. Influence on the need assessment

The need assessment in civil system is an essential step for every kind of civil system. First and foremost, we should find out the type of need in a specific civil system. What's more, determine whether a problem exists and assess the amount of need for a system. For civil infrastructure needs assessment, we can find that the need assessment is an essential step for a national infrastructure system that is efficient, affordable and sustainable. The other reason for need assessment is they can identify the drivers of future change in infrastructure networks, including economic and population growth, technological change and climate change [6].

However, for all the civil need assessment, engineer and designer will go to the field trip to determine and assess the need of the whole system. During the COVID-19, Chinese government ask anyone whose journey come from any city has identified patient to be quarantined for seven to fourteen days. Also, to ensure the need assessment, field trip is an essential part. Consequently, engineer and designer will face the dilemma between work and quarantine. Additionally, company will encounter the problem: shortage of engineer, designer, and labor force.

Huoshenshan Hospital which is built during the most difficult time of China to deal with COVID-19. It requires a impervious layer to be designed between the bottom of the above-ground building and the ground, covering the entire courtyard to ensure that contaminants do not penetrate into the soil and surrounding water [7]. For need assessment step, this would definitely complicate the step because the majority of hospitals didn't require so strict step for prevention. It will increase the difficulty of engineer and designer to measure the field.

4.3. Impact to the design of system

The design of system should be considered as well as need assessment. First and foremost, the reference is the design cost. Design costs include the costs of engineering analyses, engineering construction drawing preparations, and developing technical specification which are monetary, direct, and tangible. Also influenced by the strict restriction COVID-19 policy, the designer will be in a shortage situation which means the cost of design will increase significantly. In the drawing preparations and developing technical specification, they are a huge part of the cost in design. As a result, the cost of design and the time of design will increase significantly, and this will lead to the whole project being overdue.

Choose Huoshenshan hospital as an example, which is a hospital built for controlling COVID-19 in Wuhan. As Lv mentions that Huoshenshan Hospital strictly follows the architectural design rules for infectious disease hospitals. It not only builds the impervious layer to cover the layer for avoiding contamination, the hospital has installed rainwater and sewage treatment systems. After two chlorine disinfection treatment, it can be discharged into the municipal pipe network after reaching the standard.

DOI: 10.54254/2755-2721/23/20230620

Due to the fatalness and infection of COVID-19 virus, an impervious layer is needed to prevent contamination [8]. The design of Huoshenshan hospital should meets the requirements of preventing virus to contaminate the surrounding which will make situation worse.

4.4. Impact to the monitoring of users of civil systems

System monitoring and inspection are essential part in civil engineering which monitor the constrictions condition to prolong the life span. System monitoring and inspection include: (a) costs of inspecting the system periodically to ensure that there are no serious defects that could lead to catastrophic failures and (b) costs of monitoring the levels and patterns of usage of (or demand for) the system to assess any need for capacity enhancements. (c) cost of monitoring the impacts of the system on its environment (d) cost of monitoring the impact of the environment on the system. These costs include the salaries paid to in-house personnel (system inspectors) and the use of in-house equipment. In the monitoring and inspection stage, civil engineer will inspect the condition of the construction and do the maintenance regularly to prolong the project's life span.

Water is an important resource for preventing the virus. According to Chang, in view of the secondary environmental hazards caused by the massive use of disinfectant during the novel coronavirus pneumonia epidemic, the sewage epidemic prevention management and disinfection operation system has been designed. Through the classification, control and monitoring of stormwater channels and sewage channels, the source of pollution has been identified, as well as the places with high concentrations of pollutants collected by sewage, corresponding measures have been implemented at designated points, such as sewage testing and standard discharge. Prevent secondary environmental problems caused by water pollution. In the monitoring stage, to identify the water quality and the virus pollution during COVID-19, the cost will increase dramatically because of the difficulty in testing and lack of labor force.

4.5. Impact to end-of-life phase

The end-of-life costs incurred by the agency depend on whether the system termination was intended or unintended. For intended termination, end-of-life costs include the cost of removing and disposing of the physical system and often include the costs of demolition and addressing complaints or settling lawsuits filed by owners of nearby systems and the surrounding community affected by the system demolition. The costs associated with unintended termination include the preemptive cost of retrofitting the physical structure of the system in order to reduce its susceptibility to failure in case of a disaster event and the after-the-fact costs of recovery or repair after any such disaster. Due to the lack of medical source during the COVID-19, Chinese government decide to build some mobile cabin hospital for people who are confirmed as COVID-19 to be quarantined and cured. When all quarantine policy invalid anymore, these constructions need to be removed or reconstruct. The cost of removing and disposing these cabin hospitals in the end- of-life is high. Right now, Chinese government is handling on how to deal with these mobile cabin hospitals.

5. Conclusion

In conclusion, COVID-19 in China has affected the civil engineering. But it also provides us useful information and solutions to deal with the same dilemma under such strict policy. In the future, whenever the civil engineering is facing the same situation, we can follow the experience from the COVID-19 and improve it to solve these problems.

References

[1] Life-Cycle Civil Engineering. Fabio Biondini, Dan M. Frangopol

[2] Notice on the release of the Guiding Rules for the Adjustment of Contracts and Project Prices for Projects under Construction during the COVID-19 Epidemic in Hangzhou, the government portal of "Hangzhou, China", 2020-06-12 16:33

DOI: 10.54254/2755-2721/23/20230620

[3] Lv Jinghuan, Luo Bin. Waterproof and Seepage Prevention Engineering Design and Construction of Wuhan Huoshenshan Hospital to Fight COVID-19 Epidemics[J].China Building Waterproofing,2020(03):1-5+8.
[4] Chang J, Huo K. Design and operation management of COVID-19 public health epidemic prevention [J]. Design, 2020,33(06):98-100.
[5] Anderson Roy M,Heesterbeek Hans,Klinkenberg Don,Hollingsworth T Déirdre.How will country-based mitigation measures influence the course of the COVID-19 epidemic?[J].The Lancet,2020,
[6] Group Theory: Contemporary City · New Human Settlement · Architectural Design [J]. Architecture Journal,2020(Z1):2-27.
[7] Investigation report on the impact of the epidemic on engineering survey and design enterprises[J].Construction and Architecture, 2020(06):33-36.
[8] Ma Rujie, Xia Jianping, Xu Run, Ma Wenqi, Zhang Changyong. Research on the application of BIM technology in the investigation and design of highway and bridge reconstruction [J/OL]. Highway,2021(03):85-89[2021-03-16].