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Research Article

Comparative Analysis of Static and Dynamic Analysis of Digrid Structure using E-TAB

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Abstract

Structural design of high rise buildings is governed by the lateral loads due earthquake. Lateral load resistance of structure is provided by shear wall, wall frame, braced tube system, outrigger and tubular system. Recently the diagonal grid system is widely used for tall buildings due to its structural efficiency. In this paper, the comparison of static and dynamic analysis of study of 32-storey digrid structural system without vertical column around periphery building is presented here. The comparison of analysis of result in terms of storey displacement, storey drift for the Seismic and Dynamic analysis is presented here.

Keywords: *Digrid, Storey Drift, Storey Displacement Static analysis, Dynamic analysis.*

1. Introduction

The Digrid is perimeter structural configurations characterized by a narrow grid of diagonal members which are involved both in gravity and in lateral load resistance. The Digrid systems are the evolution of braced tube structures, since the perimeter configuration still holds for preserving the maximum bending resistance and rigidity, while, with respect to the braced tube, the mega-diagonal members are diffusely spread over the façade, giving rise to closely spaced diagonal elements and allowing for the complete elimination of the conventional vertical columns. Therefore the diagonal members in digrid structures act both as inclined columns and as bracing elements, and carry gravity loads as well as lateral forces; due to their triangulated configuration, mainly internal axial forces arise in the members, thus minimizing shear racking effects.

In this paper, a comparative study of 32 storey digrid building without straight column around periphery is considered with building height 95m. Comparison of analysis result in terms of storey Drift and point displacement is describing here.

2. Analysis of 32-storey building

2.1 Building Configuration

The 32- storey building is having unsmentriacal dimension and 95m total height of building. The storey height is 3m. The plan and elevation are shown in figure (1) and figure (2). Digrid building without vertical column around periphery. The beam sizes are 230X450 and column sizes are 300X600 or 230X600. The diagonal member's (Digrid) size is 230 mm x 230 mm. Slab thickness is taken for analysis is 125 mm thick. The live load and dead load are 3kN/m and 1kN/m^2 respectively. The design earthquake load is computed based on the zone factor 0.16, soil type III, Importance factor 1, Response reduction 5 as per IS-1893-2002.

Modal combination CQC and Directional Combination SRSS is used for Response Spectrum Analysis.

Modeling analysis is carried out using ETAB 9.7.2. The end condition for models are assumed as hinged. The support conditions are as fixed.

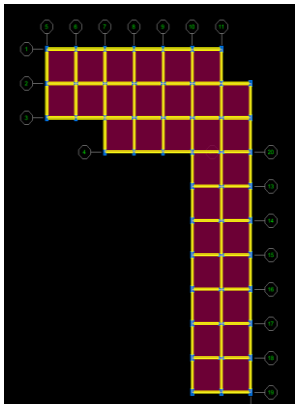

Fig.1 Plan

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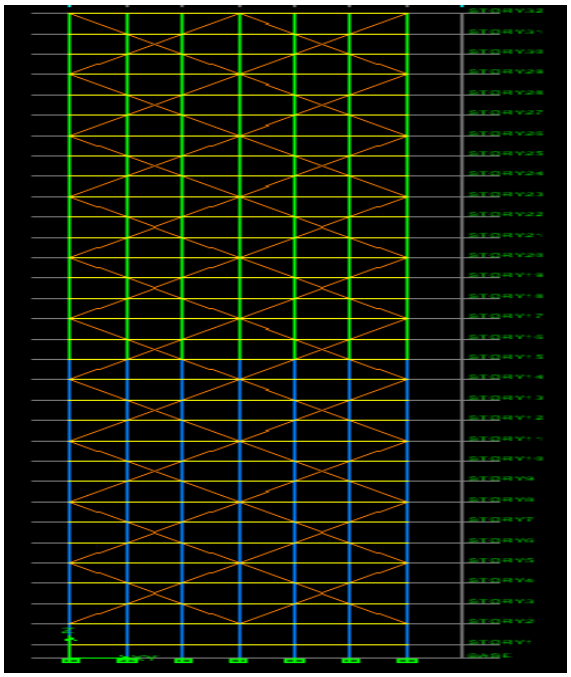

Fig.2 Elevation

2. Analysis Results

The analysis result in terms of storey drift and displacement of point object no. 25 are presented here for seismic analysis. It is observed that Values of Dynamic (Response spectrum) analysis is higher than Static Analysis.

Table 1 Drift in X Direction (m)

Storey	EQX	EQY	Spec 1	Spec 2
STORY32	0.0004	0.000139	0.0003	0.0001
STORY25	0.0006	0.000185	0.0004	0.0002
STORY20	0.0006	0.000132	0.0004	0.0002
STORY15	0.0006	0.00011	0.0004	0.0002
STORY10	0.0005	0.000067	0.0004	0.0002
STORY5	0.0002	0.000041	0.0002	0.0002
STORY1	0.0002	0.000006	0.0003	0.0002

Table 2 Drift in Y Direction (m)

Storey	EQX	EQY	Spec 1	Spec 2
STORY32	0.00013	0.00024	0.00011	0.00012
STORY25	0.00016	0.0004	0.00016	0.00018
STORY20	0.00015	0.00036	0.00014	0.00017
STORY15	0.00014	0.00034	0.00014	0.00016
STORY10	0.00011	0.00028	0.00011	0.00013
STORY5	3.6E-05	0.00014	4.6E-05	6.9E-05
STORY1	4E-06	0.0002	8.2E-05	0.00016

Table 3 Displacement in X Direction (mm)

Storey	EQX	EQY	Spec 1	Spec 2
STORY32	0.0487	0.0111	0.0326	0.0171
STORY25	0.0369	0.0069	0.0253	0.0148
STORY20	0.0275	0.0041	0.0196	0.0124
STORY15	0.0183	0.002	0.0142	0.0097
STORY10	0.0101	0.0006	0.009	0.0067
STORY5	0.0035	-0.0001	0.0041	0.0034
STORY1	0.0003	0	0.0005	0.0005

Table 4 Displacement in Y Direction (mm)

Storey	EQX	EQY	Spec 1	Spec 2
STORY32	0.0118	0.0309	0.0117	0.0138
STORY25	0.0086	0.0231	0.0088	0.0104
STORY20	0.0061	0.017	0.0066	0.0078
STORY15	0.0038	0.0113	0.0045	0.0055
STORY10	0.0019	0.0064	0.0027	0.0035
STORY5	0.0005	0.0028	0.0012	0.0019
STORY1	0	0.0004	0.0002	0.0003

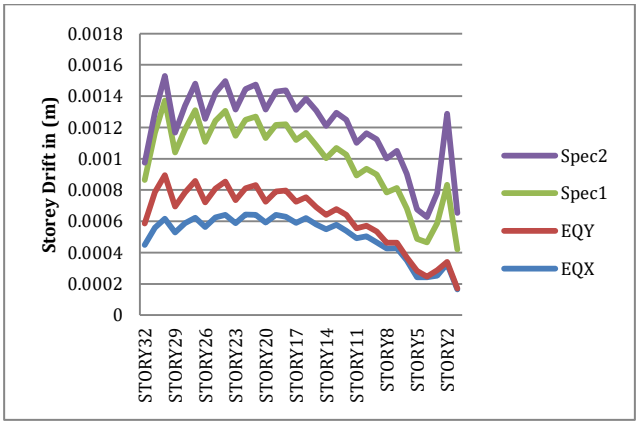

Fig.3 Storey VS Storey Drift – X Direction (m)

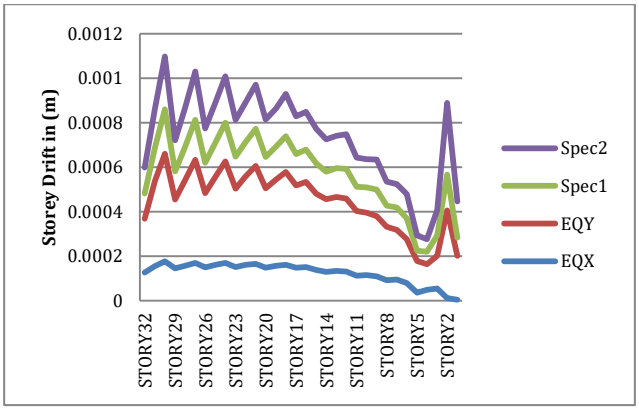

Fig.4 Storey VS Storey Drift – Y direction (m)

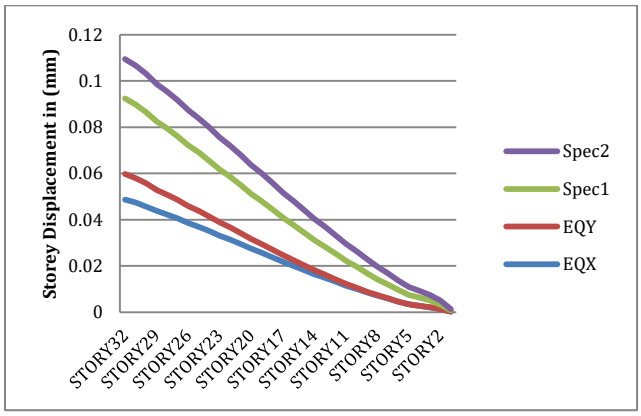

Fig.5 Storey VS Displacement – X Direction (mm)

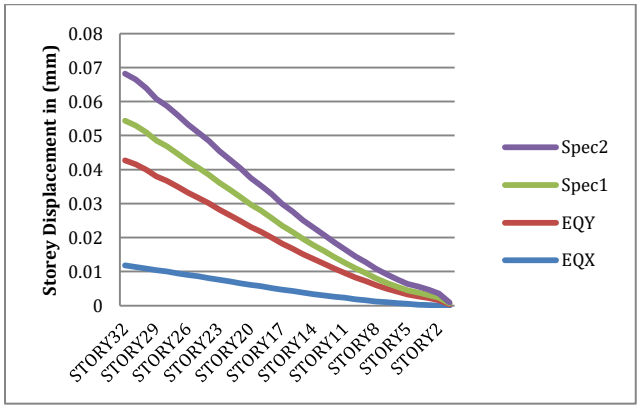

Fig.6 Storey VS Displacement- Y Direction (mm)

Conclusions

The result is obtained using E-Tab for the Static and Dynamic Analysis (Response spectrum) for Storey Drift in X and Y direction. From this analysis observed that Dynamic value for storey Drift is higher than static analysis.

Similarly Point displacement of dynamic analysis is higher than Static analysis.

The point displacement of X direction is higher than point displacement of Y direction.

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