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CHALLENGES IN RECENT APPLICATION OF BASE ISOLATION TECHNIQUE IN HOSPITALS

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As Iran is located in one of the most seismically active regions, the design and construction of hospitals should consider the need to be operational during and after strong earthquakes for post-disaster rescue purposes. Keeping performance of IO (Immediate Occupancy) for structural and nonstructural elements during earthquake is very challenging, which is not often achievable through conventional systems. One of the techniques that has been shown that is able to improve the performance level of both structural and nonstructural components of the building with sufficient reliability is base isolation system (Naeim, 1999).

This study is focused on the challenges of construction process of one of the new and modern hospitals in the country. Currently, this project is under construction in the city of Kashan, in the central part of Iran. Although there are lots of challenges in design, modelling and proper distribution of base isolation units; however, a review of application of this system to the Kashan hospital shows that the main challenges are in the management and construction phase of the project. In fact, these management and construction aspects of the project have direct impact on its structural issues. Thus, the project delivery process, construction, and installation of isolators will be discussed in this paper. The relatively higher cost of base isolation construction has always been a controversial issue for authorities. As such, this article is considered financial issues too by comparing cost of conventional structural and base isolation systems. Providing a comprehensive view of the most important parameters for a hospital base isolation project is among the most innovating aspects of this research.

PROJECT DELIVERY SYSTEM

Delivery system consists of planning, design, construction and other services necessary for organizing and completing a building facility. Project delivery system should answer these questions:

- Which parties are involving on the whole process?
- What will be the procurement method?

A proper arrangement of “project delivery system” is a pre requirement of good quality for structural and nonstructural elements of hospital. Due to some consideration, the owner of this project, decided to use dual source project delivery which means two entities were responsible for contract. As shown in Figure 1, one entity is responsible for design and the other is responsible for the whole construction process. A very important process of procurement, supplying of isolator, relied on the owner itself. As a general rule for allocation of risk among different parties involved in the project, no one should accept the problems created by the other parties. Through this structural relationship, as some part of procurement process relied on the owner, the unexpected delays of isolators affect the other parties, design firm and general contractor. Therefore it seems it would be more efficient that general contractor would be responsible for the whole procurement process. As isolators are not ready-made, and should be ordered at least 4 months before installation, any delays through this process would impose delays on the part of stages including installation of superstructure. General sequence of activities is shown in Figure 2. It should be noted that when preliminary design process is completed according to the prototype test results, verification of this process is essential.

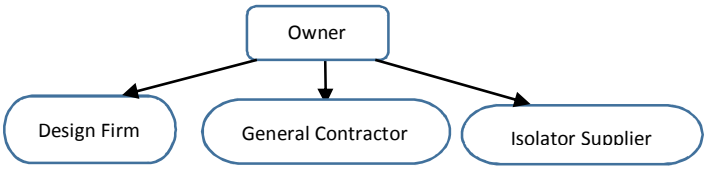

Figure 1. Structural Relationship.

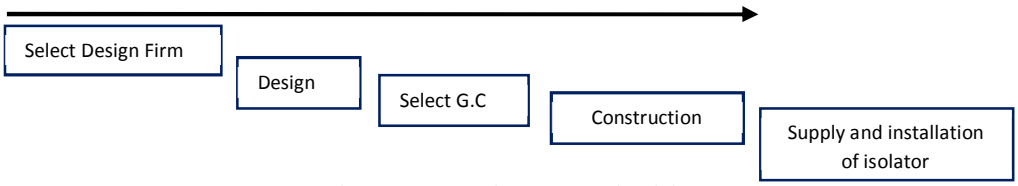

Figure 2. General sequence of activity.

CONSTRUCTION STAGES AND SCHEDULING

The diagram given on Figure 3 illustrates the time scheduling of the project. The overall planning considered construction process of substructure with fabrication of steel frames for superstructure simultaneously. That is to say, at the end of construction process of substructure, steel frames produced in the factory, are ready to install. Of course isolators would be installed between these two processes. This approach could be ideal when the time is an issue, to help in delivering the project on time. This is the most optimal way to handle the project in terms of timing. Having reduced the weight of steel frames and foundation components, obviously, the base isolation system has a cost saving on superstructure. Even neglecting this saving, the additional construction cost of base-isolation compared to equivalent conventional construction fluctuate slightly between 2 % and 3% of the total construction cost (Di Sarno et al., 2007).

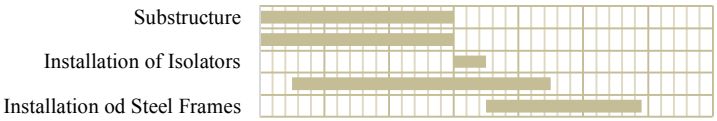

Figure 3. Time scheduling of the project.

CONCLUSION

This study is among very few researches that applied a comprehensive approach in studying a real case of building with base isolation system. The data that is provided in categories of managerial, financial and technical issues can be greatly facilitate future base isolation projects. The case study reported here is a base isolated hospital under construction in the city of Kashan. A review of application of this system to the Kashan hospital shows that the main challenges are in the management and construction phase of the project. These management and construction aspects have direct impact on its structural issues. The project delivery process, construction, and installation of isolators are discussed in the paper. It is concluded that identifying the party in charge of providing the base isolation unites and proper arrangements of the construction phases are the two most important issues affecting the application of base isolation systems in hospital buildings.

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