9.1 Summarised Introduction

Finding out of easy plus simplest system of structural analysis and process of structural design to practical life structure is the motive of this research work, I would like to describe the different processes involved and other details which are useful inputting in this introductory part.

Structural Design is an art and also science of understanding the behaviour of structural members applied loads and design them with cost-cutting measure and stylishness to give a protected serviceable and long-lasting structure.

Engineering is a professional art of applying science to the efficient conversion of natural resources for the benefit of man. Engineering, therefore, requires all creative imagination to innovate useful application for natural phenomenon. The entire procedure of structural planning and design require only thoughts and intangible philosophy but also crash knowledge of science of structural engineering in addition knowledge of practical aspect, such as new design codes and bye-laws, back up by filled experience, perception and judgement. It may be clarified that Code of practice, which is compendia of good practices drawn up by experienced engineers, is intended as guides to engineers and should never be allowed to replace the conscience and competence of engineer’s. The purpose of standards is to ensure and enhance the safety, keeping careful balance between economy safety.

The process of structural design commences with planning of the structure, primarily to meet its functional requirements, requirements proposed by the client are taken into consideration. They may be vague, ambiguous or even unacceptable from engineering point of because he is not conscious of the a variety of implications occupied in the procedure of planning and design, and about the boundaries and intricacies of the structural science.
Once the shape of the structure is certain the structural design process begins. Structural sculpture and skill of understanding the behaviour of structural members subjected to loads and design them with cost-cutting measure and stylishness to give a protected, serviceable and long-lasting structure.

This research work, finding of feasible analysis and design way (structures analysis and members design), which is to be take up to do, structures analysis plus structural design of practical life line structure. Author names practical life structure to a building structure which is often permitted and usually constructed RCC multi-storeyed building structure having minimum of ground plus three stories or extra in backward area of Karnataka state namely Hyderabad Karnataka area's (Gulbarga, Bidar, Raichur, Yadgir Districts which are considered over here). The foremost recurrently/usually constructed RCC multi-storeyed building structure is identified by the author as life line structure because these structures often come in their life line intended to do structural design. The Karnataka state's Gulbarga region which is popularly known as Hyderabad Karnataka area mainly backward area of Karnataka state where regime of India is implemented the article 371 of constitution to give extraordinary facilities this area. Educationally this region is extremely backward, totally no training facilities to training the newest existing structural software's is available over here. A committee was constituted under the leadership of eminent economist late Dr D M Nanjundappa way back in 2002 in which he had suggested removal of discriminations and amendment of the Article 371 considering its deficiency of available in this region. The report was prepared after an exhaustive and scientific study over a two year period and submitted to the then minister of Karnataka Mr S M Krishna. The same Dr D M Nanjundappa way back in 2002 had studied in detailed the Educational backwardness and submitted its report of many pages which was clearly defined the nature of Educational facilities available in this region of Karnataka which was very backward. We can understand the nature of educational and other backwardness of the region from the high power committee has also recommended formation up of the regional area
development boards such as the Hyderabad Karnataka area development boards and hence it was formed. By noticing the educational and other backwardness of this region union Government of India has given a special to this region and provided reservations in educational and other sectors for the people of this area. The research topic feasible analysis and design way for practical life line structure which the study work under deliberation is the product of constant demand from a lot of student, practicing engineers, a number of buildings designers new engineering graduates and post graduates, specially many practicing government engineers who are incapable to design with self-confidence the building structure which they get generally in their day to day life beside attainment sufficient academic qualification. And these technocrats are found visiting structural consultant for the same within this area, which has encouraged the research scholar or formed zeal in author to carry out research work under thought. It is pointed and noted that it is the burning difficulty for engineering students practising engineers, still for building designers, new civil engineering alumni and civil engineering related post alumni, specially many of the government engineers, to turn up at a simplified and easy approach of, structural analysis along with equally simplified cum easy manner structural design method which could be searched or arrived and therefore can be adopt (with self-confidence, without confusion and without tedious and time consuming calculation and without utilising large computer memories and advanced software for structural analysis which are obtainable in the market, without more affecting the limitations of technicalities like economy modishness, durability and safety and serviceability conditions via adopting assumptions/idealizations) to the, often constructed RCC multi-storeyed building structure amongst the RCC multi-storeyed building structures permitted and got constructed in Karnataka's Hyderabad Karnataka region. As it is supposed or presumed commonly that, among buildings comparatively tall building structure is technically hard to analyse and structurally, therefore for giving a solution to relatively technically hard or difficult buildings structures to deprived technocrats amongst building structures they come across in daily life the
recurrently permitted otherwise constructed tall building structure are selected as model problem, which is named as life line structure from author. The simplest mode of structural analysis in addition to structural design for these structures provide a ready reference guide to above cited or mentioned technocrats also it boost self-confidence in them for carrying out the structural analysis and structural design.

As a job of probing the easy also simple system of structural analysis and structural design to practical life line multistoried building (regularly permitted and constructed Reinforced cement concrete (RCC) Multi-storeyed building structure within Hyderabad Karnataka area of Karnataka), this work done has resulted in a break through because it has given a easy guide for structural analysis cum structural design to many of technocrats who lack confidence and self-doubting in practical concept of structural design. Thus, in this research work most commonly permitted and constructed RCC multi-storeyed building structure of Hyderabad Karnataka is investigated.

The commonly allowed by civic authorities and hence built, RCC multi-storeyed building structures existing in the area is named by author herein as practical life line structure, since this structure come commonly in their life line for doing structural design and also construction. For investigation of this structure the following methods and methodology is adopted.

By widespread study from the answerable technocrats as decided, are contacted Gulbarga, Raichur, Yadgir, Bidar districts from Karnataka as Karnataka region, and gathered data which is as follows.

Around 100 No's of wide information storeyed building structures having no of stories equivalent to or more than Ground cum three stories, which are allowed by civic authorities therefore got constructed during preceding 15 years Karnataka's Hyderabad Karnataka area is gathered. For this 100 diverse technocrats like civil Engineers from civic authorities, Civil contractors Structural engineers cum consultants, were contact to gather information Also from personnel observation, from different capital cities of districts Hyderabad Karnataka namely 1. Gulbarga 2. Raichur 3. Yadgir 4. Bidar respondents of cities are considered place within areas.
beyond city limits. Technocrats selected as mentioned above are personally met and with appropriate conversation with pertaining technicalities of structure and as well by personnel observation the information is collected, The data gathered or collected and appropriately tabulated in tables for accurate analysis to reach or arrive at the targeted conclusion.

Hence for selecting an ideal model of frame of practical life line structure, for further studies in order to continue to attain the goal under consideration the most commonly noticed typical frame i.e. Floor Plan of Typical Commercial Building of the structure under consideration is got and hence selected.

For searching, the trouble-free and simple mode of structural analysis also of structural design for the practical life line structure in order to continue the study, or various methods of structural analysis obtainable in civil engineering cum structural engineering field are conglomerated by which the building structure in consideration can be structurally analyzed. From these various methods and procedures following cautious study a simple method pulled out in such a way that it should be comparatively easy and should not eat i mean require huge time, it to be easily understandable by apprehensive or unconfident technocrat of this area, hence can be adopted without perplexity and without tedious cum time eating calculations and without utilising heavy memories of computers and latest structural analysis software’s which are available in the market, without much upsetting limitations of technicalities or mechanics like elegance, durability, economy and protection and serviceability conditions by adopting assumptions idealizations)

Similarly to decide the simplest and easy method of structural design which can be adopted (with confidence/without perplexity without tiresome and time eating or consuming calculations, without using huge memories of computers without much affecting the limits of technicalities as economy durability, elegance, safety and serviceability conditions with adopting assumptions/idealizations) is to be ascertained by which the
structure under consideration and hence its frame under consideration can be structurally Designed. The method to be adopted should be such that it should be understood easily by unconfident technocrat within this region and should save time and labour of structural designer. Therefore in order to accomplish these requirements design details can be worked out using design tables, etc, which considerably help in saving the time and labour.

**Problem Definition**

The research problem under consideration i.e finding out of a feasible structural analysis cum design way which can utilised or adopted to carry out the structural analysis and structural design of the building structure under consideration which is nothing but practical life structure that means as per author it is nothing but which is recurrently permitted and usually constructed RCC multistoried building in Hyderabad region (Gulbarga, Yadgir, Bidar, Raichur, districts are taken ed over here in the study) of Karnataka.

The foremost recurrently, generally constructed building identified by the research scholar author as life line structure since this structure regularly comes in their life line for structural analysis and design., Karnataka states Hyderabad Karnataka area is most rearward region of Karnataka where Union government has enacted of the constitution to give extraordinary facilities to this area. Educationally this region of Karnataka totally no training amenities to train latest obtainable structural design software's are available here. The topic feasible analysis and design way for practical life line structure is the result of importunate insist from many of the students, practicing engineers, a number of structural designers, new engineering graduates also post graduates, particularly lots of practicing government engineers are not able to design self-confidence to the building structure which they meet normally in routine daily beside attaining sufficient academic qualification, and regularly they found contacting structural consultants to do in this region, that encouraged the research scholar to perform the
research or study under consideration. As it is well-known that this is a burning problem prevailing related to engineering students, many of practicing engineers, also for a number of new building or structural designers, new civil engineering graduates plus civil engineering related post graduates, particularly many of the government engineers, to reach a cut down and easy mode of structural analysis also equally cut down and easy way of structural design process to be searched hence can be adopted (by self-confidence, with no confusion and without tedious and time consuming computations and without utilising large memories of computers cum highly analysis software's which are existing in market, without much upsetting the boundaries of technicalities like economy sophistication, durability safety plus serviceability conditions by adopting assumption/idealizations) to the, often build RCC multi-storeyed building structure among the RCC multi-storeyed building structures endorsed/constructed in Hyderabad Karnataka region of Karnataka. As it is supposed that, among buildings comparatively tall structure building is technically hard to structurally analyse and design, thus to provide a solution of comparatively technically difficult building structures to deprived technocrats amid the building structures which they encounter in routine day to day life to the regularly permitted otherwise constructed tall building structure is selected as a model problem, which is called as Practical life line structure from the author. Easiest and simplest technique of structural analysis and structural design of these give a ready reference guide for above mentioned technocrats and boost confidence in them to do structural analysis and design. Hence work is very important and it will be a break-through particularly for these areas technocrats and will build self-confidence in them.

Thesis scope

For developing confidence in technocrats of Hyderabad Karnataka area (Where the available facilities are meagre in almost all the directions) for designing the day to day encounter building structure then simpler forms of analysis and design methods are to be developed for analysis
and designing the technically difficult multi-storied building structure amongst the most commonly permitted and constructed building structures in Hyderabad Karnataka area of Karnataka state. These simpler methods of analysis and design should not use the latest available software of analysis and design, and advanced analysing methods of building structures. As the training for handling those software's is not available in this most backward region, and in this area as mentioned many of technocrats found visiting the structural engineers office in spite of having sufficient academic qualification and it is noticed by the author that lack of confidence in the above said technocrats to carry out the structural design to the day to day encountered building structure in their life line. Hence this piece of research work will be contributing to high level of performance.

Utility of the Study:

In the Karnataka's Hyderabad Karnataka area is the most backward area of Karnataka, over here it is observed that many of Engineers after years of completion of their graduation and post graduation and even after years of employment after graduation are unable to design the commonly encountered/constructed building structure Also there are no effective coaching centres available for teaching the engineers to utilize latest available design software's. Hence investigation of the simplest forms of Analysis and Design like Analysis by moment coefficient methods, approximate methods and structural design by using design aids like charts and graphs for the tallest building structure amongst the most commonly permitted building structures by civic authorities of Hyderabad Karnataka area/most commonly constructed building structure in Hyderabad Karnataka area, will boost confidence amongst civil Engineers of the area to design the above quoted structure in day to day life and hence builds high level of performance and productivity. Hence this piece of research work will be contributing to high level of performance and productivity in Civil engineers and many of structural engineers of this area.
Principal contributions

In this thesis work the searching of trouble-free and easy way of structural analysis as well as design to the practical life line structure (which is nothing but frequently permitted & constructed Reinforced cement concrete (RCC) Multi-storeyed building Karnataka states Hyderabad Karnataka region), This study has resulted in a breakthrough because it has given easy guide for structural analysis and design to lots technocrats who are unsure in practical structural design of RCC buildings. Hence, in this work most commonly permitted and constructed RCC storied building structure of Hyderabad Karnataka is investigated. As the author has termed Practical life line structure to the structure which is very commonly permitted by civic authorities and therefore constructed, RCC multi-storeyed building structures in this region, as comes repeatedly in their professional life line for structural design and hence construction The data gathered has exposed some astonishing that the practical life line structure got was not a massive or huge, technically complex multi-storeyed building structure but it was ground plus three storied RCC building of commercial nature comprise regular layout, and contain simpler sections and components which are cast by utilising concrete of Grade M20 to M25. Different methods of structural analysis existing in civil engineering also in structural engineering are collected by which structure in consideration can be structurally analyzed from these various methods and procedures after cautious study a simple and uncomplicated method picked and further more applied in a simplified way, so that it must be relatively trouble-free and should not consume enormous time. It to be easily understandable to unconfident technocrat of this region. As per the investigation, since the building structure under concern was having rigid plane frame, and for that requisite degree of accuracy in analysis for such a structure is not very high, the Substitute frame method have been selected or zeroed and used. This method is appropriate even for manual computations for non sway structures. And the structural design is done conveniently by methods like design aides i.e charts and tables suitable for
calculations without using latest software’s available in the market and without using the huge memories of computers.

**Summarised brief literature contribution**

This chapter provides an overview of relevant literature that falls into four areas. Firstly it discusses the work carried out related to concrete, and in related search stress is given to admixtures incorporated concrete. Secondly it discusses the work carried out by other researchers related to foundations as it is the structural component which transfers the load of the structure to the ground. Thirdly it discusses the previous work carried out by other researchers related to columns and also it discusses the previous work by the other researchers related to beams, slabs and finally discusses the work carried out by the other researchers related to overall building structure, and miscellaneous topics related to research topic as structural analysis and structural design. A Bvakdar, M. Bakhshi, and M. Ghalibafian, (2005) Herein this paper they have according to them the comparision was done for penetration of water within the depth of silica fumes and metakaolin concrete with the partial substitute of various percentages of five, ten, fifteen percentages by content of cement, and the observation was carried out at five percent substitution, the permeability of concrete produced by using silica fume was superior than that prepared by utilising metakaolin similarly at ten percent the outcome obtained for both metakaolin and silica fume concrete was found to be the same, while at fifteen percent replacement the state was impermeable for both metakaolin and silica fumes concrete[1] A Buchacz, Gilunice. (2011) In this by exact methods examination of vibrating thereafter hyper graphs are created of beam relating to of two methods of analysis. The methodology design way to propose relevance or irrelevance amongst the kind obtained by considered methods chiefly about the significance of the natural frequencies poles for beams description. Most important subject of the research is to solve the continuous free pinned (F-P) and clamped sliding (C-S) beam as a sub system of vibrating beam system. Finding this approach is a fact that approximate solution fulfils all the condition of vibrating beams and can be opening to synthesis of these systems modelled by hyper graphs.
Research limitation/implications:- is that linear continuous transverse vibrating F-P and C-S beams are considered. Sensible implication of this study is the main point is the preface to synthesis of transverse vibrating continuous beams system originality/value:- of this approach consider the application Galekkins method which concerns the analysis of beam and modelling them of transformed hyper graphs[2] A. Cheng, R. Huang, J.K. Wu, and C.-H. Chen (2005). Herein it is stated that the higher use of ground granulated blast furnace slag content protects concrete from penetration of water which causes denser structures. Herein it is reported at various incremental replacement of cement by ground granulated blast furnace slag on the permeability the results were incremental. At about twenty percent cement replacement and at about twenty seven percent company of water the interaction of metakaolinorms more calcium silica aluminium and hydration of calcium silica takes place which in turn there is a reduction in sizes of pores upto 1/10th the diameter during the initial days, which in turn there is a decrease in water uptake . As the porosity of metakaoline is decreased which leads to lessening in overall sizes of pore and which in turn higher density, strength acid resitance capacity also increased tremendously was found to be high[3] A. Dakrury El & M. Gassr (2008) The authors have found the rice husk ash presence outcome on the whole porosity of cement slurry. They have reported that increase in rice husk percentage volume results in the decrement of total porosity of slurry [4] A. N. Givi, S. A. Rashid, F. N. A. Aziz, and M. A. M. Sallh (2010) these authors have explored that absorption of concrete with the size of particles of rice husk ash, also they have reported that water absorption will be reduced better by ultrafine rice husk ash. They have done an experimental study by amalgamation silica fume with fly ash slag on the cement paste which is sulphate resisting. According to them the results for development of strength, water permeability and sizes of pores distribution was done at various days. Such as seven, twenty eight, ninty one and one hundred and eighty two days after gunny bag curing. From the results they have concluded that at early stages the reduction of permeability was more effective of silica fumes and there by reduction in calcium hydroxide. Content of cement pastes and slag was found, very slightest
effective and explain the decrease in permeability at various level by silica fumes substitution of cement by with varying water cement ratio. At six percent substitution level of cement with silica fumes at water cement ratio of 0.35 and 0.4 rendering the concrete impermeable due to enhance in cement more than ten percent the concrete permeability again starts increasing, predicting direct relationship amongst water cement ratio and permeability.[5] A.P. Mundada and S.G. Sawdatkar (2013)In their research paper the study mainly focuses on the framing drawing plus architectural drawing of the building having floating columns. Load sharing on the floating columns and a variety of effects due to it is also been studied in the paper. The study of significance and special effects due to line of action of force is also studied this paper is dealing with the comparative study of seismic analysis of multistoried building with and without floating column. For this they used STAAD Pro software. They reach to the following conclusion that:- 1. The probabilities of failure of without floating column are less as compared to with floating column.2. The difference in the probabilities of failure with floating column is more than floating column with inclined compressive member.3. Provision of floating column is advantageous in increasing FSI of the building but is a risky factor and increases the vulnerability of the building [6]. Akbas, B., Sutchiewchar, N.,Cai,W.,Wen, R and J.shen (2012) The collapse probability of ductile and non ductile concentrically braced frame was investigated using non linear dynamic response analysis. For this testing buildings with three and nine in numbers located in Boston and Los Angeles, respectively are designed with concentrically ordinary braced frame with R=31/ which are considered as non ductile structural system, comparatively in los angeles area, three storey and nine storey buildings were designed as special concentrically braces frame R equivalent to 6 to be measured as ductile structural system. In order to evaluate the of ductile with concentrically frames where R is nothing but response modification reduction factor in moderate and severe seismic portions or regions ATC would be used as reference to measure the seismic behaviour. Evaluation approach suggested by ATC-63 is used and hundreds of non analysis was performed. Through alternating the scale factor of designated ground motions median for
structural collapse intensity was for every structure. On noticing result of statistical performance assessment, the seismic behaviour of the systems was noticed and a quantity observations is made based on the study [7]. Akpila, SB and Eluozo, S.N. (2012) has studied both by using field and laboratory analysis the evaluation requirement of shallow foundations on heterogeneous soil. He has proposed the result as for raft foundation can be placed based on topography top of the overlie clay layer and subsequently back filled to meet the neighbouring highway grade level. Though in this the Raft foundation the maximum permissible deformation requirement. Conciliation on stability and deformation requirements was preached by any one of the way i.e. increasing footing dimension or placing the Raft foundation on the underline cohesion less silty and slightly silty sand formations at metre below ground level[8]. Al Ali A.A.K., and H. Krawnkler. (1998). As per the seismic requirements of the buildings with respect to height of the buildings, the authors have evolved about the effect with respect to irregularity in vertical direction. For doing this they created a model by incorporating stronger beam with weaker columns i.e. model of Colum hinge philosophy comprising totally ten stories, this was an collection of strong 15 numbers of ground motions, which are recorded in earthquakes of US western part on very firm or rocky soil or rock, in relation to parametric study. The authors have separately taken into consideration the effects of irregularities in vertical direction related to mass distribution, strength parameter and stiffness and in groupings the irregular structures seismic reaction were gauged by means of inelastic and also elastic dynamic analysis. They have concluded that least was the effect due to irregularity in mass, comparatively the effect due to irregularity in strength was greater than the irregularity due to stiffness, whereas the outcome of joined irregularity on account of strength and stiffness was found to be the largest. Also they have concluded that irregularity in vertically have not effected any way to the displacements of roofs.[9] Anshuman s and Dipendu(2011) structural systems the lateral loads with the shear walls whether these separated or connected by beams. The distribution of shear forces is proportional to the moment of inertia of The cross sections of the walls [10]. Araanda, R.G. (1995). Herein the author have studied about the
set back structures like many other researchers. If the sudden changes existis with respect to distribution mass in vertical direction and sudden alteration exists in stiffness distribution and in some cases in strength also sudden changes noticed than these structures are the set back structures. These structures are considered as made up of mainly two parts 1) the base : which is nothing but the part existing in lower region possessing no of bays  2) the tower: which exists in the upper part of the structure and made up of lesser no of bays. The author has made a very good work with respect to response to seismic forces in these structures they are as under. In soft soils the author has recorded ground motions for comparing the ductility demands amongst regular structures and set back structures. He concluded that the demand with respect to ductility were lesser for regular structures and were greater related to set back structures, they were very much prominent in the tower region of the structures.[11] Arnolfo Luevnos Rjs., Jesus Grardo Fudoa Herrra Roberto Alvarez., (2013) Herein this paper the authors have studied the analysis and design of rectangular footings by exerting it with very irregular pressures in all the four different corners from the soil and the footing is subjected with an axial load and bending moment in two different directions. Herein the authors have created a mathematical model for taking into consideration the actual effect of soil pressure which is exerted in different quantum at the footings contact surface. These all pressures the authors have presented by a mathematical element, they have presented axial load about the x moment axis and y moment axis, they have taken care that load should support the structural member when applied. Whereas we know the traditional model only takes into consideration the effect of maximum pressure which is acting at contact surface of the footing and it is considered as as acting uniformly over entire footing surface of contact for designing the footings i.e. nothing but entire contact surface of the footing posses uniform pressure. Also a comparison of two models was created between the classical or traditional model and the newly created model or the model proposed. On account of this the classical models solution cannot be recommended any more in the prevalent practice the new model and its results are proposed in the normal practice, as the new model is very proper and extra economical
and very much adjusts with the prevalent ground pressures or real condition prevalent on the sites.[12] Atik, M. Badawi, M. Shahrour I and Sadek M (2014) has and showed that continuum model form a simple and also efficient tool to analyse wall-framed high-rise buildings. This is usually used in recent decades to analyse the behaviour of these structures. He tried to revisit the related equations to study the effect of the computation accuracy for the determination of the optimum level of wall curtailment. And it has investigated the relationship between the resulting internal forces curtailment level. And level of curtailment which has come as a outcome for the least top deflection of the structure eliminates, for the sometime negative.[13] Author Kanat Burnak Bogdagan and Duygu Ozturk (2010) Within this study multistoried buildings lateral stability analysis is carried out wherein the matrix method is utilised for approximate methodology. Herein all the deformations are considered of beam which is prepared as a sandwich beam and idealised for the total complete building structure. Differential equations of stability are formed in which the deformations due to shear forces on account of walls are considered. By the utilisation of formed differential equations the solutions for shape functions related to each storey is obtained for the formed sandwich equivalent beam. For the calculation of buckling effect created load boundary system is used by shape functions in order to get the transfer matrices of storey stability. For the verification of the formulated method in the research work four numerical complicated examples are considered and solved. The concluding points are noticed to be in accordance with the previously done research works and in harmony with the presented process. The methods created by the authors are specially found to be in harmony with the famous finite element method and also the method of analytical solution which was formed by Rosmn. The developed method which can be used in the analysis of the multistoried buildings is found to be less time consuming, very simple and also sufficiently accurate to be used in the analysis for design purpose.[14] B. Suresh, P.MB Raj Kiran (2012) In their research paper the study mainly focus on the opinion to designing fresh buildings to be quake resistance will substantial additional cost among the constructional professionals. In a Swiss survey estimates between 3 and 17% on the total
building. They reach to the following conclusion The view of designing earthquake resistance building is un founded. 2. In a country of seismicity sufficient seismic resistance of may achieved at significant additional cost. [15] BIS (β00β). “IS 189γ (Part 1)-2002: For the multistoried building cases in previous code books of IS1893 irregularity in vertical direction related matter was not mentioned related to building frames whereas the affect due to irregularity in vertical direction is given in new versions of IS 1893 (Part 1)-2002 herein exclusively there is a mentioned related to buildings having configuration irregular in nature. Herein there are five different types of irregularity related to topic under discussion clearly cited. Which are 1) irregularity due to stiffness related to soft storey 2) irregularity on account of mass 3) set back structures , irregularity on account of vertically prevalent geometric condition. 4) for vertical elements which resisting lateral forces possessing discontinuity within plane 5) weak storey possessing capacity discontinuity. Almost in line with the Indian standard codes mentioned items the code of NEHRP-BSSC created in 2003 has mentioned clearly about the irregularities existing in vertical direction and the same matter found existing in the BSSC created in 2002. At per BSSC created in 2002 the ratio of strength stiffness or mass varies amongst the adjacent storeies and if it exceeds the standard minimum prescribed then the structure is considered or defined as irregular. The mentioned values are for soft storey seventy to eighty percent and for weak storey it is strictly eighty percent and for structures having set back hundred and fifty percent, but the criteria is the judged for defining the structure to be irregular. Dynamic analysis found suggested in so many codes (which may be elastic response spectrum type of analysis or elastic time history type of analysis) which will do for the irregular structures design related to distribution of lateral forces.[16]. BSS code 2003, related to frames of multistoried buildings, NEHRP BSS Code 2003, at par with IS1893 defined irregularity of frames. For the multistoried building cases in previous code books of IS1893 irregularity in vertical direction related matter was not mentioned related to building frames whereas the affect due to irregularity in vertical direction is given in new versions of IS 1893 (Part 1)-2002 herein exclusively there is a mentioned related to buildings having
configuration irregular in nature. Herein there are five different types of irregularity related to topic under discussion clearly cited. Which are a) irregularity due to stiffness related to soft storey b) irregularity on account of mass c) set back structures, irregularity on account of vertically prevalent geometric condition. d) for vertical elements which resisting lateral forces possessing discontinuity within plane e) weak storey possessing capacity discontinuity. Almost in line with the Indian standard codes mentioned items the code of NEHRP-BSSC created in 2003 has mentioned clearly about the irregularities existing in vertical direction and the same matter found existing in the BSSC created in 2002. At per BSSC created in 2002 the ratio of strength stiffness or mass varies amongst the adjacent stories and if it exceeds the standard minimum prescribed then the structure is considered or defined as irregular.[17]. C. D. Atis (2002) He has researched of high volume concrete’s resistance to abrasion. Herein he has prepared with various water binder ratios the concrete by incorporating huge quantity say fifty to seventy percent of fly ash content in it. Dorry’s abrasion machine was utilised for the computation of value of abrasion. With the increment of compressive strength it is noticed that the value of abrasion also increases which they have found from the results obtained. Concrete which was prepared without incorporation of fly ash gave less resistance compared to the concrete which was prepared by utilisation of seventy percent fly ash. Super plasticizers and conditions of curing played very unimportant role during the results as per as the abrasion value of concerned. If the concrete was cured sufficiently there exist a profit of utilising ground granulated blast furnace slag of resistance to abrasion in comparison to the concrete which is prepared by utilisation of ordinary Portland cement for equal grade of concrete, while in the case insufficient curing is done then ground granulated blast furnace slag contained concrete will be more affected than ordinary concrete. [18] C. Poon, S. Kou, and L. Lam (2006) Herin in this paper penetration of ions in concrete was lower than in the case of controlled one penetration of ions was more. The concrete prepared by utilisation of metakaolin at water cement ratio of 0.3 at the addition of metakaolin as admixture by 10% showed very good performance within the concrete.[19] C.S. Pon, S. Azhr, M. Anson, and Y.L. Wong (2003)
Herein they have carried out the experiment by incorporating temperature effect on the performance of admixture metkaolin mixed concrete to the extent of zero, five, ten, twenty percent, here they have maintained a elevated temperature of high as eight hundred degree centigrade, these experiments they have conducted on concrete of normal to high strength. Here some parameters like porosity plus average sizes of pores, penetration of chloride ion, compressive strength (residual) were considered and comparision is done with fly ash, silica fume, and concrete with ordinary Portland cement. With the temperature of 200°C there was increment in the compressive strength. Whereas concrete prepared with metakaolin showed loss in durability, related to permeability and also in compressive strength than the concrete which was prepared by utilisation of silica fume, OPC concrete at higher temperatures. Lime contained cement is found susceptible to the attack of acidity. Erosion of concrete will get caused because if water is used by condensation or of melting of ice within as it contains carbon dioxide which dissolves the calcium hydroxide exists in concrete. [20] C. Soranakom and B. Mobasher, (2007) Herein by mixing some mineral admixtures the properties of fresh concrete’s comparison is carried out. By mixing mineral admixtures in addition to ground granulated blast furnace slag, fly ash and silica fume, rice husk ash and fly ash the characteristics of durability of hardened concrete is carried out by the researchers is the theme of this paper. [21] Can Balkaya and Erol Kalkan (2003) From special form technique shear multi-storey reinforced concrete structures are in substantial seismic risk countries like chile, japan, Italy and turkey Present seismic prognosis including the uniform building code they are high resistance to earthquake excitations. [22] Chintanapakdee, C. and Chopra, A.K. (2004). He has researched the building responses by results of irregularities with strength and stiffness on displacement of floors and demand of storey drifts. On the philosophy of beam hinge model i.e. weak beam and strong column they have designed the twelve storied building, and totally forty eight frames were considered for analysis in this research work. Herein they had considered irregularities of totally three types within the distribution of properties in frames, height wise, that is strength related irregularity, stiffness wise irregularity, and also
irregularity due to both strength asual as stiffness. With the weak beam and
strong Colum criteria of frames on seismic demands they have studied the
influence of irregular frames separately in strength and stiffness distribution
and in combination also. The authors have calculated the non linear time
history analysis on the collection of twenty records of (LMSR) large magnitude
small distance, for carrying out the comparison of regular frames and irregular
frames median seismic demands. From the California earthquake readings
of magnitude varying from 6.6 to 6.9 with the 13 to 30 kilometer epicenter
distances of ground sites records of ground motion were got. As per their
conclusions demands of storey drift will get increased in the neighboring cum
modified and decreases in other stories with the incorporation of weak or soft
storey within. On the other hand demands of storey drift will get decreased in
the neighboring cum modified and increases in other stories with the
incorporation of strong storey or stiff storey within. Whereas the
displacements in the floors has got very less influenced by the upper storey’s
irregularity. In contrast displacements in the floors height wise have got very
much influenced by the lower storey’s irregularity. The results got from
models of realistic column hinge are different appreciably from this study
reported by the authors.[23] Chung-Yue Wang and Shaing-Yung Ho(2007)
This author has selected typical low rise commercial building and mid rise
residential building of Bangkok and examined in detail. He has selected four
storey apartment and has given the report for first case. [24] D. Higgins and
M. Uren (1991) These authors have reported that defence from corrosion
increases and heat of hydration decreases with the resistance to sulphates
and alkali silica reaction. For the durability of long term consideration within
concrete ground granulated blast furnace slag is beneficial because size of
pres are small and totally distribution of smaller pore sizes within.[25] D.
Jadhao Pradip and P. Shelorkar Ajay (2013) They have reported the results of
water permeability of concrete in which 4, 6, and 8% volume of cement was
replaced by metakaolin and reported lowest permeability with 8% cement
replacement [26] Dr D Daniel Thangaraj and Dr K Ilamtharuthi (2012) Structural
analysis is one important aspects in structural design, as it gives an idea
concerning performance the structure under the load. Right from the process
of development underway in the field of soil-structure interaction, to bring sophistication in the theoretical methods of analysis an effort is made. Soils Stress-strain response is not considered in the conventional analysis by the author Compatibility is not considered but still the equilibrium equations are satisfied. Actually the foundation and frame act together as a compatible single unit is reality of soil. The Non-linear response of the soil is incorporated in the analysis by multi linear isotropic (MISO) Model and parameters used in the parametric study are relative stiffness factors Krs and Ksb which are the function of modulus of soil, modulus of frame material and geometric properties of the structural elements. [27] Das, S. and Nau, J.M. (2003). As per the instructions mentioned in the Indian standard codes, the authors have found out the definition for irregular structure. They have considered the various types of irregularities into consideration like irregularity due to stiffness irregularity due to strength and irregularity due to mass and also due to construction of masonry infill was which are not taken into consideration from structural poit of view. They have carried out two varieties of structural analysis they are linear time history analysis and the non linear dynamic type of time history analysis of the totally seventy eight building having different stories like five storey ten storey and twenty stories possessing various stiffness for different stories and different strength and various ratios for mass. They had considered the buildings having three bays in the direction of motion of the ground. It was found that many of the structures have behaved well or their performance was good when they were applied by ground motion of earthquake. Hence as per them it can be concluded that restriction ELF application as mentioned in the codes books of buildings are not requied as they are not necessary, and they are very odd for certain considered irregularities. Reaction of the structure inelastic in nature will get changed on account of presence of irregularity in the structure hence storey drifts are noticed in the region of irregularity within the structure, code specified limit for the drift is two percent this is never surpass. When the structure gets attached by ground motion due to earthquake the measure of damage overall which is taken place in the structure is known as structure damage indices, which are noticed all the time within the permissible limit and it is got to be less than
reading 0.4 that means the structures were repairable. These ratios i mean
damage rations were unaffected by the concentration of the mass at a
particular place and not found sensitive to ratios of mass. The members are
designed for particular capacities of ductility curvature, thought the ductility
curvature demand was more noticed for different categories of buildings within
the plastic regions in the structural irregularity areas, which the authors have
studied the demand has never crossed the calculated capacities of curvature
ductility of the structure designed, which is a good news. Therefore it can be
concluded that on account of irregularities in the structures the affect has very
less or negligible influence related to ELF calculated responses, this is valid
for the longer structure and may not hold fit for the structure which is
short.[β8]. 'Devesh P. Soni & Bharat B. Mstry(β006), The authors have
investigated related to buildings having multistory contain frames irregular in
vertical direction and within these types of frames they have studied dynamic
response. The vertical irregularity was mentioned in many standard codes
related to buildings and in this paper this criteria is discussed. The authors
have given their findings regarding seismic performance of irregular structures
in vertical direction. For calculating the lateral forces for design, many of code
books related to buildings specify the criteria and suggest the dynamic
analysis for irregular structures in vertical direction. Mnay of the studies
related to this criteria suggest in structures having set back the drift demand
specially in tower region for the enhancement of seismic demand of buildings
in the cases of discontinuous distribution in stiffness, strength & mass. For
the cases of combined strength irregularity and stiffness highest seismic
demand is noticed. In the latest constructions in urban areas irregularity in
the buildings is noticed in majority of structures. As the structural engineers
civil engineering contractors architects and civic authorities and mainly
involved in the construction activities in the urban areas who contribute
maximum to the structural design and architectural planning of the buildings.
Therefore it frequently makes un even distribution of stiffness and hence
mass, and even strength with respect to height of the building. If such
irregular structures are to be erected in the seismic region then the role of
structural consultant or engineer becomes more crucial and tough. Hence the
structural designer has to have perfect concept related to seismic behavior of structures having irregularity. Hence over here the authors have tried to bring in the contribution of many of the past studies related to behavior of the structures when earthquake hits them, as lot of studies have been carried out regarding this topic of structures possessing irregularity in framing specially in vertical direction.[29] Dimitrios G. Lignos, Charis J. Gantes, (2003) Over here the authors have studied and assessed the pushover analysis of modals of steel structures possessing irregularites in stiffness and for this they have utilised the models comprising of four and nine in number. As every engineer is aware of the fact that at specific places cross bracing is utilised for stipulating a irregularity is stiffness in building structures. Over here by utilising ground motions twenty in number which includes excitations near faults results of time history of nonlinear analysis is compared with those got from MPA analysis. In many of the cases the collapse takes place on account of augmented p-delta effects as mechanism of storey occurs at braces, and the MPA cannot forecast this type of actions. As over here the assumption is made that there is no couple the lower intensity values because of part of modes which are higher depending on MPA are not noteworthy. In the case of low rise structures MPA calculates properly drifts of stories, moments on account of overturning and shears in stories possessing irregularities in stiffness as per as the middle hazard levels are concerned. A mode which are higher and covers till ninety percent of mass of seismic modal are effective for MPA. [30] Esteva, L. (1995). He has studied for multistoried building structures possessing first storey as soft storey for seismic response which is non linear and got attacked by accerograms possessing narrower bands. The different variables were covered over here the variable of importance is factor r which is ratio of safety factors average related to lateral shear for the top stories to at the lower bottom storey, beside covering fundamental perios, stories quantum, along its height changes in stiffness of storey etc. As a substitution to different stories of the buildings herein he has used systems of shear and beam for the characterization of various stories numbers and periods. Herein he has included also neglected the effects of p-delta by doing so he studied by taking into consideration behaviour of
hysteretic bilinear. There was excitation within some cases and he has recorded accelerograms for soft soils during earthquake of Mexico, whereas in few cases a band of artificial accelerograms possessing likewise arithmetical features. For the demands of ductility at peak for first storey which was dependent on fundamental periods having low strains he observed the extent and also the nature of pressure of the ratio $r$. Demands of ductility can be decreased to about thirty percent for very tiny periods if $r$ enhances from 1 to 3. Also demands of ductility are very less sensitive to $r$ for middle periods, whereas for larger periods they can reach to enhancement from fifty to hundred percent whereas in intervals which are stated $r$ varies. From his observation he concludes that first storey response is very much get incremented with $r$ influence provided P-delta effects are considered.[31]

Fabio D E Angelies, Donato cancellara (2012) Masonry buildings are known to be performance during seismic events, in the behaviour when they are loaded by seismical action for the structure is not optimal. while they are laden by horizontal forces coupled to the seismically activities on the structure. Therefore to characterise the dynamical properties of buildings, when they are subjected to horizontal loads with the aim of determining a structural identification of masonry building prototype a masonry building model has been take in the laboratory Plus by numerical analysis the characterisation of the structure is performed for dynamic behaviour of the masonry building. Numerical test are carried out also finite element replica of the masonry building model is offered achieving the characterisation of the dynamical parameters although a comparative analysis of the experimental and numerical data. so, in the paper an experimental movement is illustrated which is performed for masonry building prototype for structural behaviour study of the masonry building applied to harmonic horizontal forces varying intensity. A bodily replicas prepared in the lab of building. The model structure test is subjected to harmonic horizontal compel inputs supplied by a vibrodyne. Differentiate the dynamical effect of the masonry building prototype subjected to harmonic forces hence illustrate the performance of the building under the seismic input's principal action. And a finite element model of a masonry building prototype is taken into consideration and a numerical is
carried outselling the dynamical features of the arrangement. The finite element modelling of the construction has the plan to replicate experimental difficult of the masonry building functional by the harmonic force inputs. As per as the “diverse monitored nodal points are concerned of the finite mesh the incidence response functions related to the frequency load participation are determined. As a result, a relative analysis is reported executing the description related to structures suitable dynamical parameters and to confirm the structural classification of the masonry buildings. Such relative analysis between the investigational results attain on the masonry building prototype also the numerical results obtain from finite element analysis permit assessing the checking or calibration of the material dynamic parameters for characterising the dynamical behaviour of the masonry structure. The appropriate estimation of the dynamical parameters of the masonry building allow having a refined structural identification masonry building for a improved and more precise simulation of the dynamical behaviour of the arrangement [32] Fragadakis M, Vmvatsikos D. and Papdrakakis, M. (2006). For computation of response of buildings possessing irregularity in vertical direction for single storey for strength and stiffness the authors have come forward for incremental dynamic analysis with a methodology with the help of steel material frame possessing nine stories. For the assessment of response variation from elastic stage to yielding then from nonlinear to inelastic and ultimately for global dynamic instability of model the incremental dynamic analysis is very effective method of analysis as it gives accurate computation of values. Incremental dynamic analysis. In incremental dynamic analysis every record is scaled for several intensity levels of intensity many non linear dynamic analyses are carried out. Two scalars way of chategorization is done for every dynamic analysis as measurement of intensity which indicates factor of scaling for the record, whereas the behaviour of the model will get monitored by Engineering demand parameter. For the structure having priods moderate in nature a reasonable choice for (mi) having no near fault activity is five percent (sa) having (ti) five percent, whereas maximum storey drift for the building structure is a good EDP. For example prevention of collapse or instant occupancy be mentioned on every incremental demand analysis graph
and concluded to create likelihood of greater than a particular limit state. Authors given methodology is very good it clearly shows all irregularity sources consequences and gives assessment of the performance in complete range. Based on the storey where the irregularity occurs, type of irregularity, mainly on the quantum of earthquake intensity, or damaged state or response level equivalent of the structure the author concludes that irregularity in vertical direction produces many fold effects depending on the irregularity type. By degrading or upgrading the member property of total members like all beams existing in the structure and all columns with 2 as the factor of modification, which they have given the design of structure which is irregular can be done. Now onwards therefore stiffnesses of total members for upgraded stiffness are multiplied with factor 2, similarly for overall cases where stiffness’s degraded of all members are divided with β. The ratio of irregular structures mass of particular storey under concern to the regular structures mass under consideration is known as mass ratio. On the same footings one can define the ratios of strength and stiffness’s. If the structure does not posses any big discontinuities in strength stiffness, and mass for its full height then that structure is known by the author as regular structure. [33].

G L Sivakumar babu, AmitSN Murthy. (2006) In fresh years, there is substantial advances in the categorization of soil unpredictability and relevance in designs. This recognised that in using reliability or trustworthiness based design it is essential to ask all sources of improbability in examination and include them in the geotechnical based design. It is also essential to inspect the dependability based move towards in connection to deterministic approach. In study under consideration, cone tip resistance (qc) date obtained by using a static cone penetration/incursion test on a stiff clay deposit are scrutinized by utilising random field theory, and arithmetical parameter, like mean, variance, and auto correlation are premeditated in arriving at the reliability of the allowable bearing capacity for strip footing constructed on the above deposit. [34] Fernandes and Danilla H Kanda (2008) In this research, plate bending formulation of boundary element method hypothesis, is stretched to the analysis of plates are reinforced from rectangular beams. This composed construction is sculpting by plate, as the
beams symbolized by the slim sub area/region with more thickness. The integral equations are arrived by the application of weighted residual method to every sub-region, and adding them for arriving at the equation of whole plate. Equilibrium and compatibility conditions robotically imposed by the integral equations, it treat this formulated structure as a single body, for decreasing the no of degrees of freedom. Some sorts of approximations are adopted for all the two displacements and fractions along the beam width. The correctness of the planned model explained by using easy examples whose correct solution are acknowledged as well as extra complex instances whose numerical answers or results compared from a well known finite element code[35]. Gabrlela R.Fernandes and Wilson S. Venturmi over here, a boundary element made for the analysis of slabs toughened by beams, shared or not to describe a grid sub-system, is projected Kirchoffs hypothesis is assumed plate elements. Beams elements are not obligatory to be evacuated over the plate surface, so eccentricity affect is considered The derived by presumptuous a zone body wherein beam element are commence by deteriorate plates sub-regions. Following finding correctly a solitary reciprocity for the entire body, the necessary essential depictions are derived. The integral representations derived for this structural element is taken into contemplation, bending and stretch effects of both structural elements performance collectively. The equilibrium land compatibility conditions all along boundary are obviously imposed. More over the quantity of degrees of freedom requisite next the interfaces is considerably reduced, reading thus for small but more precise algebraic arrangement of linear equations. A number of instances are subsequently exposed to demonstrate the correctness of the construction, comparing the obtained result with the analytical and other numerical solutions[36].
9.2 Point wise Research Objectives

The following objectives are there of this research work

The following objectives are there of this research work

1) To explore the practical life line structure i.e. usually permitted as well as constructed reinforced cement concrete (RCC) multi-storeyed building structure containing minimum ground plus three stories or extra in (Gulbarga, Raichur, Bidar, Yadgir districts capital cities) Hyderabad Karnataka region of Karnataka state.

2) Select the most permitted and build multi-storeyed building structures in Hyderabad Karnataka. The various methods of structural analysis obtainable in civil engineering and structural engineering field are to be collected by which the structure under consideration i.e. picked or selected structure can be analyzed. From these various methods and procedures following careful study a easy method is to be picked which should be comparatively easy not to eat large time, to be easily understandable by unconfident technocrats of this area who are not capable of doing structural analysis of routinely encountered or met building structure i.e. practical life line structure.

3) Gather the different engineering philosophies and methods or procedures of structural design available in civil and structural engineering domain, from these different philosophies and method or procedures following cautious study a easy design process is to be picked which must be comparatively easy and must not eat enormous time, plus it to be easily understandable to technical people of the area who are not capable to do the structural design of day to day encountered RCC multi-storeyed building structure. And this method to be adopted With self-confidence, with no perplexity and with no tedious and time eating calculations and with no utilisation of huge memories of the computers and highly developed structural analysis software's which are obtainable in market, with no much affecting the limitations/boundaries of technicalities as economy elegance durability,
safety and serviceability conditions with adopting assumptions/idealizations) to, commonly constructed RCC multi-storeyed building structure (Practical life line structure) amongst the RCC multi-storeyed building structures permitted/constructed in Hyderabad Karnataka area.

4) Choose an idealized frame of the practical lifeline structure and carry out the structural analysis of this frame by using the investigated easy procedure or method of structural analysis and also carry out the structural design of the practical life line structure by using the investigated structural design procedure. This will boost the morale of unconfident technocrats and hence can be a guideline for them for carrying out structural analysis and structural design.

9.3 Summarised Research Methodology

For reaching to the solution of the objectives from 1 to 4 as mentioned, the following methodology is adopted.

For objective no 1: Regularly permitted with civic therefore build, RCC multi-storeyed building structures of the region is named by research scholar herein as practical life line structure, because this building structure come up often in their life line intended for structural design along construction. For investigation of this structure the following methods as well as methodology or tactics is adopted.

By wide study accountable technocrats as decided, are contacted from (1. Gulbarga
2. Raichur 3. Yadgir 4. Bidar. Districts capital cities) are collected as follows

100 No's of Extensive information of RCC multi-storeyed building construction having number of stories more than or equal to Ground plus three, which are endorsed by civic authorities and therefore got build during preceding years in Hyderabad Karnataka area Karnataka state is collected. For this reason 100 No's of diverse technocrats like Engineering officers of authorities, contractors engineering domain, Structural consultant, are got in touch with to collect
information, As well personnel scrutiny is completed, from various cities of Hyderabad Karnataka region namely 1) Gulbarga 2) Bidar 3) Raichur 4) Yadgir. Merely constructions takes place in areas away from city limits. The technocrats selected are met individually and by appropriate discussion through them on technicalities of the building structure plus also by personnel observation the data is collected, The Data collected and is appropriately tabulated tables for analysis to achieve the targeted conclusion.

For objective no 2:- Pick the Practical life line structure i.e most permitted and build RCC multi storied building structures in Hyderabad Karnataka. Thereafter the different technique of structural analysis obtainable in civil engineering and structural engineering area are to be gathered through which structure under consideration can be structurally analyzed. From these various procedures and methods after careful study a simple method or procedure is to be rounded off which have to be relatively easy and huge time, should be easily understood with unconfident technocrat of the area or region who be unable to perform the structural analysis of day today come across Practical life line structure. And it must be such that which can be adopted (with confidence, without perplexity tedious and time consuming calculations and no using large memories of the computers with no much disturbing the limitations of technicalities as economy grace/elegance, resilience I mean durability plus safety and serviceability conditions by adopting assumption and idealizations)

For objective no 3:- Select the Practical life line structure i.e largely permitted and constructed RCC multi-storeyed building structures in Hyderabad Karnataka. Subsequently the various methods and philosophies of structural Design obtainable in civil engineering along with structural engineering field are to be get together and studied with which the building structure under consideration and hence its frame under consideration able to be structurally designed. From these various methods and procedures following cautious study a easy method or procedure is to be selected which must be relatively easy and must not eat huge time, to be easily understood
by self-doubting technocrat of this region who are not capable to carry out the structural design of day to day come across RCC building i.e. Practical life line structure. The design procedure have to be such that which able to be adopted (with confidence, without perplexity and without tedious and time consuming calculations and with no using large memories of the computers with no much disturbing the limitations of technicalities like economy grace/elegance, resilience I mean durability plus safety and serviceability conditions by adopting assumption and idealizations) plus it should be saving the time and work of the structural engineer/designer.

For objective no 4: For accomplishing this target objective ideal model of frame of Practical life line structure of the region under consideration i.e. Hyderabad Karnataka be selected and its largely commonly seen Typical frame i.e. Floor Plan of practical life line structure selected, and the analysis of it is carried out as an example to demonstrate to the needy/deprived technocrats via utilising investigated/zeroed process of structural analysis for objective no 2 and likewise the investigated/zeroed procedure of structural design within for objective no 3 is utilized to do its design. For the guidance to needy technocrats in detail this can be shown in a separate chapter.

9.4 Summarised results and discussion

Results and discussion of most build multi-storeyed building

The data gathered for searching often permitted and build tall building structure contain minimum Ground plus three stories, in Hyderabad Karnataka area among the permitted and constructed tall building structures from different technocrats or pertinent responsible is gathered following detailed discussion among them and is tabularized as follows.

Table-1 shows the number to ground plus three storied or more structures got built in various districts in past 15 years.
Table-9.1: Number of G+3 storied or more, Building structures within different Selected Districts of Hyderabad Karnataka

<table>
<thead>
<tr>
<th>Sl No</th>
<th>District Name</th>
<th>G+3 Storied Buildings (a)</th>
<th>&gt;G+3Storied Buildings (b)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gulbarga</td>
<td>59</td>
<td>26</td>
<td>a&gt;b</td>
</tr>
<tr>
<td>2</td>
<td>Bidar</td>
<td>48</td>
<td>23</td>
<td>a&gt;b</td>
</tr>
<tr>
<td>3</td>
<td>Raichur</td>
<td>45</td>
<td>21</td>
<td>a&gt;b</td>
</tr>
<tr>
<td>4</td>
<td>Yadgir</td>
<td>20</td>
<td>07</td>
<td>a&gt;b</td>
</tr>
</tbody>
</table>

From the table 9.1 it is clear that within all the districts considered over here in the studies i.e. Gulbarga, Bidar, Raichur, Yadgir and its headquarter cities considered for investigation, G+3 structures are faraway more in comparison with the structures which are excess than G+3 stories. For Gulbarga it is 59 and for Bidar it is 48 and the yadgir city which is newly formed city it is 20 in number, compared to 26,23,21,07 respectively as per as the storied concerned. Hence it evident that practical life line structure lies definitely in G+3 storied one.

Likewise Table 9.2 shows the split up varied nature of buildings like 1. Simply commercial buildings 2. Solely residential buildings 3.constructed in total number of Ground plus three storied buildings got constructed in different districts. The largest figure is of G+3 commercial buildings, next largest is G+3 storied residential buildings third largest is G+3 storied residential cum commercial buildings.
Table-9.2 Quantum of G+3 storied or more, Residential/Commercial/ Residential cum Commercial Building structures within different selected district

<table>
<thead>
<tr>
<th>Sl No</th>
<th>District Name</th>
<th>G+3 Storied Commercial buildings (a)</th>
<th>G+3 Storied Residential Buildings (b)</th>
<th>G+3Storied Residential cum Commercial buildings (c)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gulbarga</td>
<td>37</td>
<td>18</td>
<td>5</td>
<td>a&gt;b&gt;c</td>
</tr>
<tr>
<td>2</td>
<td>Bidar</td>
<td>30</td>
<td>14</td>
<td>4</td>
<td>a&gt;b&gt;c</td>
</tr>
<tr>
<td>3</td>
<td>Raichur</td>
<td>27</td>
<td>15</td>
<td>4</td>
<td>a&gt;b&gt;c</td>
</tr>
<tr>
<td>4</td>
<td>Yadgir</td>
<td>12</td>
<td>6</td>
<td>2</td>
<td>a&gt;b&gt;c</td>
</tr>
</tbody>
</table>

From the Table 9.2 it is apparent that the quantum i.e. mean total number of G+3 storied commercial buildings are more in all the capital cities of the districts considered compared to G+3 storied purely residential buildings and also compared to all the storied residential cum commercial buildings got constructed in the region. The quantum for Gulbarga, Raichur, Bidar, Yadgir are respectively for G+3 storied commercial buildings. And 18, 14, 15, 06 respectively for Gulbarga, Bidar, Raichur, Yadgir cities as per as G+3 storied purely residential buildings are concerned. And 5, 4, 4, 2 respectively for Gulbarga, Bidar, Raichur, Yadgir cities as per as G+3 storied residential cum commercial buildings are concerned. This figure reveals clearly that the practical life line structure definitely lies in G+3 storied buildings.

Likewise for work out of the different Grades of concrete utilised within construction of G+3 storied commercial buildings the Table drawn which explain number of buildings get constructed by (M20-M25) Grade of concrete
use in their different components districts. Large numbers of building components are constructed by utilising (M20-M25) grade concrete.

**Table 9.3: Number of G+3 storied commercial buildings parts or components build by (M20-M25) concrete Grade**

<table>
<thead>
<tr>
<th>Sl No</th>
<th>District</th>
<th>No of G+3 Storied commercial buildings/their components constructed with particular Grade of concrete</th>
<th>Grade of concrete used for respective components of the building structure constructed</th>
<th>Slab</th>
<th>Beam s</th>
<th>Column s</th>
<th>Footin gs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>&gt;M25 Grade concrete i.e Group-II</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M20-M25 Grade concrete Group-I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Gulbarga</td>
<td>37</td>
<td>32 M20 M25 Grade concrete</td>
<td>5</td>
<td>M20</td>
<td>M30</td>
<td>M20</td>
</tr>
<tr>
<td>2</td>
<td>Bidar</td>
<td>30</td>
<td>27 M20 M25 Grade concrete</td>
<td>3</td>
<td>M20</td>
<td>M25</td>
<td>M20</td>
</tr>
<tr>
<td>3</td>
<td>Raichur</td>
<td>27</td>
<td>24 M20 M25 Grade concrete</td>
<td>3</td>
<td>M20</td>
<td>M25</td>
<td>M20</td>
</tr>
<tr>
<td>4</td>
<td>Yadgir</td>
<td>12</td>
<td>11 M20 M25 Grade concrete</td>
<td>1</td>
<td>M20</td>
<td>M25</td>
<td>M20</td>
</tr>
</tbody>
</table>

Table 9.3 is drawn which demonstrate number of buildings got constructed from using (M20-M25) Grade of concrete used in their different components in different districts. Majority of building components got constructed by using (M20-M25) grade of concrete. Gulbarga, Bidar, Raichur, Yadgir cities got constructed using (M20-M25) 32,27,24,11 respectively which are higher compared to 5,3,3,1 respectively of buildings.
and their components got constructed by using higher grade of concrete than M25, this is very astonishing to notice.

Likewise for computing the different Grades of concrete utilised during the construction of G+3 storied commercial buildings Table 9.4 is drawn which demonstrate got constructed by utilising (>M25) concrete Grade used in their various components in various districts. Majority of building components were erected by using M20-M25 variety i.e Group-I of concrete Only in Gulbarga district meagre 5 number of building which is also only their columns were erected by using M30 Concrete grade.

Table -9.4: Quantification of (>M25) Grade of concrete used in different components of G+3 Storied buildings

| SI No | District  | No of G+3 Storied commercial buildings/their components constructed with particular Grade of concrete | Grade of concrete used for respective components of the building structure constructed
|-------|-----------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------
|       |           |                                                                                                   | >M25 Grade concrete i.e Group-II                                                                 |
|       |           | Total | M20-M25 Grade concrete Group-I | >M25 Grade concrete Group-II | Slab | Beam s | Column s | Footings |
| 1     | Gulbarga  | 37    | 32 | 5 | M20 | M20 | M30 | M20 |
| 2     | Bidar     | 30    | 27 | 3 | M20 | M20 | M25 | M20 |
| 3     | Raichur   | 27    | 24 | 3 | M20 | M20 | M25 | M20 |
| 4     | Yadgir    | 12    | 11 | 1 | M20 | M20 | M25 | M20 |
Table 9.4 is drawn which shows number of purely commercial multi-storeyed buildings were built by using (M20-M25) Grade of concrete utilised in their various components in various districts. Maximum number of building components were got constructed by using (M20-M25) grade of concrete. The respective figures for Gulbarga, Bidar, Raichur, Yadgir cities got constructed using (M20-M25) are 32, 27, 24, 11 respectively which are higher compared to > M25 Grade concrete.

Results and discussion regarding methods of analysis Practical life line structure.

The various methods of structural analysis presented engineering also in structural engineering field are gathered with which the structure in consideration Practical life line structure can be structurally analyzed. From these various procedures and methods after cautious study a simple method or procedure is picked in a way that it should be comparatively consume vast time. To be comfortably or easily understood by apprehensive or unconfident technocrat of this area. Zeroed methods to be appropriate for even hand computations sway structures too.

The different approaches of structural analysis are given underneath

2. Limit Analysis which is based on Ultimate Load Theory or Plastic Theory. Generally elastic analysis be real used into permissible stress method of design popularly known as Working Stress Method [WSM], the Limit analysis which is used into ultimate load or say ultimate strength method of design [ULM]. Modified version of ultimate load method is known as Limit State Method.

Therefore, Limit State Method of design comprise design meant for ultimate limit state on which ultimate load theory relate, and as well for service state on which elastic theory applies, so requiring learning of both the theories. At the same time, one must not get confused in between limit state philosophies of design with limit analysis. Latter is method of analyzing the
structure at collapse/crumple, as the previous be a method of design intended for different limit states.

Elastic Analysis Elastic analysis concerns amid the study of strength, behaviour and performance of the constituent members and structures at working loads.

It stands on the following supposition

i. Relation among force and displacement is linear, where Hook's law is applicable.

ii. Displacements are tremendously minute compared to the geometry of structure in the sense to they do not influence the analysis.

Procedures or methods of elastic analysis which can be broadly categorize as under

i) Classical Methods:

ii) Relaxation/Iterative Methods:
    a) Moment Distribution Method, b) Kanis Method.

iii) Computer Methods:

iv) Approximate Methods
    a) Substitute Frame Method, b) Cantilever Method  c) Portal Method.

v) Coefficient Method: Where coefficients given in Codes or design hand books are utilised to get bending moment, shear force etc.

Through availability and effortless access of computers, the above cited methods will currently be divided in two major groups. In first group those methods are which are appropriate for hand calculations for smaller works.
Moment Distribution Method, Method of Consistent Deformations, Approximate Methods, Kanis Method, and Coefficient Method comes under this group. On frames for analyzing the effects of horizontal loads Substitute Frame Methods are quite suitable.

Second group consists the methods requiring the usage of computers. Matrix Methods and Computer Methods come under this group.

Because scope of my research work is about finding a easiest or simple method of analysis among the different various methods mentioned above lines for the analysis of practical life line structure which is almost nothing but Ground plus three storied commercial building, therefore limited to usage of substitute frame method analysis of building frames used for vertical loading. Coefficient method or the approach of find in the design forces (e.g. Shear force, bending moment, axial loads etc.) by using coefficients available or obtainable for standard loading cases, which is very common within building design for structural analysis of simple frames also for standard beams such as simply supported, cantilever, continuous beams or slabs, and one bay single storied rectangular portal frames.

Limit Analysis

Limit Analysis which is analysis dealing among the study of strength and actions or behaviour of members also structure at collapse. Mainly it is based on plastic theory for structures must be made up from perfectly plastic material like steel, though it is based reinforced concrete's ultimate load theory for structures, therefore behaviour of this is characterized via crushing of concrete plus yielding of steel at collapse. Therefore It must be borne within mind that ultimate state is clearly never allowed to be attained by using appropriate safety factors. Information of strength also behaviour at the collapse is completely necessary to be familiar with the exact margin of safety.

Between all these methods, substitute frame method appears to be suitable as remaining methods are either time eating in calculations or requires for calculations computers, for the structural analysis of ground plus
three storied commercial building as this is under consideration. For a multi-storeyed structure, with the increment in height, effects of horizontal loads require consideration. As a result, such structures hence provided with rigid frames comprising rigid joints. A multi-storeyed structure is assumed possessing simple connections, it is possibly to collapse under the act of horizontal loads (in walls absence) owing to lack of rigid connections connecting the component members. As in a rigid frame, forces will get distributed or spread between the components to rigidity of connection hence, analysis of structures as a whole turn out to be necessary. Therefore, in case of practical life line which is almost a office building having a regular layout comprised of four stories, furthermore which be capable of divided in a number of alike vertical plane frames have been considered in the discussion over here, as this is the largely constructed multi-storeyed building structure of Hyderabad Karnataka or Gulbarga region of Karnataka. Since degree of accuracy requisite in analysis intended for such a R.C. building is low or not very high, hence for such structures analysis the substitute frame method which has been found appropriate in the midst of all the methods of building structural analysis as mentioned above, because this method is suitable also for manual calculations for non sway structures. Within this method three various or different types of substitute frames (Bay frame, Floor frame, Beam-column systems) able to be analysis.

Analysis for vertical loads of practical life line structure and brief discussion it can be considered as substitute frame, in fact is a three dimensional frame i.e. a space frame. Analysis of a space frame is complex, laborious and also time consuming. Besides it is also not necessary (or not even justified) for the degree of accuracy required R.C. construction. Therefore as a first degree (or level) of approximation, the three dimensional space frame is divided into a number of two dimensional plane frames.

Each plane frame is analysed for the loads vertical or horizontal) in the plane of the frame and is assumed to behave independently i.e. disregarding its interconnection with the adjacent frames. This assumption holds, so that there is no relative deformation between in the loading conditions and the
structural properties (stiffness’s of adjacent frames, the relative deformations which are caused owing to them are uncared for in the structural analysis with first degree approximation. As an illustration, torsion/lateral bending stiffness of say members (cross beams) which exist at right angles are ignored. Though, these members are assumed to give lateral support to the plane frame (i.e. It is assumed that cross members are to be rigid), through the result, the vertical frame which be plane prior to loading remains plane subsequent to loading.

Thus, the basic frame considered for analysis of a R.C. building is a vertical plane frame. This plane frame is additionally subdivided into substitute frames into various manners making further approximations. The method assumes forces (i.e. B.M. and S.F.) in the beam of any floor are influenced by the loading on that floor ignoring the effect of loading on the lower and upper floor.

In the second degree of approximate, the whole vertical frame as is subdivided into requisite quantum of two storey frames in every floor.

In the third degree level of approximation, as an alternative of taking all beam segments in addition to all columns in the adjacent two storeys, this frame is again further subdivided into separate bay frames every single consisting of the beam of concern jointly with connected columns and beams within the adjacent spans merely, fixed at their far ends.

This third degree approximate holds good, theoretically, for symmetric frames for symmetric loadings. The consequently results are probable to differ from exact values inside case of unsymmetrical frames and /or unsymmetrical loading. However, the difference is hardly beyond 10%. Such frame is also analysed for different loading cases to get maximum forces in columns and beams usual.

**Results and discussion for design of Practical Life line structure**

There are different design philosophies accessible in civil and also in structural engineering sphere by using which the practical life line structure
under consideration can be designed. We have to pick the simplest and easiest method to do structural design of the practical life line structure. The different design philosophies available by which concrete structures can be designed are

- a. Working stress method (WSM)
- b. Ultimate load method (ULM)
- c. Limit state method (LSM)

a) Working Stress Method which is also known as Modular Ratio Method: This is the traditional method of design, utilised not just for reinforced concrete also for structural steel, timber. Close to about hundred years old, the method is based on linear elastic theory or the classical elastic theory. Method of design was evolved around 1900 and was the first theoretical method accepted by the National Codes of Practice for the design of concrete sections. This method ensures adequate safety by suitably restricting the stresses in the materials (i.e., concrete and steel) induced the expected working loads on the structure. This assumption of linear elastic behaviour be considered justifiable since the specified or allowable stresses are kept well below the ultimate strength of the material. The ratio of yield stress of the steel reinforcement or the strength of the concrete to the corresponding permissible or working stress is usually called the factor of safety. The WSM uses a factor of about 3 with respect to the concretes cube strength and factor of safety about 1.8 with respect to the yield strength.

Reinforced concrete is a composite material. The WSM presume strain compatibility whereby the strain within the Reinforcing steel is presumed to equivalent to that in the adjoining concrete to which it is bounded. Consequently the stress in steel linearly related to the stress in adjoining neighbouring concrete by a constant and steady factor named the modular ratio defined as the ratio of the modulus of elasticity of steel to that of concrete. Working stress method is therefore also known as the modular ratio method.
Demerits of working stress method

Largely structures in accordance or harmony with working stress method have been generally performing suitably and satisfactorily for a lot of years however the method has the following demerits:

1. The WSM not demonstrate the real strength nor provide the accurate factor of safety of the structure under failure.
2. Modular ratio design results in larger percentage of compressive steel than that given by the limit state design thus leading to uneconomic design
3. Because of non linear stress strain relationship and creep concrete will not have definite modulus of elasticity.
4. The working stress methods short to distinguish amid different types of loads that act concurrently however possess different uncertainties. Merits of WSM

1. In above defects the WSM has the advantage of its simplicity both in concept as usual as in application. The design generally end result in relatively sections of structural members in comparison to the ultimate load method. Due to this, structures designed by WSM give better performance example (i.e. less deflection, less track width etc,) under working loads, WSM is the only method available when one has to investigate the R.C. selection for service stresses and for the serviceability states of deflection and cracking. It is essential to have knowledge of WSM since it forms a part of limit state design (LSD) for a serviceability condition.

b) Ultimate load method (ULM)

The ultimate load method (ULM) was in 1950 as an alternative to the WSM. The method is foot on the ultimate strength of reinforced concrete at ultimate load. The obtained by enhancing the service load by some factor referred to as load factor for giving a desired margin of safety. Hence the method is referred to by the load factor method or ultimate strength method. The ULM was introduced seeing that alternative to working stress method in ACI Code in 1956, the British Codes in 1957 and the Indian code in 1964. In the ultimate load method, stress condition next to the collapse [se of the
structure is analysed, thus using non-linear stress-strain curves for concrete and steel the safety measure in the design is obtained by the use of proper load factor. This makes it possible to use different load factors under combined loading conditions. It is carefully noted that satisfactory strength performance of it at ultimate loads does not promise satisfactory serviceability in plastic region inelastic region) and of ultimate strength of member, the resulting section is very slender or thin. This gives rise to excessive deformation cracking. Also, the method does not take into consideration the affects of creep and shrinkage.

Merits of ultimate load method

1. It uses only the nearly linear part of stress-strain curve; the ULM uses fully the actual stress-strain curve. In other words, the stress parameters are defined by the actual stress-strain curve
2. The load factor gives the exact margin of safely against collapse.
3. To use different load factors for different types of loads and the combination thereof.
4. The failure load computed by ULM matches with experimental results.
5. The method is based on the ultimate strain as the failure criteria. The method utilises the reserve of strength in plastic region.

Demerits of ULM

1. The method does not take into consideration the serviceability criteria of deflection and cracking.
2. Use of the high strength reinforcing steel and concrete results in increase of deflection and crack width.
3. The method does not consider the effects of creep and shrinkage.
4. In ultimate load method, the distribution of stress resultants on ultimate load the redistribution of stress resultants takes place when the loading is augmented as of service loads to ultimate loads.

To summarise, the ultimate load method ensures safety at ultimate loads but disregards the serviceability at service loads.

C) Limit State Method (LSM)
We have seen that while the WSM gives satisfactory performance of the structure at working loads, it is unrealistic at ultimate state of collapse. Similarly, while provides realistic assessment of safety, it does not guarantee the satisfactory serviceability requirements at service loads. An ideal method is one which takes into account not only the ultimate strength of the structure but also the serviceability and durability requirements. The emerged Limit State Method of design is oriented towards the simultaneously satisfaction of all these requirements. Into structure is designed planned for safety for or against collapse i.e in order to resist ultimate load for ultimate strength to as well as checked for serviceability on working loads, as it will result into rendering the structure fit for its future use. Thus, the LSM includes consideration of at both the working and the ultimate load levels with a view to satisfy the requirements of safety and serviceability.

The European concrete (CEB) and the international federation for pressurising (FIP) where amongst the most primitive to bring in the philosophy of limit state method, which is reliability-based in concept. Recommendations for an international code of practice for reinforced concrete: known as the book was published in 1963 by CEB and the complimentary report; international recommendations for the design of concrete structures; known as book, was published in 1970 by CEB along with FIP. These were subsequently revised by CEB-FIP as the; model codes for concrete structures; as for national codes to follow. The LSM was introduced in the British code in 1973 and the Indian code in 1978. However, is introduced in 1971 in a slightly different format of; strength and serviceability design.

The acceptable limit of safety and serviceability requirements, before failure occurs, is called a Limit state. A Limit state is a state of impending failure, beyond which a structure ceases to perform its intended function satisfactorily, in terms of either safety or serviceability, i.e it either collapses or becomes unserviceable. The aim of design is to achieve acceptable probabilities that the structure will not become unfit for the use for which it is intended, i.e, it will not reach a limit state. As per IS 456:2000, all limit states shall be considered in design to ensure an adequate degree of safety and
serviceability. In general, the structure shall be designed on the basis of the most critical limit state and shall be checked for other limit states.

For ensuring the above objectives, the design should be based on characteristics values for material strengths and applied loads, which takes into account the variations in the material strengths and in the loads to be supported. The characteristic values should be based on statistical data if available: where such data are not available, they should be based on experience. The design values are derived from the characteristic values through the use of partial safety factors, one for the material strengths and the other for loads.

The limit state method of design is the best one, amongst all the above cited philosophies of design.

One of the method to Practical life line structure can be designed is by using Tables and Charts available in SP 16 and IS 456-2000, which is a very simple way of structural design.

**Results regarding Selection of ideal frame of Practical life line structure**

For accomplishing the objective no 4 ideal model of frame of practical life line structure from the region under consideration i.e Hyderabad Karnataka be selected and its largely commonly seen typical fram i.e Floor plan of practical life line structure selected, and the analysis of it is carried out as an example to demonstrate to the needy/deprived technocrats via utilising investigated/zeroed procedure of structural design within objective no 3 is utilised to do its design. For it to be a readily available guide to needy technocrats in detail this be shown via a separate chapter.

**9.5 Conclusion**

**Conclusion for Practical life line structure**

From the results and discussions as mentioned and discussed in the following conclusions can be drawn as per as the Practical life line structure is concerned, which is the one of the objective of the researchscholar.
1. From discussion it can be concluded that the mainly, commonly or often build buildings of Hyderabad Karnataka area of 1) Gulbarga 2) Bidar 3) Yadgir 4) Raichur districts which is termed from author as practical life line structure, as per the authors extensive investigation found that it is a Ground plus three storied commercial building, comprised of uncomplicated simple layout. And concrete Grade used in the building i.e. in practical life line structures members is simple conventional concrete of M20 to M25 Grade

**Conclusion for Investigated structural analysis procedure**

As per as the easiest simplest method of structural analysis by which the above i.e. Practical life line structure can be analysed is concerned as it is the one of the objective of the research scholar, from the results and discussion in chapter 5 the following conclusions can be drawn.

As the required degree of accuracy in the structural analysis of such a Reinforced concrete building is not very high, therefore substitute frame method has found appropriate solve the problem, as to analyse the structure under consideration it is simplest and easiest amid all the various methods of structural analysis which can be investigated or searched. The method is suitably used even by manual calculations for non sway in this method three different types of substitute frame viz Bay frame, Floor frame, and Beam-column systems which can be utilised in the structural analysis. Remaining methods are either time consuming or computer requirement becomes a must. For doing calculations

**Conclusion of Investigated structural Design.**

As per as the easiest and the simplest method of carrying out the structural design of the practical life line structure is concerned as this is also the objective of the research scholar, all the three philosophies of structural design which are available in civil Engineering/structural Engineering domain and the different procedures and methods of structural design by which the reinforced concrete structures can be designed are analysed by the author. And as out come to reach the
targeted goal Practical life line structure is designed in a simplest way by using Tables and Charts available in SP 16 ands with design way which is to be adopted.

**Conclusion for idealized frame of the practical lifeline structure**

For accomplishing the objective no 4 ideal model of frame of practical life line structure from the region under consideration i.e Hyderabad Karnataka be selected and its largely commonly seen typical fram i.e Floor plan of practical life line structure selected, and the analysis of it is carried out as an example to demonstrate to the needy/deprived technocrats via utilising investigated/zeroed procedure of structural design within objective no 3 is utilised to do its design. For it to be a readily available guide to needy technocrats in detail this be shown via a separate chapter.

**Comprehensive conclusion**

From the results and discussions as mentioned and discussed in above paras the following conclusions can be drawn per as the Practical life line structure is concerned, which are the objectives of the research scholar.

1. From the above discussion it can be concluded that the most commonly or frequently erected buildings of Hyderabad Karnataka area (Practical life line structure) comprising of 1) Gulbarga 2) Raichur 3) Bidar Yadgir districts capital cities, which is named by author or research scholar as practical life line structure, is not a complex huge multi-storeyed building, but as per the authors extensive investigation found that it is Ground plus three storied very simple commercial building. Furthermore Grade of concrete utilised in construction of components this practical life line structure is by simple conventional concrete of M20 to M25 Grade.

2) As per as finding of easiest simplest method of structural analysis by which the above structure i.e Practical life line structure can be analysed is concerned as it is the one of the objective of the research scholar, from the results and discussion done in above paras the following conclusions can be drawn.
Since required degree of accuracy in the structural analysis for such a R.C. building is not very much or high, therefore substitute frame method is found suitable for the problem as to analyse the structure under consideration it is easiest cum simplest amongst all the procedures or methods of structural analysis which were searched. For non sway structures this method can be used appropriately for manual computation. In this substitute frame method three different kind of substitute frame (viz Beam-column systems and frame) can be utilised in the structural analysis. Remaining methods are either time killing in computation or computer is required for computations.

3) As per as the easiest and the simplest method of carrying out the structural design of the practical life line structure is as this is also the objective of the research scholar, all the three philosophies of structural design which are available in civil Engineering structural Engineering domain and the different procedures and methods of structural design by which the reinforced concrete structures can be designed are analysed by the author. And as out come to reach the targeted goal Practical life line structure is designed in a simplest way by Tables and Charts available in SP 16 and IS 456-2000.

4) For accomplishing this target or objective ideal model of frame of Practical life line structure from the region under consideration i.e Hyderabad Karntaka be selected and its largely commonly seen typical frame i.e. Floor plan of practical life line structure selected, and the analysis of it is carried out as an example to demonstrate to the needy/deprived technocrats via utilising investigated/zeroed process of structural analysis in objective no 2 and likewise the investigated/zeroed procedure of structural design within objective no 3 is utilised to do its design. For it to become a readily available guide to needy technocrats, in detail this is shown within Chapter no 8 i.e. via a separate chapter.
List of Publications

