International Journal of Innovative Research in Science and Engineering
Vol. No.2, Issue 05, May 2016
www.ijirse.com
ISSN: 2454-9665

PERFORMANCE BASED DESIGN OF HIGH RISE BUILDINGS FOR OCCUPANT COMFORT

Krishnachandran VN[1], Dugalakshmi K M[2]

[1]*Assistant Professor, Dept. of Civil Engineering, Sreepathy Institute of Management & Technology,*
Vavanoor, Palaghat, Kerala, (India)
[2]*M.Tech Structural Engineering Student, Sreepathy Institute of Management & Technology,*
Vavanoor, Palaghat, Kerala, (India)

ABSTRACT

Structural design is almost as much of an art as a science; there is still no one best solution that a computer can automatically provide. A high rise building can be structurally defined as a building that its height will be affected by lateral forces resulting from various forces such as wind, earthquake forces etc. to extend that such forces will play a major role in the process of design. This, necessarily general, and free from applications and details, starts with the fact that all high rise structures have many areas in common, including architectural and economic considerations, methods of structural analysis, choice of loads, and human tolerances. Performance-based design is the process or methodology used by design professionals to create buildings that protect functionality and the continued availability of services.

This paper explains an outline for the criteria for the performance based design of high rise buildings with respect to the occupant comfort performance objectives. This paper tries to evaluate the various aspects of performance based design of high rise building considering the wind and earth quake loading condition for occupant comfort. The paper also includes a clarification on the structural configuration of high rise residential building for its sustainable performance.

I INTRODUCTION

A building is an enclosed structure that has walls, floors, a roof and usually doors windows etc. A tall building is a multi-storey structure in which number of people as occupants used as residential and or office use. The most prominent tall buildings are called high rise buildings. A high rise building can be defined as building whose height creates different conditions in the design, construction, and use than those that exist in common buildings of a certain region and period (definition by The Council of Tall Buildings and Urban Habitat). A high rise building can be defined in many ways. Most building engineers, inspectors, architects and similar professionals define a high rise as a building that is at least 75 feet tall. As per BNBC-93, high rise building can be defined as any building which is more than 6 storeys or 20m high. But from the structural point of view it can be defined as a building that its height will be affected by the lateral forces resulting from earthquakes and wind forces to extend that such forces will play a major role in the process of design.

In India, a building greater than 75ft, generally 7 to 10 stories, is considered as high rise. According to the building code of India, a tall building is one with four floors or more or high rise building is one with 15 meters or more in height. The outward expansion of cities into the suburbs has resulted in increased travel time and traffic gridlock. The prospect of travelling for a long time, to and from work, is detrimental to social well-being of the commuter and results in losses of fuel and productivity. Clustering of buildings in the form of tall buildings in densely built-up areas is the opportunity for creating open spaces like playgrounds, plazas, parks, and other community spaces by freeing up space at the ground level.

II DESIGN OF A HIGH RISE BUILDING

While established by local building codes for any given structure, the recommendations are now undergoing very careful appraisal. Construction loads can easily exceed those of subsequent occupancy, so they must be taken into account in the design or arrangements made to spread them out in a manner that will keep them within design assumptions. Dead loads should be evaluated with some care and also not arbitrarily assumed. The effects of live loads can be reduced by a factor probabilistically determined and dependent upon the number of floors and the floor area supported and the relative magnitudes of live and dead loads. Wind loads are closely related to wind velocities upon which much meteorological information has been accumulated. However, the possible shielding by nearby structures should be considered. Generally, wind forces have been treated as static loads covering the projected exposed area completely.

In designing structures to resist these forces of dead and live loads, vibration, wind and earthquakes, analyses vary from the simplest to the most sophisticated and often combine many attacks on the problem. It is also possible to develop a satisfactory structural frame by rather simple assumptions. As long as these simple assumptions are applied to structures similar to those where they have already produced satisfactory results, it is likely that they will give safe results and the major concerns are economy and the possible behaviour under a combination of adverse circumstances, i.e., the magnitude of the overall factor of safety. Simple methods are a necessity in shaping up an initial skeleton to which more refined methods can be applied.

It is very difficult for the engineer who is not an expert at programming to see that each step and each item is properly accounted for, to learn which criterion determined the result, or what modification in design might greatly improve the result. Structural design is still almost as much of an art as a science; there is still no one best solution that a computer can automatically provide. This summary, necessarily general, and free from applications and details, starts with the fact that all high rise structures have many areas in common, including architectural and economic considerations, methods of structural analysis, choice of loads, and human tolerances.

III PERFORMANCE BASED DESIGN

The term “performance,” as it relates to exposure to natural hazards, usually refers to a building’s condition after a disaster, i.e., it signifies a level of damage expected or a load that can be resisted. Building performance is an indicator of how well a structure supports the defined needs of its users. Acceptable performance indicates acceptable levels of damage or condition that allow uninterrupted facility operation. Consequently, performance-based design is the process or methodology used by design professionals to create buildings that protect functionality and the continued availability of services.

Performance-based design can be defined as a systematic method of designing structural systems to achieve predictable and desirable performance of both structural and non-structural elements. In order to ensure the desirable performance of buildings at different design levels, the strength, stiffness, and deformability of the structures should be reasonably proportioned. To achieve this proportionality, a performance- based design of reinforced concrete structural walls at the serviceability and life- safety levels is presented. The performance-based design approach is not proposed as an immediate substitute for design to traditional codes. Rather, it can be viewed as an opportunity to enhance and tailor the design to match the objectives of the community's stakeholders. The design team is made up of the architects, engineers, and other design professionals and consultants.

In "performance-based" design, many of the old ideas and prescriptive rules are set aside in favour of establishing mutually agreed design, construction and safety goals and objectives. This method allows the widest possible design and construction latitude while assuring a reasonable level of safety for the occupants and structure. Some characteristics of performance-based designs are their ability to deal with unique design and engineering challenges, their reliance on stakeholder participation and goals, their aim to reduce construction costs while maintaining safety, their use of bounding conditions to restrict a buildings use and perhaps, invalidate its performance design and their dependence on critical design assumptions developed early in the design process. The performance-based design approach allows the comparison of safety levels provided by various alternative designs. Performance-based design also provides a mechanism for determining what level of safety is acceptable to the stakeholders, and at what cost.

IV PERFORMANCE-BASED DESIGN PROCESS

The performance-based design process explicitly evaluates how building systems are likely to perform under a variety of conditions associated with potential hazard events. The process takes into consideration the uncertainties inherent in quantifying the frequency and magnitude of potential events and assessing the actual responses of building systems and the potential effects of the performance of these systems on the functionality of buildings. Identifying the performance capability of a facility is an integral part of the design process and guides the many design decisions that must be made.

In terms of affecting the functionality and performance of a facility, the failure of non-structural systems can be as significant as the failure of structural components. Performance-based design provides a framework for considering the potential hazards that can affect a facility or site, and for explicitly evaluating the performance capability of the facility and its components including non-structural systems and components.

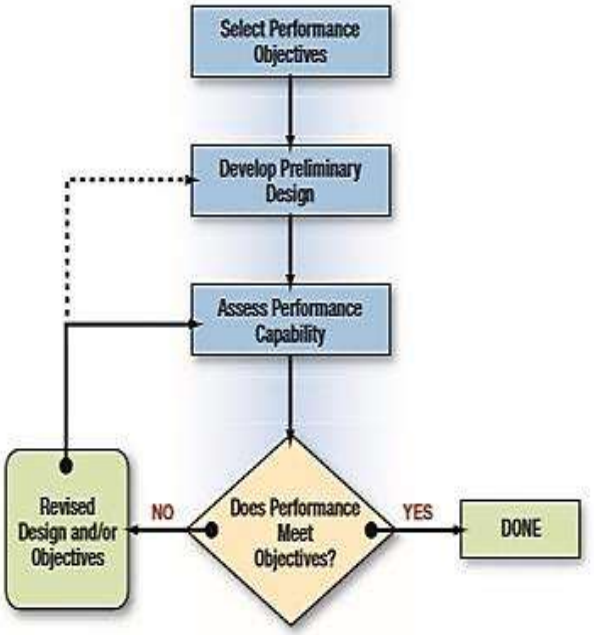


Fig 4.1 Performance based design process flow chart

Performance-based design starts with selecting design criteria articulated through one or more performance objectives. Each performance objective is a statement of the acceptable risk of incurring different levels of damage and the consequential losses that occur as a result of this damage. Losses can be associated with structural or non-structural damage, and can be expressed in the form of casualties, direct economic costs, and loss of service costs. Loss of service costs may be the most important loss component to consider, especially for critical facilities such as schools.

After the preliminary design has been developed based on the selected performance level, the next step in the performance- based design process is to perform a series of simulations to estimate the probable performance of the building under various design scenario events. If the simulated performance meets or exceeds the performance objectives, the design may be considered complete. If not, the design must be revised in an iterative process until the performance objectives are met.

4.1 Acceptable Risk and Performance Levels

The performance-based design process begins with establishing the acceptable risk and appropriate performance levels for the building and its systems. Acceptable risk is the maximum level of damage to the building that can be tolerated from a realistic risk event. Acceptable risks are typically expressed as acceptable losses for specific levels of hazard intensity and frequency. They take into consideration all the potential hazards that could affect the building and the probability of their occurrence during a specified time period.

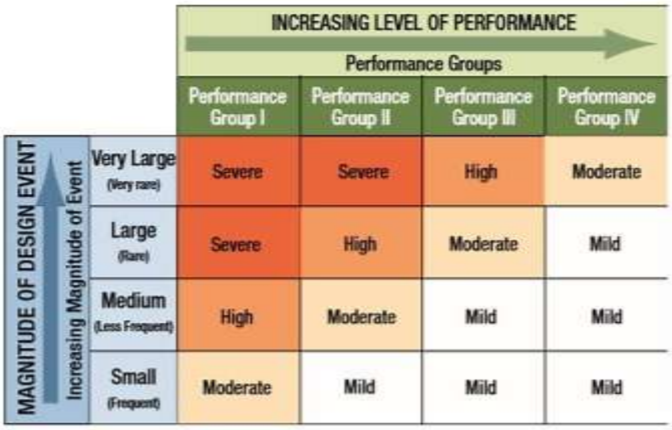
The overall analysis must consider not only the intensity and frequency of occurrence of hazard events, but also the effectiveness and reliability of the building systems to survive the event without significant interruption in the operation. Types of damage vary according to the hazard. The four performance levels are as follows:-

- ***Mild Impact:*** **-** At the mild impact level, there is no structural damage and the building is safe to occupy. Injuries are minimal in number and minor in nature.

- ***Moderate Impact:*** - At the moderate level, moderate, repairable structural damage, and some delay in re-occupancy is expected, although some clean up and repair may be required. Injuries may be locally significant, but are generally moderate in number and in nature. Some hazardous materials are released to the environment, but the risk to the community is minimal.
- ***High Impact:*** - At the high impact level, significant damage to structural elements, but no large falling debris, is expected. Repair of structural damage is possible, but significant delays in re-occupancy can be expected. Injuries to occupants may be locally significant with a high risk to life, but are generally moderate in number and nature.
- ***Severe Impact:*** - At the severe impact level, substantial structural damage is expected and repair may not be technically feasible, though all significant structural components continue to carry gravity load demands. The building is not safe for re-occupancy, because re-occupancy could cause collapse. Injuries to occupants may be high in number and significant in nature.

Consideration of site specific lateral loading due to wind or earthquake loads along with vertical gravity loads is important for finding the behaviour of the tall buildings. Safety of the structure is checked against allowable limits prescribed and other relevant references in literature on effects of earthquake and wind loads on buildings.

Table 4.1 Performance level of buildings with respect to wind



MAGNITUDE OF DESIGN EVENT (Increasing Magnitude of Event)	INCREASING LEVEL OF PERFORMANCE Performance Groups Performance Group I	Performance Group II	Performance Group III	Performance Group IV
Very Large (Very rare)	Severe	Severe	High	Moderate
Large (Rare)	Severe	High	Moderate	Mild
Medium (Less Frequent)	High	Moderate	Mild	Mild
Small (Frequent)	Moderate	Mild	Mild	Mild

4.2 Performance-Based Wind Design

The performance levels and objectives for schools and other critical facilities exposed to wind hazards are Mild Impact, Moderate Impact, High Impact and Severe Impact. Wind in general has two main effects on the Tall buildings firstly it exerts forces and moments on the structure and its cladding, secondly it distributes the air in and around the building mainly termed as Wind Pressure. Sometimes because of unpredictable nature of wind it takes so devastating form during some Wind Storms that it can upset the internal ventilation system when impasses into the building. For these reasons the study of air -flow is becoming integral with the planning a building and its environment. An important problem associated with wind induced motion of buildings is concerned with human response to vibration and perception of motion. At this point it will be sufficient to note that humans are astonishingly sensitive to vibration to the extent that motions may feel uncomfortable even if they correspond to relatively low levels of stress and strain. Therefore serviceability considerations will rule the design for most tall buildings and not strength issues.

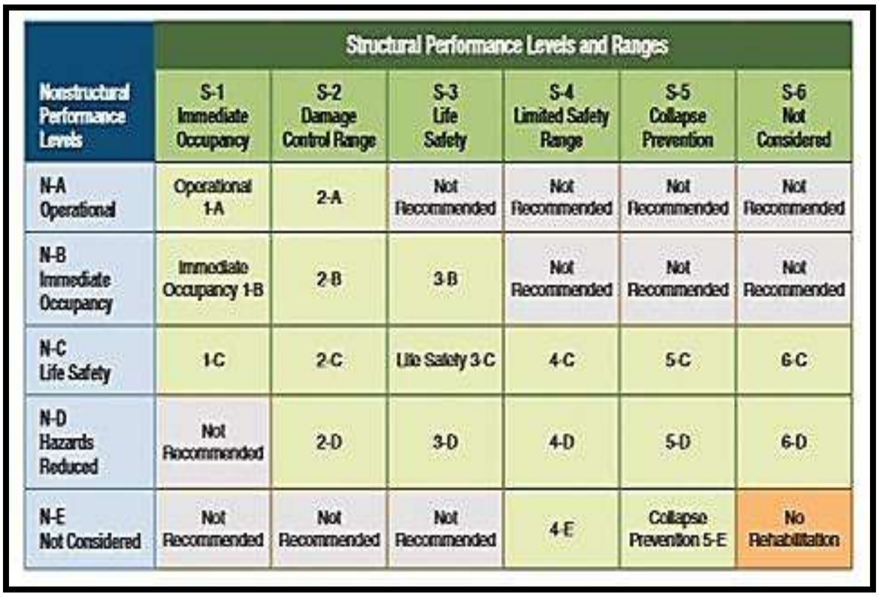
Tall buildings are flexible and are susceptible to vibrate at high wind speeds in all the three directions(x, y, and z) and even the building codes do not incorporate the expected maximum wind speed for the life of the building and does not consider the high local suctions which cause the first damage. Due to all these facts the Wind Load estimation for Tall Buildings are very much important.

In the case of wind force, near the earth's surface the motion is opposed and the wind speed will reduce by the surface friction. At the surface the wind speed reduces to zero and then begins to increase with height and at some height known as gradient height the motion may be considered to be free of earth's frictional influence.

4.3 Performance-Based Seismic Design

For performance-based seismic design, the performance levels described in American Society of Civil Engineers (ASCE) 41, Seismic Rehabilitation of Existing Buildings (2007), for both structural and non-structural systems are the most widely-recognized characterizations. These performance levels are summarized in a matrix and allow specification of an overall performance level by combining the desired structural performance with a desired non-structural performance.

Table 4.2 Performance level of building with respect to earthquake



Nonstructural Performance Levels	Structural Performance Levels and Ranges					
	S-1 Immediate Occupancy	S-2 Damage Control Range	S-3 Life Safety	S-4 Limited Safety Range	S-5 Collapse Prevention	S-6 Not Considered
N-A Operational	Operational 1-A	2-A	Not Recommended	Not Recommended	Not Recommended	Not Recommended
N-B Immediate Occupancy	Immediate Occupancy 1-B	2-B	3-B	Not Recommended	Not Recommended	Not Recommended
N-C Life Safety	1-C	2-C	Life Safety 3-C	4-C	5-C	6-C
N-D Hazards Reduced	Not Recommended	2-D	3-D	4-D	5-D	6-D
N-E Not Considered	Not Recommended	Not Recommended	Not Recommended	4-E	Collapse Prevention 5-E	No Rehabilitation

"Mild" is similar to Operational (1-A); "Moderate" Is similar to Intermediate Occupancy (1-B), "High Impact" is similar to Life Safety (3-C), and "Severe" is similar to Collapse Prevention (5-C). These four performance levels are described below.

Operational Building Performance Level (1-A):-

Buildings that meet this building performance level are expected to sustain minimal or no damage to their structural and non-structural components. The building is able to continue its normal operations with only slight adjustments for power, water, or other utilities that may need to be provided from emergency sources. Full functionality is normally considered difficult to achieve in the immediate aftermath of strong earthquake shaking.

Immediate Occupancy Building Performance Level (1-B):-

Buildings that meet this building performance level are expected to sustain minimal damage to their structural elements and only minor damage to their non-structural components. While it is safe to reoccupy a building designed for this performance level immediately following a major earthquake, non-structural systems may not function due to power outage or damage to fragile equipment. Consequently, although immediate occupancy is possible, some clean up and repair and restoration of utility services may be necessary before the building can function in a normal mode. The risk of casualties at this target performance level is very low. This level provides most of the protection obtained under the Operational Building Performance Level without the costs of standby utilities and rigorous seismic equipment performance. Designing to the Immediate Occupancy Building Performance Level is more realistic than the Operational Building Performance Level for most buildings.

Life Safety Building Performance Level (3-C):-

Buildings that meet this building performance level may experience extensive damage to structural and non-structural components. Repairs may be required before re-occupancy, though in some cases extensive restoration or reconstruction may not be cost effective. This building performance level allows somewhat more extensive damage than would be anticipated for new buildings designed and constructed for seismic resistance.

Collapse Prevention Building Performance Level (5-E):-

Although buildings that meet this building performance level may pose a significant hazard to life safety resulting from failure of non-structural components, significant loss of life may be avoided by preventing collapse of the entire building. The Collapse Prevention Building Performance Level is intended to prevent only the most egregious structural failures, and does not allow for continued occupancy and functionality or cost-effective damage repair of structural and non-structural components.

The Provisions uses the Seismic Design Category (SDC) concept to categorize structures according to the seismic risk they could pose. There are six SDCs ranging from A to F with structures posing minimal seismic risk assigned to SDC A and structures posing the highest seismic risk assigned to SDC F. As a structure’s potential seismic risk as represented by the Seismic Design Category increases, the Provisions requires progressively more rigorous seismic design and construction as a means of attempting to ensure that all buildings provide an acceptable risk to the public.

Structures are assigned to a Seismic Design Category based on the severity of ground shaking and other earthquake effects the structure may experience and the nature of the structure’s occupancy and use. The nature of the structure’s occupancy and use used in determining a Seismic Design Category is broken into four categories of occupancy.

Table 4.3 Occupancy categories used in determining Seismic Design

Category	**Representative Buildings**	**Acceptable Risk**
i	Buildings and structures that normally are not subject to human occupancy and that do not contain equipment or systems necessary for disaster response or hazardous materials.	Low probability of earthquake-induced collapse.
ii	Most buildings and structures of ordinary occupancy except those buildings contained in other categories	Low probability of earthquake-induced collapse. Limited probability that shaking-imposed damage to non-structural components will pose a significant risk to building occupants.
iii	Buildings and structures that: • Have large numbers of occupants • Shelter persons with limited mobility (e.g., jails, schools, and some healthcare facilities) • Contain materials that pose some risk to the public if re- leased.	Reduced risk of earthquake-induced collapse relative to Occupancy Category II structures. Reduced risk of shaking-imposed damage to non-structural components relative to Occupancy Category II structures. Low risk of release of hazardous materials or loss of function of critical lifelines and utilities.
Iv	Buildings and structures that are essential to post-earthquake response (e.g., hospitals, police stations, fire stations, and emergency communications centers) or house very large quantities of hazardous materials.	Very low risk of earthquake induced- collapse. Low risk that the building or structure will be damaged sufficiently to impair use in post-earthquake response and recovery efforts. Very low risk of release of hazardous materials.

The potential seismic risk associated with buildings in the various Seismic Design Categories and the primary protective measures required for structures in each of the categories.

Table 4.4 Seismic Design Categories, Risk, and Seismic Design Criteria

SDC	**Building Type and shaking**	**Seismic Criteria**
A	Buildings located in regions having a very small probability of experiencing damaging earth- quake effect	No specific seismic design requirements but structures are required to have complete lateral- force-resisting systems and to meet basic structural integrity criteria.
B	Structures of ordinary occupancy that could experience moderate intensity shaking	Structures must be designed to resist seismic forces.

C	Structures of ordinary occupancy that could experience strong and important structures that could experience moderate shaking	Structures must be designed to resist seismic forces. Critical nonstructural components must be provided with seismic restraint.
D	Structures of ordinary occupancy that could experience very strong shaking and important structures that could experience shaking	Structures must be designed to resist seismic forces. Only structural systems capable of providing good performance are permitted. Nonstructural components that could cause injury must be provided with seismic restraint.
E	Structures of ordinary occupancy located within a few kilometres of major active faults capable of producing or more intense shaking	Structures must be designed to resist seismic forces. Nonstructural components that could cause injury must be provided with seismic restraint. Special construction quality assurance measures are required.
F	Critically important structures located within a few kilometers of major active faults capable of producing intense shaking	Structures must be designed to resist seismic forces. Only structural systems capable of providing superior performance are permitted. Special construction quality assurance measures are required.

For a good performance against earthquake and wind, a high rise building design should result the following principles:-

- ***Building Configuration: -*** The building should have a simple rectangular plan and be symmetrical both with respect to mass and rigidity so that the centres of mass and rigidity of the building coincide with each other. If symmetry of the structure is not possible in plan, elevation or mass, provision shall be made for the effects due to earthquake forces in the structural design or the parts of different rigidities may be separated through crumple sections. The length of such building between separation sections shall not preferably exceed three times the width. Buildings having plans with shapes like, L, T, E and Y shall preferably be separated into rectangular parts by providing separation sections at appropriate places.
- ***Continuity of Construction: -*** As far as possible, the parts of the building should be tied together in such a manner that the building acts as one unit. Concrete slabs shall be rigidly connected or integrally cast with the support beams. Additions and alterations to the structures shall be accompanied by the provision of separation between the new and the existing structures as far as possible, unless positive measures are taken to establish continuity between the existing and the new construction.

- ***Lightness:*** - Since the earthquake force is a function of mass, the building shall be as light as possible consistent with structural safety and functional requirements. Roofs and upper storeys of buildings, in particular, should be designed as light as possible.
- ***Walls:*** - Well burnt bricks conforming to IS 1077:1992 or solid concrete blocks conforming to IS 2185 (Part 1):1979 and having a crushing strength not less than 3.5MPa shall be used. The strength of masonry unit required shall depend on the number of storeys and thickness of walls (IS 1905 : 1987). Squared stone masonry, stone block masonry or hollow concrete block masonry, as specified in IS 1597 (Part 2) : 1992 of adequate strength, may also be used.
- ***Projecting and Suspended Parts:***- Projecting parts shall be avoided as far as possible. If the projecting parts cannot be avoided, they shall be properly reinforced and firmly tied to the main structure, and their design shall be in accordance with IS 1893:1984. Ceiling plaster shall preferably be avoided. When it is unavoidable, the plaster shall be as thin as possible. Suspended ceiling shall be avoided as far as possible. Where provided they shall be light, adequately framed and secured.
- ***Foundation:***-The structure shall not be founded on such loose soils which will subside or liquefy during an earthquake, resulting in large differential settlements.
- ***Ductility:*** - The main structural elements and their connection shall be designed to have a ductile failure. This will enable the structure to absorb energy during earthquakes to avoid sudden collapse of the structure. Providing reinforcing steel in masonry at critical sections, as provided in this standard will not only increase strength and stability but also ductility.
- ***Roof:*** - All roof trusses shall be supported on reinforced concrete or reinforced brick band. The holding down bolts shall have adequate length as required for earthquake forces in accordance with IS 1893 : 1984.

V STRUCTURAL CONFIGURATION OF A SUSTAINABLE HIGH RISE BUILDING

A good high rise building has been realized having high characteristics together with superior living comfort. The structural components in a typical multi-storey building, consists of a floor system which transfers the floor loads to a set of plane frames in one or both directions. The floor system also acts as a diaphragm to transfer lateral loads from wind or earthquakes. The frames consist of beams and columns and in some cases braces or even reinforced concrete shear walls. As the height of the building increases beyond ten stories (tall building), it becomes necessary to reduce the weight of the structure for both functionality and economy. For example a 5% reduction in the floor and wall weight can lead to a 50% reduction in the weight at the ground storey. This means that the columns in the lower storeys will become smaller leading to more availability of space.

Concrete structural walls are commonly used as the primary lateral force resisting system for high-rise concrete building. Due to their stiffness and strength, structural walls attract a considerable amount of lateral force when subjected to earthquake induced displacement reversals. The building should have a simple rectangular plan and be symmetrical both with respect to mass and rigidity so that the centres of mass and rigidity of the building coincide with each other in which case no separation sections other than expansion joints are necessary. Buildings having plans with shapes like, L, T, E and Y shall preferably be separated into rectangular parts by providing separation sections at appropriate places. Earthquake forces generate inertia forces in building which are proportional to the building mass. These forces travel downward through slabs to beams, beams to column and walls and then to foundation from where they are dispersed to the ground. As the inertia forces accumulate downward from the top of the building, the columns and walls at the lower storey experience higher earthquake induced forces and are therefore designed to be stronger than the storey above.

The structure shall be designed to have adequate strength against earthquake effects along both the horizontal axes. The design shall also be safe considering the reversible nature of earthquake forces. The structure shall not be founded on such loose soils which will subside or liquefy during an earthquake, resulting in large differential settlements. Foundation has most importance in earthquake design it should possess various properties.

Column sizes are made as small as possible by using high strength materials. Columns are spaced and shaped to fit into intersections of partitions and similar out-of-the-way spots to keep room areas clear. Columns must be far enough apart to permit unobstructed rooms of adequate size between them or they might be exposed and free-standing in a larger room. The efficiency of a structural wall system can be improved by proper coupling of two or more consecutive walls through the use of short coupling beams. This coupling action reduces the demand for flexural stiffness and strength from the individual walls by taking advantage of their axial stiffness, strength, and the distance between the centroidal axes of adjacent walls to provide additional resistance to overturning moment.

The shear wall can resist forces directed along the length of the wall. When shear walls are designed and constructed properly, they will have the strength and stiffness to resist the horizontal forces. Shear walls are most efficient when they align vertically and are supported on foundation walls or footings. When shear walls do not align, other parts of the building will need additional strengthening. Connections to the structure above transfer horizontal forces to the shear wall. This transfer creates shear forces throughout the height of the wall between the top and bottom shear wall connections. Shear walls also provide lateral stiffness to prevent the roof or floor above from excessive side-sway. Wind excited vibrations of high-rise buildings can be reduced by installing additional damping devices. Wind excited vibrations of high-rise buildings impair the structural safety as well as the well-being of the residents. For reducing the vibrations to a tolerable size additional damping devices can be installed. As a matter of fact, tuned mass dampers are widely used to suppress vibrations of civil engineering structures.

A tuned mass damper, also known as a harmonic absorber, is a device mounted in structures to reduce the amplitude of mechanical vibrations. Their application can prevent discomfort, damage, or outright structural failure. Tuned mass dampers stabilize against violent motion caused by vibration. The force of wind against tall buildings can cause the top of skyscrapers to move more than a meter. This motion can be in the form of swaying or twisting, and can cause the upper floors of such buildings to move. Certain angles of wind and earthquake properties of a building can accentuate the movement and cause motion sickness in people. A TMD is usually tuned to a certain building's frequency to work efficiently.

VI CONCLUSION

The height of the tallest building changes year by year because skyscrapers are constructed constantly worldwide. With this development that buildings are raising, there will be a larger awareness of occupants comfort due to different loads induced acceleration in the top floors of a high rise structure.

The designer of a high rise flexible structure should consider all the potential problems of excessive building motions. The designer must attend the problem, first by predicting its probability and second by judging its tolerance. If it is found that the predicted motion is not acceptable, the design should be modified to decrease its effect and make it acceptable for occupants comfort in all aspects.

From this study, we can conclude that Performance-Based Building Design is an approach to the design of any complexity of building, from single-detached homes up to and including high-rise apartments. A building constructed in this way is required to meet certain measurable or predictable performance requirements without a specific prescribed method by which to attain those requirements. This is in contrast to traditional prescribed building codes, which mandate specific construction. Such an approach provides the freedom to develop tools and methods to evaluate the entire life cycle of the building process, from the business dealings, to procurement, through construction and the evaluation of results. Also it is concluded that the various structural components, their characteristics and requirements for the good performance and occupant comfort of high rise buildings.

REFERENCE

1. Baldev D. PrajapatiandD.R. Panchal (2013): "Study of Seismic and Wind effect on Multi storey R.C.C,Steel and Composite Building",*InternationalJournalof Advances in Engineering & Technology*, Vol. 6, No 4, Sept 2013, pp. 1836-1847
2. EnricaBernardini and Seymour M. J. (2014): "Performance Based Design of High Rise Buildings for Occupant Comfort", *International Journal of Structural Engineering*, 10.1061/(ASCE)ST.1943-541X.0001223
3. Masayoshi Nakai., nkkkkhaw (2012): "Performance Based Seismic Design for High Rise Buildings", *International Journal of High Rise Buildings*, Vol. 1, No 3,Sept 2012, pp. 155-167
4. IS-4326-1993 "Indian Standard Earthquake Resistant Design and Construction of Buildings – Code of Practice", Bureau of Indian Standards (*Second Revision*), (Reaffirmed 1998), Edition 3.2 (2002-2004), New Delhi 110002