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LINEAR AND NONLINEAR ANALYSIS OF THE RESULTS IN REGULAR CONCRETE STRUCTURE

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Resumen: Las estructuras de hormigón armado suelen estar diseñadas para cumplir con las normas de seguridad y funcionamiento. Con el fin de asegurar el nivel de utilización de las estructuras de hormigón armado, se requiere en cargas de servicio, el craqueo y la deformación de estas estructuras se predice. Para evaluar el margen de seguridad contra el fallo de las estructuras de hormigón armado, es necesaria una estimación precisa de la carga final y predecir el comportamiento de las estructuras elásticas-plásticas de deformación del tiempo en toda la gama es Mvrdnyazmy. Sin embargo, los códigos de diseño habituales, tales como el análisis elástico lineal estándar de 2800 para predecir la respuesta estructural sísmica y la evaluación de las necesidades, saben bastante, pero porque el comportamiento real de las estructuras bajo plan de terremoto para un análisis lineal no lineal parece inadecuado e inadecuado. En las nuevas recetas basadas en el diseño basado en el desempeño trabajado, como 440 FEMA y recetas Rehabilitación Sísmica (Publicación 360), los métodos de análisis de los hallazgos no lineales lugar especial para que al limitar las condiciones de uso de los métodos de análisis lineal prácticamente diseñadores el uso de análisis no lineal de la mercancía. Por lo tanto, desde 2800 Irán y los códigos de rehabilitación de carga sísmica, los miembros de análisis y control, y los criterios de admisión, que se complementan entre sí y por lo tanto, la evaluación sísmica de los edificios diseñados por 2800 utilizando las instrucciones sismic reequipamiento puede ser útil.

Palabras clave: Análisis estático, Análisis dinámico espectral, Análisis dinámico Historial de tiempo, Análisis no lineal de pushover

Abstract: Reinforced concrete structures usually are designed to meet safety standards and operation. In order to ensure the level of utilization of reinforced concrete structures, is required under service loads, cracking and deformation of these structures are predicted. In order to assess the safety margin against failure of reinforced concrete structures, accurate estimate of the ultimate load is necessary and predict the behavior of elastic-plastic time-deformation structures across the range is Mvrdnyazmy. However, the usual design codes, such as 2800's standard, linear elastic analysis to predict seismic structural response and needs assessment know enough, but because the actual behavior of structures under earthquake plan for non-linear, therefore, linear analysis seem inaccurate and inadequate. In new recipes based on performance based design worked, such as 440 FEMA and recipes Seismic Rehabilitation (Publication 360), analysis methods of non-linear special place findings so that by limiting the conditions of use of methods of linear analysis practically designers the use of non-linear analysis of the commodity. Accordingly, since 2800 Iran and rehabilitation codes seismic loading, analysis and control members, and admission criteria, they complement each other and are therefore the seismic assessment of buildings designed by 2800 using the instructions Seismic Retrofit can be useful.

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Keywords: Static analysis, Spectral Dynamic Analysis, Dynamic Analysis Time History, Nonlinear pushover analysis

1. INTRODUCTION

With increasing knowledge about earthquakes and how structures behave during an earthquake, a new strategy to improve the safety of buildings against this phenomenon has been proposed. The solutions offered are mainly focusing on the structural behavior. Design based on structural behavior has created a new way of designing that is called performance based design. Performance based design is based on the limit state design. Performance based design methods which are proposed are mainly based on nonlinear static analysis. Due to the use of non-linear static analysis of high speed and simplicity of the analysis, interpretation of the results of the analysis.

Structural analysis methods using static, semi-dynamic (spectral) and dynamic (time history) are divided. The dynamic method is the most accurate method. The static methods and spectral try to predict the behavior of a structure in reality. But analysis of the dynamic behavior of structures in time and shows step by step.

Linear and nonlinear analysis methods for linear and non-linear analysis are divided into two groups. Non-linear manner on the structures more accurately than linear analysis. Because in real earthquakes are usually all buildings nonlinear behavior.

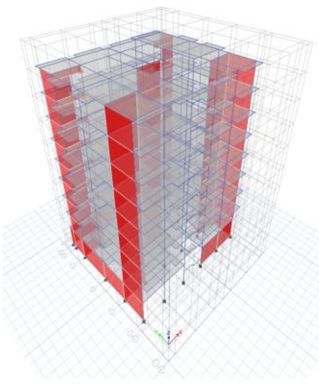


Figure 1. Three-dimensional model made in etabs2015

2. STATIC ANALYSIS

Static analysis of which briefly called static analysis, only by taking the first fashion designs, simple and acceptable method has to offer.

Shear Force Base:

Shear Force Base, or cutting base position Jlnby earthquake forces that can be applied at any level of the building Krdd base. This force can be obtained using any of the buildings stretches.

V_u=C.W

C=ABI/R_u

Vu: shear force resistance level.

Seismic lateral force distribution in the height of the building:

$$F_{ui} = \frac{W_i h_i^k}{\sum_{j=1}^{n} W_j h_j^k} \quad (1)$$

F_{ui}: lateral force at floor level

W_i: class weight includes the weight of the roof and part of the overhead I and half the weight of the walls and columns that are located above and below the roof.

h_i: I floor ceiling height levels of the ground state

n: number of floors from ground level to the top

K: is a factor that fluctuates according to the original construction period T is obtained from the following equation:

$$K=0.5T+0.75 \qquad 0.5\leq T\leq 2.5 \text{ sec} \quad (2)$$

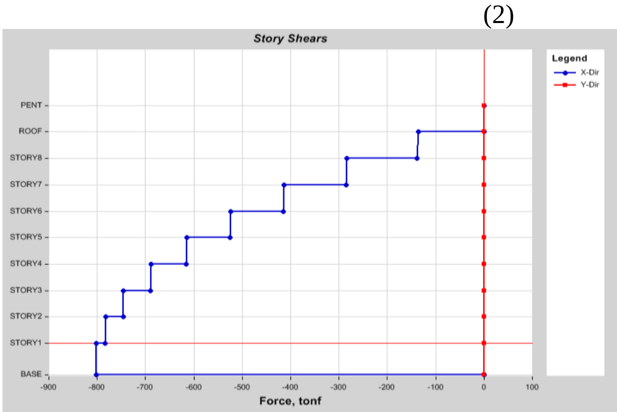


Figure 2. The shear in the x direction

$$U = \sqrt{\sum_{n=1}^{N} u_n^2}$$

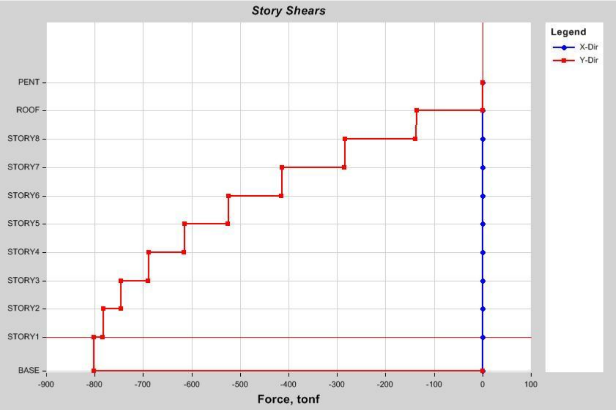


Figure 3. The shear in the Y direction

3. SPECTRAL DYNAMIC ANALYSIS

The lateral force method using the Dynamic Albedo of the structure during the earthquake ground motion caused by the earthquake is determined from the show itself. These include spectral analysis method and time history analysis. The use of any of these two buildings is optional. Ground motion effects to a whole statements reflect the acceleration and acceleration is determined time to change history. The reflectance spectrum momentum for this earthquake is called the whole plan. The regulations for the whole spectrum of standard design or special design structure used in accordance with its own standards. The use of any of the spectra for all buildings is optional. Only the use of the whole site should be noted that special scheme should not be less than two-thirds of its value in the whole scheme of such standard. Dynamic Analysis of spectral analysis method using mods: Applied to hardware acceleration, maximum shift, forces and internal stresses mods are calculated for individual structures. The tidal values for a specific output parameters are combined with one of the following methods specific to the particular output produced a positive result.

3.1 SRSS method

This method results in squares of different modes together, then the square root of the result of their output as they are announced. The assumption becomes independent mods results Khych of the interaction between different modes results will not be considered. The general reflection U along each degree of freedom can be obtained from the following equation:

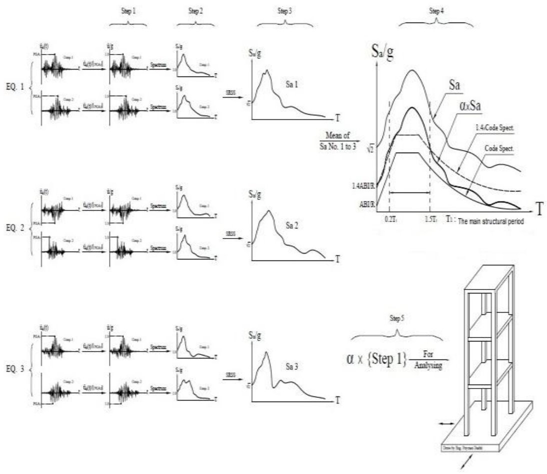
3.2 CQC method

The combination of perfect squares method in 1981 was presented by Mr. Viljoen and bio. This method is a combination of default. In this way, due to the close interaction modes, according to mode attenuation, is considered. Increasing the damping mode enhances the interaction modes are close together. If the relationship is not true CQC method should be used. The general reflection Azrabth U along each degree of freedom is given:

$$U = \sqrt{\sum_{n=1}^{N} u_n^2 + 2\sum_{n=1}^{N-1}\sum_{m=n+1}^{N} \rho_m u_n u_m}$$

(3)

CQC method we use to collect works of modes and damping structures typical of 0.05 is assumed. Note CQC method is similar to SRSS but the tide sum of squares of damping should also be considered. If the damping is zero superposition results CQC, SRSS will be together.



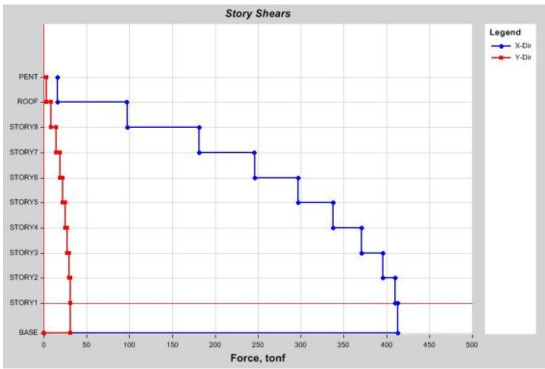


Figure 4. The shear in the X direction by SRSS

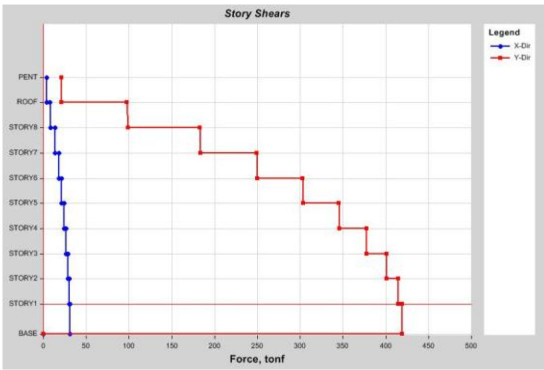


Figure 5. The shear in the Y direction by SRSS

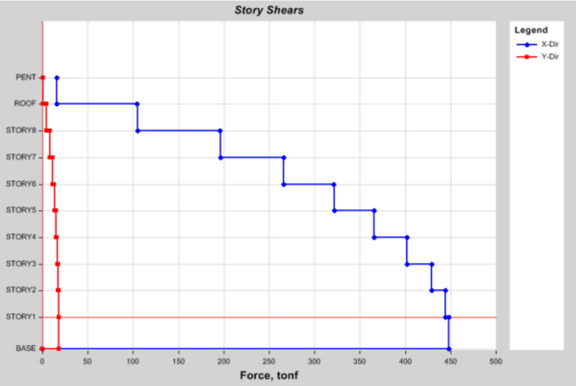


Figure 6. The shear in the X direction by CQC

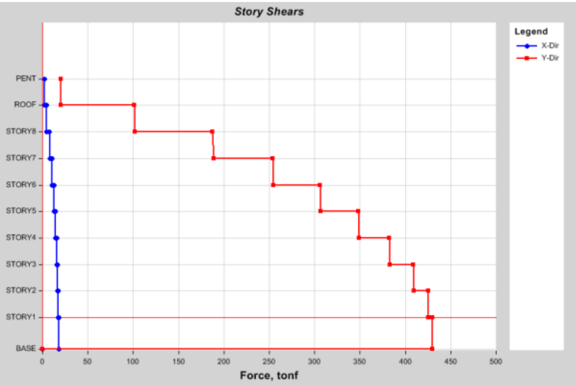


Figure 7. The shear in the Y direction by CQC

4. DYNAMIC TIME HISTORY ANALYSIS

In this manner, the dynamic analysis of structures with the effects of the acceleration of the earth as a function of time, a ground state and response calculations assuming a linear mathematical model building done. In this analysis, we can order 5% damping ratio of structure, unless it can be shown that other values are more appropriate structures. Acceleration of land based on mapped Shntab that have been developed with the foregoing condition is determined. Shtb each pair mapped out in that paragraph at the same time in two directions perpendicular to each other, the original structures along strike, to that effect will be reflected in the structure as a function of time is determined. Final reflections to the maximum reflection of the structures obtained from the analysis of three couples mapping acceleration is desired.

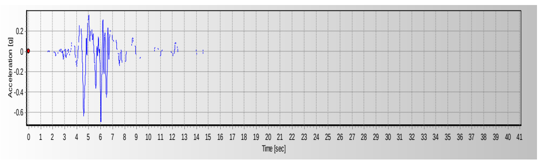
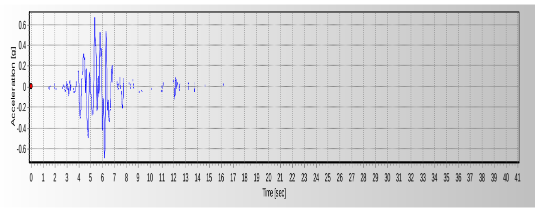


Figure 8.Accelerations for Kobe earthquake –(L)

Dynamic time history analysis method



Figuere 9.Accelerations for Kobe earthquake –(T)

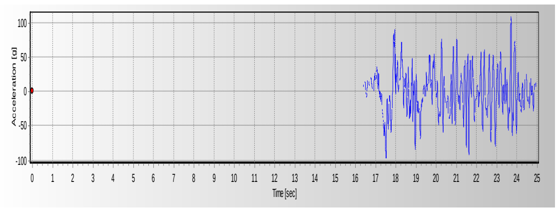


Figure 10.Accelerations for Bam earthquake –(L)

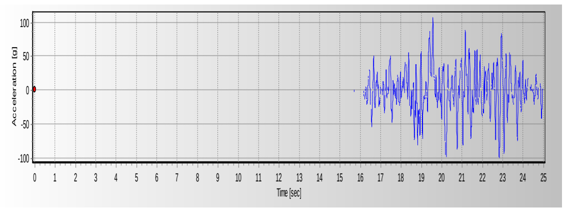


Figure 11.Accelerations for Bam earthquake –(T)

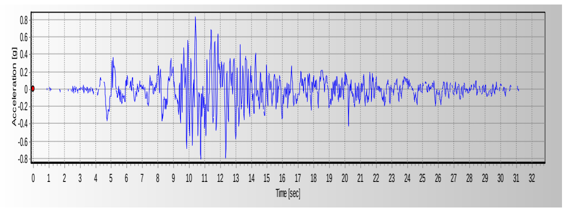


Figure 12.Accelerations for Tabas earthquake –(L)

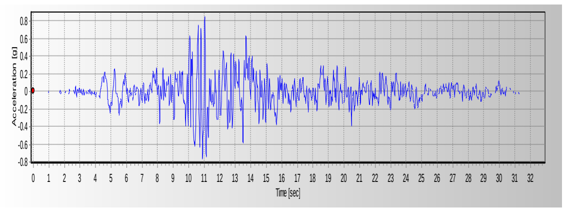


Figure 13.Accelerations for Tabas earthquake –(T)

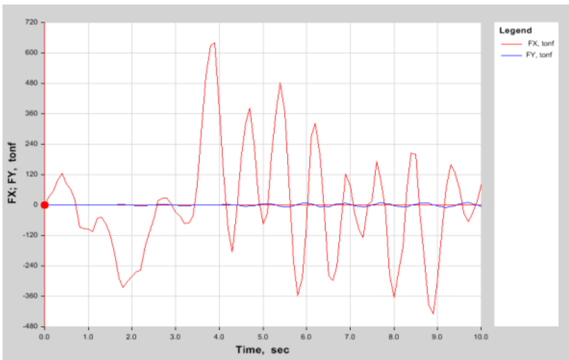


Figure 14. The shear in the X,Y direction by Bam earthquake TH-X

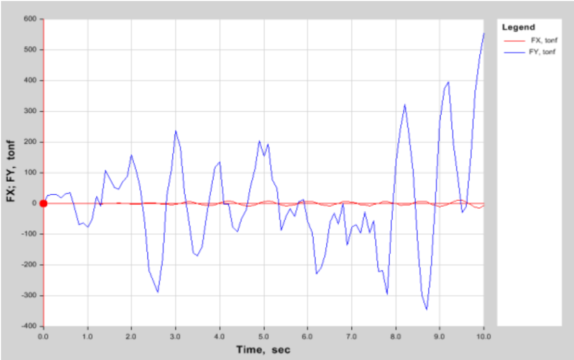


Figure 15. The shear in the X,Y direction by Bam earthquake TH-Y

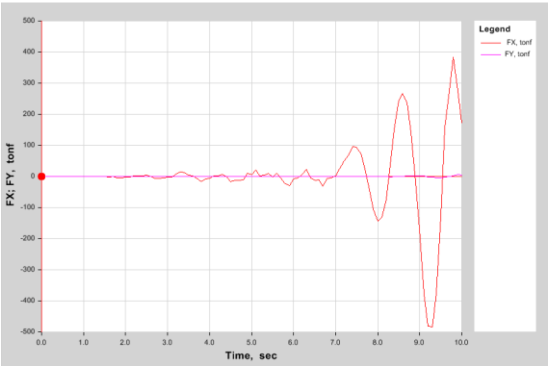


Figure 16. The shear in the X,Y direction by kobe earthquake TH-X

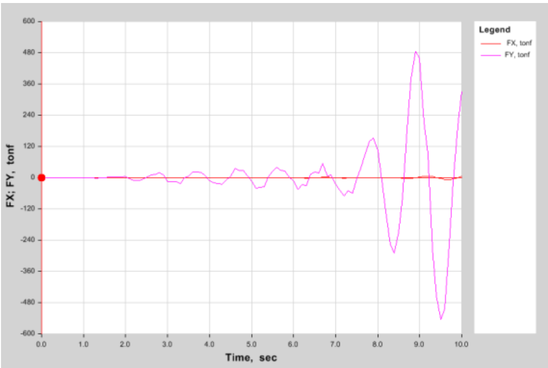


Figure 17. The shear in the X,Y direction by kobe earthquake TH-Y

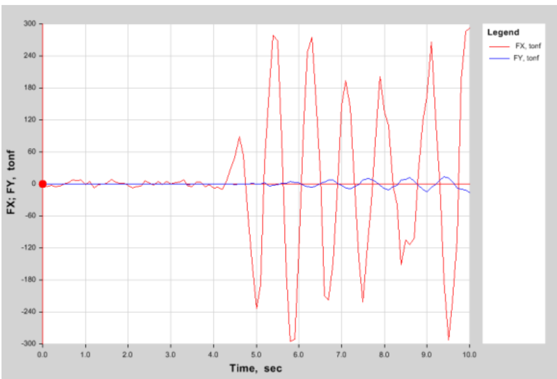


Figure 18. The shear in the X,Y direction by Tabas earthquake TH-X

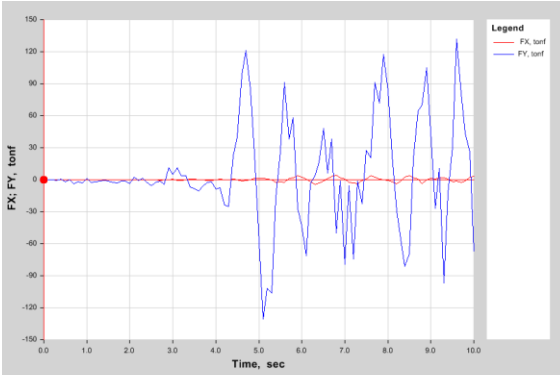


Figure 19. The shear in the X,Y direction by Tabas earthquake TH-Y

5. NON-LINEAR STATIC ANALYSIS PUSHOVER

There are two main philosophy for the design of structures, design-driven philosophy and philosophy of performance-based design. Power design, the structure is designed to withstand a certain amount of strength and deformation amount does not exceed the specified value.identify structural damage in varying levels of performance. With this type of structural design philosophies in addition to being safe, economically efficient structural design. In the design of the force-displacement function to control the nonlinear analysis of structures should be used, so familiarity with this type of analysis is very important.

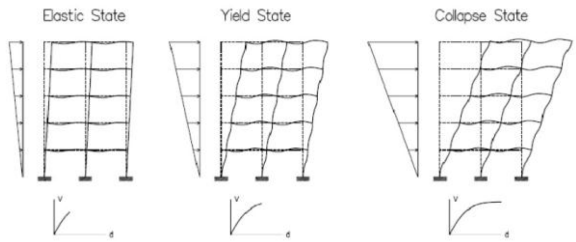


Figure 20. The structural behavior under lateral load

During the analysis, the gradual increase in lateral load, deformations and internal forces or compare all components are calculated. Unlike linear analysis methods, in this way because in consideration of nonlinear behavior of materials, internal forces, with the expected values of equality is under earthquake.

In nonlinear static analysis of the whole design software is used. So not sensitive to changes in cycle time. One disadvantage of this approach is that due to the reciprocating movement of the nonlinear behavior of structural components are not directly order. Because in this way, only a quarter of the frequency of vibration is investigated.

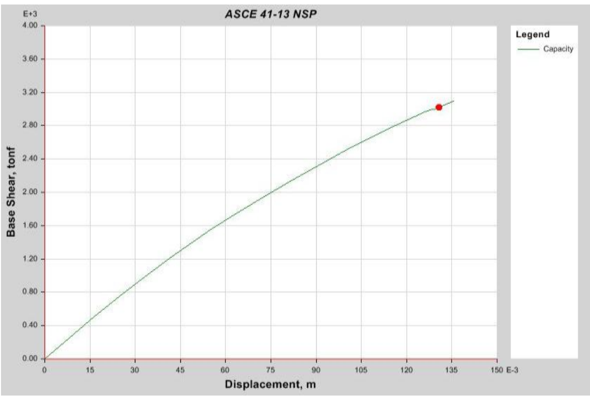


Figure 21. Load-shifting in the direction X.

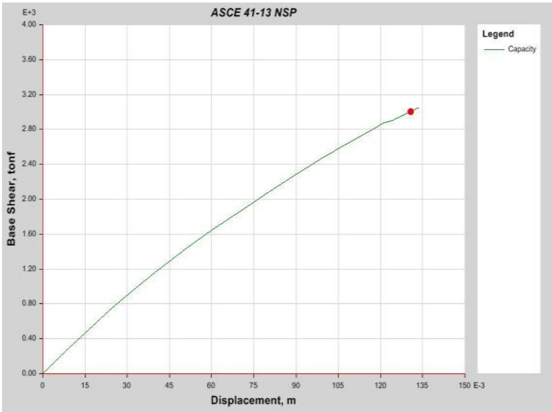


Figure 22. Load-shifting in the direction Y.

Table1. Results

in the direction Y.			in the direction X.			type	Analysis method
Anchor reversal (ton.m)	Cutting base (ton)	**relocation (mm)**	Anchor reversal (ton.m)	Cutting base (ton)	**relocation (mm)**	**type**	**Analysis method**
16900	800	73	16900	800	55	Linear	static
9150	415	46	9000	410	31	Linear (SRSS)	**Dynamic Spectrum**
9200	430	46	9800	448	35	Linear (CQC)	
11560	550	36	13850	660	26	Linear (Bam)	**Dynamic Time History**
11343	540	43	10291	490	28	Linear (kobe)	
2739	130	17	6196	295	20	Linear (Tabs)	
65165	3003	130	65600	3023	131	Nonlinear	Static (pushover)

5. CONCLUSION

-For the most current design methods based on standard procedures strength. So the new regulations rather than resistance criteria of standards of conduct, to design their structures.

- better than joints, where the columns will be formed action (weak beam mechanism-strong column) due to severe earthquake damage significantly due to inelastic behavior of structures to be imported, because according to the curveThat's why it can be more realistic behavior of structures, than ever before achieved in the event of an earthquake specified.

- Given that the non-linear analysis of structural capacity is used up, In order to carry out rehabilitation and style of structures according to the level of performance required by the employer is very reliable.

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