Seismic Analysis And Effect of Photovoltaic Panel Load on Commercial Building In Bhandara Region

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Abstract- *Structural engineering is a part of civil engineering dealing with the analysis and design of structures that support or resist loads. The building is subjected to different seismic zones and variation in load type especially Photovoltaic Panel load. This project deals with the study of various types of models of RCC and Steel will developed in STAAD-PRO will carry out on them to evaluate the performance of structure under seismic activity under Photovoltaic Panel load. In this we are dealing with analyze and observe the behavior, performance and response of multistory building. The equivalent static analysis is carried out on the entire project mathematical 3D model using the software STAAD Pro and the comparison of these models are being done. This will help us to find the various analytical properties of the structure and we may also have a very systematic and economical design of the structure.*

Keywords- Multistory Buildings with Photovoltaic Panel load, seismic analysis, STAAD Pro.

I. INTRODUCTION

The rapid growth of urban population and limitation of available land, scarcity and high cost of available land, the taller structures are preferable now days. As the height of structure increases then the consideration of structural loads is very much important. For that the various structural load resisting system becomes more important than the structural system that resists the gravitational loads. Design of civil engineering structures is based on prescriptive methods of building codes. Building codes can provide reliable indication of actual performance of individual structural elements, it is out of their scope to describe the expected performance of a designed structure as a whole, under large forces. Recently, some photovoltaic (PV) equipment manufacturers have developed and implemented non-anchored or "isolated" PV array support on relatively flat rooftops on large commercial and institutional buildings. However, concerns regarding possible seismically-induced horizontal movement and wind uplift of PV arrays surround the introduction of this new technique, which currently is required to be considered as an "alternative means of compliance" for rooftop PV array implementation. The isolated approach explicitly relies upon friction between a PV array and its supporting roof membrane, which in principle is similar to the use of friction in a seismic isolation system. This paper describes the key seismic considerations related to this innovative method of PV installation on flat or near-flat building rooftops, and presents a rational approach for the evaluation of PV array seismic sliding displacements and determination of corresponding gaps for seismic movement.

STAAD Pro. V8i is the most popular structural engineering software product for model generation, analysis and multi-material design. It has an intuitive, user-friendly GUI, visualization tools, powerful analysis and design facilities and seamless integration to several other modeling and design software products. The main scope of this project is to apply class room knowledge in the real world by designing a multi-storied commercial building with photovoltaic (PV) panel (Solar Panel). In this project various types of models of RCC and Steel will developed in STAAD-PRO. will carry out on them to evaluate the performance of structure under seismic activity.

II. OUTLINE OF PROJECT

The work to be carry out is divided into different phases which are given as follows,

- Study of non-linear analysis of multistoried building to evaluate the performance of structure under seismic activity.
- Study of Seismic analysis of multistoried building with photovoltaic (PV) panel.
- Structural modeling of single bay single storey RCC and steel frame building with photovoltaic (PV) panel.
- Seismic analysis of single bay single storey RCC and steel frame building with photovoltaic (PV) panel.
- Structural modeling of multistoried RCC and steel frame building with photovoltaic (PV) panel.
- Seismic analysis of multistoried RCC and steel frame building with photovoltaic (PV) panel.

- Structural modeling of combined RCC and steel frame building with photovoltaic (PV) panel.
- Seismic analysis of combined RCC and steel frame building with photovoltaic (PV) panel.

III. LITERATURE REVIEW

Literature review related to the seismic analysis and effect of various loads of multistory building was carried out.

V.Kilar and D. Koren, (2008)[1] suggested that the usage of a simplified nonlinear method for seismic analysis and performance evaluation (N2 method) for analysis of base isolated structures. In the paper the N2 method is applied for analysis of a fixed base and base isolated simple four-storey frame building.

Anshuman S. et al. (2011)[2] have determined solution of shear wall location in multi-storey building based on its both elastic and elastoplastic behaviors'. An earthquake load is calculated and applied to a building of fifteen stories located in zone IV. Elastic and elastoplastic analyses were performed using both STAAD Pro 2004 and SAP V 10.0.5 (2000) software packages. Shear forces, bending moment and story drift were computed in both the cases and location of shear wall was established based upon the above computations. It has been observed that the in inelastic analysis performance point was small and within the elastic limit. Thus result obtained using elastic analyses are adequate. Hence, concluded that shear wall can be provided in 6th and 7th frames or 1st and 12th frames in the shorter direction.

Vijayakumar and D. L. Venkatesh Babu, (2012)[3] studied that A Three storied hostel reinforced concrete bare frame was taken for the investigation. The frame was subjected to design earthquake forces as specified in the IS code for zone III along X and Y directions.

Rohit Kumar Singh et al. (2014)[4] have designed and analyzed concrete diagrid building and compared it with conventional frame building. A regular five storey RCC building with plan size 15 m X 15 m located in seismic zone V is considered for analysis. The STAAD Pro software is used for modeling and analysis of structural members. All structural members are designed as per IS 456:2000 and load combinations of seismic forces are considered as per IS 1893(Part 1): 2002. The comparison is carried out the analysis results in terms of storey drift, node to node displacement, bending moment, shear force, area of reinforcement and economical aspects. From the results and observations it has been concluded that diagrid building showed less lateral displacement, storey drift. Diagrid showed more economical in terms of steel and better resistance to lateral loads.

Raman Kumar et al. (2014)[5] investigate the seismic behavior of the buildings with shear wall at different locations and compared the results in terms of storey drift, average displacement and member forces induced in the various members of the buildings. The analysis of the building has been carried out by seismic coefficient method approach using STAAD pro 2005. Two reinforced concrete framed regular buildings with different locations of shear walls situated in seismic zone V have been analyzed in this study. Ten storey and fifteen storey buildings were taken with four different locations of shear-walls i.e. at central frame, external frame, internal frame, and combined external and internal frames. It has been conclude from the results that the storey drift increases with increase in number of storey. Storey drift decreased with the provision of shear walls. The average displacement increases with the increase in number of storey. The provision of shear wall results in reduction of average displacements. Minimum average displacement is observed when shear walls are placed at internal frames. Axial force (Fx) increases with the increase in number of stories.`

Ugale Ashish B. and Raut Harshalata R. (2014)[6] have studied effect of steel plate shear wall on behavior of Structure by designing and analyzing G+6 storey steel building frame with and without steel plate shear wall. Equivalent static analysis is carried out for steel moment resisting building frame having (G+6) storey situated in zone III. Steel plate shear wall and the building are analyzed by using software STAAD Pro. The parameters considered for comparing the seismic performance of building such as bending moment, shear force, deflection and axial force. From the results, it is concluded that due to using of steel plate shear wall in building the value of different parameters is reduced as compared to building without steel plate shear wall and also the quantity of steel is reduced. Steel building with steel plate shear wall is economical compared to without steel plate shear wall.

Saket Yadav and Dr. Vivek Garg (2015)[7] have studied the advantages of steel diagrid building over conventional building by design and analyses under gravity and seismic loading of a regular G+15 storey steel building with a plan size of 18 m x 18 m, located in a seismic zone V by STAAD Pro. All structural members are designed as per Indian standard for general construction in steel (IS 800:2007) and the seismic forces are considered as per Indian code provision for earthquake resistant design of structure (IS 1893 (Part 1): 2002). The results are compared to evaluate the utility of diagrid. It has been concluded that a significant decrease of

bending moment in interior columns of diagrid building is found in comparison to the conventional building. The use of diagrid significantly decreases the maximum shear force and maximum bending moment in internal and perimeter beams. The sign of maximum bending moment also changes in perimeter beams of diagrid building. The diagrid configuration provides a reduction in the span of perimeter beams at alternate floors, hence reducing the beam forces at alternate floors. The sectional requirement of the members has been reduced in diagrid building when compared to the conventional building. This results in an advantage of approximately 12% in weight for diagrid building.

Abhinav et al. (2016)[8] has performed seismic analysis of multi-storey building with the shear wall using STAAD Pro. an RCC building of 11 floors placed exposed to earthquake loading in zone V is considered and earthquake load has calculated by a seismic coefficient method using IS 1893 (Part I): 2002. The three models of an 11-floor building have been made with the shear wall at corner, shear wall along periphery and shear wall at the middle of the building. The comparative study of deflection of building with and without a shear wall is carried out in X and Z directions. The lateral deflection for building with the shear wall along periphery is reduced in comparison to other models. Hence, it has been concluded that the building with the shear wall along periphery is much more efficient than all other models with a shear wall.The paper has presented a simple computer-based method for push-over analysis of steel building frameworks subject to equivalent-static earthquake load.

Priyanka Soni et al. (2016)[9] has analyzed multi-storey building of different shear wall locations and heights and studied the analysis of various research works involved in enhancement of shear walls and their behavior towards lateral loads. Six models of G + 10 G + 20 and G + 26 storey's with storey height 3.5m, earthquake zone II are prepared by using STAAD Pro. V8i software and two locations of shear wall are considered. The different parameters such as inter storey drift, base shear and lateral displacement for all models have studied. Seismic performance of composite special moment frame systems composed of reinforced concrete columns and steel beams is investigated. A composite building, designed according to recently proposed seismic design standards, is analyzed by static push-over and nonlinear time history analyses under a series of ground motions at different hazard levels.

Ms. Priyanka D. Motghare (2016)[10] perform analytical studies carried out to evaluate the performance of RCC frame under different position of floating columns. Building with a column that hangs or floats on beams at an intermediate storey and do not go all the way to the analysis had been carried out on a five storey RCC frame structure which has been analyzed. Analysis was carried out considering different positions of floating column by using STAAD pro. The effect of position of floating column was also studied. The bending moments were higher for all the floating column cases. The final maximum bending moments values were also influenced by the presence of floating column.

IV. CONCLUSION

We studied that comparative seismic analysis of multistoried building with and without Photovoltaic Panel Load, analytical study is carried out on structure. Preliminary study is carried out on a building model comparing three cases. Following are some conclusions based on work done in the present study. In the model Photovoltaic Panel Load are provided at the specified locations in different cases. The 3- D analysis of building is carried out for Seismic Analysis of Multistorey Building with Photovoltaic Panel Load all three cases i.e. normal framed building without Photovoltaic Panel Load and with Photovoltaic Panel Load comparative study is done. The main objective of the study is to improve the seismic performance of building with Photovoltaic Panel Load and proper design of building with Photovoltaic Panel Load.

V. METHODOLOGY

1. Analysis different models of multistorey building under Photovoltaic Panel Load using STAADPro.
2. Studying seismic analysis of buildings under Photovoltaic Panel Load.

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