JOURNAL OF MECHANICS OF CONTINUA AND MATHEMATICAL SCIENCES
www.journalimcms.org

ISSN (Online) : 2454 -7190 Vol.-15, No.-9, September (2020) pp 31-41 ISSN (Print) 0973-8975

SEISMIC ANALYSIS OF MULTI STOREY BUILDING WITH AND WITHOUT HANGING COLUMNS

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https://doi.org/10.26782/jmcms.2020.09.00003

(Received: July 19, 2020; Accepted: August 27, 2020)

Abstract

A-pillar is a vertical section, preliminary from footing level also shifting weight to the base. Hanging or stub section similarly a precipitous element which closes (as of model design/site condition) on its base level, lies on level part i.e., beam (horizontal section). Such sections (hanging or stub) where the burden was mulled over using point load. Present examination on G+12 model with/without hanging section is studied by applying response spectrum & time history procedures beneath quake load at zone two also differentiates with storey shears, lateral burden, storey relocations, storey drifts by using Etabs. From the final output, it was clear that storey shears, lateral burden, storey displacements, storey drifts are increased for the model without hanging sections concerning model with hanging section.

Keyword : storey shear, lateral burden, storey displacements, response spectrum, ETABS

I. Introduction

Innumerable capital (city) multi-storey constructions in India these days has first storey open as a predictable lookout. It is predominantly implemented for house stopping, gathering risk rooms at the essential storey. There were many structures where hanging sections are being used, mainly above the level of the ground. Wherever distribution beams are being used, with the objective that undeniably clear zone available at ground floor. Hanging sections were satisfactorily expert to get hold of gravity mass, nevertheless, distribution beams must have suitable dimensions with a minor deflection. Distribution beams must design prudently, particularly at quake occurrence zone. Configuration elements of the model which was affected due to quake force should be kept away if not, configuration elements must limit. So, houses previously built with discontinuous sections must jeopardize at seismic tremor zones. Those constructions cannot be crushed, instead, the examination must carry out strengthen the structure or scarcely any recuperating features can propose.

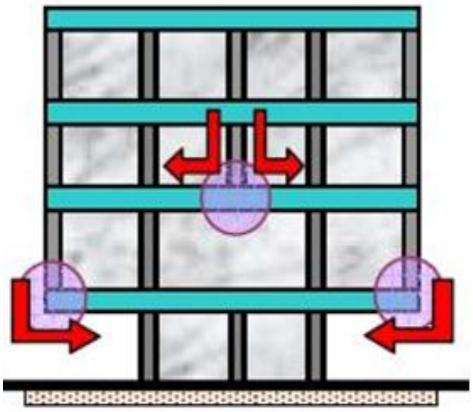

Fig. 1: Hanging column structure

II. Methodology

Response Spectrum Technique:

Response spectrum is a chart of highpoint and constant state reaction of the arrangement of an accelerator of fluctuating frequency which remained inhibited to movement via identical vibration, shake. It is a procedure to find the quake reaction of the model by using vibrational mode shapes. Computer investigation can be applied for guessing out modes of model. By utilizing the design spectrum each mode reaction can be known. After understanding the modal mass & frequency they remained combined on the certain approximation of absolute reaction of the model. In this, we have to figure the consequence of force at Y, X, Z direction and formerly observe the effects on the structure. Integrate approaches contain the following:

Absolute peak method
CQC method
SRSS method

The procedure of SRSS is utilized when the distance among eigenvectors or eigenvalues have more gap then we use this method. CQC procedure is utilized when eigenvalues are in the locale of ten per cent then we follow this method. Therefore, the entire reaction on every floor that has extreme values doesn't happen on a similar period, at a similar period immediately they can't remain added. So, for the accomplishment of the entire reaction 2 procedures were used.

Time history method:

Time history practice contains a stage-by-stage evaluation of model reaction, applying discretized data which was recorded/planned seismic records by way of ground wave input. A couple of ground-level motion records intended for coetaneous study along all flat axis of model essential to remain constant. Steady couples remain regular waves predictable on a specified location mainly depend upon alike seismic tremor. In time history practice, the reaction of the model towards ground level expansion is determined at time-space & wholly phase statics are subsequently sustained. In the situation wherever the model is extremely uneven, extremely elevated, Response Spectrum is not appropriate besides advanced complicated technique is desirable.

III. Modelling

Loads and Intensities:

Live load of the floor- 3 kN/m^2

wall load- 3.9 kN/m^2

Finishing off the floor- 1.5 kN/m^2

Parapet load- 1 kN/ m^2

Building details of modelled structure:

Storey height of Bottom story- 3.0 m

Storey height of typical storey- 3.0 m

Height of structure- 36 m.

Plan area- 8.5 m x 8.5 m

Structure type- Symmetrical and regular

Structure Frame system- O.M.R. F

No. of storeys- G+12

Support- fixed

Seismic Properties:

Seismic zone- II

Time history function- Elcentro seismic tremor data

Soil type- Medium

Damping ratio- 0.05

Response reduction factor- 5%

Zone factor- 0.10

Importance factor (I.F)- 1

Properties of Materials:

Reinforced concrete (R.C) density- 25 kN/m^3

Young's modulus (E_s)- 2 x 10^{8}kN/m^2

Steel Grade- Fe415

Young's modulus (Ec)- 27386127.87 kN/m^2

Concrete Grade- M30

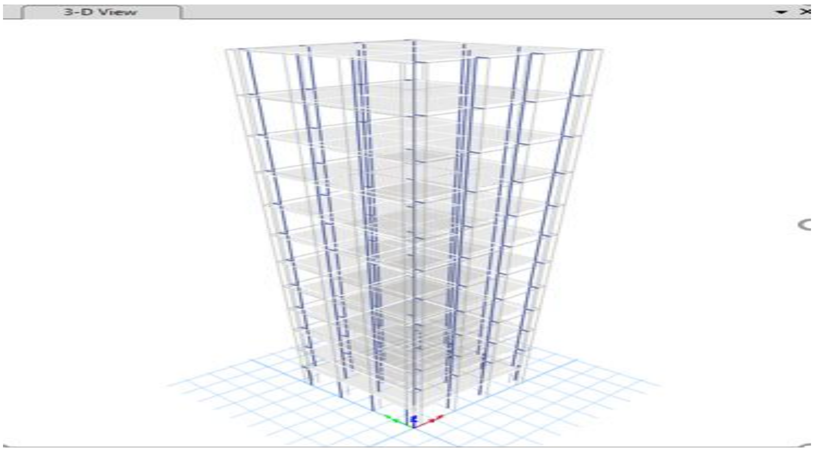

Fig..2: Elevation view of G+12 structure with hanging columns

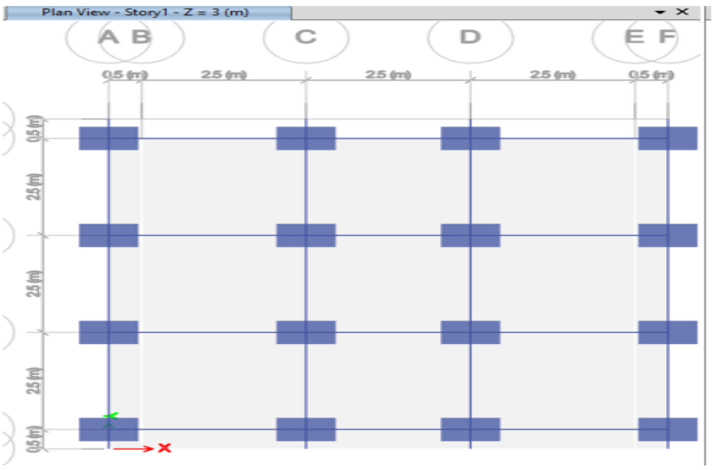

Fig. 3: Plan view of story 1 of G+12 structure with hanging columns

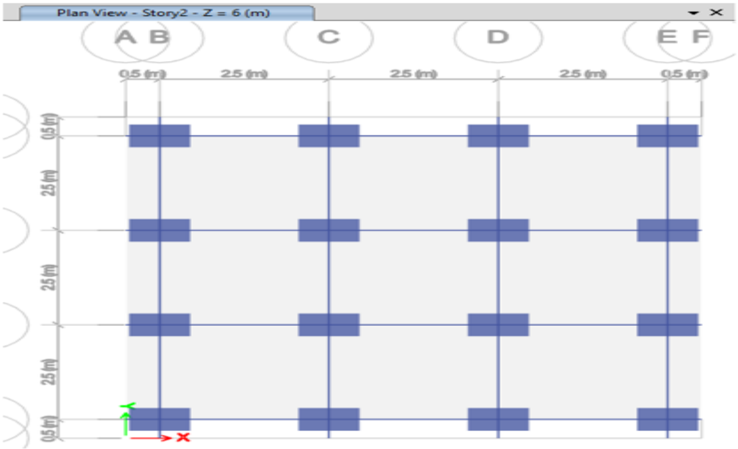

Fig. 4: Plan view of story 2 of G+12 structure with hanging columns

From figure 3&4 Insertion of hanging column exposed clearly.

IV. Results and Discussions

Results of G+12 structure with hanging columns

Lateral loads:

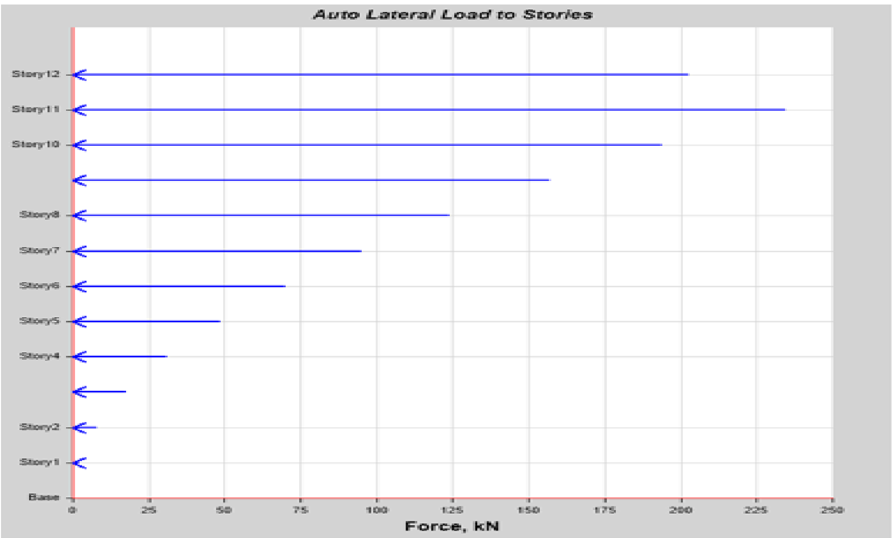

Fig. 5: The lateral burden in direction X at a storey of structure with hanging columns

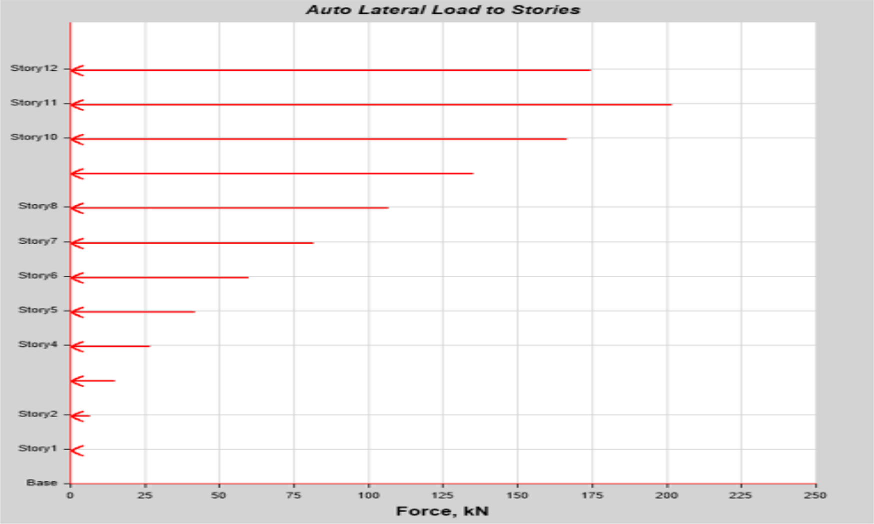

Fig. 6: The lateral burden in direction Y at a storey of structure with hanging columns

The lateral burden is Live loads that were acted parallel to the level of ground i.e., they remain flat forces applied on a model. It was seen that lateral weight for the model with a hanging column in direction X is greater w.r.t direction Y as shown in figure 5&6. lateral weight on model with the hanging column is lesser than the model without hanging column.

Storey shear:

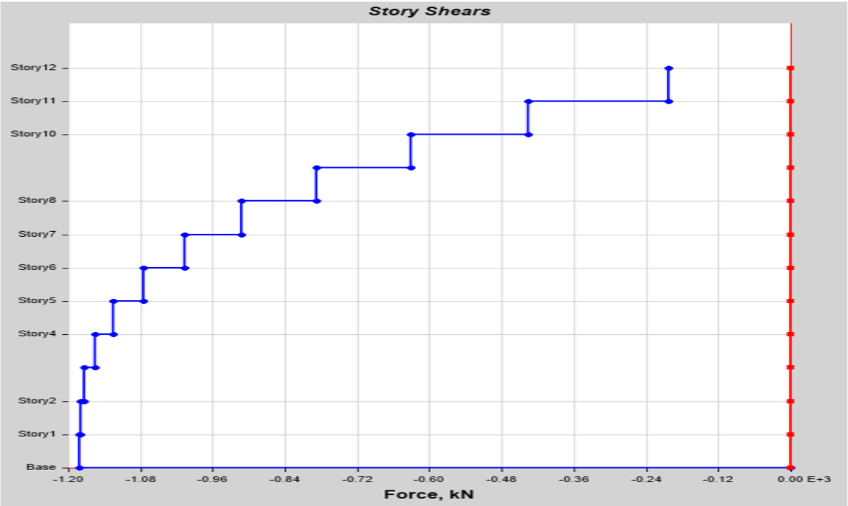

Fig. 7: Storey shear in direction X at a storey of structure with hanging columns

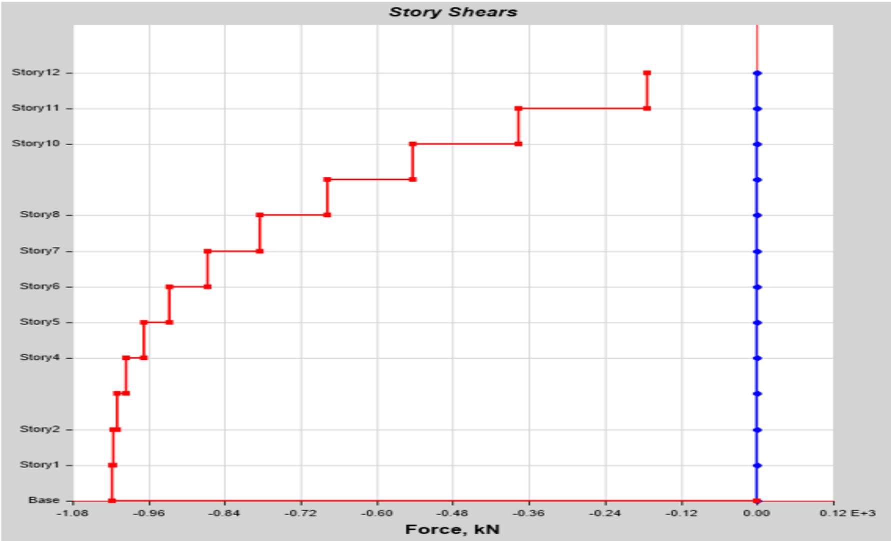

Fig. 8: Storey shear in direction Y at a storey of structure with hanging columns

In storey shear we can imagine conceivable leading lateral burden at a particular storey in a specified path and this determination will help to empathetic and examine where wind governs over quake in a particular direction. It was seen that storey shear for the model with a hanging column in direction Y is lesser w.r.t direction Y as shown in figure 7&8.

Storey drift:

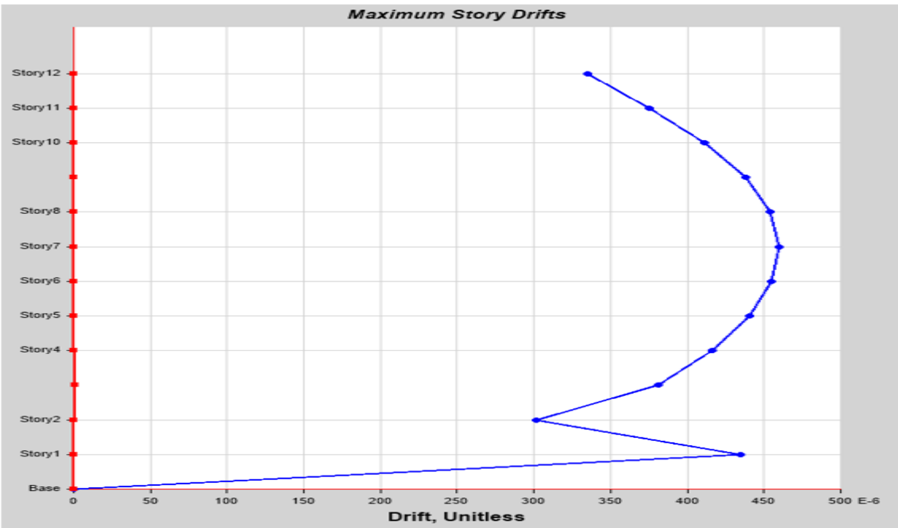

Fig. 9: Storey drift in direction X at a storey of structure with hanging columns

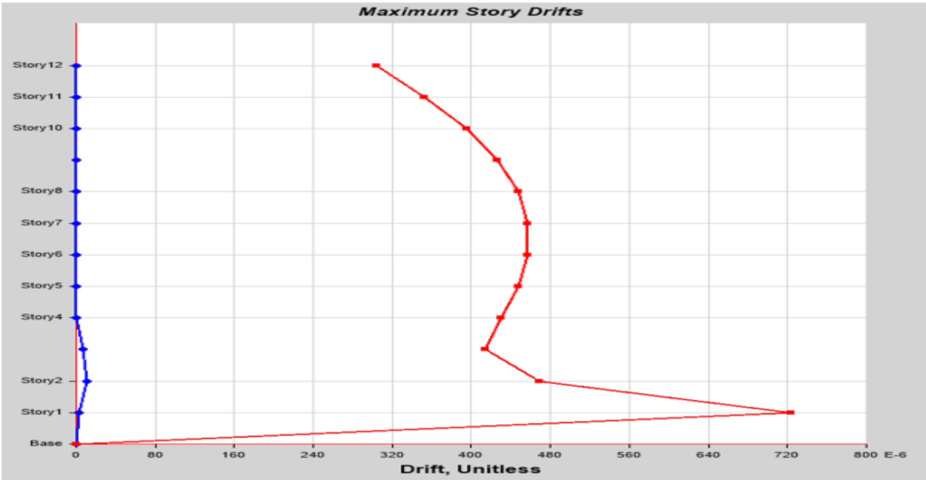

Fig. 10: Storey drift in direction Y at a storey of structure with hanging columns

Storey drift is the dislocation of one floor w.r.t the other floor it was seen that storey drifts for structure with a hanging column in direction X are decreased w.r.t direction Y as shown in figure 9&10.

Results of G+12 structure without hanging columns:

Storey Displacements:

Fig. 11: Storey displacements in direction X at a storey of the structure without hanging columns

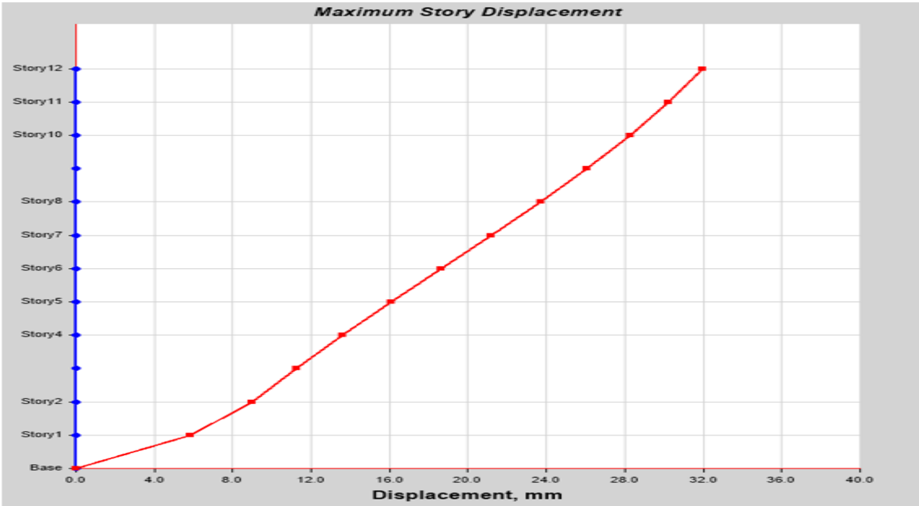

Fig. 12: Storey displacements in direction Y at a storey of the structure without hanging columns

Storey displacements are the dislocation of a floor w.r.t ground level of a structure. it was clear that displacements for the model without hanging column in direction Y is greater than direction X as shown in figure 11&12.

For different periods base shear of a structure:

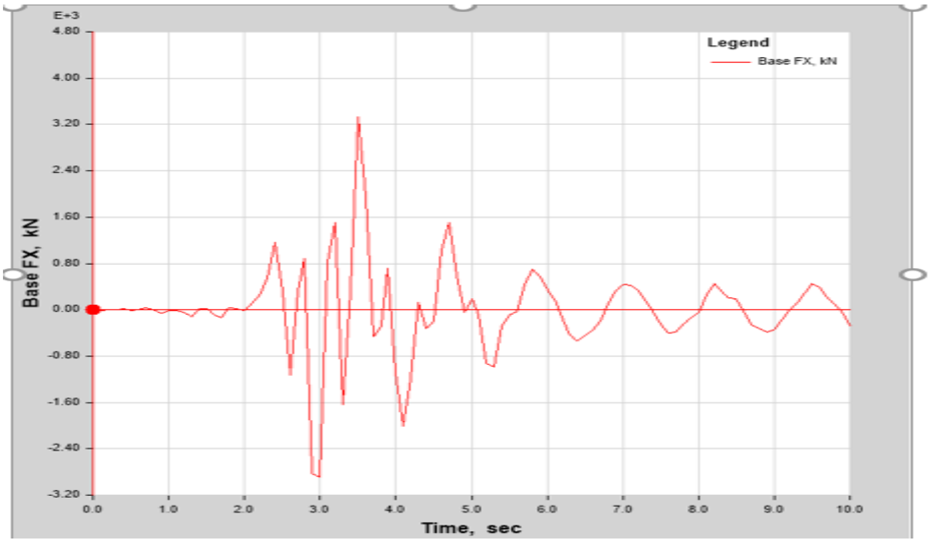

Fig. 13: Base shear for a structure without hanging columns at various periods.

It was demonstrated that with 3333.6 Kilo newton highest base shear befallen for a structure without hanging column at 3.5 seconds as shown in fig.13.

V. Conclusion

The response of high rise structure with and without hanging column is analysed under various earthquake excitation. The finite detailed model was created for observing dynamic conduct of multi-storey frame. Free vibration and static results acquired by utilizing present finite component code which was approved and it was finalized that.

1. The storey shear of structure with a hanging column in X-direction is more concerning Y-direction. The storey shear of structure with hanging columns is 48 per cent decreased than the structure without hanging columns.
2. The storey drifts for structure with hanging columns in Y-direction is more concerning X-direction. The storey drift of structure with hanging columns is 60 per cent decreased than the structure without hanging columns.
3. By increasing the ground floor column maximum displacement, base shear, overturning moment storey drift values are decreasing.
4. The horizontal loads on structure with hanging columns are 45 per cent decreased than structure without hanging column.
5. It has been seen that structure with the hanging column is stiffer than structure without hanging columns.
6. It has been seen that structure with hanging column has increased period as compared to the structure without hanging columns.
7. The storey displacement of structure with hanging columns in X-direction is more concerning Y-direction. The storey displacement of structure with hanging columns is 50 per cent decreased than the structure without hanging columns.
8. It has been seen that structure with hanging column has decreased base shear concerning the structure without hanging column. The maximum base shear occurred in structure with the hanging column is -283.42 Kilonewton at five seconds and the maximum base shear occurred in structure without hanging columns is 3333.6 Kilonewton at 3.5 seconds.

VI. Future Scope

This research can be extended by keeping the hanging columns at various storeys and various locations. We can examine in severe seismic tremor zones by keeping the seismic tremor resistant structural elements to the structure with hanging columns.

Conflict of Interest:

There was no relevant conflict of interest in this report

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