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Seismic Behavior of Two Layers of Drum And Up To the Mouth of the Mouth Depth Changes

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Abstract: *In this study Space structures widely used in large openings are covered. Space lattice structures are more used than the similar ones.Shape and position of these families are common to both cask layers. Dynamic and seismic behavior of these structures has increased considerably in recent years. It was thought that long structures are vulnerable to earthquakes. However, the events of the Kobe at 1995 earth quake and ... Showed that although these structures are safer than conventional structures, but it should not be considered as absolutely safe. Among the notable studies on anti-seismic behavior ofthese space structures we can point out to works of Japanese researchers [1] Ishikawa, Kato and Sadeghi [2] and [3].*

Keywords: *industrial technology building, concrete construction, tunnel format, capabilities and limitations*

I. Introduction

casks with two types of different angle of deflection to span ratio of (0.2,0.3,0.4), which are designed only for dead and live loads, have been selected.Treatment of the two- layer casks due to anchor point and horizontal components of displacement, the earthquake, the non-linear material and geometric nonlinear analysis was conducted and for this purpose all the finite element analysises have been done by the software of ANSYS [4].

II. Shape and characteristics of casks

Several layers casks with the square on square tashe and with deflection to opening rates of (0.2,0.3,0.4) considered that spans were over 34 meters and the height of (13.6, 6.8, 10.2) meter.Figure 1 shows an example of the cask. Cask fitting joint.And the angle of deflection was various for each cask type. The first type is called A and the support structures located on either side of the top layer.The first type is called A and the support structures located on either side of the low layer.Bilayer structures in cask Formian [5] Tashh transduction was then performed to determine the exact coordinates of the points above, and elements.The results of the structural geometry (Geometry only) for software defined as " Mechanikal Desktop" and then SAP 2000 software for design and for nonlinear dynamic analysis software of ANSYS have been transferred.Every structure has been defined with abbreviation symptoms based on deflection to opening.The first letter (B) is the first letter of (Barrel Vaults).The second letter indicates the anglesituation, The first number is the ratio of deflection to span (H / S) is the percentage. And the second number represents the span depth ratio (D / S).Right letter of H shows earthquake force in the horizontal direction H (Horizontal).

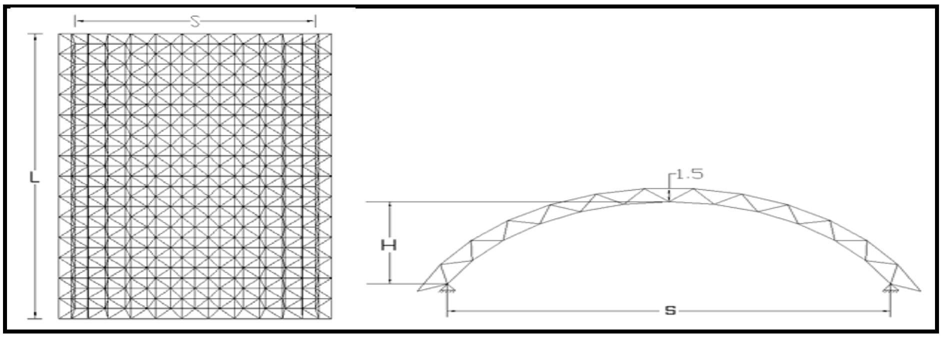

Fig1: casks charactristic

III. Static analysis for structural design

Structural geometry and sections in the initial selection, proper design requires Members to be able to construct an adequate safety factor to handle the loads. Resistance of structural members must be more than the maximum stresses induced by external loads and other factors. Used elements are of hollow tubes.

The designation, based on steel structures design codes(the tenth topic of the National Building Regulations) took place. The slimness of all members are considered by cask of 100. Loaded cask in the sixth topic of regulations for snow loads for arc roofs is as the two followings:

1 - symmetric loading 2 – asymmetric loading

Dead load: load weight and coating facility and space structure together is 50kg / m² and a concentrated load is applied on all the nodes above.

After loading, the models were analyzed and designed in 2000 SAP and crossings of each of the models obtained. Steel Building characteristics seen in the tables used in the analysis are as follows:

E (Young's modulus) $2.1 \times 10 ^ 11$ (N / m²):
ν (Poisson's ratio): 0.3
P (mass per unit volume of material): 7850 (kg / m²)
σy (flow stress): $2.4 \times 10 ^ 8$ (N / m)

After designing and obtaining the whole weights sections, each section and weight of models in Table 1 as the ratio of the weight of steel used in models up to the mouth of the mouth depth of 0.2 to 0.4 and by the ratio of 0.007353 and 0.02941, the aforementioned models are all chosen terms.

According to this table, the following results were obtained:

1 - On the rise to span ratio (0.2,0.3,0.4), the largest structural steel is used in the chorus: first base A then B happens.

2 - deflection the mouth to increase steel consumption increases with increasing depth to span ratio is reduced by this amount.

IV. Modal Analysis and its Application in Structure Analysis

The first model has a static analysis and we get it's cross sections and then the program of ANSYS using element 180 Link sections devoted to modeling and modal analysis is performed.Due to the force of the earthquake in X enters the surfing output modal analysis must consider the output of the X ...

To obtain the frequency and the second mass participation factor of together and the greatest rate of participation was considered their frequencies.

For the structural damping ratio = 0.02 ξ space considered

In formula (1) are replaced by the same formulas of Rayleigh and Rayleigh coefficients are obtained.

(1)

$$\beta = \xi \frac{2}{f_i + f_j} \qquad \alpha = \xi \frac{2 f_i f_j}{f_i + f_j}$$

Table 1 - Weight of steel used in models up to the mouth of the mouth depth of 0.2 to 0.4 Vbansbt 0.007353 and 0.02941

Model Name	Total steel used (kg)	Total steel used in each square meters (kg/m²)
BA-0.2-0.007353	**42558.16**	**33.37**
BB-0.2-0.007353	**9302.42**	**7.29**
BA-0.2-0.0220	**18154.29**	**14.23**
BB-0.2-0.0220	**16098.21**	**12.62**
BA-0.2-0.03676	**15128.04**	**11.86**
BB-0.2-0.03676	**13237.57**	**10.38**
BA-0.2-0.05882	**13965.22**	**10.95**
BB-0.2-0.05882	**11259.83**	**8.83**
BA-0.3-0.007353	**66972.29**	**47.35**
BB-0.3-0.007353	**57260.56**	**40.48**
BA-0.3-0.0220	**21592.63**	**15.26**
BB-0.3-0.0220	**18831.32**	**13.31**
BA-0.3-0.03676	**17831.26**	**12.60**
BB-0.3-0.03676	**15682.66**	**11.08**
BA-0.3-0.05882	**15628.42**	**11.04**
BB-0.3-0.05882	**12627.09**	**8.92**
BA-0.4-0.007353	**132273.31**	**84.39**
BB-0.4-0.007353	**111421.5**	**71.08**
BA-0.4-0.0220	**27789.94**	**17.72**
BB-0.4-0.0220	**25212.43**	**16.08**
BA-0.4-0.03676	**21918.26**	**13.98**
BB-0.4-0.03676	**19538.27**	**12.46**
BA-0.4-0.05882	**20264.55**	**12.92**
BB-0.4-0.05882	**16674.91**	**10.63**

Results concerning the eigenvalues (period comparison) in different support conditions and with increased deflection to depth and span to mouth of the casks: (H / S)

Results concerning the eigenvalues (period comparison) in different support conditions and with increased deflection and depth to span the mouth of the cask: (H / S)

Modal analysis of this model is that the following would be the first mode is the most effective one.For the models with the rich depth of the mouth and the mouth of different support conditions can be compared with each other. All conditions except the rich depth of the mouth and the mouth and support conditions are considered equal. Due to a Figures

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(10-2) observed that the models with support requirements of A than the models of B, with equal deflection to mouth and depth to mouth have greater period.

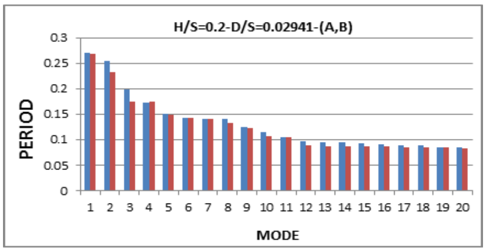


Fig3.Mode period diagram for **B}-0.2-0.02941)**

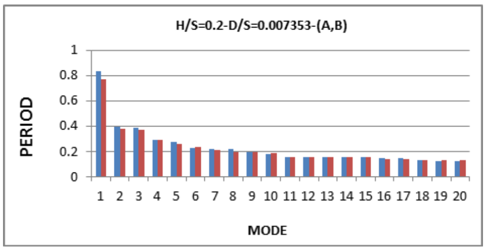


Fig2. Mode period diagram for **B{A,B}-0. 2-0.0**

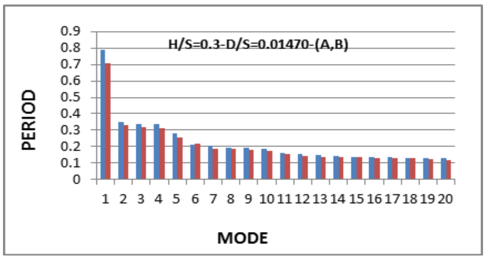


Fig5.Mode period diagram for **01470)**

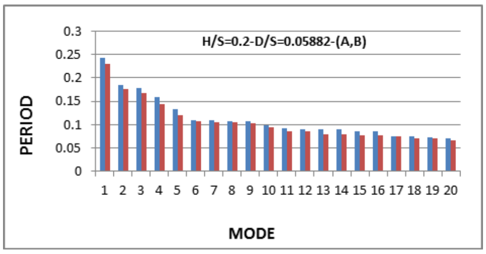


Fig4.Mode period diagram for**(B{A,B}-0.2-0.05882)**

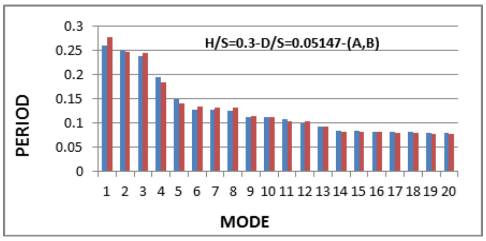


Fig7.Mode period diagram for **B{A,B}-0.3-0.05147**

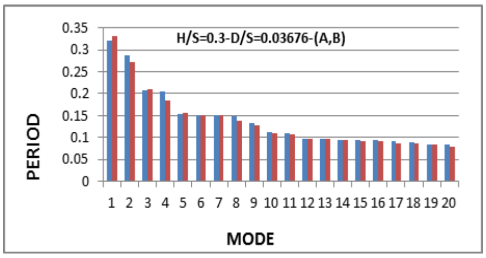


Fig6. Mode period diagram for **(B{A,B}-0.3-0.03676)**

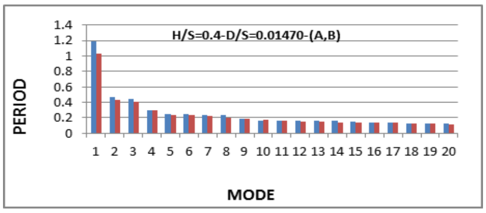


Fig9.Mode period diagram for **B{A,B}-0.4-0.04411**

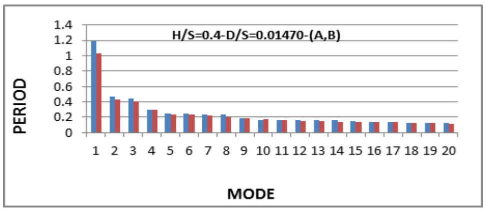


Fig8.Mode period diagram for **(B{A,B}-0.4-0.01470**

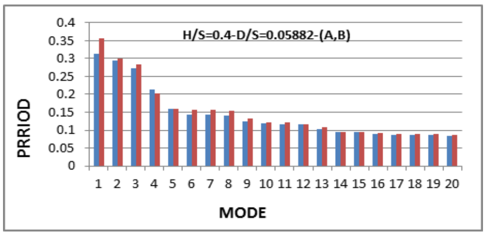
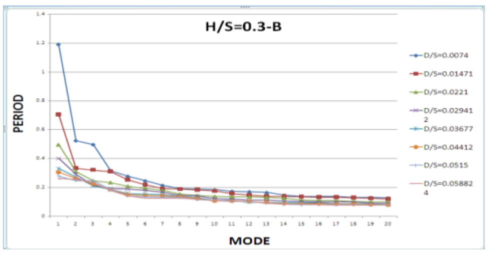


Fig10.Mode period diagram for **(B{A,B}-0.4-0.05882)**

According to the figures(, 13-11) for models with different depths of the mouth to mouth depth increase structural period increases..



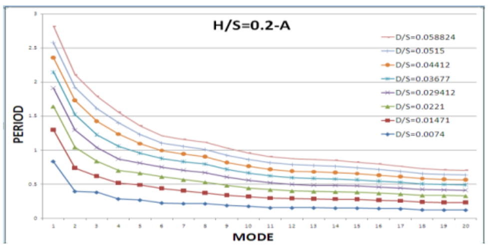


Fig12:Structural comparison period to increase the depth of the mouth (the mouth up to 0.3)

Figure 11 - Comparison of time-frequency structures to increase the depth of the mouth (the mouth up to 0.2)

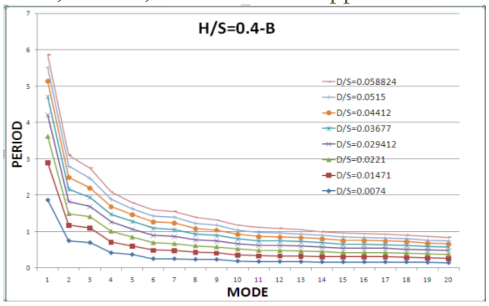


Figure 13 - Comparison of the structure with increasing depth in the opening period (rise to span ratio of 0.4)

Forms (14) and (15) with the support of BA and BB shows the period time of " Deflection to span" by increasing this ratio, The period increases with increasing depth to span ratio of period decreases.

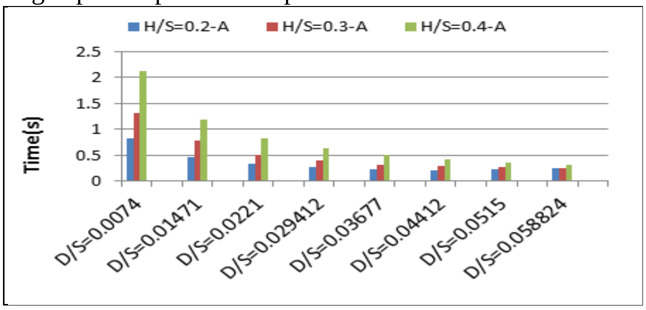


Fig14. Period diagram in depth to mouths of 058824 to 007352, The ratio of rise to span the fulcrum A

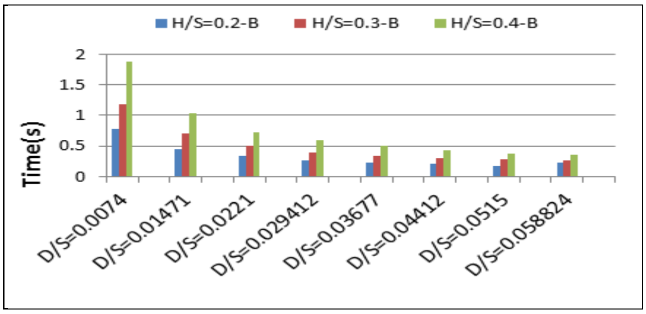


Fig15.Period diagram in depth to mouths of 058824 to 007353 the ratio of rise to span the fulcrum B

Rayleigh coefficients α and β in the calculation of dynamic analysis, fj and fi, respectively, first and second frequency components are dominant. To obtain the first and second frequencies, the mass participation factor and mode compared with large mass participation factors are considered, the effective mass for each mode models for mass participation factor V between the fortieth mode is the fifth mode.

V. Analyzings for of the dynamic analysis

In this case earthquakes in the database, under the theoretical due to the large selection of PGA has been used. Table (2) information about the selected earthquakes in the seismic analysis, it has been seen.

Table 2 - Earthquake theoretical information TABAS

Earthquake	TABAS , Iran 1978/09/16	TABA ,Iran 1978/09/16 (V)
Record/component	TABAS /TAB-TR	TABAS/TAB-UP
HP(Hz)	0/05	0/05
LP(Hz)	null	null
PGA(g)	0/852	0/688
PGV(cm/s)	121/4	Mar-98
PGD(cm)	94/58	76/37

The defining feature of nonlinear geometry and nonlinear material for dynamic analysis in ANSYS Azalmanhay MASS21 and COMBIN39 used. Membership models, structures Fzakar desired coefficients wasting 100 addressed and values thinness of the formula (2) and Figure (16) by Mr. Kato and Ishikawa obtained have been used.

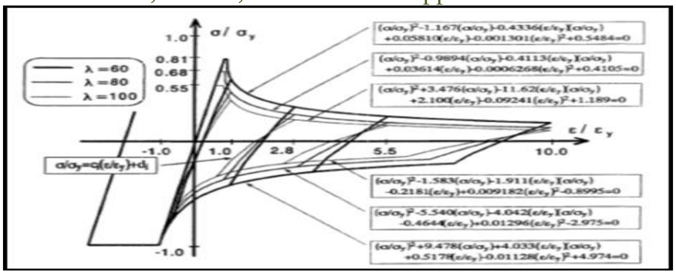


Figure 16 - Graph coefficients are thin 60-80-100 by Mr. Ishikawa and Kato

(2)post-buckling formula for weight loss: 100

$$\left(\frac{\sigma}{\sigma y}\right)^2 + 3.476\left(\frac{\sigma}{\sigma y}\right) - 11.62\left(\frac{\varepsilon}{\varepsilon y}\right)\left(\frac{\sigma}{\sigma y}\right) + 2.10\left(\frac{\varepsilon}{\varepsilon y}\right) - .09241\left(\frac{\varepsilon}{\varepsilon y}\right)^2 + 1.189 = 0$$

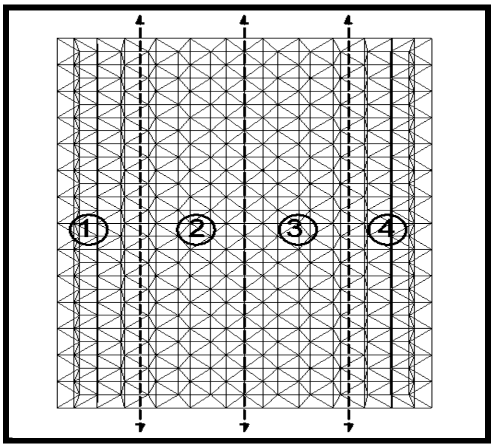


Figure 17 - cask divided into four equal regions

Because the structures go into non-linear phase during earthquakes (member) therefore geometrically nonlinear behavior for structures and materials have been applied. The post-buckling curves after slimness of 100 were defined for this model. These models for 19.5 seconds were applied to the quake of (TABAS) Iran
Placed in the horizontal direction H and the seismic behavior of the casks have been studied., some of the results are shown in Table (3)

Number of Buckled members	First buckling zone	First buckling time(s)	The greatest nodal displacement in y direction	The greatest nodal displacement in x direction	Model
-	-	-	.04048	0	BA-.2-.007353
.	Top	4.52	.03801	.03092	BB-.2-.02941
4-1	Top-jan	4.8	.02145	.01895	BA-.3-.03176
-	-	-	.001985	.002467	BB-.3-.0220
4	Jan	1.74	0	1.82	BA-..4-.2941
14	jan	7.89	.05821	.02357	BB-.4-.007351

The BB-0.4-0.02941 with a fuller analysis model is investigated. This model can be used to analyze the seismic TABAS. As of the form (18) View node created for this model to be the biggest shift in the direction of (x) the amount of node 276 m 0.02357 and Also, the form (19) observed that the largest shift in the positive direction for the model node (Y) the number of nodes is 231 m 0.05821 times the amount of Tabas earthquake. Forms (20) and (21) local buckling of members which have been with the show, In the first buckling in the second layer of jan has happened.

And first-time of buckling is 7.89 seconds. Then, by passing time, In District members of top layer and in district 2, members of jan layer, and in district three, members of jan layer and in district four, members of the top layer go buckling.Finally, for the first time and last time buckling 14 members in jan layer, and in last buckling time, 18 members in the layer above and 2 members in low layer and 42 members in the jan layer have gone buckling. Now we investigate the buckling behavior of buckled member with slimness of 100.
Figure (23) shows that, a, b, respectively, have been the biggest change for Model BB-0.4-0.02941 buckling length member show.And these points on the graph where the buckling shapes (22) are corresponding.

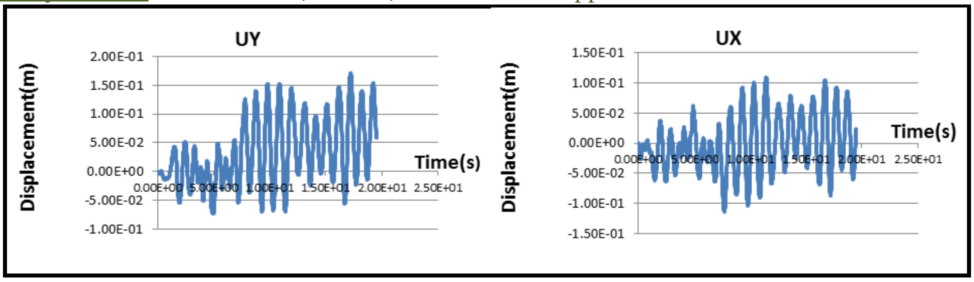
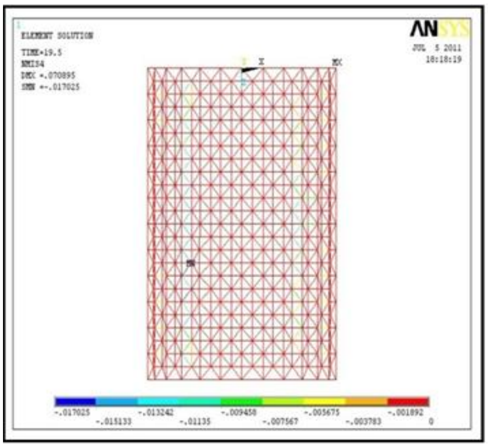
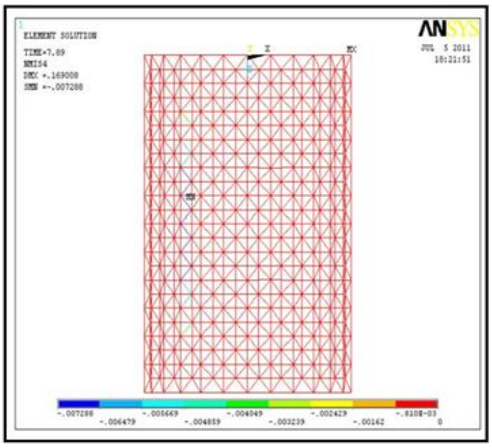
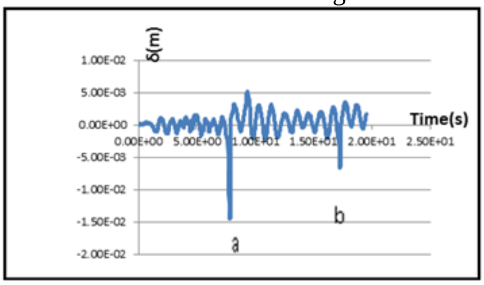


Fig.19. Chart shift - time for Y to model **BB-0.4-0.02941**





The BB-0.4-0.02941 Figure 21 - The last time the buckling model BB-0.4-0.02941



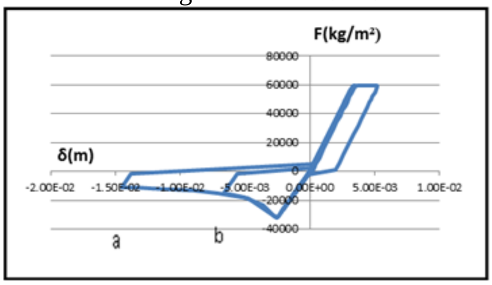


Figure 22 - Graph to model the buckling member of BB-0.4-0.02941 Figure 23 - Change Over Chart (Member) - Time for Model BB-0.4-0.02941

VI. Conclusion

1 - The time of the first buckling doesn't differ a lot, and is between 4 to 5 seconds in most of the models.

2 -It seems that the best supporting situations based on structural stability is first A and then B and the best deflection to mouth proportion is 0.2

3 - With the increasing of deflection to mouth in constant depths displacement of the structure is greater than the potential structural failure occurs and the buckling of the top layer is Jan.

4 - With the increase in the ratio of depth to span in constant and variable rates of deflection to mouth, the number of members buckling will be variable.

5 - Buckling earliest times in structure is for model of BA-0.4-0.02441 equal to 1.74
And the last Buckling times in structure is for model of BB-0.4-0.007353 equal to 7.89

6 - Increasing deflection to mouth, in earthquake of TABAS (IRAN) time of the first buckling reduced extreme cask with a rich mouth H / S = 0.2 . Members buckling get very least, and in many cases no buckling in them does not happen if for cask with a deflection to mouth of H / S = 0.4, the buckling members will increase a lot and members get buckling in majority of times.

REFRENCES

[1] Ishikawa, K. and Kato, S., Dynamic Buckling Behaviourof Single and Double Layer Latticed Domes due to Vertical Earthquake Motions, Park, G.A.R. ed., SpaceStructures 4: Proceedings of the Fourth International Conference of Space Structures, Vol. 1, Thomas Telford, 1993, pp. 466-475.

[2] Sadeghi, A., "Horizontal Earthquake Loading and Linear/Nonlinear Seismic Behaviour of Double Layer Barrel Vaults", International Journal of Space Structures, Vol. 19, No 1, 2004.

[3] Sadeghi, A, "Vertical effects of earthquakes on the double layer barrel vaults ", J. of Space Structures,Vol. 19, No.2, 2004.

[4] Ansys Theory Reference, 1 7.7, Spectrum Analysis.

[5] Nooshin,H,"Course on Space Strucures, Kerman, Iran, May 2003