PERFORMANCE STUDY OF CONCRETE STRUCTURES OF HOSPITALS IN KERMAN, IRAN

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Keywords: Concrete Structures of Hospitals, Seismic Rehabilitation, Performance Based Design, Pushover Analysis Target Displacement

Hospital is accounted as an organization which satisfies the needs of humans and also it is one of the main parts of the health system. Based on the necessity of using the hospitals during the earthquakes, studying the seismic behavior of concrete structures of Kerman hospitals, considering the performance level which indicates the real performance and behavior of structures during earthquake and also determining the weakness points of the aforementioned structures based on the Instruction for Seismic Rehabilitation of Existing Buildings NO. 360 (First Revision), seems essential as well, whether these kinds of structures that must provide the services to the patients during the event of earthquake possess their performance which is the immediate occupancy [Basic Safety Earthquake 1 (BSE 1)] and life safety level [Basic Safety Earthquake 2 (BSE 2)] or not. So, in this paper, these issues will be studied. The resulted applications from this article are the acceptability of codes of designing (Iranian Code for Design) the most important structures such as hospitals which are based on the power/force and also comparing it with the Instruction of Rehabilitation as designing is based on the level of performance and deformation. In this article, four concrete structures of hospitals in Kerman which are the most important hospitals of this city were evaluated by the non-linear static analysis and Seismic Rehabilitation of Existing Buildings NO. 360 (First Revision). The first hospital which was evaluated was Afzali Poor with an area of 40,000 m2 located in the highway of Imam Khomeini. This hospital which was designed by the design consultant in 1986 and its construction process was initiated in 1999 is accounted as the most hospital of Kerman. In 2002, this hospital was opened and initiated its activities. The aforementioned hospital consists of 33 blocks (1-33) in two and three stories [floors] and due to its width, block no.: 10 was studied. This block with the infrastructure [area] of 3,000 m2 is in three stories. The second hospital which was studied is the psychiatric hospital with an area of 10,000 m2. This hospital was designed by the design consultant in 2013 and its construction process was initiated in 2014. Due to its width, only three blocks "A, G and F" were studied. Block F with an infrastructure [area] of 3000 m2 is in two floors and also Block G and Block A with infrastructures of 1000 m2 and 382 m2 are in two and one floors, respectively.

Based on the displacement of the final aim in Basic Safety Earthquake 1 (BSE 1) and life safety level [Basic Safety Earthquake 2 (BSE 2)] of the modeled structures, it is observed that the structure of block 10 of Afzali Poor hospital does not reach its displacement means 25 cm. The general enveloping curve of structure continues to 22 cm and it faces failure in this displacement and affects the whole structure or damages it. But the enveloping curve of blocks A, F and G pass these target displacements and do not face failure. This means that the structure of models can carry the target displacement in Basic Safety Earthquake 1 (BSE 1) and life safety level [Basic Safety Earthquake 2 (BSE 2)] . Moment in the beams of the structures of psychiatric hospital in Kerman is the control deformation as it was shown in the figures related to the plastic hinges of beams. Most of hinges which are formed in the beams maintain their needs which are the immediate

occupancy [Basic Safety Earthquake 1 (BSE 1)] and life safety level [Basic Safety Earthquake 2 (BSE 2)]. Axial force and the moment of columns in these structures is the control deformation which is being defined by the plastic hinges related to the graph of the interaction of axial force and flexural moment as it was shown in the figures of formed plastic hinges in the columns based on BSE 1 and BSE 2. All hinges of columns will be in the immediate occupancy and life safety level as provide the performance of the above mentioned structure in BSE 1 and BSE 2. Shear in the beams and columns is accounted as the control force. So, all beams and columns satisfy the required shear in BSE 1 and 2. As well, moment in the beams of Afzali Poor hospital is the control deformation. So, most hinges which are being formed in the beams are in the domain of immediate occupancy. Axial force and beams' moment in this structure is the control deformation. Most hinges of the columns are in the field of complete failure and damages the whole structure. The main reason of the lack of general enveloping curve of the structure toward the target displacement is the weakness of columns and the formation of flexural mechanism in the columns. By studying the concrete hospitals of Kerman (as mentioned in the results of hospitals), it seems that the hospitals which were investigated by the new edition of designing codes (Iranian Code for Design) (such as Blocks A, F and G of psychiatric hospital) in BSE 1 and 2 are able to reach their target displacements which is the level of the considered performance of structure and also do not affect the task of health system that is providing the services to the patients. The hospitals which were used in the design (based on the previous edition of designing codes) such as Blocks 10 of Azali Poor are not able to reach the target displacement in BSE 1 and 2 and for this reason, these hospitals are so vulnerable in the earthquakes of BSE 1 and 2. So, reinforcement is required.

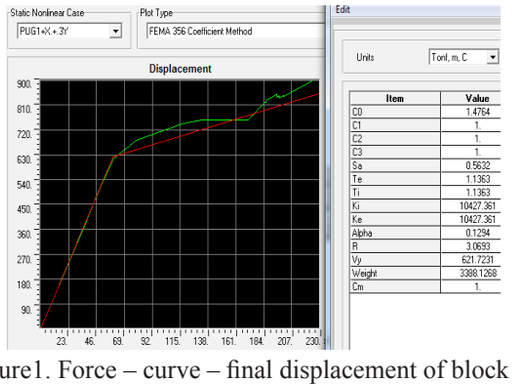

Figure1. Force – curve – final displacement of block 10

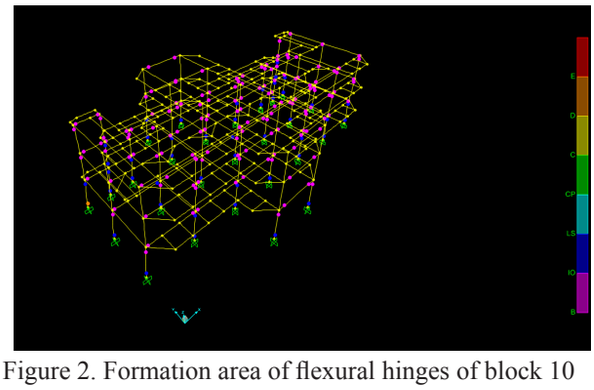

Figure 2. Formation area of flexural hinges of block 10

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