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Assessment of concrete by using incremental dynamic analysis method

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ABSTRACT: *In this paper, the seismic performance of reinforced concrete constructions with moment frame system that by using the common rules has been designed, by probabilistic method is evaluated. In this study, six concrete moment frames with medium formability and with high degree of importance in Tehran city on the basis of regulations and standards of Iran design and in Open Sees software modeling and assigned of nonlinear behavior of structural components was performed. To perform incremental nonlinear dynamic analysis from the suggested number of 22 pairs of accelerograph related to remote domain available in FEMAP-695 regulations about hard soil was used. Selective accelerographs into two methods by using spectral acceleration of IDA curve mean once and once again with spectral acceleration of 2800 standard plan were scaled and in time history analysis of frameworks under the study were used and mean values of maximum relative displacement between the floor and maximum displacement of roof was obtained. for better judgment about frameworks under studied in SAP software under incremental nonlinear static analysis taking into account the target displacement to maximum displacement mean of roof obtained from nonlinear time history analysis was placed and components yield and the entire structure was investigated. Also the results resulting from probability of exceeding the performance of concrete moment frame structures with very high importance and high performance range shows the continuous use.*

Keywords -*incremental nonlinear dynamic analysis (IDA), seismic performance, concrete moment frame, breakdown, uninterrupted usability*

I. INTRODUCTION

In recent years with advances in technology and experiences from past earthquakes researchers found that for safety design against earthquake control methods with power are not responding to the needs of structural seismic and the displacement controller factor is more effective method. On this basis design based on performance for different levels of earthquake was created, in which inelastic displacements more than design based on the elastic forces isnecessary. These researchers nonlinear static method to check non-elastic displacements and predict the behavior after materials flow at the disposal, and it by applying different loading patterns have expanded so that now this method because of the ease and well accuracy in all regulations of the world including 440,360,274,273FEMA and ATC-40 and Vision 2000 etc. has been proposed. Researchers like passage of static analysis only to incremental static analysis (push over) and from time history analysis only to incremental time history analysis so that the earthquake loading be scaled on that, have conducted. With the advancement of computer science and its calculations capability, Cornell and Vamvatsikos [1] devised the IDA method, that is a parametric analysis method that needs and seismic capacity by influence the structural models to the different accelerographs of the earthquake that have also scaled are achieved. So that this method has recently been accepted by FEMA as IDA incremental dynamic analysis as a modern method to determine the overall capacity of structures has been authenticated. In fact, all the researchers with comparing the existing methods to improve these methods and Invented a new way were discussed so evaluation of earthquake lateral load distribution methods has a long history.

According to the 2800 standard of Iran National Building Regulations sixth issue of Iran, moment frames is frame in which the behavior of members and connections are mainly moment. As a result of severe earthquakes, moment frames should be able to meanwhile the experience of relative deformations of levels without destroying in their beams and columns, tolerate lateral forces and be transmit. So in this system columns under axial force and moment and cut are placed and beams are under the cut and moment. [2]According to the ninth issue of Iran National Building Regulations formability is the ability of energy dissipation by the nonlinear behavior the whole structure or its members, under the influence of deformations of going and backing with large range without an appreciable reduction in their resistance. Also this regulation defines the following three regions formability according to the power of energy dissipation of structures and for each one also offers criteria whether in design or whether in construction site discussion. [3]

FEMA and ATC regulation's writers by regarding the importance and accuracy of incremental dynamic analysis issue in a joint project with the name of FEMAP-695 were studied this method and conditions and recommendations for conducting this analysis were presented in this study, addition using them but also for more accuracy from the selective accelerographs of this regulation has also been used. In the majority of scientific researches to dynamic analysis of two-dimensional frame are confined and from the effect of the interaction frames are ignored. So in this research according to the latest changes of FEMAP-695 instruction to evaluate the two-dimensional concrete moment frame a structure with medium ductility by internal regulations rules has designed to two-dimensional incremental the dynamic analysis method is discussed. Up to fact of these frames performance based on being two-dimensional of model and analysis, taking advantage of incremental dynamic analysis and applying the measures of latest instructions (FEMAP-695) fully is checked.

in this paper, three concrete structural frames, that from each one 2 frame, with a span length and different height with medium ductility base on the 2800 standard and the sixth and ninth issue of national building regulations by using SAP2000 software is analyzed and designed, and to evaluate the performance of them as well as the ability to attract and energy dissipation caused by various earthquakes, by using criteria of FEMAP695 and remote area records proposed inn these regulations and recorded on the site of PEER, and two-dimensional simulation in Open Sees software, under the incremental nonlinear dynamic analysis were placed until in relevant curves, seismic performance area of threshold of breakdown to be explored. The level of breakdown performance is said to the level of performance that structure to lose the ability of vertical and lateral bearing. this limit for IDA curve according to FEMA (2000a, b) equal to equal to 10% or gradient of the curve of IDA, to reach of 20% of the elastic gradient can be selected that point as the performance point of structural breakdown.

II. Materials and methods

1.1. Incremental nonlinear dynamic analysis method

Since the to achieve capacity of structure beyond the elastic limit need to use of nonlinear analysis and considering that in the meantime incremental dynamic analysis method (IDA) due to the lack of lateral load pattern and distribution of shear in height in terms of theoretical and practical have much lower problems, to this reason for monitoring and evaluation of unusual and irregular structures or structures with a high degree of importance from this method is used. As a result of IDA method is to obtain one or more curves that in them damage parameter can be expressed in terms of intensity or vice versa. The unique information these curves express about the nature of the response of a few degrees of freedom constructs that can be justification on the development of this method by existing of time difficult process on it. In addition, with high accuracy of this method can be received performance of other methods presented also well. It is worth noting that previous methods did not have this ability completely. The purpose of the four-lane curve: Area of elastic, hardening positive (non-negative), negative hardening and smoothly resistance of final residual is that by falling towards decays the zero resistance. By having this curve the actual system behavior and design parameters will be much clearer and can be realized to verify the previous methods such as types of lateral loads pattern of Push Over method or spectral and linear method for estimated in behavior after the structure failure Because the concrete and its behavior in range of nonlinear behavior is a bit complicated, so by having such an instrument can be studied with more detail to the performance of a concrete structure against earthquake [4].The first step in performing an IDA analysis having a good understanding of inputs and outputs of this type of analysis recently Seismic Research Institute in Berkeley, California is a logical process for solving this problem has been presented. This process is defined as way which initially by performing a seismic risk analysis in desired area a parameter called seismic intensity measure or IM as an input to the structure to be applied. In the next stage by incremental nonlinear dynamic analysis for every IM, structural response to existing seismic stimulation, obtained and by name of engineering parameter of representative structure needed (EDP) will be achieved. In the next step with the introduction of a structural damage indicator can be achieved damages occurrence

probability or exceed the maximum allowed probability of vibration input of a specific amount and also in next steps can be determined the repair costs amount caused by compensation. The IDA curves are a series of IM curves against EDP that the probability of lateral studies on it will be done. [5]

✓ **Scale factor (SF)**

Scale factor is a non-negative scaled integer accelerograph that with it's multiplied in initial accelerograph, accelerograph scaled is obtained. Although the scale factor is the easiest way to create an accelerograph scaled. [6]

✓ **Intensity Measure of earthquake (IM)**

Earthquake intensity measure a accelerograph scaled, a non-negative number that by a function dependent on the initial accelerograph and increases linearly with increasing the SF. Large quantities for determining the intensity of an earthquake have been suggested but may be how to scaling them not always clear. Such as: seismic moment, earthquake duration and the modified Mercalli intensity and typical examples of IM, including peak ground acceleration (PGA), peak ground velocity (PGV), acceleration response spectra for 5% damping and mode in the first cycle time for structure ((T1, 5%) Sa) and more. [6]

✓ **Damage Measure (DM)**

Damages Measure is a non-negative number that represents the response of a structure modeled in effect of seismic loading determined in the previous section. In other words, DM is a visible quantity that is part of output relevant nonlinear dynamic analysis or is derivable from it. [6] Types of malfunction indicator are: Maximum shear of foundation, nodal periods, maximum formability floors, different damage indices (such as the cumulative hysteretic energy, the index of maximum relative displacement for roof or ROOF $^{\theta}$, or the maximum relative displacement or MAX$^{\theta}$ floors etc. Selecting a suitable DM depends on the type of structure and type of application. May be of two or more DM For different response characteristics, Limit states or failure modes be used. To assess the damage to non-structural members in a multi-floor frame of the maximum accelerations the floors is a good choice, On the other hand to assess the structural damage to a building, MAX$^{\theta}$ well is in relation to the period of connections and general or local breakdown for the structure And a DM is appropriate.In this study MAX$^{\theta}$ as DM used has been selected. Response of structures often marked numerically is usually the absolute value of them is used. Or positive and negative sections are discussed separately. [1]

2.1. Modeling the frameworks of under the studied

Concrete structures 4, 8 and 12 floors from each 2 frame with length And various floors based on the height of 2800 standard (Third Edition) sixth issue of National Building Regulations loaded And by using the software of SAP2000 And reinforcement (tensile and compressive) beam and columns sections by using ACI318- 99 regulation of this program have been determined.

It is noteworthy that for the design of these armatures moment, once by combining the ACI318- 99 load and conditions the same regulation, determined And once again by combining load of the ninth issue and regulation of concrete Canada, 2004 were determined and choose the diameter of the armature based on the obtained areas by so performed that be covered both regulation.

In addition, to ensure once For the most critical loading position Ninth loading compounds issue of Forces Created in a determined element And Based on the regulations issue of Ninth National Building Regulations rebar design was done. Results mainly between the results of ACI318- 99 and concrete Canada regulation of 2004 were placed and the number of elected rebar was responsive requirement of this regulation as well.So can be claimed that moment armatures of these models criteria issue of Iran's ninth national building regulations are satisfied... Shear armatures (stirrups) also based on the regulations formability of Ninth National Building Regulations issue and the most critical loading position has been determined.

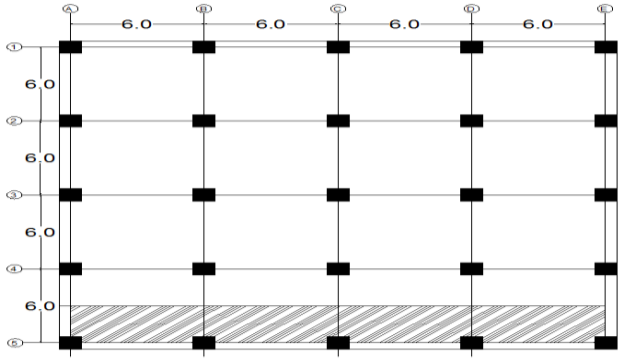


Fig. 1. Structures Plan of S14, S18, S112

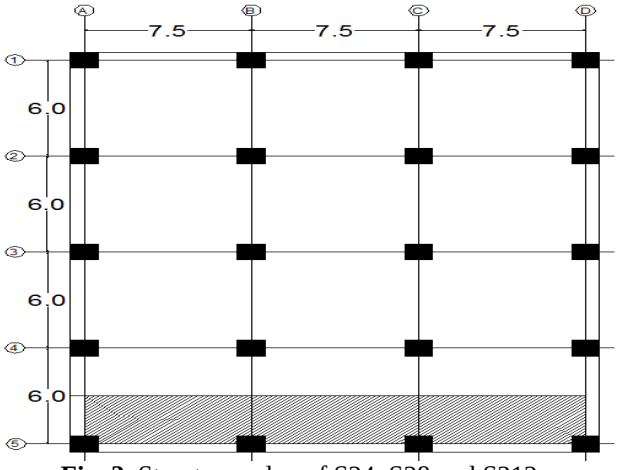


Fig. 2. Structures plan of S24, S28 and S212

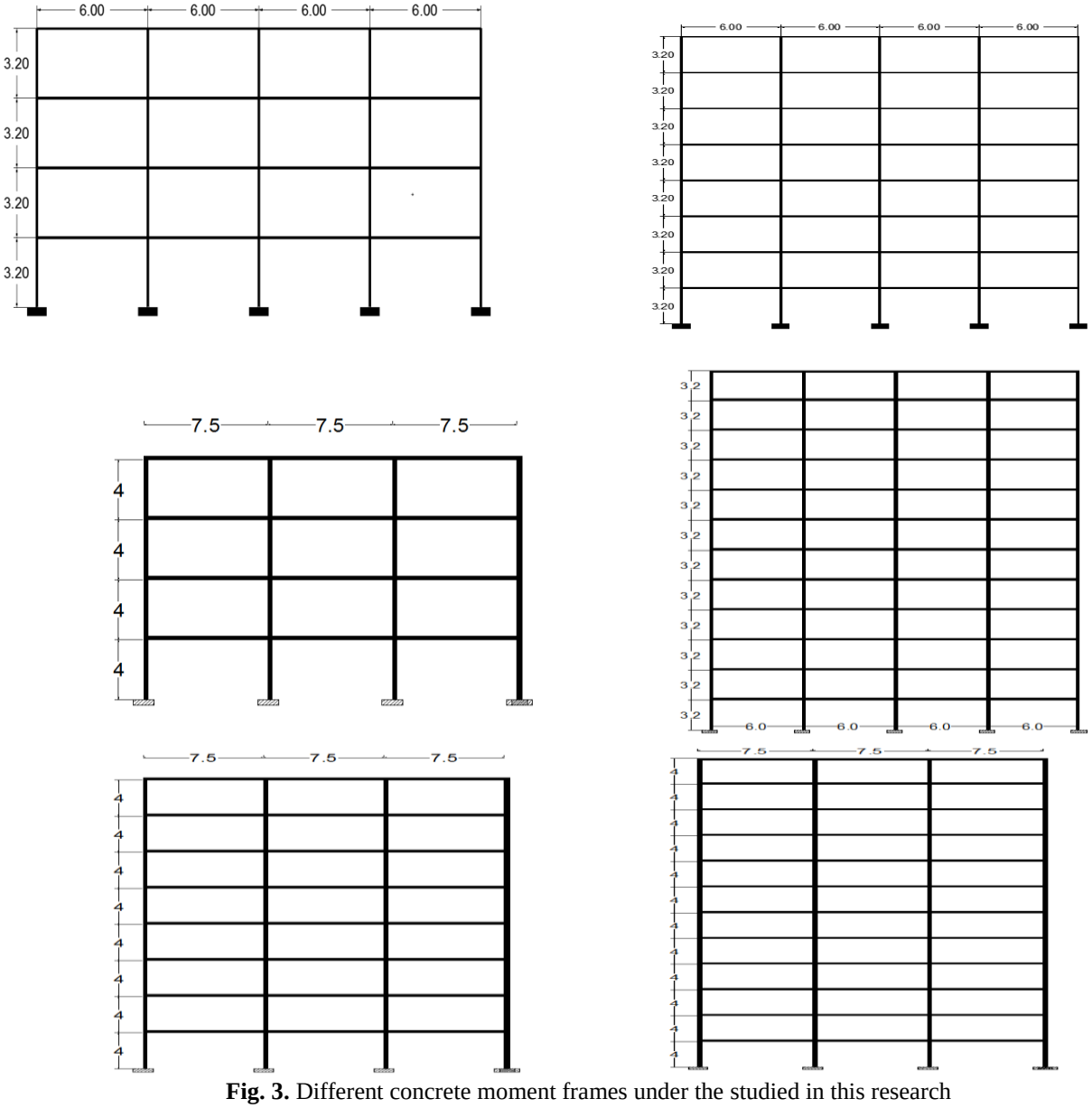


Fig. 3. Different concrete moment frames under the studied in this research

Once again based on the modifications made on nonlinear static analysis that this is not just to compare analysis results of nonlinear static and incremental nonlinear dynamic has been done. Total of 22 accelerographs from collection of accelerographs related to remote area available in regulation of FEMAP-695 belongs to the soil type 2 (according to the standard definition in 2800) we choose. So incremental nonlinear dynamic analysis of these accelerographs have been used.

The studied models in the Open Sees software made modeling and then based on the accelerographs of the selective in the previous step, incremental nonlinear dynamic analysis was conducted and the curve of this analysis (Figure IDA) for every 6 structure will be achieved. The outputs obtained from analysis (structural response to a gradual increase in the intensity of earthquakes) graphically depicted by using Excel software and the capacity of uninterrupted usage mode has been determined at 50% for every six frames.in this study from the two method scaling the pairs of accelerographs for evaluation Frames under study has been used: in the first method, at first should be drawn range of all selective pairs accelerographs and then spectral acceleration corresponding to like period, denoted item of structure (% 5, T1 (Sa)) to be extracted and the spectral acceleration corresponding like period of denoted item of structure (% 5, T1 (Sa)).Range of Iran's 2800 standard plan be achieved and obtained by dividing the spectral acceleration pairs of spectra accelerographs on the resulting spectral acceleration from range of 2800 standard plan, scale factor for all accelerographs pairs with this method is obtained.The second method is similar to pervious method With the difference that instead of spectral acceleration mode period of the first structure obtained from range of 2800 standard plan, Spectral acceleration of curve 50% (average curve) obtained from IDA analysis corresponding by maximum relative displacement between floors of 1% for performance level of usability without interruption have been used.After the scaling pair of accelerographs to two methods titled by using Open Sees software frames under study with selective accelerographs pair again put under the nonlinear time history analysis and results of maximum relative displacement between the floors and displacement of corresponding roof we extract and from them is taken the average. In addition to the better judgment of nonlinear static analysis (pushover) and viewing the range of plastic hinges in SAP software is used.

II. Results and discussion

From the frames, under the incremental nonlinear dynamic analysis (IDA), has placed and for all frames, viscous damping, equivalent (ξ =% 5) be considered that the amount conventional is for frames. Each frame, under the different intensities of selective accelerographs collection, was placed and their various responses, including relative displacement (Drift), Lateral displacement of floors and shear of foundation was measured.Each accelerograph with incremental indexes of 0.1g started and by step of 0.2 g, as far as software results reflects the lack of convergence, which probably indicate the general instability of the frame, has been continued. Also effects of soil-structure interaction have been ignored, but the effects of P - Δ in the analysis has been considered.

2.1. Curve of incremental nonlinear dynamic analysis

in analysis of IDA that by using the accelerographs numerous is done, like this article that from the 22 accelerograph pair have been used, instead of only a curve of IDA, we have a set of these curves that they say to it a curve set of (IDA Curve Set),. Each frame, will be had a curve set of IDA. In this article, by having 6 concrete moment frame models with the different average formability, Totally 6 curve set of IDA, will be produced. Selecting a proper damage measure (DM) or demand parameter (EDP) depends on application or the desired structure target.If the purpose of assessing the damage entered to non-structural elements available in a multi-floors frame, maximum acceleration parameter of floors is the best choice on the other hand, if the assessment of damage and damage entered to shear building be considered, the parameters of maximum relative displacement between floor (maxIDR) can be described as well the rotation of structural connections and plastic joints composed and thus general and partial breakdown of building, so is a good option nominated for parameter of EDP. Relative displacement parameter between floors (IDR) of a floor is the difference of displacement the roof of desired floor parameter of relative displacement between floors (IDR) of a floor, Displacement is the difference between floors and ceiling from the movement of the floor, divided by the floor height. Relative displacement between the floors of all floors Calculated for each time step in dynamic analysis and the maximum amount of it between floors is recorded And parameter of maximum relative displacement between floors (maxIDR), is obtained. So in this study, parameter of maximum relative displacement between floors (maxIDR) as the engineering demand parameter (EDP) has been selected. [1]

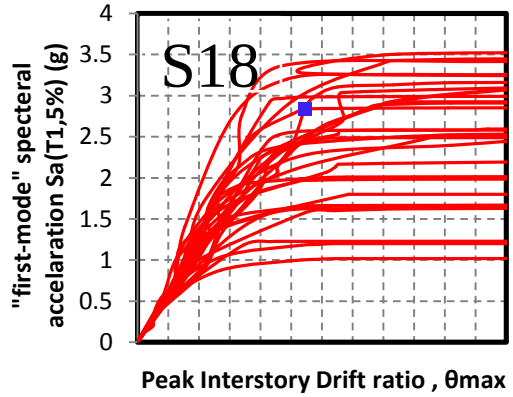
2.2. Review the outputs obtained from incremental nonlinear dynamic analysis

Something that has of importance equal to analysis, the next step of processing the data obtained and perhaps most important measure selection earthquake intensity (IM) and damage measure (DM) is appropriate. Several effective communication with the measure selection earthquake intensity (IM) there is [1], so here

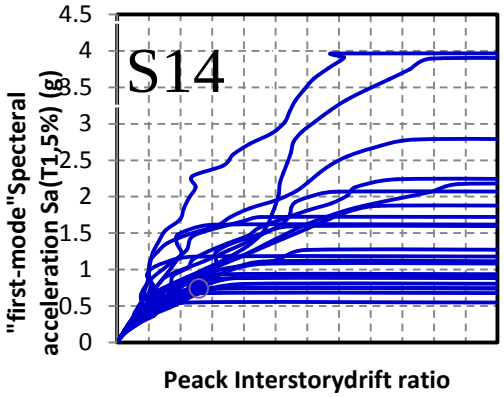
spectral acceleration) (SA (T1, 5%), Measure of earthquake intensity (IM) and maximum relative displacement between the floors (DM) have been our selective parameters. So only a small number of ground motion accelerographs to provide favorable demand and capacity estimates are necessary because it provides a complete description of response. After selecting Measure of earthquake intensity (LM) and damage measure (DM) we still have a lot of information obtained from incremental dynamic analysis (IDA) we face which should significantly ordered and be classified, that by using proper software This task very easily is performed. IDA curves set related to under study frames in Figure 4 have been shown.

2.3. Summary the curves of incremental nonlinear dynamic analysis

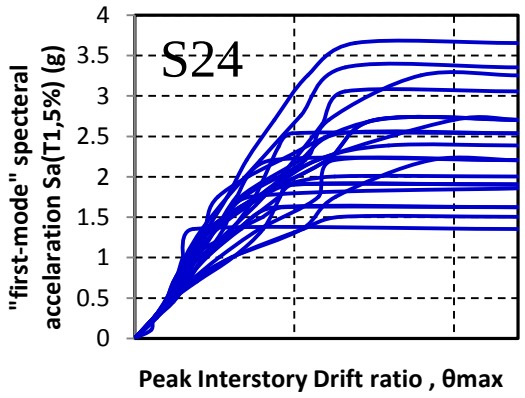
By creating curves of IDA for each record and then the definition of limit state, a lot of information can be collected. Only part of this information in the form of (4) has been shown. IDA curves shows a wide range of structural behavior and considerable changes of one record to another record that must by using the appropriate methods, are summarized. This information to distribution of mentioned damage measure in intensity measure of the earthquake and exceed of the threshold probability, a certain breakdown that in the level of mentioned intensity measure of the earthquake will be reduced. Capacities of limit state can be summarized easily in a number of central values such as (mean or median) and a measure of dispersion, for example (mean deviation). As a result we mean curve (50 percentages) of damage measure and intensity measure of the earthquake, have calculated, that in the Figure 5 as the graph has been plotted.



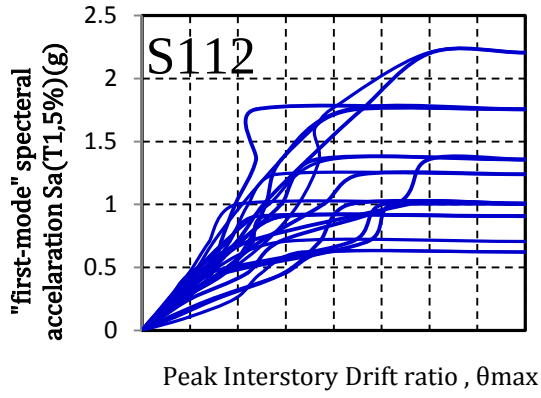
8floors 4 spans



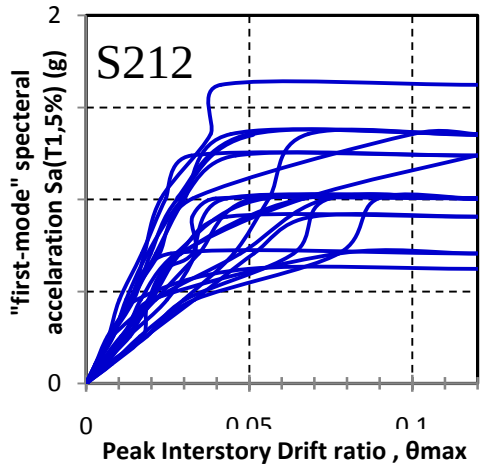
4floors 4 spans

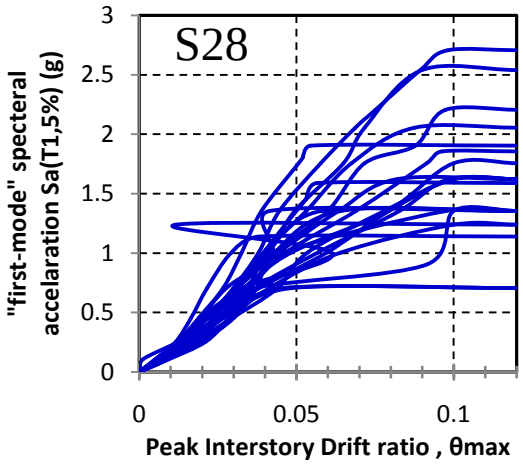


3floors 4 spans



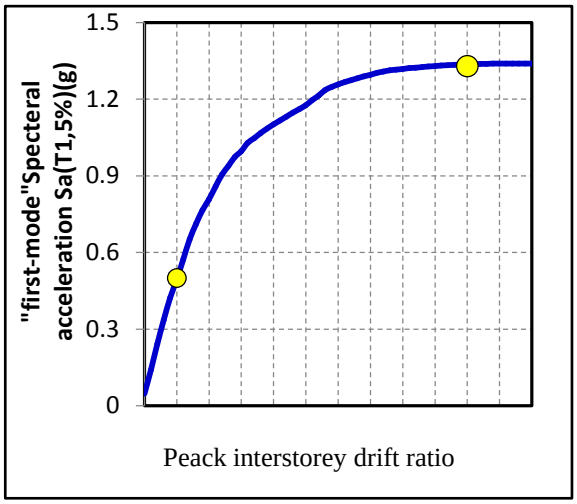
4floors 12 spans



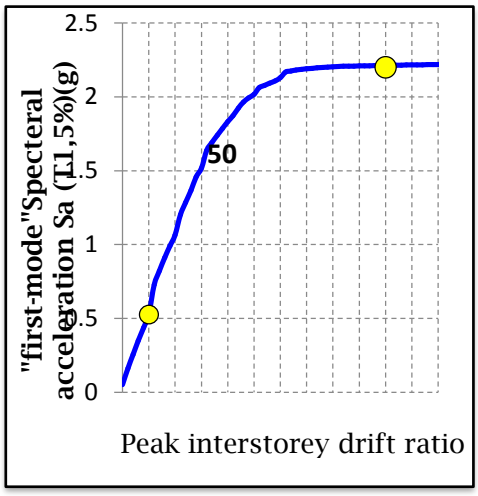


3floors 12 spans 3floors 8 spans

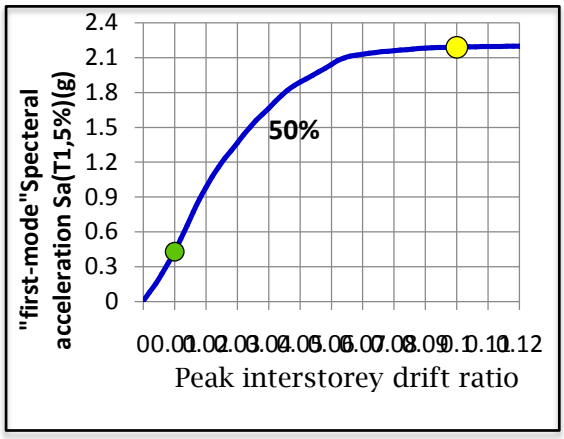
Fig. 4. IDA curves set related to different frame



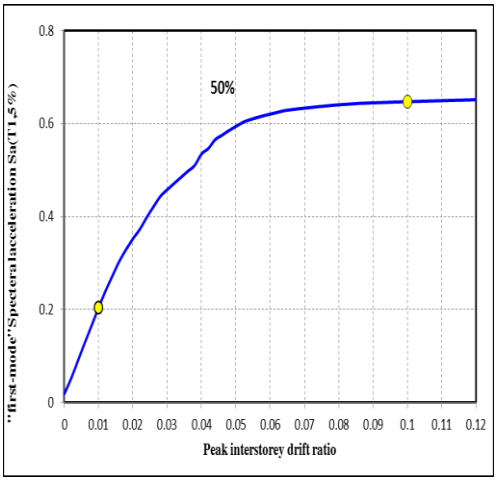
4floors 8 spans



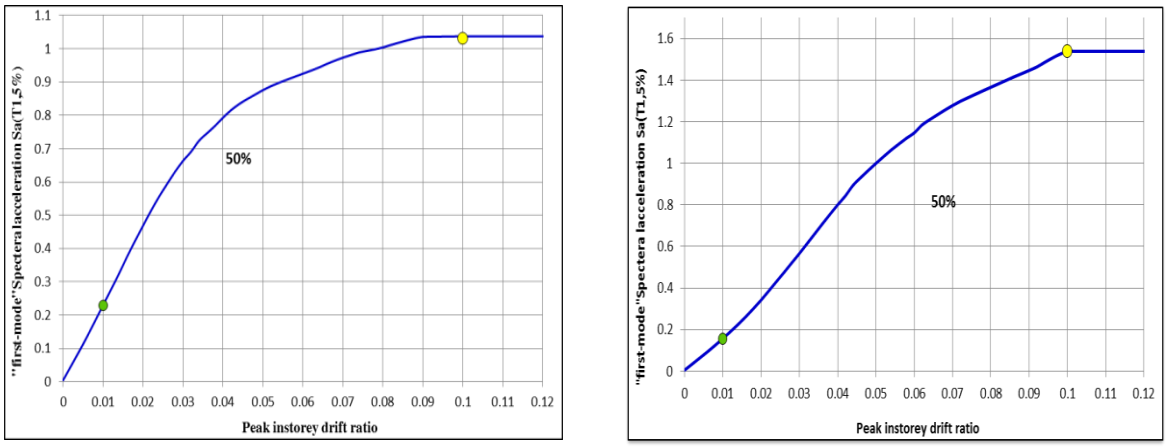
4floors 4 spans



3floors 4 spans



4floors 12 spans



3floors 12 spans 3floors 8 spans

Fig. 5. Summarize the average curve of IDA different frames

2.4. Evaluation of seismic frames performance of under study

In this study to evaluate the seismic performance of frames under study, from the average curve of IDA and range of 2800 standard plan of Iran (soil type 2) in order to scaling the selective accelerographs to perform time history analysis and extract the maximum relative displacement between floors and maximum displacement of roof has been used. Thus, the following two methods to scaling the accelerographs have been used:

The first method: first should be drawn range of all the selective accelerographs pair and then corresponding spectral acceleration with period like first mode of structure (Sa (T1, 5%)) based on the range of Iran's 2800 standard plan be achieved and obtained by dividing the spectral acceleration pair spectra accelerographs On the obtained spectral acceleration from the range of plan 2800 standard, Scale factor for all accelerographs pair with this method is obtained.

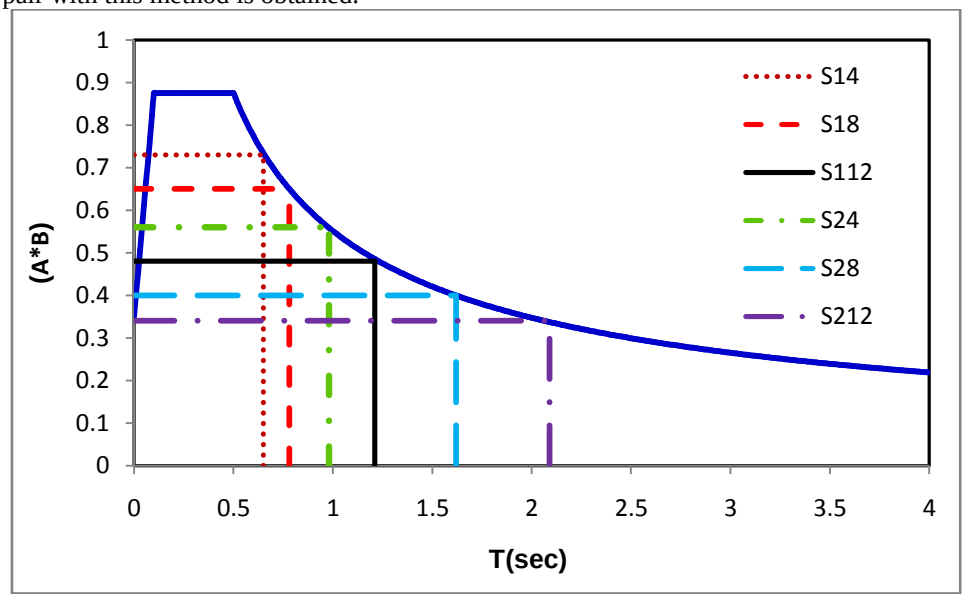


Fig. 6. spectral acceleration corresponding with period like under study first mode frames

The second method: this method is similar to pervious method with the difference that instead of spectral acceleration first mode period structure obtained from range of 2800 standard plan, Spectral acceleration curve 50% (average curve) obtained from IDA analysis Corresponding with maximum relative displacement between floors of 1% For level of performance of usability without interruption have been used. After the scaling accelerographs pair to two methods titled by using Open Sees software under study frames with selective accelerographs pair again put under the nonlinear time history analysis and maximum results of relative displacement between floors and displacement corresponding of roof extracted and is taken average

from them that aim of this controls the under study frames in range of performance level uninterrupted usability (IO). Thus to judge engineering in two ways has been performed as follows:

1. The average control of maximum relative displacement between the floor obtained from nonlinear time history analysis with uninterrupted usability performance (IO) equal = maxθ % 1. [7]

2. The average maximum displacement corresponding roof obtained from nonlinear time history analysis as displacement of aim to perform the nonlinear static analysis (Pushover) in SAP software and view the range of plastic hinges in the beams and columns and a range of performance of members and entire structural are used. Summary information on the average maximum relative displacement between floor and roof displacement as Table (1) and Table (2), and the statistics charts in Figures (7) to (9) has been provided.

Table 1. The average of maximum relative displacement between floor and roof displacement obtained from nonlinear time history analysis scaled with spectral acceleration of 2800 standard

	Span 6 m-Iran Spectrum				Span 7.5 m-Iran Spectrum			
Story	IDR 1	IDR 2	DIS-1	DIS-2	IDR 1	IDR 2	DIS-1	DIS-2
12	0.0509	0.0516	427.3	425.2	0.0625	0.062	422.96	430.3
8	0.0121	0.012	132.7	135.5	0.0223	0.023	518.81	493.9
4	0.009	0.0098	93.67	97.83	0.0126	0.0123	154.788	155.1

Table 2. Average of maximum relative displacement between floor and roof displacement obtained from nonlinear time history analysis scaled with curve spectral acceleration of 50% obtained from IDA analysis Corresponding maximum relative displacement between floors of 1%

	Span 6 m-IDA				Span 7.5 m-IDA			
Story	IDR 1	IDR 2	DIS-1	DIS-2	IDR 1	IDR 2	DIS-1	DIS-2
12	0.015	0.0157	125.2	138.03	0.015	0.0158	288.61	278.1
8	0.009	0.0096	106.35	110.52	0.01	0.010	146.056	147.0
4	0.006	0.0065	62.07	64.48	0.0098	0.00987	116.72	119.2

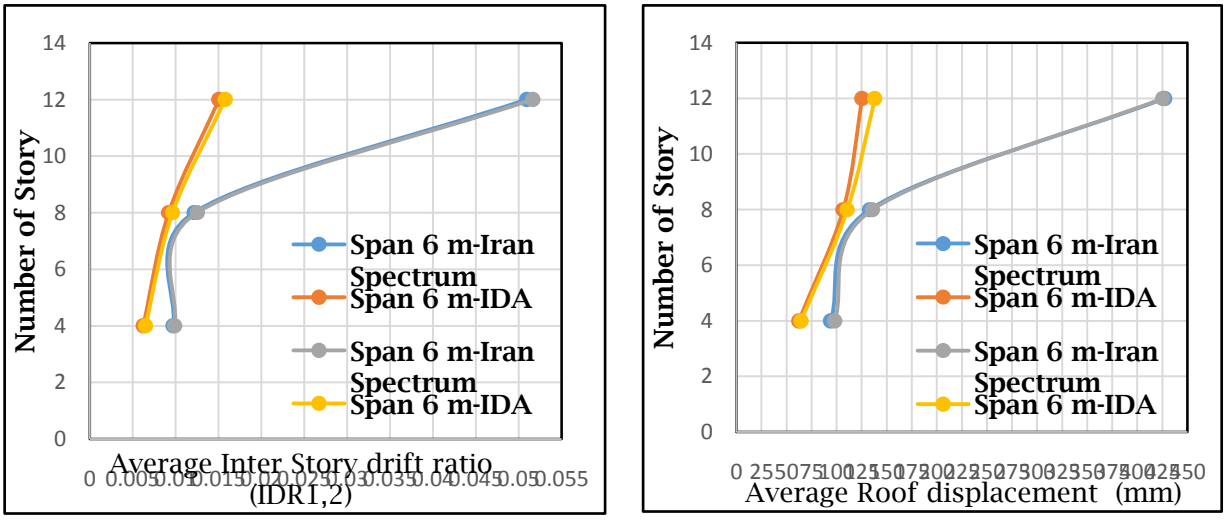
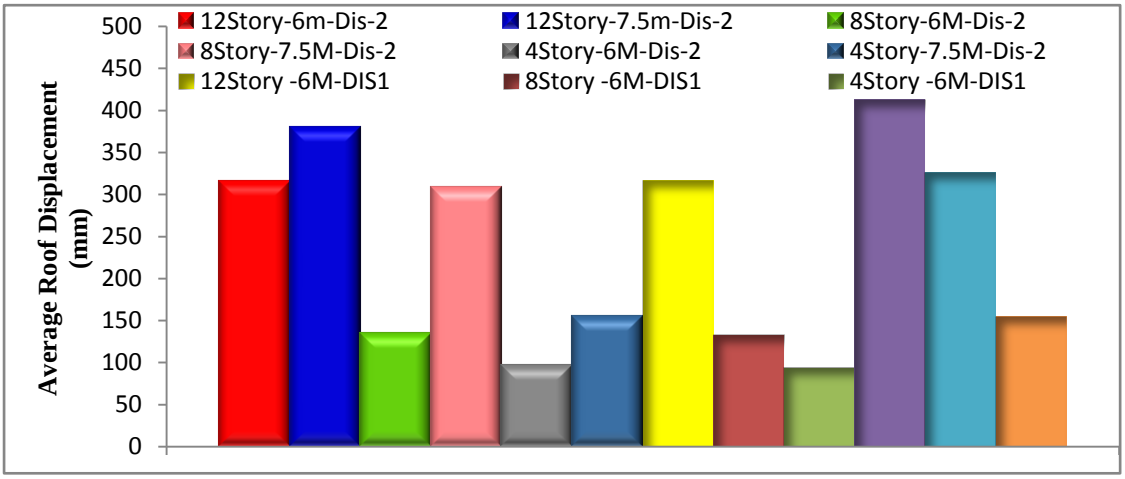


Fig. 7. Figure maximum relative displacement between floor and maximum displacement roof for frames of S14, S18, and S112 For both sides of accelerographs



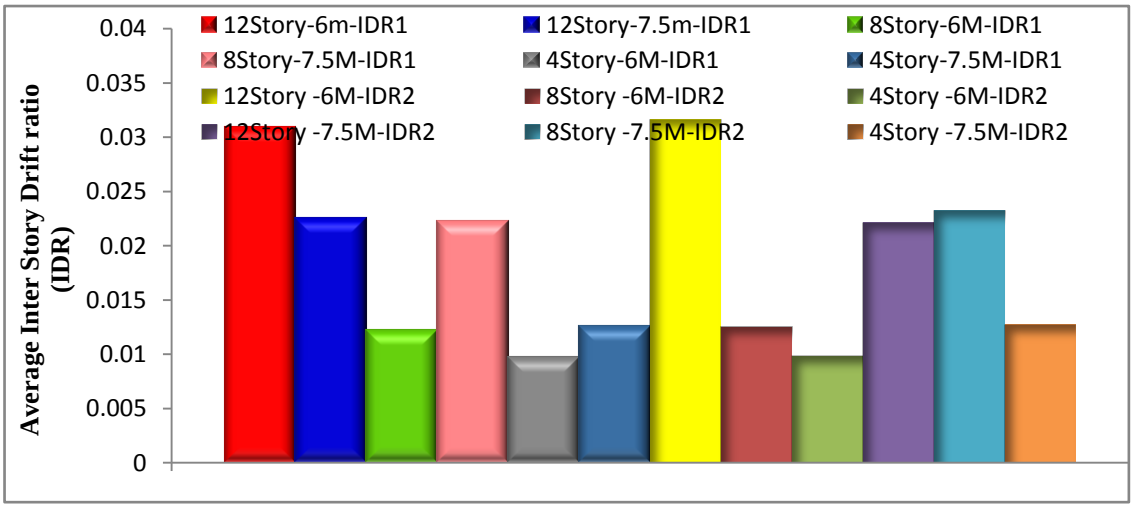
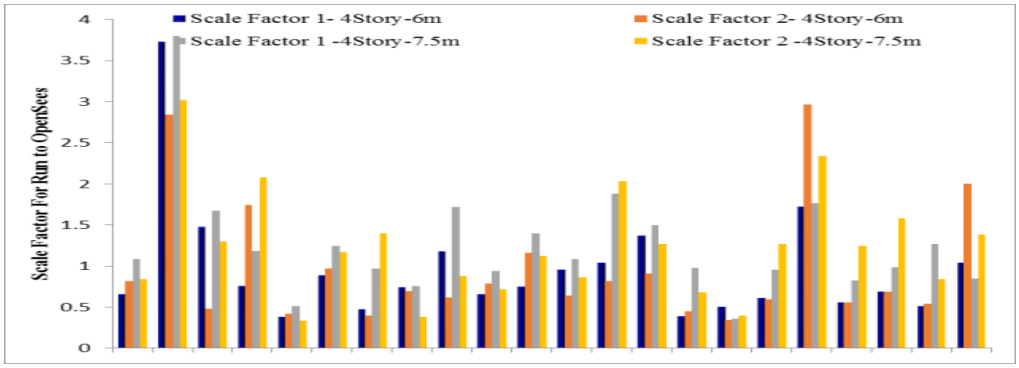


Fig. 8. by maximum relative displacement between floor diagram and maximum displacement of roof for frames of S24, S212, S28 and S14, S18, S112 For both sides of accelerographs



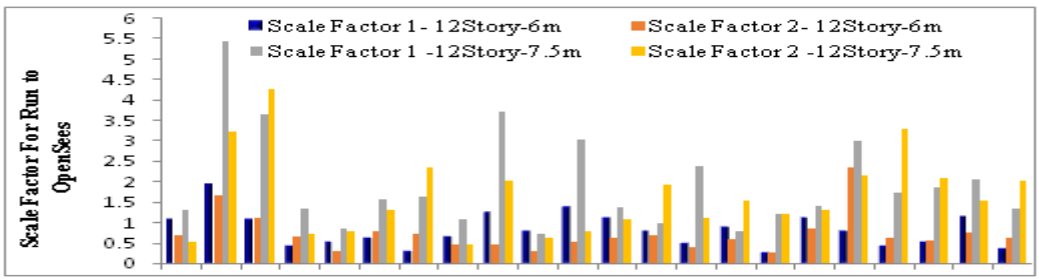


Fig. 9. statistical diagram of scale factor used in the nonlinear time history analysis for structures with spans of 6 and 7.5 meter with 4 floors, 8 floors and 12 floors

Table 3. The evaluation results of the present study frames with nonlinear time history analysis

		Span 6 m			Span 7.5 m		
Method	Story	IDR≤ 1%	IDR > 1%		IDR≤ 1%	IDR > 1%	
IDA	12	0.01	------	Ok	------	0.0158	Not Ok
	8	0.0096	------	Ok	0.0102	------	Ok
	4	0.0064	------	Ok	0.0098	------	Ok
2800	12	------	0.0516	Not Ok	------	0.0625	Not Ok
	8	------	0.0125	Not Ok	------	0.0232	Not Ok
	4	0.0098	------	Ok	------	0.01277	Not Ok

According to figures of 7 to 9 and Table 3, it can be concluded that the structures under study were examined by IDA, uninterrupted performance levels and the threshold of breakdown except S212 structure other structures as well as the performance levels has not violated. But the structures that by 2800 code have been scaled all except S14 structure have violated their performance level. With this interpretations it can be concluded that the structure which are evaluated by IDA have more accurate than structures which are evaluated by 2800.

2.5. Pushover analysis of produced models

In this study, with the help of SAP software and frames pushover analysis with displacement equivalent to maximum displacement for roof in nonlinear time history analysis, frames status are examined and deformed form of structure and joints created in structure in the last analysis, in Figures of (10) to (12) has been shown.

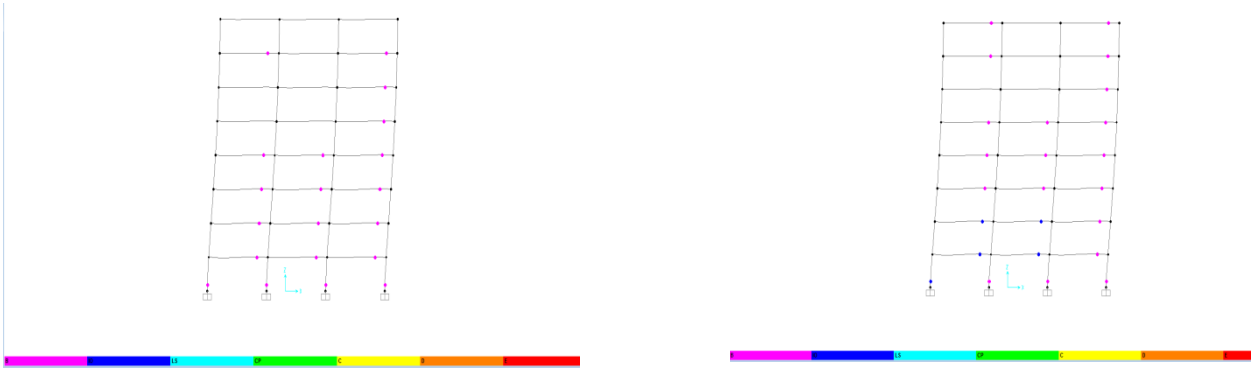


Fig. 10. display plastic joints of frame S28 Modeling in SAP software and under the pushover analysis with displacement of goal obtained from scaled method with range 2800 standard plan and with spectral acceleration of curve 50% obtained from IDA analysis corresponding to the maximum relative displacement between floors 1%

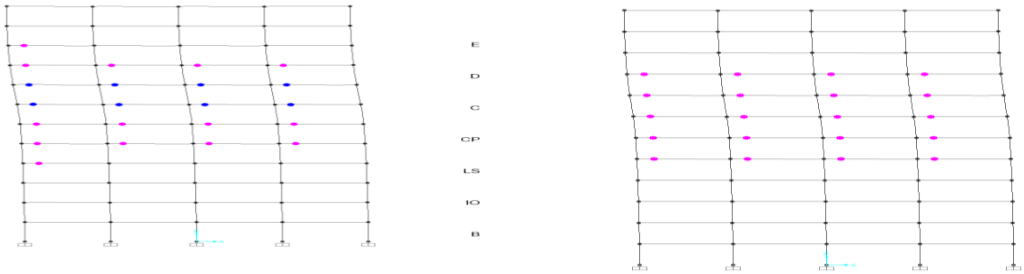


Fig. 11. display plastic joints of frame S112 Modeling in SAP software And under the pushover analysis with of goal displacement Obtained from the scaled with range of 2800 standard plan and with spectral acceleration of curve 50% obtained from IDA analysis corresponding to the maximum relative displacement between floors 1%

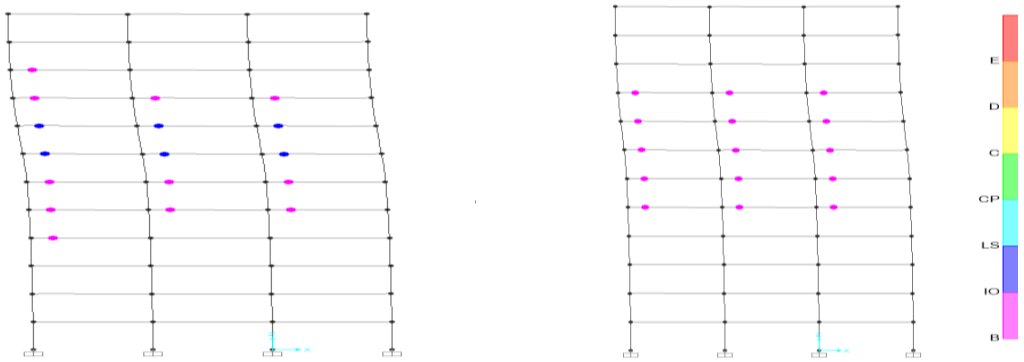


Fig. 12. display plastic joints of frame S212 Modeling in SAP software and under the pushover analysis with displacement of goal Obtained from scaled method with range of 2800 standard plan and with spectral acceleration of curve 50% obtained from IDA analysis corresponding to the maximum relative displacement between floors 1%

Table 4. The results of under study frames by using incremental nonlinear static analysis in SAP software

		Span 6 m		Span 7.5 m	
Method	Story	Displacement		Displacement	
IDA	12	255	Ok	368.03	Ok
	8	110	Ok	147.04	Ok
	4	64	Ok	119.26	Ok
2800	12	425	Not Ok	530.88	Not Ok
	8	135	Not Ok	493.89	Not Ok
	4	97	Ok	155.15	Not Ok

According to the table above, under study structures of S24, S28 and S212 with spans of 7.5 meters, and first method of scaling, It is necessary Initially should be drawn entire range of selective accelerographs pair and then spectral acceleration corresponding to period like denoted item of structures (T1 (Sa,5%)) to be extracted (T1 (sa,5%)) 2800 standard plan range of Iran obtained and by dividing the spectral acceleration achieved from the range of accelerographs pair on the spectral acceleration resulting from range of 2800 standard plan, scaled factor for all accelerographs pairs by this method is achieved none of the structures did not provided the level of uninterrupted performance. Considering that 2800 regulation life safety performance level is having none of under study structures that by 2800 method have been scaled performance level of breakdown threshold have not provided; but all structures under study that by using IDA method have been scaled uninterrupted performance level and the breakdown threshold have covered.

III. Conclusion

In this study, six concrete moment frame with average formability and with high importance degrees in Tehran Based on Regulation and standards in Iran design and in Open Sees software modeling and assigned nonlinear behavior of structures components was performed. For incremental nonlinear dynamic analysis the number of 22 accelerograph pair suggested related to remote area available in regulation of FEMAP-695 related to hard ground was used. After performing incremental nonlinear dynamic analysis By using program outputs of the IDA curves set And the average curve of IDA is drawn Then on the average curve of IDA Corresponding spectral acceleration maxθ=1% was determined. Accelerographs selective in two ways: Once by using spectral acceleration of curve average of IDA and once again, spectral acceleration 2800 standard plan scaled and in time history analysis under study frames was used and averages values of maximum relative displacement between floors and the maximum displacement for roof was obtained.

According to the material presented in the previous chapters, the results obtained are:

1. nonlinear time history analysis with accelerographs scaled by spectral acceleration of curve by 50% obtained from IDA analysis corresponding to maximum relative displacement between floors 1%, Because of lower

values of averages maximum relative displacement between floors and maximum roof displacement more capacity and a higher performance level of the structure than nonlinear time history analysis with accelerographs scaled spectral acceleration 2800 standard shows.

2. Due to being constant the number of floors and increasing the height and spans of beams and increasing period of the structure damages measure of DM or maximum relative displacement between floors increased and shows the lower performance level of under study frames.

3. the obtained results of pushover analysis it can be seen structures of S18, S112 and S14 in nonlinear time history analysis have more maximum relative displacement between floors of than maxθ=1% In this analysis, have joints with uninterrupted usability performance level.

4. The results obtained indicate that 12 floors structures three spans (S212) and eight floors three spans (S28) as well as 4 floors structures three spans (S24) that in nonlinear time history analysis have more maximum relative displacement between floors than max θ=1% uninterrupted usability performance levels have rejected.

5. According to the results related to this research all structures under study that by IDA have been scaled both levels of uninterrupted performance usability performance levels and threshold of breakdown have provided.

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