

# Influence of Hoarding Frame on Response of RC Framed Host Structure

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**ABSTRACT:** In the contemporary time, the storing outlines assume an awesome part in human social orders and in this manner a great deal more consideration is presently being paid to accumulating outlines than it was previously. As storing casings are the main method for upgrading the commercial on the parkways more accumulating edges are introduced now a days. The course and tallness of edge alongside the width is totally administered by the practical necessities of promotion. The best place for storing casings is on ground however in urban regions the accessibility of area which would be most perfect is to a great degree constrained giving no option yet to embrace housetop accumulating outlines with negligible modification as far as position. In this perspective, wind investigation of rooftop top accumulating outlines has been considered under the impact of wind burden having shifting fundamental wind pace of 33m/sec, 44m/sec and 50m/sec, according to rules of Seems to be: 875 (section iii) 1987. The investigation has been performed on accumulating outline situated on top of host structure with using so as to fluctuate positions of storing casing programming bundle Staadpro. Furthermore, thought about the outcomes (i.e., parallel relocations, hub powers and minutes in  $M_x$  and  $M_z$  of sections) got from the investigation in light of its positions of storing edges with changing wind speeds.

**KEYWORDS:** Displacements, axial forces and moments, comparison of displacements, axial forces and moments.

## I. INTRODUCTION

Hoardings can be all around mounted, detached on a plinth or raised on a tower to see from a flyover. (Showcasing) an expansive board utilized for showing publicizing blurbs, as by a street. Additionally called (esp US and Canadian): announcement. (Building) a transitory wooden wall raised cycle a building or destruction site. Wind is air in movement with respect to the surface of the earth. The essential driver of wind istraced to earth's revolution and contrasts in physical radiation. The radiation impacts are fundamentally in charge of convection either upwards or downwards. The twist for the most part blows even to the ground at high wind speeds. Since vertical segments of air movement are generally little, the expression "wind" means only the level wind, vertical winds are constantly recognized in that capacity. The wind rates are evaluated with the guide of anemometers or anemographs which are introduced at meteorological observatories at statures by and large shifting from 10 to 30 meters over the ground. Exceptionally solid winds (more prominent than 80 km/h) are by and large connected with cyclonic tempests, rainstorms, dust storms or enthusiastic storms. A component of the cyclonic tempests over the Indian zone is that

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(An ISO 3297: 2007 Certified Organization)

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they quickly debilitate in the wake of intersection the coasts and move as despondencies/lows inland. The impact of a serious tempest in the wake of striking the coast does not; all in all surpass around 60 kilometers, however some of the time; it might stretch out even up to 120 kilometers. Short span sea tempests of high wind speeds called KalBaisaki or Norwesters happen decently much of the time amid summer months over North East India. The wind speeds recorded at any area are greatly variable and notwithstanding enduring wind whenever, there are impacts of blasts which might keep going for a few moments. These blasts cause increment in pneumatic force however their impact on steadiness of the building may not be so imperative; regularly, blasts influence just part of the building and the expanded nearby weights might be more than adjusted by a transient diminishment in the weight somewhere else. As a result of the inactivity of the building, brief period blasts may not bring on any obvious increment in anxiety in principle parts of the building in spite of the fact that the dividers, rooftop sheeting and individual cladding units (glass boards) and their supporting individuals, for example, purlins, sheeting rails and coating bars might be all the more truly influenced. Blasts can likewise be critical for configuration of structures with high slimness proportions. The obligation of a working to high wind weights depends not just upon the land area and closeness of different checks to wind current additionally upon the attributes of the structure itself. The impact of wind on the structure all in all is controlled by the consolidated activity of outer and interior weights following up on it. In all cases, the computed wind loads act typical to the surface to which they apply. The solidness figuring's all in all should be done considering the joined impact, and also isolate impacts of forced loads and twist loads on vertical surfaces, rooftops and other part of the working above general rooftop level. Structures might likewise be planned with due consideration regarding the impacts of wind on the solace of individuals inside and outside the structures.

## II. RELATED WORK

**William H. Greene<sup>12</sup> (1985)** A system is depicted for mechanized measuring of the individuals and determination of demand qualities for guyed receiving wire towers. The tower comprises of a triangular cross area, tubular part pole bolstered by various arrangements of claim folks. The measuring method utilizes a nonlinear limited component investigation coupled to a nonlinear numerical programming based streamlining agent. Numerical studies were performed on an average VLF radio wire arrangement to get least weight tower plans. Different stacking conditions, tower statures, and tower materials were considered.

**Reginald T. Nakamoto, Arthur N. L. Chiu<sup>10</sup> (1985)**, Full-scale wind speed and auxiliary reaction information from a tall guyed tower have been broke down to acquire data concerning wind qualities and element reaction. Anemometers and accelerometers were introduced at five stations along the stature of the tower, and orthogonal parts of wind speeds and tower increasing speeds were recorded. Plan rules indicate 1/7 as the force law type for wind profiles in waterfront locales. Be that as it may, information from this task, however constrained in number of tests and conditions, show a mean type of 0.287. Computerized connection and ghastly examination are connected to the tower speeding up information to get evaluations of thunderous frequencies and basic damping proportions

**Mehran Keshavarzian<sup>8</sup> (2003)** Depending on the application, self-bolstered tubular steel post (cantilever) structures in the United States are intended for amazing wind loadings in view of either ASCE 74 (for electric utility applications), ANSI/TIA/EIA 222 (for reception apparatus applications), AASHTO (for thruway sign and activity signal applications), or ASCE 7 (for general applications, for example, stadium announcements). This paper analyzes the edges of wellbeing of self-upheld tubular steel structures intended for compelling wind loadings taking into account ASCE 74, TIA/EIA, AASHTO and ASCE 7. Taking into account this examination, a basic survey of the ASCE productions and their individual configuration prerequisites and security elements are displayed.

**Eric James Sullins, Dr. Hani Salim<sup>2</sup> (2006)** The MoDOT radio correspondence tower system was made in the 1950s and 1960s. There is a need to evaluate the state of the towers in the system furthermore to figure out whether they are breakthrough with current codes. A condition indexing (CI) framework is a dependable evaluation device. In any

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case, a systematic technique for deciding the information parameters for the CI should be resolved. Thusly, the target of this exploration is to build up a methodical investigative strategy for foreseeing the reaction of the towers under regular perils. In this venture, a guyed and an unattached tower were displayed utilizing ERITower and SAP2000 under wind, ice, and seismic burdens. The impact of decay on the reaction of the towers was assessed utilizing a parametric study. The slanting bracings controlled the limit of the towers under wind and ice stacking, while the folks were the most touchy to crumbling under seismic burdens. The consequences of this task show that a few segments of the towers are basic and could control disappointment. It is suggested that definite investigation of the towers'critical parts be performed to add to a nitty gritty danger evaluation of the towers.

**Amiri G., Massah S.R., A. Boostan1(2007)**, Telecommunication tower is a vital part of the fundamental foundation of correspondence frameworks and in this way saving them in occasions of common calamities -, for example, a serious seismic tremor - is of high need. In past studies, analysts have for the most part considered the impacts of wind and quake incited loads on 3-legged (triangular cross-area) self-supporting steel telecom towers. In this study, the seismic affectability of 4-legged telecom towers is explored in light of modular superposition examination. For this reason, ten of the current 4-legged self-supporting telecom towers in Iran are contemplated under the impacts of wind and tremor loadings. To consider the wind impacts on the models, the procurements of the TIA/EIA code are utilized and the wind is dealt with as a static burden all through the investigation. Furthermore, to consider the tremor consequences for the models, the standard outline range in light of the Iranian seismic code of practice and the standardized spectra of Manjil, Tabas and Naghan quakes have been connected. Since Iran is thought to be situated in a high seismic danger area, a base outline increasing speed of  $A = 0.35$  g is utilized for standardization of the spectra. It was watched that on account of towers with rectangular cross area, the impact of concurrent tremor stacking in two orthogonal headings is imperative. Toward the end, various experimental relations are exhibited that can help originators to rough the dynamic reaction of towers under seismic loadings.

**FarzadFaridafshin, S. Ali GhafariOskoei and GhyslaineMcClure<sup>3</sup>(2008)** Tall telecommunication masts are slender structures whose lateral resistance is provided by clusters of guycables anchored to the ground at several support points. The main goal of this study is to demonstrate the importance of considering realistic three-dimensional ground motion with asynchronous input when evaluating the seismic response of these tall multi-support structures. Three existing masts with heights of 213, 313 and 607 m and different guy cable arrangements have been modeled and investigated in detail with three classical historical earthquake records using a commercial finite element program (ADINA). Both synchronous and asynchronous ground shaking were considered. The effect of asynchronism in multiple support excitations was studied by varying the shear wave velocity of the surface traveling wave corresponding to different degrees of soil stiffness. The three towers have shown sensitivity to asynchronous shaking of their supports. More severe response was obtained for softer soil conditions, and the 607 m mast was sensitive even for relatively stiff soils.

**Siddesha.H<sup>11</sup>(2010)** Open latticed steel towers are used widely in a variety of civil engineering applications. The angle sections are commonly used in microwave antenna towers. This paper presents the analysis of microwave antenna tower with Static and Gust Factor Method (GFM). The comparison is made between the tower with angle and square hollow section. The displacement at the top of the tower is considered as the main parameter. The analysis is also done for different configuration by removing one member as present in the regular tower at lower panels.

**NitinBhosale, Prabhat Kumar, A K Pandey<sup>9</sup>** (2012) In the contemporary era, the telecommunication industry plays a great role in human societies and thus much more attention is now being paid to telecommunication towers than it was in the past. As telecommunication tower are the only means of enhancing both the coverage area and network reliability more and more telecommunications tower are installed nowadays. The direction and height of tower along with the antennas mounted on it is completely governed by the functional requirements of network. The

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most ideal place for tower is on ground but in urban areas the availability of land which would be most ideal is extremely limited giving no alternative but to adopt rooftop tower with marginal adjustment in terms of position. In this present study, the seismic analysis of 4 legged angled section rooftop telecommunication tower has been studied under the effect of design spectrum from Indian seismic code of practice for zone-iii along with wind analysis as per IS 875 (part 3) 1987. The analysis has been performed on tower located on roof of host structure by varying the positions of tower in Etabs software. The stresses in beam grid of rooftop tower foundation, stresses in host structure, retrofitting in host structure, axial forces in tower are the main parameters considered for the study. The host structure also analyzed with flexible base, to see the effect of flexibility of soil on host structure and tower response.

## III. THEORY/METHODOLOGY

**3.0 GENERAL:** In this chapter, discussed about model specifications, modeling of structures, loads and load combinations. And also to give brief overview of study flow chart was prepared.

### 3.1 BASIC MODEL SPECIFICATIONS

Building type	:	RC frames with and without hoarding frame of regular building.	
REGULAR BUILDING	:	31.37mX	14.07m
Storey Height	:	3m	
No. of Stories	:	G+4.	

- Comparisons of displacements of both the structures with and without hoarding frame were done by doing analysis in STAADPRO.

### 3.2 MATERIAL PROPERTIES

- The material used for analysis is reinforced concrete with M-20 grade concrete and Fe-415 grade reinforcing steel.
- The Stress-strain relationship used is as per IS 456-2000. The basic material properties are as follows:

Modulus of Elasticity of steel,  $E_s = 20,000\text{MPa}$  Ultimate strain in bending,  $\sum_{cu} = 0.0035$  Characteristic strength of concrete,  $f_{ck} = 20\text{MPa}$  Yield stress for steel,  $f_y = 415\text{Mpa}$

### 3.3 MODELING OF STRUCTURE

A regular RC framed structure is chosen with and without hoarding frame; the plan of the apartment and 3d views of R.C framed structure with hoardings at different positions are shown in figure 3.1, 3.2, 3.3 and 3.4 and the structure was modeled for G+4 storey. All the considered frames are assumed to be fixed at ground level and storey height are taken as 3m. All the members of the structure are assumed to be homogenous isotropic and having elastic modulus same in compression as well as in tension. Constant beam and column sizes were taken at all floor levels for each considered frame. Sizes of structural members shown in table given below:

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**Table 3.1 Sizes of structural members for G+ 4 storeys**

MEMBER	SIZE(mm)
Beam	230X450
Column	230X450
Slab thickness	150

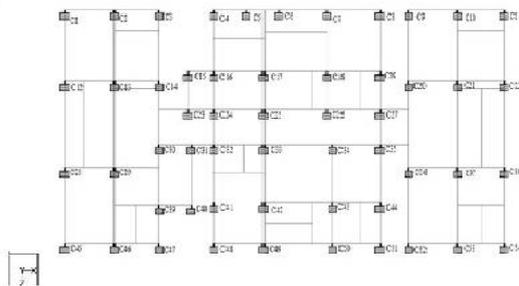


Fig. 3.1

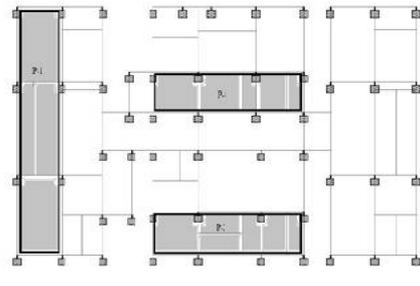


Fig. 3.2

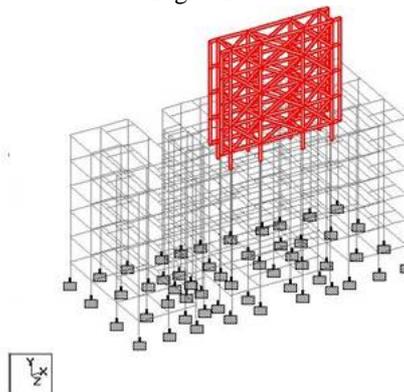
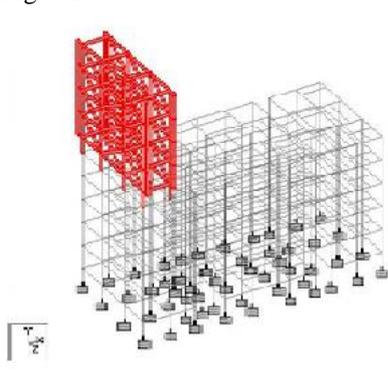


Fig. 3.3

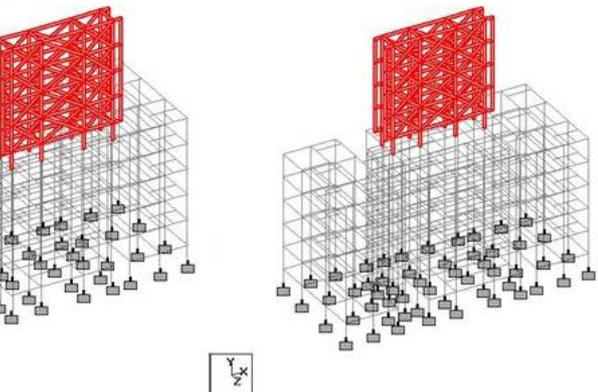


Fig. 3.4 Fig. 3.5

Figure 3.1 Plan showing R.C. frame structure without hoarding frame with column numbers, 3.2 Plan showing R.C. frame structure with hoarding frames positions, 3.3, 3.4 and 3.5, shows the 3d-view of R.C. frame structure with hoarding frame at various positions are analyzed in the Staadpro. for varying basic wind speeds of 33m/sec, 44m/sec and 50m/sec.

### 3.4 LOADS CONSIDERED

- Dead load
- Live load
- Wind load

### 3.5 Loads considered as per IS 875(part V) for limit state of collapse

- 1.5(D.L.+L.L.)
- 1.5(D.L.+WLX)
- 1.5(D.L.+WL-X)
- 1.5(D.L.+WLZ)
- 1.5(D.L.+WL-Z)
- 1.2(DL+LL+WLX)
- 1.2(DL+LL+WL-X)

- 1.2(DL+LL+WLZ)
- 1.2(DL+LL+WL-Z)

**IV. RESULTS AND DISCUSSIONS**

**4.0 GENERAL**

Wind analysis of roof top hoarding frames has been studied under the effect of wind load having varying basic wind speed of 33m/sec, 44m/sec and 50m/sec, as per guidelines of IS: 875 (part-iii) 1987. The analysis has been performed on hoarding frame located on roof of host structure with varying positions of hoarding frame by using software package Staadpro. And the results (i.e., lateral displacements, axial forces and moments in Mx and Mz of columns) obtained from the analysis based on its positions of hoarding frames with varying wind speeds are discussed.

**4.1 R.C. FRAME**

**4.1.1 R.C.FRAME WITHOUT HOARDING FRAME (Position 1)**

4.1.1.1A frame of G+4 building without hoarding frame has been considered and graphs were plotted for Displacements Vs Height at a wind speed of 33m/sec.

Table 4.1: Displacements Vs Height for G+4frame without hoarding frame for columns at 33 m/sec wind speed for a load combination 1.5(DL+WLX) at 3m interval for 15m height.

4.1.1 R.C.FRAME WITHOUT HOARDING FRAME (Position 1)									
Load Combination	Height	Column Numbers (Displacements in (mm))							
		C1	C2	C12	C13	C28	C29	C45	C46
1.5(DL+WLX)	-1.8	0	0	0	0	0	0	0	0
1.5(DL+WLX)	0	0.828	0.97	1.005	1.293	1.114	1.468	0.876	1.059
1.5(DL+WLX)	3	3.039	3.295	3.045	3.703	3.372	4.205	2.835	3.207
1.5(DL+WLX)	6	4.625	4.985	4.717	5.547	5.145	6.332	3.967	4.516
1.5(DL+WLX)	9	5.713	6.155	5.877	7.016	6.269	7.743	4.553	5.268
1.5(DL+WLX)	12	6.326	6.824	6.615	7.393	6.9	8.562	4.789	5.528
1.5(DL+WLX)	15	6.531	7.01	6.929	8.3	7.159	8.869	4.804	5.526

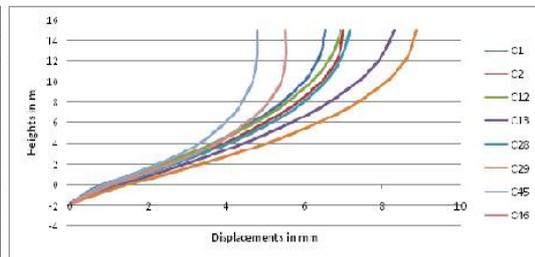


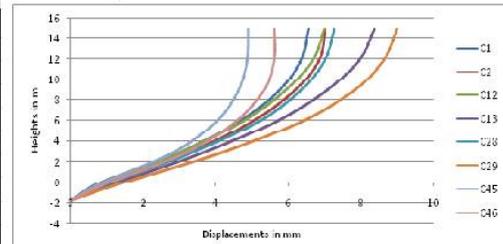
Figure 4.1: Displacements Vs Height for G+4frame without hoarding frame for columns at 33m/sec wind speed. From figure 4.1, it was observed that maximum displacement of 8.869 mm occurs at top storey(i.e. 15m level) for C29 column, which is an interior column. So, it is clear from the values that interior column sharing more load than the end columns.

**4.1.2 R.C.FRAME WITH HOARDING FRAME (Position 1)**

4.1.2.1 A frame of G+4 building with hoarding frame has been considered and graphs were plotted for Displacements Vs Height at a wind speed of 33 m/sec.

Table 4.2: Displacements Vs Height for G+4frame with hoarding frame for columns at 33m/sec wind speed for a load combination 1.5(DL+WLX) at 3m interval for 15m height.

4.1.2 R.C.FRAME WITH HOARDING FRAME (Position 1)									
Load Combination	Height	Column Numbers (Displacements in (mm))							
		C1	C2	C12	C13	C28	C29	C45	C46
1.5(DL+WLX)	1.8	0	0	0	0	0	0	0	0
1.5(DL+WLX)	0	0.846	0.988	1.023	1.309	1.136	1.487	0.896	1.077
1.5(DL+WLX)	3	3.08	3.338	3.085	3.742	3.424	4.252	2.881	3.251
1.5(DL+WLX)	6	4.674	5.039	4.777	5.705	5.222	6.405	4.032	4.579
1.5(DL+WLX)	9	5.76	6.21	5.952	7.092	6.373	7.84	4.634	5.346
1.5(DL+WLX)	12	6.356	6.868	6.701	7.981	7.028	8.648	4.871	5.621
1.5(DL+WLX)	15	6.551	7.03	7.012	8.396	7.287	9.013	4.899	5.62



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Figure 4.2: Displacements Vs Height for G+4frame with hoarding frame for columns at 33m/sec wind speed From figure 4.2, it was observed that maximum displacement of 9.013 mm occurs at top storey (i.e. 15m level) for C29 column, which is an interior column. So, it is clear from the values that interior column sharing more load than the end columns.

Table 4.3: Comparison of moments on x-direction of frames with hoarding frame and without hoarding frame

COLUMN NO.	R.C.F WO HF Mz	R.C.F WHF MX KNM
C1	+ve 18.956	18.359
C2	+ve 20.4	20.044
C12	+ve 18.367	17.763
C13	+ve 19.799	19.442
C28	+ve 16.336	15.753
C29	+ve 18.008	17.66
C45	+ve 16.345	15.811
C46	+ve 17.516	17.214

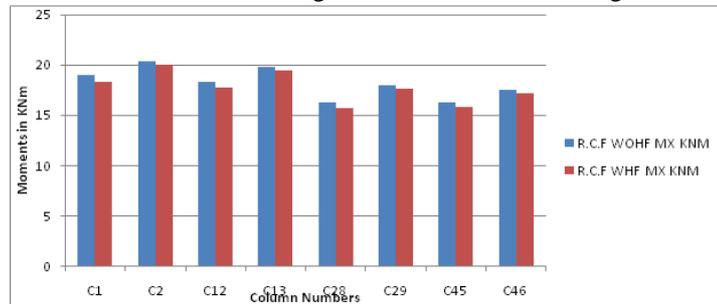


Figure 4.3 Comparison of moments on x-direction of frames with hoarding frame and without hoarding frame From the figure 4.3, it was observed that there was a decrease in percentage of moments at columns are 3.14, 1.74, 3.28, 1.80, 3.56, 1.93, 3.26 and 1.72 % for columns C1, C2, C12, C13, C28, C29, C45 and C46 respectively, for frames with hoarding frame when compared to structure without hoarding frame; therefore observed a maximum percentage of variation of moment at column C28.

### 4.3.9.3. Comparison of moments on z-direction of frames with hoarding frame and without hoarding frame

Table 4.4: Comparison of moments on z-direction of frames with hoarding frame and without hoarding frame

COLUMN NO.		R.C.F WO HF MZ KNM	R.C.F WHF MZ KNM
C1	+ve	6.471	6.543
C2	+ve	7.168	7.251
C12	+ve	4.714	4.733
C13	+ve	3.01	3.037
C28	+ve	2.791	2.822
C29	+ve	0.788	0.81
C45	+ve	6.323	6.385
C46	+ve	6.604	6.676

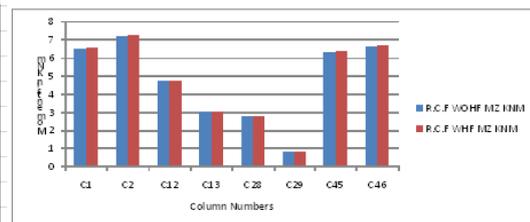


Figure 4.4 Comparison of moments on z-direction of frames with hoarding frame and without hoarding frame From the figure 4.4, it was observed that there was an increase in percentage of moments at columns are 1.11, 1.15, 0.40, 0.89, 1.11, 2.79, 0.98, 1.09 % for columns C1, C2, C12, C13, C28, C29, C45 and C46 respectively, for frames with hoarding frame when compared to structure without hoarding frame; therefore observed a maximum percentage of variation of moment at column C29.

## V. CONCLUSION

Studied the influence of hoarding frames on response of R.C. framed structure for varying basic wind speed (i.e., 33m/sec, 44m/sec and 50m/sec). Following were the conclusions drawn from the study.

1. The hoarding frame placed on position 1 of host structure, it was observed a minimum and maximum percentage of variation for lateral displacement of 0.28 % at column C2 and 1.97 % at column C45 for 33m/sec, 0.14 % at

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column C1 and 0.93 % at column C29 for 44m/sec and 2.27 % at column C29 and 3.14 % at column C45 for 50m/sec when compared to structure without hoarding frame.

2. The hoarding frame placed on position 2 of host structure, it was observed a minimum and maximum percentage of variation for lateral displacement of 2.41 % at column C41 and 54.20 % at column C51 for 33m/sec, 4.36 % at column C42 and 15.67 % at column C51 for 44m/sec and 4.04 % at column C42 and 10.34 % at column C51 for 50m/sec when compared to structure without hoarding frame.

3. The hoarding frame placed on position 3 of host structure, it was observed a minimum and maximum percentage of variation for lateral displacement of 13.92 % at column C16 and 30.94 % at column C19 for 33m/sec, 0.30 % at column C16 and 7.72 % at column C19 for 44m/sec and 1.89 % at column C16 and 6.15 % at column C19 for 50m/sec when compared to structure without hoarding frame.

4. The hoarding frame placed on position 1 of host structure, it was observed a minimum and maximum percentage of variation for axial forces of 1.03 % at column C29 and 26.13 % at column C1 for 33m/sec, 0.93 % at column C29 and 6.60 % at column C1 for 44m/sec and 9.42 % at column C29 and 63.93 % at column C1 for 50m/sec when compared to structure without hoarding frame.

5. The hoarding frame placed on position 2 of host structure, it was observed a minimum and maximum percentage of variation for axial forces of 1.24 % at column C50 and 22.46 % at column C42 for 33m/sec, 1.18 % at column C42 and 9.14 % at column C51 for 44m/sec and 1.21 % at column C42 and 6.18 % at column C51 for 50m/sec when compared to structure without hoarding frame.

6. The hoarding frame placed on position 3 of host structure, it was observed a minimum and maximum percentage of variation for axial forces of 1.20 % at column C25 and 1.71 % at column C26 for 33m/sec, 1.08 % at column C18 and 1.38 % at column C19 for 44m/sec and 1.10 % at column C18 and 1.35 % at column C19 for 50m/sec when compared to structure without hoarding frame.

7. The hoarding frame placed on position 1 of host structure, it was observed a minimum and maximum percentage of variation for moments of 3.56 % at column C28 and 1.72 % at column C46 for 33m/sec, 0.53 % at column C12 and 0.28 % at column C46 for 44m/sec and 4.01 % at column C2 and 6.00 % at column C46 for 50m/sec for  $M_x$  moment and 0.40 % at column C12 and 2.79 % at column C29 for 33m/sec, 0.19 % at column C12 and 0.46 % at column C46 for 44m/sec and 4.83 % at column C45 and 8.26 % at column C29 for 50m/sec for  $M_z$  moments when compared to structure without hoarding frame.

8. The hoarding frame placed on position 2 of host structure, it was observed a minimum and maximum percentage of variation for moments of 0.16 % at column C48 and 0.65 % at column C50 for 33m/sec, 4.73 % at column C41 and 5.85 % at column C43 for 44m/sec and 4.76 % at column C2 and 6.44 % at column C43 for 50m/sec for  $M_x$  moment and 21.69 % at column C48 and 8.11 % at column C41 for 33m/sec, 1.31 % at column C48 and 4.92 % at column C41 for 44m/sec and 1.71 % at column C51 and 4.43 % at column C41 for 50m/sec for  $M_z$  moment when compared to structure without hoarding frame.

9. The hoarding frame placed on position 3 of host structure, it was observed a minimum and maximum percentage of variation for moments of 0.09 % at column C17 and 0.54 % at column C26 for 33m/sec, 2.00 % at column C17 and 5.92 % at column C19 for 44m/sec and 4.57 % at column C18 and 5.35 % at column C25 for 50m/sec for  $M_x$  moment and 4.03 % at column C19 and 0.33 % at column C24 for 33m/sec, 1.67 % at column C19 and 2.42 % at column C26 for 44m/sec and 3.67 % at column C19 and 4.80 % at column C24 for 50m/sec for  $M_z$  moment when compared to structure without hoarding frame.

10. The hoarding frame placed on position 3 of host structure shows better performance compared to hoarding frame placed on the other positions on the hosting structure.

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