

# QUICK SEISMICALLY DIAGNOSIS OF IRANIAN HISTORIC BRICK BUILDINGS, THE ESSENTIAL SUSTAINABILITY STUDY; BY FOCUSED ON THE SADOSSALTANEH HISTORIC BUILDINGS COLLECTION OF QAZVIN

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## ABSTRACT

Accurate and reliable assessment to determine the seismic vulnerability of Iranian historic brick buildings can be a costly, lengthy operation and would be requires special equipment. Therefore, the ability to accelerate Iranian seismic vulnerability of architectural heritage is very important and timely decisions while preserving will be design, or at maintenance, strengthening, restoration and retrofitting of these buildings. This study explains the proper procedure on how to speed up the seismic vulnerability of monuments based on historical collection of brick buildings of Qazvin Sadossaltaneh; belonging to the Qajar period of history has done. This study utilizes the expertise Methods and local examination Iranian and International codes that are valid for qualitative and quantitative assessments of the required technical standards and regulations in the comment are relevant engineering. The results of this study are the classification of cases of major damage in the historic brick buildings; identify the destructive effect of the failure to explain the development process, treatment and methods of proportional strengthening to the damage cases of emergency. The main result of this research also identified of damage of brick buildings collection against of ability rate of the historic seismic vulnerability of these buildings. This study shows that although the geometric shapes and the relative of the walls in the historic brick structures in against earthquakes, potential and ability for seismic response is calculated according to provides; but due to lack of integration of technical components, the material weakness and lack of integrity in structural connections, seismic strengthening of the historic brick buildings is a problem and collection of this historic buildings will require seismic retrofitting. Finally, the basic criterion for evaluating the seismic vulnerability historic buildings to be observing the regulating criteria; is identify the ability rate of materials used in components and connections joints a historic structure.

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## KEY WORDS

Seismic diagnosis, Sustainability of brick buildings, Architectural heritage, Historical collection, Sadossaltaneh of Qazvin

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## INTRODUCTION

Comprehensive assessment of the risk to be monuments of engineering materials characterization, position and shape of the use of these materials, the structure of the buildings studied. The perimeter of the building can be helpful in determining risk historic structures. Therefore, studies to assess the stability, reliability and sustainability traditional materials used in monuments in dealing with the destructive agents of chemical, physical, mechanical and biological significance will be extraordinary.

In this regard, the performance evaluation of mechanical destructive on dynamic detection of seismic vulnerability of historic buildings due to the possibility of irrecoverable injury and human and financial losses due to the high value of historic buildings in the earthquake's destructive potential is important. Seismic vulnerability assessment and identify the strengths and capabilities of other monuments in Qazvin region with very high risk is the most important thing necessary for the provision of protection and maintenance of important architectural heritage, as the historic Sadossaltaneh collection.

In the other hand, the intervention of the seismic rehabilitation of historic buildings requires a detailed documentation, principled, rapidly and without any destruction or change in current status of monuments. Of course this matter is difficult to assess and analyze the problems faced by them. In addition, the application of visual and rapidly inspection to help normal traditional equipment causing uncertainty in the accuracy of the identification of weak components and materials used in the building by technical aspects of the specification are together with the lack of accurate diagnosis and correct positions the cracks and the risk of cracking of the structures within the

structural elements of monuments. So in this way, adequate assurance in the pathology even after the intervention of seismic performance and seismic rehabilitation of historic structures would not be achieved.

The use of non-destructive evaluation equipment and no contact surveying of seismic wave surveying temperature surveying data obtained from layer to complete the surveying and ensure the desired approximate analytical models in the initial stages of determining the seismic response of the monuments at the site for the buildings necessary to deal with earthquakes actions. Therefore, in the absence of sufficient time and lack of proper equipment, the specific intervention plans, it can be rapidly way to evaluate visual and valid standard codes applications easily with quickly enough goals to be achieved.

### **The process of pathology and develop conservation plans**

The process of pathological and destructive environmental and human factors in historic buildings it can be said, however, acting on the basis of theoretical principles policies, basic and focused executive management can be effective; but the maintenance and upgrading such buildings should pay attention to the environment and the up-to-date demands of social isolation developed. The general formulation of detailed plan explaining the historical context of the original structure and prioritize the valuation of the plan Building retrofitting and rehabilitation of existing buildings is necessary to prioritize. So in the pathology studies and reviews on existing historic buildings, identification of materials, mortars, structural system, construction technology, and restoration in accordance with the environmental conditions and needs of day are important [1]. If the management is evaluating and developing an outline and detail preservation, maintenance, consolidation, strengthening and retrofitting of historic buildings; the main factors that determine the structure of the system is affected by neurological or genetic pattern to be used, prevented waste of energy and rework, repair operations can be improved [2]. Thus the use of intelligent assessment system that can simultaneously detect defects and structural defects, probable causes and repair methods appropriate to the announcement, the process will be more effective [3]. On the other hand, to investigate the possibility of restoration of historic buildings, but they need to maintain the status quo, at first of all; it should be enough to cause damage done. Because restoring monuments to their previous status in some cases can cause their collapse and failure is intensified. Also important structural issues such as the unwanted buckling and dangerous (P- $\Delta$ ) deformation to its worn monuments had not been released [4].

Thus, in line with sustainable development, monuments need to maintain and deliver to the next generation and to preserve the cultural identity of technical specialists must comply with environmental protection of historic monuments of enduring utilizes [5]. Environmental considerations also play the role in the destruction of historical monuments acid rain due to atmospheric pollutants such as sulfur dioxide, nitrogen and carbon are worthy to study. These pollutants are cause of paint timber, metal corrosion, loose stone and lime mortar historical monuments [6]. In relation to the determination method of the need for retrofitting of historical monuments, considering the wear and tear and mechanical weakness existence of historical monuments structural elements; Retrofitting is not the only deciding factor in the history of well tolerated and of historical monuments should have to deal with severe destructive earthquakes. Historic building materials can not only be done to improve the technical quality of seismic damage and prevent future seismic and analysis of the historical monuments is an essential objective [7].

### **Analysis of the historic buildings and destructive factors**

In thermal expansion behavior and failure analysis of structural elements of the historic brick buildings, by finite element methods for the detection and display of cracking and the ability to track the damage and determine the cause of the collapse of the development process as well as numerical methods can be used [8]. Of course pathology of the damage to historic buildings should be based on assessment criteria for fatigue, creep and control elements of historic structures under long-term loading and fatigue cyclic loading part of poses done [9]. Therefore the modeling and analysis of mechanical behavior of historic brick buildings under long-term static cyclic loading and fatigue causes by tension turn up will be necessary [10]. Seismic vulnerability of historic brick buildings should also performance analysis as nonlinear seismic methods of historical structures, under the effect of external load destructive pages and the page with horizontal and diagonal cutting performance shearing to take place [11]. The nonlinear dynamic analysis of historic brick buildings were also found to be the best model for seismic evaluation of the mechanical behavior of these buildings is a material breaking the brittle evaluation. Because of the nonlinear structures under the external loading on this surfaces destructive influence of breaking brittle and tough to show weakness existence of [12]. Evaluation of shear behavior of historic brick walls of the

interior surfaces cyclic loading, with the ability to determine the diagonal represent a large cracking is worthy to retrofitting of [13]. However, according to traditional methods of evaluating seismic creative historic brick buildings, pay attention to the historic structure, the combination of structural walls and roofing components packaging, domes and minarets elements of the importance of internal and external style surfaces loaded at the junction elements of historic structures is clearly evident. However, the flexibility of the materials used in the historic structures, solid content (the absence of large openings) and wall thickness of the structure represents a historic brick buildings are seismic affordable [14].

In relation to the failure of historic brick walls can be as follows [Figure-1] be noted below:

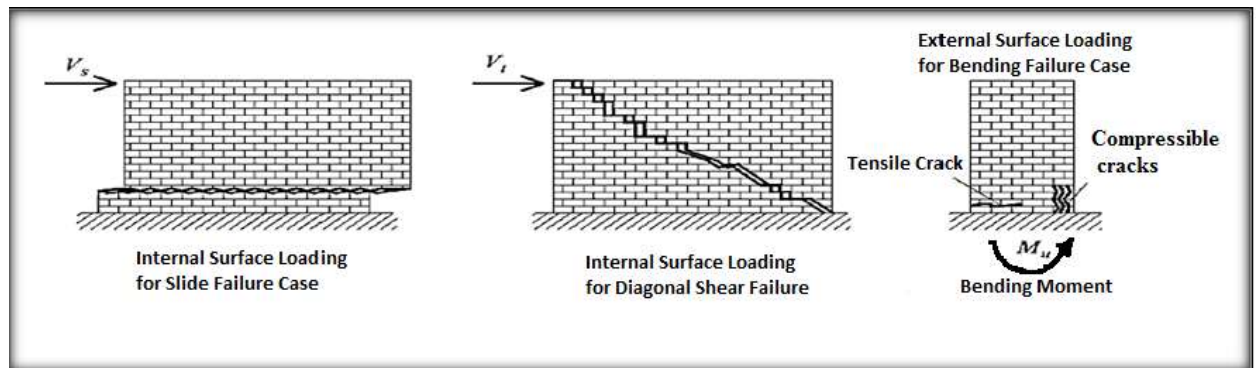


Fig.1. Diagram of the failure patterns by loadings on brick walls inside and outside of surfaces

### The consolidation planning scheme, strengthening and retrofitting:

Potential damage from frost to ease based on porosity, permeability and water absorption may be determined in structural materials of monuments, therefore, the probability of frost of rainfall on ground is the next problem should be studied porosity [15]. The porosity of the mortar used in the components of the historic monuments of clay, gypsum, lime with gravel and sand are mixed; could be the most important factor in determining the ability of destruction and retrofitting plan that is to be developed [16].

Lime gypsum mortars in terms of durability and sustainability for the restoration of monuments has been very successful [17]. Therefore, the use of mortars containing lime or limestone grout injection of resin that has the raw materials of monuments with sufficient homogeneity, due to the porous nature of lowering of monuments old mortars; these mortars in the design of these retrofitting can be utilized [18].

Organic additives plant or animal use in the traditional techniques, these mortars in the technology of monuments restoration is as well as to prevent the corrosive water penetration [19]. The normal practice is to reduce the amount techniques, these mortars carbonation pores are set in these mortars to 0.03 micrometer pore size limit [20]. So use of containing additives waterproof for restoration of historic brick buildings very useful and the appearance of items such as small micro cracks bumps and spines in the building to prevent the destruction [21]. The other hand containing pozzolan against atmospheric pollution and marine waters are corrosive resistance and good durability and even in the heating of the sun are also very resistant and sustainable [22].

Durable components and materials in the field of historic brick buildings (the brick) can also be said that there is the impurity; especially uncontrolled baking temperature of the bricks in the durability is very effective. In Contrary to the observations as follow [Figure- 2]if the bricks between 1000-800 °C baking temperature is adhered, low porosity and pore size of the bricks and well resistance over many years and have good sustainability [23].



**Fig: 2. Show the weakness of Components of the brick and mortars brick walls of the historical influence of long-term deterioration**

According to conventional seismic rehabilitation of the of the historical brick buildings by cause of brick walls weakness due to the structural elements of the dynamic performance of the earthquake; Mainly to strengthen the walls and provide a hard double diaphragm or adding shear walls or the use of seismic energy dumpers and use of materials and structural show the weakness of Components of slimy among historical monuments acting [24].

### Plan needs to decide on intervention

Develop a plan for the protection, maintenance, consolidation and retrofitting the performance of seismic Strengthening of historical monuments of Sadossaltaneh collection, at first of all we need; goals, philosophy and the design requirements specified by the employer. In other words, based on the level of performance required by the employer duties measures will be necessary in order to plan. Therefore, according to the prediction of earthquakes of intensity (low to very destructive) with a return period of 10 years, 475 years and 2475 years, the seismic performance of desirable for employer in historic monuments in five levels or functional aspect of the retrofitting plan can be developed and implemented in stages:

- 5-1- Meters exploitation capabilities without interruption and without any financial deterioration or damage
  - 5-2- Availability in mind the risk of local failure or limited of the historical structures
  - 5-3- Availability only in terms of ensuring of life safety to the people present at there
  - 5-4- Availability in terms of the probability of reaching the verge of fast collapse and destruction of the historical structures
  - 5-5- Availability of urgency in certain situations likely to be unstable and collapse stage of monument structures
- So in this case to determine the technical condition of the existing buildings with desired conditions Technical Engineering assessment should be done in two directions as follows:
- a) The need to provide structural stiffness in dealing with the destructive earthquake and with no cracking
  - b) The need to provide structural strength in dealing with the destructive earthquake and flexibility
- So in the above technical studies and structural analysis of the structural members and structures of historical monuments, in the field of stationary (static) and dynamism (dynamic), the dual linear or non-linear states under favorable views of the employer could be done [25].

Then determining the limit of need for intervention in Strengthening and retrofitting of the historic brick buildings have special importance. In other words, it should be noted that the extent of intervention of the buildings of collection. On the other, the act must be appropriate for earthquake Strengthening and empowering potential as a percentage of acceptable failures and the grouping of the expected failures prioritize the destruction and renovation of historical of will be given for each structure of historical collection. For example, because of historical monuments mainly set of in four porches and the floors are not a lot, creating the risk of earthquake damage for visitors high to escape the building small (Because all people have access to the facilities at any location in the central courtyard). So determine aspect in developing performance level of retrofitting plan set of the historic brick buildings Sadossaltaneh collection acting According to rows (5-4) above, namely: availability in terms of the probability of reaching the verge of collapse and failures the historic structures fast, the best suitable, most economical and most executive stage in determining the level of performance expected from the historic set of historic structures will be considered.

### Technical Regulations and Guidelines or valid codes

Among the set of or valid codes regulations and guidelines on the evaluation and analysis of the seismic performance of historical monuments in Iran and more particularly described as follows of Qazvin Sadossaltaneh collection of historical monuments are worthy of presentation:

- 6-1- Regulations 2800 for earthquake in the design standard buildings (buildings, regular up to a maximum of 50 meters or irregular up to 18 meters in height)
- 6-2- Seismic of retrofitting of technical publications and guidelines issued by the Management and Planning Organization formerly (the vice president of strategic monitoring) number of publications: 251, 345, 360, 361, 363, 364, 371, 376 and the 390 necessity guidance, interpretation and description of service
- 6-3- Regulations and international standards as: ASCE and FEMA and CHBC and UCBC
- 6-4- The instructions in vulnerability analysis and seismic rehabilitation of existing buildings Building unreinforced and compile and promotion of national regulations issued by the office of the Department of Housing and Urban Development
- 6-5- Section VIII of the National Building Regulations the Building Design and Construction of Buildings issued by the Office of the National Building Regulations

It should be noted that presentation set of regulations have been published over the past decade largely formulated in their content than the dignity and civility. Most importantly, the regulation in accordance the specific of requirements for seismic rehabilitation of historical monuments in Iran worthy the formulation is not over.

Globally, the regulations for the protection of historical buildings in California CHBC published in America in 2007; seismic vulnerability analysis of historical monuments to Building Regulations, the regulations on the Protection of buildings of collection unreinforced standard UCBC, has been postponed.

Therefore, as our evaluation, can be specifically designed according to the 2800 for earthquake Iranian standard buildings [26] and rapid assessment guidelines [27] the masonry and building of retrofitting regulation for unreinforced [28] (Publication No. 364 and 376 vice president of strategic planning and monitoring) the historic brick buildings of collection set of Sadossaltaneh collection in Qazvin and pathology would be evaluated.

### The process of seismic retrofitting plan in design category

These categories include five sections, identification, pathology, performance analysis, develop conservation plans and interventions for the treatment of the seismic weakness. Seismic pathology department for historic structures collection of both qualitative and quantitative measures must be principled. In other words, after the initial assessment of the relevant of historical monuments and determine the priorities and objectives identified in the seismic performance level desired, the technical characteristics of these the historic buildings, as well as geophysical and geotechnical properties of context of the site recognition of these buildings will apply. The seismic vulnerability assessment of seismic rehabilitation of buildings of collection based on the objectives and performance level defined and also select appropriate strategies, develop maintenance plans, seismic Strengthening and of retrofitting plan of will be used.

In other words, due to economic considerations, political and social as well as proposed solutions and executive stage facilities and specific terms of each monument; executive stage interventions related to the maintenance, conservation, monitoring and continuous assessment of the failure process and the phased executive stages, much of the consolidation, seismic Strengthening and retrofitting the buildings will be developed to execute on.

The analysis of the seismic performance of each of the Show the weakness of elements of set of the historic structure should be considered as separate from one another. In other words, given the destructive effects of natural factors such as light, heat, cold, wind, water, moisture, freezing and apply knowledge of mathematics and geometry, physics, chemistry, mechanics and strength of materials, skills and capabilities of the performers and practices and methods and the production of conventional materials and the elegant historic buildings and of historical monuments, including the specification of structural elements following; foundation, walls, arches, domes, minarets, or are stairways separately.

This means that the development plan for the seismic rehabilitation of historical monuments set of Sadossaltaneh collection cannot rely on exclusively building engineering. It should form a formidable engineering task force and the artistry in science and engineering motivated the philosophical vision of preservation and authenticity of limit of need for a sense of duty towards the preservation of historical monuments includes all fields of architecture,

structure, mechanic and electric, construction of buildings and landscaping execution, interventionist activities, designed and implemented.

So to summarize qualitative and quantitative pathology of historical monuments as the following could form the seismic rehabilitation plan will be effective:

7-1- qualitative pathology objects: including inspection and engineering data collection, preparation of technical documentation for site of buildings and properties, initial assessment of the status quo in terms of geometry, structure and neighborhood, previous interventions, laws and regulations and technical considerations executive stages and specific tests are needed determine type and quality of reporting vulnerabilities the general considerations and determine necessary to carry out the next phase. (for quantitative pathology)

7-2- quantitative pathology objects : including determine the seismic site and Liquefaction of mental capacity, consolidation, define and determine intensity of earthquake acceleration performance level during the earthquake, providing site-specific acceleration range, determine detailed information of the seismic vulnerability of historic buildings, maps as built and complete technical documentation related to the monument, mechanical determination of properties of materials and Show the weakness of elements of the historic structures and stiffness determine capacity and deformability are performed detailed studies of the seismic behavior of the members as quantities' objects help modeling structure, load carried by the possibility and determining the amount of inner stress of members and deformation likely to report quantitative vulnerability in the case of joints and seismic rehabilitation of vulnerable members qualified for the interaction site and historic buildings in the case for earthquake [27].

### **Theoretical Basis and technical engineering requirements of retrofitting plan**

In recognition of the current status of seismic performance of their monuments and in dealing with the destructive earthquake Technical Engineering relevant to the goals and expectations must be from qualitative and quantitative aspects of seismic vulnerability detection and the system of building structure How it works in the event a structural disaster, we have enough information. In particular, the map modifications, floor modifications, modifications and additions in the facade decorations, resistance changes, modifications material hardness materials, modifications made to the structural and non-structural components And also technical and constructive errors and mistakes of the previous executive stages, must be specified.

Then improvement of retrofitting plan with respect to the formulation of appropriate design, low weight materials to high strength material , good speed of the executive operations, no need for heavy equipment, parts ease of installation cutting preparation, sufficient resistance to corrosion weathering, a good formability , reliable pre stressing before and after the operation,Sufficient compatibility with previous the historic of mechanical structural materials, sufficient to justify the economic conditions, ability to maintain stiffness, strength integrity in the joint with right to respond in accordance the terms seismic to pay [29].

### **The rules in force in historic buildings set of Sadossaltaneh collection**

Although the major of historical monuments of the general aspects of traditional architecture with its strong fundamentals to witness the historical stability and against pests environmental disasters, particularly earthquakes has local horrific have survived, But the identification of the seismic capacity of historical monuments such as the conventional masonry building, before any interventions falling awkwardly valuable architectural originality; procedural rules should be controlled. If the of the deterioration of materials system of structure should to eliminate the creep acceptable failures of the action. Accordance with the paragraph (8-2) issue VIII of national regulations required for the overhaul of buildings all of the administrative and technical procedures in the whole of country (especially brick buildings without tie packaging) must be specialized the site in flood, for earthquake ground liquescence, large consolidating, falling rocks, landslides were safe and reliable operation of existing materials to be been detected. Also length is twice the maximum width of the building. The maximum size is limited to 25 meters. The building is almost symmetrical with respect to both its major axis. Be sure to continue on the foundation seam separation is required. The maximum of building height of each floor is three meters. Holder at each edge should not be more than one-fifth of that edge. Structural integrity of in the joint would be well established. The building would not be built on sloping ground. The width of the foundations must be one and a half time due the width of walls rely upon them. Foundations must be made by lime quality as concrete base on the lime mortar by grade of at least 350 kilograms per cubic. Seats on the following packaging at least 30 cm

above the floor is finished done with adequate moisture insulation. The structural walls packaging stiffeners must be in maximum distance of 5 meters. The minimum width of the building of 35 cm walls at least one-tenth of would not be height of the wall. The wall opening up area level third area level would not be structural walls. More importantly; packaging the flat or sloping or curved roofs must be enclosed the tie horizontal packaging. The minimum height of the arch or arches rise into the middle third of the diameter by radius must be in the lateral openings. The maximum height of the chimney would be one and half meters above the top level of the roof. Facade decoration would be associated with the structural system. Asphalt Shingles moisture insulation out of the wet ceiling roof must be principles and technical direction of the slope with the sufficient overlap [30].

### The essential of seismic buildings pathology set of the historic Sadossaltaneh collection

The considerable for the set of in accordance Sadossaltaneh historic buildings collection are above regulations as follows;

- 10-1- necessity of preserving architectural heritage authenticity of the valuable set of historic Sadossaltaneh collection the historic to transfer the wealth to the next generation
- 10-2- considering on geotechnical and geophysical characteristics of context of the site, determine possibility falling objects and debris capturing risks related to the neighborhood of the buildings
- 10-3- continuity of structural members, the weakness of elements , the rate of oldness in existing materials between components, broke ability the brittle elastic mechanical behavior, the degree of gravity, inertial motion of the historic structures
- 10-4- status presence of underground water, water effects, descending, ascending penetrating moisture from inside or outside the body of historic structures
- 10-5- option to keep maintenance, conservation or seismic Strengthening and retrofitting the historic structure while maintaining the form, original shape materials the historic authenticity of the historic structure
- 10-6- considering on the failure modes failure process structural members, the weakness of brick elements of historical monuments (unreinforced without tie packaging) severe to in site-specific earthquake
- 10-7- gain sufficient knowledge of the properties of shear cracks in horizontal or vertical compressive or tensile cracks in the plane diagonal horizontal cracks or bending cross outside surface
- 10-8- pay attention to the cracks of the horizontal torsion asymmetric buildings And also horizontal existing cracks in the roof, the roof and Holder unusual horizontal sliding roofs edge
- 10-9- accuracy about the cracks and bumps caused by and deformation caused by the driven arched roofs or dome without having to tie horizontal packaging
- 10-10- considering about of the placed openings severe to in the walls of the structural members, distribution of pore in structural wall members of historical monuments
- 10-11- sufficient attention into the structural wall members, separation severe to in longitudinal and cross axes and assessment of compliance in a maximum length of 25 meters to separate the structural wall members for integrity of unreinforced buildings (unreinforced with ties)
- 10-12- careful review of of interventions to performed before the effect of modifications severe to in geometrical, physical, chemical, mechanical effects resulting particularly severe to in seismic performance and the bearing capacity of relevant

In final statement and a brief description: inspect the damage to the health and empowerment system of structure of historical monuments should be done as a whole. It means that the destructive effect of destructive environmental factors cannot afford to tolerate the effects of these factors severe to in materials and the weakness of brick elements system of structure, for preserving the authenticity of has the raw historic structures before and after the implementation of the seismic rehabilitation should be considered.

## RESULTS







By reviewing the presentations in the form of excerpts and highlights can be said According to the evaluation table of contents [Table- 1] although aspects of the geometry form the relative supply of the historic structural relative ratio percent (Gahremany yard and Negarossltaneh yard) severe to in earthquake, the good talent capacity to respond the expected seismic calculation is according to, but some basic technical and constructive problem were occurred, diagnosis of historic buildings such as the seismic stability, doubt that they should be analyzed in more detail.

Of course, these causes would take in the images on the table [Figure- 3] that have been classified:

**Table: 1. Quantitative evaluation status by geometric structural relative ratio percent valuable set of historic Sadossaltaneh collection. (in 2800 seismic design code)**

| The minimum required percentage | The relative percentage of lateral wall | The relative percentage of longitudinal wall | Name and Situation Of the Building | row |
|---------------------------------|---|--|------------------------------------|-----|
| 4%                              | 15.7%                                   | 17.7%  | Gahremany yard                     | 1   |
| 6%                              | 18.1%                                   | 22.1%  | Negarossltaneh yard                | 2   |

The assessments made accordance with by the Local in Views Pictures presented in the table below at images [Figure- 3]with the classification of the by geometric evaluation, vulnerability assessment, evaluation of the destructive environmental factors and ultimately the destructive incremental unwanted deformation on structural stage has provided:

|   |   |  |   |
|---|---|--|---|
| status openings<br>wall height and<br>geometric proportions                               |   |   | 1 |
| status deterioration of<br>severe to in bricks mortars in<br>structural buildings members |  |  | 2 |
| effect of precipitation<br>Water penetration<br>up and down of the buildings              |  |  | 3 |





**Fig. 3. The pictures of the destruction of the buildings seismic instability factors of the buildings in set of historic Sadossaltaneh collection**

11-1- walls of buildings of historic Collection In Contrary regulations or valid codes points surveyed, more than three meters high therefore need packaging horizontal.

11-2- structural walls that mentioned have openings with more than a third of area level surface of the wall.

11-3- the above structural walls has not the insulation seats by technical and constructive packaging, mainly from corrosion and moisture penetration, traction clay, salt corrosion and exhaustion.

11-4- roofs and the arch of that mentioned the buildings due to the lack of adequate insulation and moisture penetration of falling water, and washing cause lethargy of the vertical load-bearing the vertical structural walls, and the columns provides that explain.

11-5- foundation and the structural walls due to moisture passes through the ascending, descending, penetrating continuous weathering freezing removal periodic with clay mortar elimination, consolidation lethargy links have been.

11-6- no suppression packaging Horizontal curved roofs in the roofs, causing for sliding Horizontal roof and at the top of the side to create a diversion displacement of up to 60 cm into the central yard.

11-7- deviation non-vertical the edge of the central yard, which intensifies affects of (P- $\Delta$ ) the curvature and buckling unauthorized the structural walls is marginal increase the risk of the structural walls collapse.

11-8- due to the very high risk for earthquake site lethargy lack of the structural walls integrity of the roof and walls of historical monuments, the seismic response will not be consistent.

11-9- considering the possible penetration seasonal rainfall and damaging freezing cracking in the future due to roofs insulation, the structural walls strength lethargy destruction of the elements of aggravated will be.

11-10- to preserve the authenticity of historical monuments during earthquakes of early intervention and assessment, the buildings, the evaluation should be complemented with a non-destructive, non-contact equipment will be done.

11-11- because buildings of historic any interruption of the seams are not completely certain about the historic structures any neighborhood in the central between 25-30 yards of neighboring the buildings have not been separated, the cumulative probability of in the inertial mass unwanted Horizontal earthquake reached for all that mentioned the buildings in the collection of the structural walls elements, there will be currently.

11-12- due to the lack of separate collection buildings of historic of the structural walls, especially the lack of alignment in the roof of the adjacent layers; problem were occurred may hit the roof level air destructive these historic structures, especially in the corners and at the junction of the roofs there will be aligned non-connected.

## CONCLUSION

According to the results, the seismic rehabilitation of historical monuments currently reasons cited is required. So improving the quality and strength of materials is an essential building of historic. On the other hand the structural walls interventions in the historical monuments by cause a central courtyard with a minimum of procedures; (availability in the conditions the probability of reaching the collapse failure process structures fast) would be suitable and economical. In addition, in order to avoid duplication in the interventions should more accurate evaluation of seismic of the buildings the buildings set of historic Sadossaltaneh collection a comprehensive, integrated, non contact with specialized equipment for nondestructive even if a quantitative done. In this evaluation, modeling and analysis of the seismic performance of structural elements are particularly technical evaluation the interface between adjacent historic structures in that mentioned is essential.

**CONFLICT OF INTEREST**

None

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