# Seismic Vulnerability Assessment of Existing RC Buildings in Vijayawada City

Thesis submitted in partial fulfillment of the requirements for the degree of

Master of Science in Civil Engineering by Research

by

S. L. N. Sastry 200850051 sln@research.iiit.ac.in



International Institute of Information Technology, Hyderabad (Deemed to be University) Gachibowli, Hyderabad – 500032 INDIA February 2024 Copyright © February 2024 All Rights Reserved

## **International Institute of Information Technology**

Hyderabad, India

### CERTIFICATE

This is to certify that the thesis entitled "Seismic Vulnerability Assessment of Existing RC Buildings in Vijayawada City" submitted by S. L. N. Sastry (Roll No. 200850051) to the International Institute of Information Technology Hyderabad, for the award of the degree of Master of Science in Civil Engineering by Research is a bonafide record of the research work done by him under my supervision. The contents of this report, in full or in parts, have not been submitted to any other Institute or University for the award of any degree or diploma.

Date

**Prof. Pradeep Kumar Ramancharla** Earthquake Engineering Research Centre International Institute of Information Technology, Hyderabad

### Acknowledgements

I express my gratitude to my Thesis Guide Dr. Pradeep Kumar Ramancharla, for his support and guidance throughout the work. He was always available for advice and discussions. His willingness to provide necessary resources and materials whenever needed is highly appreciated.

I am also grateful to Professors Venkateshwarlu M, of EERC, for enriching my technical learning through the courses he taught. His encouragement and motivation helped me during the progress of the thesis work.

I extend my sincere thanks to Dr. Aniket Bhalkikar, for his continuous support for my thesis work. I cherish the lighter moments I had with Bharat Prakke, S. Saranya and Dharmil Baldev that helped me for the smooth thesis work ride!

I am thankful to my research centre colleagues Velani Pulkit. D, Raghu Nandan Vyas Pammi, Lakshmi Supriya Yerramsetty, and Niharika Talyan without their support my work could not have been completed.

My special thanks to Sri V. Ramudu, Director of Town & Country Planning, Govt. of AP for his support in arranging all the building plans required for my thesis purpose.

My thanks to G. Prabhakar, Driver of VC & MD, TSIIC, who helped me in taking Rebound Hammer Test readings for RC members of all buildings I surveyed in Vijayawada.

My wife, Sarada Salaka who has the understanding of my passion to conduct this thesis & supported me in every way possible.

Finally, I am thankful to Almighty, who has bestowed me with countless blessings that helped me complete this thesis.

Yours truly, S. L. N. Sastry 200850051

#### Abstract

About 57% of the land area in India lies within the moderate-to-severe seismic zone, where approximately 80% of the population resides. Consequently, a substantial proportion of India's buildings are at risk due to seismic hazard and building stock in seismically active regions. The pre-earthquake safety assessment of the built environment plays a crucial role in mitigating damage and losses by identifying structures that are susceptible to earthquakes and implementing suitable measures to minimize their impact. The process of rapid visual screening (RVS) plays a vital role in evaluating the seismic vulnerability and potential risks of existing buildings in urban areas. The preservation and safety of existing buildings assume greater significance as urban areas undergo continuous growth and expansion. The Rapid Visual Survey (RVS) is a crucial instrument used to identify structures that necessitate more comprehensive assessment and potential retrofitting in order to improve their ability to withstand seismic activity.

In the present study, a total of 15 reinforced concrete framed buildings of above 10 m. Height were selected randomly from nearly 6 different locations in Vijayawada city falling in Seismic Zone III. Studies for Rapid Visual Assessments as well as detailed assessment were conducted and the results of both assessments are discussed. The study finds: (i) the construction practices in India must be checked regularly and also must evaluated regularly; (ii) there is urgent need to spread the awareness among engineers and builders about the seismic code provisions and municipal guidelines.

## NOMENCLATURE

Е	-	Edge point of column at specified level and direction
М	-	Midpoint of column at specified level and direction
FFL	-	Finished Floor Level
Ah	-	Horizontal seismic co-efficient.
Ι	-	Importance factor
Ζ	-	Zone factor
R	-	Response reduction factor
$s_{a}/g$	-	Average response acceleration coefficient.

## **CONTENTS**

Chapte	r	Page
1.	Introduction	1
	1.1 Background	1
	1.2 Motivation	2
	1.3 Objective and scope of study	4
2.	Review of Literature	5
	2.1 Literature survey	5
	2.2 Observed Vulnerability	6
	2.3 Summary	11
3.	Seismic Assessment Methods	12
	3.1 Overview	12
	3.2 Rapid assessment	12
	3.3 Preliminary assessment	13
	3.4 Detailed assessment	14
	3.5 Summary	15
4.	Seismic Assessment of Buildings in Vijayawada City	16
	4.1 History of Vijayawada city	16
	4.2 Buildings selected for assessment	17
	4.3 Rapid assessment of buildings	27
	4.4 Result analysis of rapid assessment	
	4.5 Result analysis of detailed assessment	31
	4.6 Summary	36
5.	Conclusion	37
	5.1 Conclusions	37
	5.2 Future scope	37
6.	Annexure	
	I. Rapid Visual Screening of Buildings.	
	II. Detailed Building plans with Sections & Elevations.	
	III. R Values of columns of all buildings.	
	<ul><li>IV. Concrete testing.</li><li>V. Seismic weight of buildings &amp; base shear calculations</li></ul>	
7.	8	134
/.	Bibliography	102

## **List of Figures**

Figure	Page
2.1 Horizontal irregularity	6
2.2 Torsional irregularity	7
2.3 Mass irregularity in horizontal direction	8
2.4 Diaphragm discontinuity	8
2.5 Vertical irregularity	8
2.6 Buildings with Soft storey	9
2.7 Building with setback irregularity	9
2.8 Re-entrant corner	10
2.9 Mass irregularity in vertical direction	10
2.10 Out of plate irregularity	11
3.1 Sample RVS form	13
4.1 Vijayawada City Map	16
4.2 Building No.1 Tickle road	17
4.3 Building No.2 Sitarampuram	
4.4 Building No.3 Governerpet	19
4.5 Building No.4 Choultry	19
4.6 Building No.5 Jammidoddi	20
4.7 Building No.6 Mahanadu	21
4.8 Building No.7 Brindavan	21
4.9 Building No.8 GPV	22
4.10 Building No.9 GPV Hostel	23
4.11 Building No.10 Mark	23
4.12 Building No.11 AB Plaza	23
4.13 Building No.12 Chakradhar	24
4.14 Building No.13 High School	24
4.15 Building No.14 Ranganath	25
4.16 Building No.15 Machavaram	25
4.17 Location of Surveyed buildings	26
4.18 Summary of assessment as per BMTPC Method	27
4.19 Contribution of each factor in overall risk	
4.20 Contribution of vulnerable parameters related architectur	ral issues
in overall risk of building	29
4.21 Contribution of vulnerable parameters related structural i	
in overall risk of building	29
4.22 Contribution of vulnerable parameters related soil issues	
In overall risk of building	
4.23 Contribution of vulnerable parameters related construction	
In overall risk of building	30
4.24 Locations on structural members for doing NDT	32
4.25 Boxplot of NDT readings for Building 1(Tickel road)	
4.26 Barplot of NDT readings for Building 1(Tickel road)	34
4.27 Capacity curve of Building 1(Tickel road)	
4.28 Capacity curve of Building 9 (GPV Hostel)	35
4.29 Capacity curve of Building 10 (Mark Residency)	

## List of Tables

Table		Page
4.1	Latitude and longitude of surveyed buildings	26
4.2	Analysis of variance of building 1 (Tickle road)	34

## Chapter 1 Introduction

#### 1.1 Background

Reinforced concrete (RC) buildings are widely used in construction due to their strength, durability, and versatility [1]. However, ensuring their seismic performance is of paramount importance in earthquake-prone regions. During an earthquake, RC buildings undergo complex dynamic responses that can be influenced by various factors, including building configuration, structural system, material properties, and design detailing [2, 3]. The seismic performance of RC buildings is influenced by two main considerations: (a) lateral load resistance and (b) ductility and energy dissipation [4].

RC buildings resist lateral loads primarily through their structural systems, including shear walls, moment frames, and their combinations. Shear walls provide the primary lateral load resistance, while moment frames enhance the building's overall stiffness and ductility. The interaction between these elements determines the overall response of the building under seismic forces. Moreover, RC buildings must exhibit ductile behavior during earthquakes [5]. Ductility refers to the ability of the structure to undergo large deformations without losing its load-carrying capacity. This is achieved through proper detailing of reinforcement, adequate concrete strength, and confinement measures. Ductile behavior allows the structure to absorb and dissipate seismic energy, reducing the potential for catastrophic failure [2, 4].

However, the seismic performance of an RC building becomes more complex if any irregularities are present in the building. Irregularities in the design and construction of reinforced concrete (RC) buildings can significantly impact their structural performance. It can severely affect the building's response to lateral loads. Irregularities in RC buildings can occur in various forms, affecting different aspects of the structure. Some common types of irregularities include:

- 1. Vertical Irregularities: Vertical irregularities involve variations in the height or stiffness along the vertical axis of the building. Examples include setback or step-back configurations, soft stories (floors that are significantly less stiff or strong than the floors above), and extreme changes in floor height.
- 2. Horizontal Irregularities: Horizontal irregularities refer to variations in the distribution of mass, stiffness, or strength along the horizontal plane of the building. Examples include torsional irregularities (asymmetric mass or stiffness distribution causing torsional effects), discontinuous vertical elements (such as columns or shear walls), and irregular floor plans.
- 3. Plan Irregularities: Plan irregularities occur when the building's shape or layout deviates from regular geometric forms, such as rectangular or symmetrical shapes. Examples include L-shaped or T-shaped buildings, buildings with reentrant corners, and complex architectural features.

The most commonly observed implications of irregularities on seismic performance of RC buildings are: (a) increase in seismic demand; (b) non-uniform response; and (c) loss of strength and stiffness. Irregularities lead to concentration of forces which results in localized areas experiencing higher seismic demands. This leads to higher stresses and potential failure modes in specific regions of the structure. Further, it even induces uneven distribution of forces, causing non-uniform response and torsional effects which results in amplified displacement demands, increased inter-story drifts,

and potential damage concentration [6]. Some irregularities such as discontinuities or changes in structural elements can compromise the load path and reduce the ability of the building to resist lateral loads effectively. Understanding the implications of irregularities and implementing appropriate mitigation strategies are essential for enhancing the safety and resilience of RC structures. But ensuring the safety of existing buildings remains a challenging task.

#### **1.2 Motivation**

A study on the Indian subcontinent shows that about 60% of the country's land area, which is having nearly 78% of the country's population, is under the threat of moderate-to-severe seismic shaking [7]. Moreover, construction as per the owner's choice without any engineering inputs is a common construction practice followed in many parts of India [8]. In such cases, the building becomes an irregular building causing often unexpected behavior, leading to severe damage or even sometimes collapse of the building [9]. Lack of awareness about the earthquake resistant design guidelines is another reason for this. As a result, the engineers face a critical question that must be answered immediately: which buildings are safe, and which must be strengthened or demolished?

For decades researchers have been studying and developing seismic vulnerability assessment procedures to overcome this problem. These vulnerability assessment procedures can be categorized into three types based on the level of complexity involved while performing [10-12]. The first level of seismic assessment procedures is known as the screening phase (also known as rapid visual screening). This very first level of the assessment procedure is the quickest and a street survey that involves the ranking of buildings in building stock. The typical parameters used in this type of assessment procedure are the number of storeys, age of the building, vertical irregularities, plan irregularities, location etc.

The assessment method in which more detailed and reliable information is needed falls in the second category, the preliminary evaluation phase. The information required for this phase is like the screening phase with some more additional data such as building plan, sizes of structural members (slab, beam, column, and shear wall), their orientation and material property etc. The information collected is used to find the structural capacity and checked against expected demand, and finally, from comparison, the performance of the building is predicted. When a more in-depth evaluation is carried out by collecting comprehensive information about the building, which assessment method falls into the third category, i.e., the detailed evaluation phase. The data is collected from the structural drawings and the as-built features, including the geometrical properties of structural components, mechanical properties of materials, and reinforcement detailing of the structural components [13]. Upon collecting all the information, the building is modeled in some sophisticated software, and nonlinear analysis is performed to check the building behavior for seismic actions. Later, the behavior of buildings is compared with some standard accepted values to decide the expected building performance. Though the latter two assessment procedures are perfectly capable of identifying the deficit buildings but are costly, time-consuming and involve much more workforce. Compared to these procedures, the first procedure, i.e., rapid visual screening procedure, is the best alternative that requires significantly less time and serves the purpose.

In the field of structural engineering and risk assessment, the rapid visual screening (RVS) of existing buildings plays a crucial role in identifying potential vulnerabilities and assessing the overall seismic performance of structures [14]. This proactive approach enables engineers, architects, and decision-makers to prioritize resources and take appropriate actions for ensuring the safety and resilience of buildings in the face of potential earthquakes or other hazards. This write-up aims to provide an introductory overview of RVS, its purpose, methodology, and benefits.

The primary purpose of RVS is to quickly assess the seismic vulnerability of existing buildings, particularly in regions prone to earthquakes. The process involves a visual inspection of the building's exterior and interior to identify key factors that contribute to its structural performance and potential weaknesses. RVS helps professionals identify high-risk structures that require further evaluation and prioritize them for detailed assessments or retrofitting measures. Rapid visual screening typically follows a systematic procedure that involves the following key steps:

- 1. Pre-screening: Initial data collection, including building characteristics, occupancy, construction type, and historical records, helps determine the overall risk level and prioritize the screening process.
- 2. Visual inspection: Qualified personnel conduct a visual examination of the building's exterior and interior components, including the foundation, walls, floors, and roof. They look for signs of distress, damage, inadequate construction, or potential structural weaknesses.
- 3. Screening forms: Specific screening forms or checklists are utilized to document observations, note deficiencies, and assign a rating or score based on predefined criteria. These criteria may include building age, construction quality, foundation type, structural system, and others.
- 4. Vulnerability assessment: The collected data is evaluated to estimate the building's seismic vulnerability. This assessment can involve comparing the observed conditions with established building codes, standards, and guidelines. The vulnerability rating provides an indication of the level of risk associated with the structure.

This rapid visual screening method utilizes a scoring system with a checklist of building irregularities (i.e., vulnerable parameters) and score values. The results of this procedure can be used in identifying buildings that require preliminary or detailed assessment[15]. However, preliminary, and detailed assessments on sample Bldgs. should be used for benchmarking the scores with damage levels. Later, rapid visual screening methods can be used for understanding the vulnerability of large Bldgs. stocks. Rapid visual screening offers several benefits for building owners, engineers, and communities, includes:

- 1. Cost and time efficiency: RVS allows for a quick assessment of multiple buildings, enabling efficient allocation of resources by identifying structures that require further evaluation or prioritized retrofitting measures.
- 2. Early identification of vulnerabilities: By identifying potential weaknesses, RVS enables early intervention, enhancing the safety and resilience of existing buildings against seismic events.
- 3. Prioritization of mitigation measures: RVS helps decision-makers prioritize buildings for further evaluation or retrofitting based on their level of vulnerability, ensuring that limited resources are allocated effectively.
- 4. Public safety and risk reduction: By identifying high-risk structures, RVS supports proactive measures to mitigate risks, thereby reducing potential casualties and property damage during earthquakes or other hazards [16].

Rapid visual screening plays a crucial role in the initial assessment of existing buildings' seismic vulnerability. This proactive approach aids in identifying high-risk structures and prioritizing resources for further evaluation or retrofitting measures. By enhancing the safety and resilience of buildings, RVS contributes to the overall resilience and well-being of communities in seismic-prone regions. As research and advancements continue in this field, RVS techniques and methodologies will further evolve, leading to improved risk assessment and mitigation strategies.

### 1.3 Objective and Scope of Study

As the determination of seismic safety of existing buildings is a time-consuming process, many rapid visual screening methods were developed. The present study makes use of one of available rapid visual screening method to assess the safety of reinforced concrete buildings in the Vijayawada city. The reason for selecting the Vijayawada city for present study it its topography. The city is located on banks of Krishna River; it is also located on foot hills and surrounded by hills of Eastern Ghats. Moreover, the city is falls in seismic zone III. Therefore, the decision was taken to focus on the seismic safety assessment of existing reinforced concrete buildings in Vijayawada city.

--000--

## Chapter 2 Review of Literature

#### 2.1 Literature Survey

The rapid visual screening (RVS) of existing buildings is a crucial process for assessing their seismic vulnerability and potential risks in urban areas. As cities continue to grow and expand, the preservation and safety of existing buildings become increasingly important. RVS is an essential tool for identifying buildings that may require further detailed evaluation and potential retrofitting to enhance their seismic resilience [17].

Rapid visual screening involves a preliminary evaluation of buildings based on visual observations and limited data collection. Various methodologies have been proposed to streamline and standardize this process. One such widely used method is the FEMA's (Federal Emergency Management Agency) "Rapid Visual Screening of Buildings for Potential Seismic Hazards" (FEMA 154) [18]. This method employs a set of building attributes, including construction type, age, and number of stories, and occupancy, to classify buildings into different seismic vulnerability categories. While FEMA 154 provides a useful starting point, researchers have acknowledged the need for further refinement to account for regional variations and building-specific characteristics. For instance, Mohanty and Gupta (2017) proposed a modified rapid visual screening method for reinforced buildings in India [19]. Their approach incorporates additional parameters such as the quality of construction, reinforcement details, and seismic design provisions to improve the accuracy of vulnerability assessments. The modified method offers a more refined classification of building vulnerability and assists in prioritizing retrofitting efforts [20].

Rapid visual screening (RVS) of existing buildings in urban areas is a crucial step in assessing their seismic vulnerability and mitigating potential risks. In India, where rapid urbanization is a significant phenomenon, the need to ensure the safety of existing buildings becomes even more critical [21-23]. Rapid visual screening of existing buildings in Indian cities faces unique challenges due to the country's diverse building stock, urban density, and data availability. One of the primary challenges is the lack of comprehensive building inventories and reliable data sources. Many Indian cities lack updated building records, and informal settlements often remain unaccounted for, leading to an incomplete assessment of the overall seismic risk [24]. Moreover, the varying construction practices across different regions in India necessitate localized RVS methodologies. Building materials, construction techniques, and architectural styles can significantly influence a building's seismic vulnerability. The socioeconomic aspects also play a vital role in RVS implementation. Retrofitting existing buildings can be costly, and building owners may be reluctant to invest in seismic upgrades. Identifying economically feasible retrofitting solutions and implementing incentive programs become crucial in promoting seismic resilience.

Gupta and Sharma (2015) developed a seismic risk assessment framework that combines building data with historical seismicity and local site conditions. Their approach incorporates rapid visual screening as an initial step to prioritize buildings for detailed evaluation and retrofitting [22]. This framework emphasizes the importance of collecting data on building materials, age, construction type, and occupancy. Sharma et al. (2019) presented a building typology-based seismic risk assessment method for Indian cities. Their methodology categorizes buildings into groups based on structural characteristics and vulnerability factors, enabling efficient RVS on a larger scale. This typology-based approach accounts for the diverse building stock present in Indian cities and is particularly useful in regions with mixed construction types [24]. The application of rapid visual screening for vulnerability assessment of existing reinforced buildings in India has gained traction in recent years. Several studies have been conducted in different regions to evaluate the seismic vulnerability of reinforced structures. Sharma et al. (2018) applied rapid visual screening to assess the vulnerability of residential reinforced buildings in Delhi. The study identified key deficiencies in building construction and provided valuable insights for seismic risk mitigation. Additionally, Das and Venkataramana (2019) conducted a city-wide rapid visual screening of existing reinforced buildings in Bengaluru. The study aimed to identify areas with a higher concentration of vulnerable buildings, helping urban planners and policymakers prioritize retrofitting strategies [25]. Luco et al. (2015) conducted a rapid visual screening survey in downtown San Francisco to assess the seismic risk of unreinforced masonry buildings. The study identified areas with a higher concentration of vulnerable buildings, providing valuable insights for targeted retrofitting strategies [26].

Despite its effectiveness, rapid visual screening for vulnerability assessment of existing reinforced buildings in India faces certain challenges and limitations. One significant challenge is related to the complex construction practices and variations in building codes and design standards across different regions of India. The diversity in building typologies and construction materials requires customized RVS methodologies that consider regional variations [24]. Moreover, the availability of trained personnel for conducting rapid visual screening is a limitation. Proper training and expertise are essential to ensure accurate and consistent assessments. Therefore, efforts to train engineers, architects, and building officials in RVS techniques are necessary to improve the quality of vulnerability assessments [21].

#### 2.2 Observed Vulnerability

Seismic vulnerability assessment is a critical process that helps evaluate the potential susceptibility of structures to damage or failure during seismic events. It involves assessing various structural elements and systems to identify weaknesses and vulnerabilities. Here is the key vulnerability observed in the structures:

#### 2.2.1 Horizontal Irregularities

Horizontal irregularities in reinforced concrete buildings can compromise the overall structural integrity and safety of the structure, particularly during seismic events. The following are the types of horizontal irregularities commonly observed in reinforced concrete buildings.

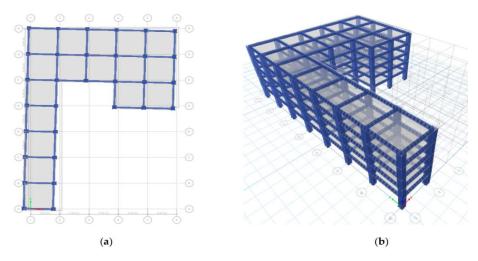


Fig. 2.1 Horizontal irregularity

#### 2.2.2 Torsional Irregularity

Torsional irregularity occurs when there is a significant difference in stiffness or mass distribution along the building's perimeter. This irregularity creates an imbalance in resisting torsional forces during seismic events, leading to excessive twisting and rotational motions in the structure. The reasons of torsional irregularity are: (a) asymmetrical building shapes or floor plans; (b) Off-center or irregular placement of mass or vertical elements (columns and walls); and (c) Varied lateral stiffness between building wings.

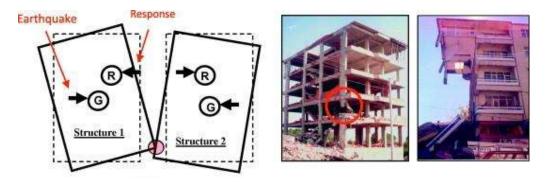


Fig. 2.2: Torsional irregularity

#### 2.2.3 Mass Irregularity

Mass irregularity refers to uneven distribution of mass along the height or plan of the building. Buildings with significant variations in mass are prone to differential lateral movements during seismic events. The reasons for mass irregularity are: (a) inconsistent distribution of mass due to varying floor layouts or architectural design choices; and (b) changes in building function or occupancy at different levels.

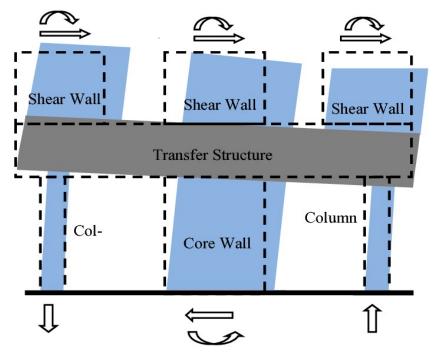


Fig. 2.3: Mass irregularity in horizontal direction

#### 2.2.4 Diaphragm Discontinuity

Diaphragm discontinuity occurs when there is a lack of continuity or stiffness in the building's horizontal diaphragm, which is responsible for distributing lateral forces to the vertical elements. Irregular layout of floor slabs or inconsistent diaphragm materials causes diaphragm discontinuity.

· · · ·	2 23
DAPHRAGM	K-SHEAR WALLS OPENING
PLAN	- Ne e e e e e e e e e e
-DIAPHRAGM_DIS	CONTINUITY

Fig. 2.4: Diaphragm discontinuity

#### 2.2.5 Vertical Irregularities

Vertical irregularities in reinforced concrete buildings are deviations from standard design or construction practices that can significantly affect the building's structural integrity and performance during seismic events. Five types of vertical irregularities observed in reinforced concrete buildings, their causes, potential consequences, and effective mitigation strategies.



Fig. 2.5: Vertical irregularity

#### 2.2.6 Soft Story Irregularity

A soft story irregularity refers to a significant difference in stiffness of two adjacent stories, usually found in buildings with an open ground floor (parking space) and residential or commercial spaces above. During an earthquake, the soft story can experience excessive lateral drift, leading to severe structural damage or even collapse. Inadequate lateral bracing or shear walls on the ground floor, removal or reduction of walls for parking space without appropriate compensation in lateral resistance are major reasons for causing soft story irregularity.



Fig. 2.6: Buildings with soft storey

#### 2.2.7 Setback Irregularity

Setback irregularity occurs when a building's mass is reduced at higher levels, creating setbacks. This design feature can lead to significant torsional effects during seismic events, causing uneven distribution of lateral forces and increasing structural vulnerability. The major reasons behind the setback irregularity are: architectural considerations that prioritize aesthetics over structural performance and use of cantilevered sections or varying floor layouts.



Fig. 2.7: Building with setback irregularity.

#### 2.2.8 Re-entrant Corners

Re-entrant corners refer to a building's floor plan with inward projections or recesses, such as U or L shapes. These corners concentrate lateral forces, creating stress concentration points susceptible to damage during seismic events.

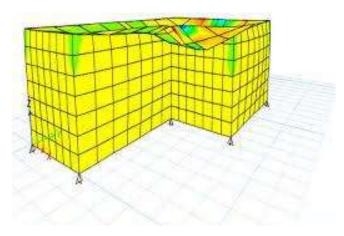


Fig. 2.8: Re-entrant corner

#### 2.2.9 Mass Irregularity

Mass irregularity occurs when there are significant variations in mass distribution along the height of the building. This irregularity can lead to unequal distribution of seismic forces, resulting in differential drifts and increased structural vulnerability. Uneven distribution of mass due to design choices or construction errors, and changes in building function or occupancy at different levels leads to mass irregularity.



Fig. 2.9: Mass irregularity in vertical direction

#### 2.2.10 Out-of-Plane Irregularity

Out-of-plane irregularity arises when a building's vertical elements, such as columns or walls, are not perfectly aligned vertically. This can lead to eccentricities and uneven distribution of lateral loads during seismic events. Construction errors or lack of proper alignment during building construction and foundation settlement or movement leads to the out of plane irregularity.

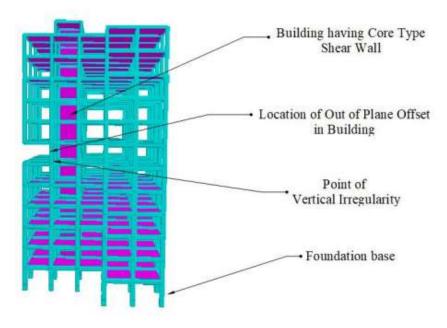


Fig. 2.10: Out of plate irregularity

### 2.3 Summary

Irregularities in reinforced concrete buildings can significantly influence their seismic performance. Vertical, horizontal, and plan irregularities can introduce complexities and vulnerabilities that impact the building's response to lateral loads. Understanding the implications of irregularities and implementing appropriate mitigation strategies are essential for enhancing the safety and resilience of reinforced concrete structures.

--000--

## Chapter 3

## Seismic Assessment Methods

#### 3.1 Overview

There is an urgent need to assess the seismic vulnerability of buildings in urban areas of India. Detailed seismic vulnerability evaluation is a technically complex and expensive procedure and can only be performed on a limited number of buildings. It is therefore very important to use simpler procedures that can help to rapidly evaluate the vulnerability profile of different types of buildings, so that the more complex evaluation procedures can be limited to the most critical buildings [18]. These are the following methods of seismic assessment of buildings.

- 1. Rapid visual screening (RVS) procedure requiring only visual evaluation and limited additional information (Level 1 procedure). This procedure is recommended for all buildings.
- Preliminary/Simplified vulnerability assessment (SVA) procedure requiring limited engineering analysis based on information from visual observations and structural drawings or on-site measurements (Level 2 procedure). This procedure is recommended for all buildings with high concentration of people.
- **3.** Detailed vulnerability assessment (DVA) procedure requiring detailed computer analysis, similar to or more complex than that required for design of a new building (Level 3 procedure). This procedure is recommended for all important and lifeline buildings.

#### 3.2 Rapid Assessment

The motive behind the rapid visual screening method is to save and minimize the resources required for the safety assessment of buildings in great numbers. The RVS procedure is a simple procedure for quick evaluation of large building stock, usually based on the walk down surveys onsite for each building to indicate the buildings need more advanced analysis. This method utilizes the scores given to building type (known as a structural score or base score) and performance modifiers to decide the level of risk of building. The performance modifiers reflect the effect of building deficiencies (i.e., vulnerable parameters) on its response during ground shaking. Therefore, from the RVS result (i.e., final score), one can prioritize the buildings [12]. It also depicts that the score values assigned to each vulnerable parameter play a crucial role in deciding the risk (i.e., performance) of building. The format of all the RVS forms is similar to the one shown in Figure 3.1. The most important section in the RVS form is the checklist of vulnerable parameters and scores assigned to each parameter. The score value is the numerical depiction of the effect of parameters on a building's behavior. Thus, for a sample RVS form shown here, a smaller value indicates a higher effect of parameters on building behavior, which may sometimes cause severe damage or collapse [15]. The damage in a building may occur due to the presence of one or more vulnerable parameters. The final score of the building depicts the damaged state of the building. This method can be used for the safety assessment of buildings before an earthquake and after an earthquake. If used before an earthquake, the final score of the building depicts the most likely possible damage that the building might experience during a future earthquake. In this way, it helps extrapolate the damage and loss estimation of buildings in any region.

				Add	dress:					
	+								Pin	
	+									
				Oth	her Identifiers					
					S Coordinates (					
	No	No. Stories Year Built								
	+++				veyor					
				Tot	al Floor Area (sq.	ft/sq. m)				
				Bui	lding Name					
				Use						
				Cur	rent Visual Cond	ition: Exceller	t D/ Good D/	Damaged D/ D	istressed D	
				Bui	Iding on Stilts / O	pen Ground I	Floor: Yes C/ N	lo 🗆		
					struction Drawin					
						gritten autore.	the state of the set			_
				+						
		_								
	+		+							
	+ + +	_					DUOTOCH	ADU		
							PHOTOGR		0501	
						(OR SPECI	PHOTOGR FY PHOTOG		IBER)	
Man and Elevation So	ale:					(OR SPECI	20000000000000		IBER)	
Man and Elevation Sc	OCCUPANO	the second s		SOIL	TYPE (IS 189		20000000000000	RAPH NUM	IBER) HAZARD	
Van and Elevation So ssembly Govt. ommercial Historic mer. Service Industrial	OCCUPANO Office Residential	the second s	er of Persons 11 - 100 1000+	SOIL Type I Hard Soil	TYPE (IS 189) Type II Medium Soil		20000000000000	RAPH NUM		□ Othe
isembly Govt. ommercial Historic	OCCUPANO Office Residential	Max. Numb 0 - 10 101 - 1000	11 - 100 1000+	Type I Hard Soil	Type II	3:2002) Type III Soft Soil	FY PHOTOG Chimney	RAPH NUM	HAZARD	
isembly Govt. mmercial Historic ner. Service Industrial	OCCUPANO Office Residential	Max, Numbe 0 - 10 101 - 1000 BA3 51	11 - 100 1000+ SIC SCORE, 52	Type I Hard Soil MODIFIE	Type II Medium Soil RS, AND FIN	3:2002) Type III Soft Soil AL SCORE C3	FY PHOTOG Chimney URM1	FALLING Parapet URM2	HAZARD	
sembly Govt. mmercial Historic ner. Service Industrial UILDING TYPE	OCCUPANO Office Residential School Wood	Max. Numbo 0 - 10 101 - 1000 BA S1 (FRAME)	11 - 100 1000+ SIC SCORE, S2 (LM)	Type I Hard Soil MODIFIE (MRF)	Type II Medium Soil RS, AND FIN C2 (SW)	3:2002) Type III Soft Soil AL SCORE C3 (INF)	Chimney URM1 (BAND-RD)	FALLING Parapet URM2 (BAND-FD)	HAZARD Cladding URM3	Othe URM
sembly Govt. mmercial Historic ner. Service Industrial UILDING TYPE asic Score	OCCUPANG Office Residential School Wood 6.0	Max. Numbe 0 - 10 101 - 1000 BA (ST (SRAME) 4.6	11 - 100 1000+ SIC SCORE, 52 (LM) 4.6	Type I Hard Soil MODIFIE (MRF) 4.4	Type II Medium Soil RS, AND FIN (2 (SW) 4.8	3:2002) Type III Soft Soil AL SCORE (INT) 4.4	Chimney (BAND-RD) 4.6	FALLING Parapet URM2 (BAND-FD) 4.8	LICARD Cladding URM3 4.6	Othe URM 3.6
sembly Govt. mmercial Historic ner. Service Industrial UILDING TYPE asic Score lid Rise (4 7 stories)	OCCUPANO Office Residential School Wood	Max. Numbo 0 - 10 101 - 1000 BA S1 (FRAME)	11 - 100 1000+ SIC SCORE, S2 (LM)	Type I Hard Soil MODIFIE (MRF)	Type II Medium Soil RS, AND FIN C2 (SW)	3:2002) Type III Soft Soil AL SCORE C3 (INF)	Chimney URM1 (BAND-RD)	FALLING Parapet URM2 (BAND-FD)	HAZARD Cladding URM3	Othe URM 3.6 -0.6
sembly Govt. mmercial Historic ner. Service Industrial UILDING TYPE asic Score fid Rise (4 7 stories) igh Rise (> 7 stories)	OCCUPANO Office Residential School Wood 6.0 N/A	Max, Numbb 0-10 101-1000 BA (SRAME) 4.6 +0.2	11 - 100 1000+ SIC SCORE, SZ (LM) 4.6 N/A	Type I Hard Soil MODIFIEI (MRF) 4,4 +0,4	Type II Medium Soil RS, AND FIN (2 (SW) 4.8 -0.2	3:2002) Type III Soft Soil AL SCORE C3 (INF) 4.4 -0.4	Chimney , S URM1 (BAND-RD) 4.6 -0.2	FALLING Parapet URM2 (BAND-TD) 4.8 -0.4	HAZARD Cladding URM3 4.6 -0.6	URM
sembly Govt. Inimercial Historic ner. Service Industrial UILDING TYPE asic Score tid Rise (> 7 stories) igh Rise (> 7 stories) ertical Irregularity an Irregularity	OCCUPANC Office Residential School Wood 6.0 N/A N/A N/A -3.0 -0.8	Max. Numbe 0 - 10 101 - 1000 BA2 S1 (FRAME) 4.6 +0.2 +1.0	11 - 100 1000+ SIC SCORE, SZ (LM) 4.6 N/A N/A	Type I Hard Soil MODIFIEI (MRF) 4,4 +0,4 +1,0	Type II Medium Soil RS, AND FIN C2 (SW) 4.8 -0.2 0.0	3:2002) Type III Soft Soil AL SCORE C3 (NY) 4.4 -0.4 -0.4	FY PHOTOG Chimney , S URM1 (BAND+RD) 4.6 -0.2 N/A	FALLING Parapet URM2 (BAND-FD) 4.8 -0.4 N/A	HAZARD Cladding URM3 4.6 -0.6 N/A	URM 3.6 -0.6 N/A -1.5
sembly Govt. Inimercial Historic ner. Service Industrial UILDING TYPE asic Score tid Rise (> 7 stories) igh Rise (> 7 stories) ertical Irregularity an Irregularity	OCCUPANC Office Residential School Wood 6.0 N/A N/A N/A -3.0 -0.8	Max. Numbi 0 - 10 101 - 1000 BA2 51 (FRAME) 4.6 +0.2 +1.0 -2.0	11 - 100 1000+ SIC SCORE, 52 (LM) 4.6 N/A N/A N/A	Type I Hard Soil MODIFIEI (MRF) 4.4 +0.4 +1.0 -1.5	Type II Medium Soil RS, AND FIN C2 (SW) 4.8 -0.2 0.0 -2.0	3:2002) Type III Soft Soil AL SCORE C3 (INF) 4.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4	Chimney Chimney 4.6 -0.2 N/A -1.5	FALLING Parapet URM2 (BAND-TD) 4.8 -0.4 N/A -2.0	LIRM3	0the URM 3.6 -0.6 N/A -1.5 -0.8
isembly Govt. ommercial Historic	OCCUPANC Office Residential School Wood 6.0 N/A N/A N/A -3.0 -0.8	Max. Numb 0 - 10 101 - 1000 BA/ S1 (SRAME) 4.6 +0.2 +1.0 -2.0 -0.8	11-100 1000+ SIC SCORE, SZ (JM) 4.6 N/A N/A N/A N/A N/A -0.8	Type I Hard Soil MODIFIE (MRF) 4.4 +0.4 +1.0 -1.5 -0.8	Type II Medium Soil RS, AND FIN C2 (SW) 4.8 -0.2 0.0 -2.0 -0.8	3:2002) Type III Soft Soil AL SCORE C3 (INF) 4.4 -0.4 -0.4 -2.0 -0.8	Chimney , S URM1 (BANG-RD) 4.6 -0.2 N/A -1.5 -0.8	FALLING Parapet URM2 (BAND-FD) 4.8 -0.4 N/A -2.0 -0.8	HAZARD Cladding URM3 4.6 -0.6 N/A -1.5 -0.8	URM 3.6 -0.6 N/A
isembly Govt. mmercial Historic ner. Service Industrial UILDING TYPE asic Score Mid Rise (> 7 stories) ligh Rise (> 7 stories) ertical Irregularity ode Detailing	OCCUPANC Office Residential School Wood 6.0 N/A N/A N/A -3.0 -0.8 N/A	Max. Numb 0 - 10 101 - 1000 BA2 51 (SRAME) 4.6 +0.2 +1.0 -2.0 -0.8 +0.4	11-100 1000+ SIC SCORE, 52 (JM) 4.6 N/A N/A N/A N/A N/A N/A	Type I Hard Soil MODIFIEI (MRF) 4.4 +0.4 +1.0 -1.5 -0.8 +0.6	Type II Medium Soil C2 (SW) 4.8 -0.2 0.0 -2.0 -0.8 +0.4	3:2002) Type III Soft Soil AL SCORE C3 (INIF) 4.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.8 N/A	Chimney (BANG1-RD) 4.6 -0.2 N/A -1.5 -0.8 N/A	FALLING Parapet URM2 (BAND-FD) 4.8 -0.4 N/A -2.0 -0.8 N/A	HAZARD Cladding URM3 4.6 -0.6 N/A -1.5 -0.8 N/A	0the URM 3.6 -0.6 N/A -1.5 -0.8 N/A

Fig. 3.1: Sample RVS for
--------------------------

#### **3.3 Preliminary/Simplified Assessment**

In Preliminary assessment of reinforced concrete buildings utilizes engineering information such as size and lateral stiffness of the building. This data is used to carry out simplified analysis of the structure to estimate the building drift. The analysis results between building drift and damage can be used to estimate the potential seismic hazard. However, this involves lot of computational work.A preliminary/simplified vulnerability assessment of reinforced concrete buildings provides valuable insights into potential weaknesses and lays the foundation for further in-depth evaluations. A simplified assessment can provide valuable insights for initial risk evaluation.

The assessment includes visual inspection, records analysis, historical data examination, and non-destructive testing. The identified vulnerabilities are then addressed through appropriate mitigation strategies to enhance the building's resilience. The preliminary vulnerability assessment includes the following steps:

*Visual Inspection:* A team of engineers conduct a comprehensive visual inspection of the building's interior and exterior. They observed several concerning findings, including:

- a) Cracks on the exterior concrete panels, particularly around corners and joints.
- b) Minor spalling and concrete delamination on some floors and ceilings.
- c) Signs of rust stains and corrosion on exposed steel reinforcement at certain locations.

*Records and Documentation Analysis:* The team reviews the original construction documents, building plans, and maintenance records. The building's construction adhered to the seismic design code in effect is checked.

*Historical Data Examination:* The seismic history of the region needs to be studied whether the area had experienced several moderate seismic events over the past few decades. While the building had not suffered any major damage, it became evident that its vulnerability to seismic forces needed to be addressed.

*Non-Destructive Testing:* Non-destructive testing methods, if needed like ultrasound and infrared thermograph, can be employed to assess the condition of the concrete and reinforcement elements.

This procedure is more complex (and therefore more accurate) than the rapid assessment procedure. As mentioned, this method utilizes engineering information such as size and strength of lateral load resisting members and more explicit information on the design ground motion. This data is used to carry out a highly simplified analysis of the structure to estimate the building drift. Since good correlation exists between building drift and damage, the analysis results can be used to estimate the potential seismic hazard of the building. Unlike the rapid assessment procedure, the simplified vulnerability assessment requires the use of a computer; however, the required inputs can be collected in paper form for later entry into the software system.

#### **3.4 Detailed Assessment**

In detailed vulnerability assessment (DVA) of a building detailed engineering analysis is carried out while considering the nature of potential ground motions and the non-linear behavior of the structural members. The procedure requires in depth information regarding a building, which may not be readily available. The detailed vulnerability assessment procedure is most suitable for important structural buildings. It is crucial to understanding the performance of reinforced concrete buildings during seismic events. By identifying vulnerabilities and weak points, engineers can develop effective retrofitting strategies to enhance the building's seismic resilience and ensure the safety of occupants and assets. This assessment goes beyond a general inspection and focuses on intricate aspects of a structure's design, construction, and maintenance that could make it susceptible to damage or failure during various hazards, such as earthquakes, hurricanes, or other extreme events. Key aspects of detail vulnerability assessment:

*i. Component-Level Evaluation*: Detail vulnerability assessment involves scrutinizing individual building components such as columns, beams, walls, connections, and foundations. This microscopic examination helps identify inadequate materials, substandard construction techniques, or compromised structural integrity.

*ii. Material and Workmanship*: The assessment pays close attention to the quality of materials used and the craftsmanship during construction. Flaws such as inadequate reinforcement, poor concrete mix, or faulty welds can significantly impact a building's overall performance under stress.

*iii. Non-Structural Elements*: Beyond structural components, detail vulnerability assessment considers non-structural elements like partitions, facades, windows, and utilities. These elements can influence the building's functionality, occupant safety, and overall resilience.

*iv. Load Paths and Redistribution*: The assessment analyzes load paths, load-bearing capacities, and the potential for load redistribution in case of localized failures. This helps determine if the structure can effectively distribute loads and maintain stability even if certain components fail.

v. Connections and Joints: Connections between structural elements and joints play a crucial role in transferring forces within a building. Detail vulnerability assessment examines the integrity of these connections, ensuring that they are designed and executed to withstand the anticipated loads and movements.

*vi. Deficiencies and Deterioration*: Over time, buildings can experience deterioration due to environmental factors, corrosion, or wear. The assessment evaluates these potential deficiencies, identifying areas that require maintenance or repair to prevent further degradation.

*vii. Functional and Aesthetic Considerations*: While the primary focus is on structural integrity, detail vulnerability assessment also considers the functionality and aesthetic aspects of a building. Ensuring that a building remains functional and retains its architectural and functional features even after an extreme event is crucial.

#### 3.5 Summary

Each type of vulnerability assessment procedure caters to specific hazards and challenges that a building may face. Depending on the building's location, purpose, and potential risks, stakeholders can choose the appropriate assessment method to ensure the building's safety and resilience in the face of various hazards. These various types of seismic vulnerability assessment procedures offer nuanced approaches to understanding a building's behavior during earthquakes. Though the latter preliminary assessment and detailed vulnerability assessment procedures are perfectly capable of identifying the deficit buildings but are costly, time-consuming and involves much more workforce. Compared to these procedures, the RVS procedure, i.e., rapid visual screening procedure, is the best alternative that requires significantly less time and serves the purpose.

--000--

## Chapter 4

## Seismic Assessment of Buildings in Vijayawada City

#### 4.1 History of Vijayawada City

Vijayawada is a historical city situated in Andhra Pradesh on the banks of Krishna River with latitude 16 03'11" N and longitude 80 03'91" E. The climate is tropical, with hot summers and moderate winters. The peak temperature reaches 47 °C in May - June, while the winter temperature is 20-27 °C. The average humidity is 78% and the average annual rainfall is 103 cm. Vijayawada gets its rainfall from both the south - west monsoon and north - east monsoon.

Vijayawada is located at the head of the Krishna delta, 70 km from the sea, bounded by the Indrakiladri Hills on the west and the Budameru River on the north. The Northern, North - Western, and South - Western parts of the city are covered by a low range of hills, while the Central, South - Western and North - Western parts are covered by rich and fertile agriculture lands with three major irrigation canals.

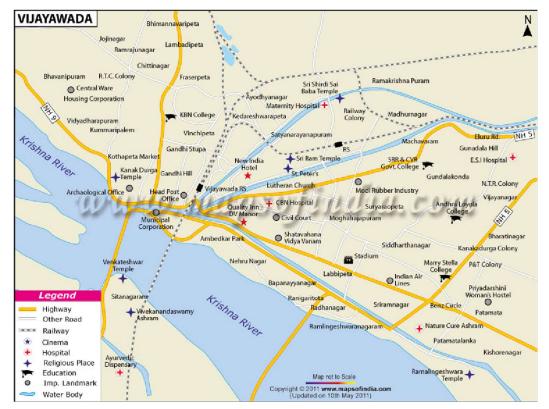


Fig. 4.1: Vijayawada City Map

The topography of Vijayawada is flat, with a few small to medium sized hills. The Krishna River runs through the city. The hills are part of the Eastern Ghats cut through by the Krishna River. It has very low elevation compared to the average elevation of the Ghats. This historical town has originated on the northern bank of the river Krishna and, by 1855 AD the town was in the form of small settlement on the eastern side of the Indrakiladri hills. It is also the commercial capital of the state of Andhra Pradesh, the third largest city in the state and largest city in Krishna District. The population growth has been rapidly registering almost three-fold increase in 3 decades ending 2011 with a population account of 10.48 lakhs.

Vijayawada has a lot of scope for development and urban growth. With ever increasing population and unprecedented growth the city's landscape is undergoing unwanted changes. The impervious nature imparted to the land surface because of construction of concrete roads has resulted in increased runoff and inundation of the low lying areas in the city even from the normal spell of rainfall. Urban Heat Island is one of the upcoming climatological problems developing in the city. With inhabiting population of more than one million Vijayawada is the largest commercial center in the State of Andhra Pradesh and is well interconnected to many other cities in the region. It is also an important railway junction connecting north & south India. The airport which is located at a distance of 25 km is also contributing to the city's growth. Vijayawada urban agglomeration consists of Vijayawada Municipal Corporation (VMC), Mangalagiri municipality and four panchayats.

#### 4.2 Buildings Selected for Assessment

#### 4.2.1 Tickle Road, Valluru Purnachandra Rao Road

This is a residential building with Stilt + 3 Floors, located on plain ground facing Tickle Road nearby Benz Circle with Geographic Coordinates  $16^{\circ}29'53''$  NL and  $80^{\circ}38'54''$  EL. Krishna River is 1.00 KM away and Bandar Canal is 0.50 KM from this building. The soils met with for foundations are Black Cotton soils. The height of each floor is 3.00 Mts.

The building shown in Fig. 4.2 is a G+3 storied residential reinforced concrete building. The building is roughly 35 years old and a moment resisting frame type building. It has symmetry or regularity in its plan but has vertical irregularity. The building has an open ground story which is used for the purpose of parking. This open ground story leads to vertical irregularity. Moreover, as can be seen in Fig 4.2 also, the space between the adjacent buildings is very small and not as per the Codal provisions. This might lead to a pounding problem in the future.



Fig. 4.2: Building no.1 Tickle road

#### 4.2.2 Sitarampuram (Durga Agraharam)

This is a residential Building bearing H.No.30-17-30 in Sitarampuram area with Stilt + 5 floors located on plain ground near Eluru Road (Kothavanthena Centre). The Geographic Coordinates of this building are 16°31'07" NL and 80°38'22" EL. Ryves canal is 0.30 KM from this building. The soils are Black Cotton expansive soils. The height of each floor is 3.00 Mts.

The building shown in Fig. 4.3 is a G+5 storey residential reinforced concrete building. The building is roughly 26 years old and a moment resisting frame type building. It has symmetry or regularity in its plan but has vertical irregularity. The building has an open ground storey which is used for the purpose of parking. This open ground storey leads to vertical irregularity. Moreover, the space between the adjacent buildings is very small and not as per the Codal provisions. This might lead to a pounding problem in the future.



(a)



(b)

Fig. 4.3: Building no.2 Sitarampuram

#### 4.2.3 Governerpet (Venkateswara Rao Street)

This is a residential building with H. No. 29-3-8 located in Ward No. 24 in Governorpet area with Geographic Coordinates 16°30'48" NL and 80°37'51" EL. The Ryves canal is about 0.50 KM from this building. The foundations are met with Black Cotton soil. The height of each floor is 3.00 Mts.

The building shown in Fig. 4.4 is a G+3 storey residential reinforced concrete building. The building is roughly 23 years old and a moment resisting frame type building. It has symmetry or regularity in its plan but has vertical irregularity. The building has stiffness variation between ground floor and Fist floor (hold RVS) an open ground storey which is used for the purpose of parking. This open ground storey leads to vertical irregularity. Moreover, the space between the adjacent buildings is very small and not as per the Codal provisions. This might lead to a pounding problem in the future.



Fig. 4.4: Building no.3 Governerpet

#### 4.2.4 Choultry (Madapati Guest House) Tarapet

This is a commercial building being used as a Guest House with Stilt + 3 floors, located in Commercial area of Vijayawada Old town near Railway Station. The Geographic Coordinates of this building are  $16^{\circ}31'06''$  NL and  $80^{\circ}36'41''$  EL. The soils met with are Black cotton soils. The height of each floor is 3.66 Mts. The building shown in Fig. 4.5 is a G+3 storey residential reinforced concrete building. The building is roughly 20 years old and a moment resisting frame type building. It has Symmetry and regularity in its plan and has vertical irregularity safe to assume for RVS. The building has an open ground storey which is used for the purpose of parking and Stair case head room. This open ground storey and staircase head room leads to vertical irregularity.



Fig. 4.5: Building no.4 Choultry

#### 4.2.5 Jammidoddi (Endowments Dept. office)

This is an office building of Endowments Department with Stilt + 4 floors, located in old town of Vijayawada in hill slope of Indra Keeladdri Hill.



Fig. 4.6: Building no.5 Jammidoddi

The Geographic Coordinates of this building are 16°30'58" NL and 80°40'33" EL. The soils met with in foundations are hard gravel / murram. The height of each floor is 3.66 Mts. sliding of hill slopes is common during rainy season in this area. The building shown in Fig. 4.6 is a G+4 storey Govt. office reinforced concrete building. The building is roughly 11 years old and a moment resisting frame type building. The Plan is 'L' Shaped Plan Irregularity and has vertical irregularity. The building has an open ground storey which is used for the purpose of parking. This open ground storey leads to vertical irregularity. Moreover, as can be seen in Fig 4.6 also, the space between the adjacent buildings is very small and not as per the Codal provisions. This might lead to a pounding problem in the future.

#### 4.2.6 Mahanadu Road, Gunadala

This is a residential building H.No.48-19-17, with Stilt + 5 floors, located in Gunadala area of Vijayawada city close to Mahanadu Road. The Geological Coordinates of this building are  $16^{\circ}30'52''$  NL and  $80^{\circ}40'33''$  EL. The soils met with in foundations are pure Black cotton soils. These were all agricultural lands until 20 years back. The roof height of each floor is 3.00 Mts.

The building shown in Fig. 4.7 is a Stilt+5 storey residential reinforced concrete building. The building is roughly 10 years old and a moment resisting frame type building. It has symmetry or regularity in its plan but has vertical irregularity. The building has an open ground storey which is used for the purpose of parking. This open ground storey leads to vertical irregularity. Moreover, as can be seen in Fig 4.7 the space between the adjacent buildings as per the Codal provisions.



Fig. 4.7: Building no.6 Mahanadu

#### 4.2.7 Brindavan (Labbipet)

This is a residential building in Brindavan Nagar of Labbipet area H. No.40-15/2-19/8A near Benz Circle with Stilt + 4 floors. The Geological Coordinates of this building are 16°29'57" NL and 80°38'48" EL. Krishna River is 1.00 KM away and Bandar Canal is 0.50 KM from this building. The soils met with foundations are Black Cotton. The height of each floor is 3.00 Mts. The building shown in Fig. 4.8 is a Stilt +4 storey residential reinforced concrete building. The building is roughly 5 years old and a moment resisting frame type building. It has symmetry or regularity in its plan but has vertical irregularity. The building has an open ground storey which is used for the purpose of parking. This open ground storey leads to vertical irregularity. Moreover, as can be seen in Fig. 4.8 the space between the adjacent buildings as per the Codal provisions.



Fig. 4.8: Building no.7 Brindavan

#### 4.2.8 GPV - ECE Block (Benz circle fly over)

This is the Govt. Polytechnic Building for Electronics & Communications Engineering Lab in Ground + 2 Floors facing Ring Road Benz Circle Flyover on NH-16. The Geographic Coordinates of this building are  $16^{\circ}30'16''$  NL and  $80^{\circ}39'30''$  EL. The soil is Black Cotton. The roof height of each floor is 3.60 Mts.

The building shown in Fig. 4.9 is a G+2 storey reinforced concrete building with educational classrooms. The building is roughly 21 years old and a moment resisting frame type building. It has symmetry or regularity in its plan and vertical regularity. Moreover, the space between the adjacent buildings is as per the Codal provisions.



Fig. 4.9: Building no.8 GPV



Fig. 4.10: Building no.9 GPV Hostel

#### 4.2.9 GPV Hostel Block, Benz Circle Fly over

This is Govt. building with G + 2 floors, located facing Benz Circle Flyover on NH-16 opp. to Ramesh Hospitals, used for Polytechnic Students Hostel. The Geographic Coordinates of this building are 16°30'20" NL and 80°39'34" EL. The soils are Black Cotton.Roof height of each floor is 3.00 Mts. The building shown in Fig. 4.10 is a G+2 storey residential hostel reinforced concrete building. The building is roughly 10 years old and a moment resisting frame type building. It has symmetry or regularity in its plan and vertical regularity. Moreover, the space between the adjacent buildings is as per the Codal provisions.

#### 4.2.10 MARK Residency, A. S. Ramarao Road Gunadala

This is a residential building with Stilt + 5 floors located in Moghalrajpuram East Hill slope area abutting A. S. Ramarao Road. The soils are Black cotton. Landslides during rainy season in this area are common. Geographic Coordinates of this building are  $16^{\circ}30'15''$  NL and  $80^{\circ}39'30''$  EL. The roof height of each floor is 3.00 Mts. The building shown in Fig. 10.0 is a Stilt +5 storey residential reinforced concrete building. The building is roughly 8 years old and a moment resisting

frame type building. It has symmetry or regularity in its plan but has vertical irregularity. The building has an open ground storey which is used for the purpose of parking. This open ground storey leads to vertical irregularity. Moreover, as can be seen in Fig. 4.11 also, the space between the adjacent buildings is as per the Codal provisions.



Fig. 4.11: Building no.10 Mark



Fig. 4.12: Building no.11 AB Plaza

#### 4.2.11 AB Plaza, Krishna Lanka, NH-16 & 65

This is a residential building with Stilt + 5 floors, located in Krishna Lanka flood affected area in between Krishna River and Bandar Canal abutting NH-16 & 65. The soil is black cotton / soft. The Geographic Coordinates of this building are  $16^{\circ}29'45''$  NL and  $80^{\circ}38'49''$  EL. The roof height of each floor is 3.00 Mts. The building shown in Fig. 4.12 is a Stilt +5 storey residential reinforced concrete building. The building is roughly 16 years old and a moment resisting frame type building. It has symmetry or regularity in its plan but has vertical irregularity. The building has an open ground storey which is used for the purpose of parking. This open ground storey leads to vertical irregularity. Moreover, as can be seen in Fig. 4.12 also, the space between the adjacent buildings is as per the Codal provisions.

#### 4.2.12 Chakradhar, No.5 Route, ITI Road

This is an office building with Stilt + 5 floors, located in Ramachandra Nagar, facing ITI Road. The soil is black cotton / soft. The Geographic Coordinates of this building are  $16^{\circ}30'17''$  NL and  $80^{\circ}39'19''$  EL. The roof height of each floor is 3.00 Mts.

The building shown in Fig. 4.13 is a STILT +5 Floors reinforced concrete building with office spaces and residential. The building is roughly 7 years old and a moment resisting frame type

building. It has irregularities in its plan and vertical irregularity. The building has an open ground storey which is used for the purpose of parking. This open ground storey leads to vertical irregularity. Moreover, the space between the adjacent buildings is as per the Codal provisions.



Fig. 4.13: Building no.12 Chakradhar

Fig. 4.14: Building no.13 High School

#### 4.2.13 High School Road, Patamata

This is an office-cum-residential building with stilt +4 Floors located on plain ground facing High School Road in Auto Nagar area of Patamata with Geographic coordinates 16°30'03" NL and 80°40'12" EL. The roof height of each floor is 3.00 Mts. The building shown in Fig. 2.14 is a Stilt +4 storey reinforced concrete building with office spaces & residential. The building is roughly 7 years old and a moment resisting frame type building. It has irregularity in its plan but has vertical irregularity. The building has an open ground storey which is used for the purpose of parking. This open ground storey leads to vertical irregularity. Moreover, the space between the adjacent buildings is as per the Codal provisions.

#### 4.2.14 Ranganath Residency, Bandar Road, Mogalrajpuram

This is a residential building with Stilt + 5 floors, located on plain ground in Mogalrajpuram near Bandar Road. The Geographic Coordinates of this building are 16°30'08" NL and 80°39'01" EL. The roof height of each floor is 3.00 Mts. The building shown in Fig. 2.15 is a Stilt +5 Floors storey residential reinforced concrete building. The building is roughly 15 years old and a moment resisting frame type building. It has symmetry or regularity in its plan but has vertical irregularity. The building has an open ground storey which is used for the purpose of parking. This open ground storey leads to vertical irregularity. Moreover, the space between the adjacent buildings is as per the Codal provisions.



Fig. 4.15: Building no.14 Ranganath

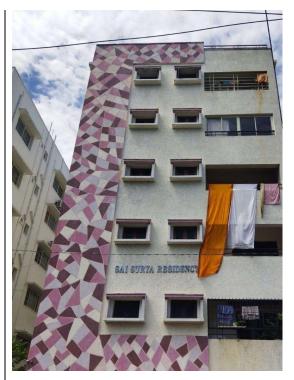


Fig. 4.16: Building no.15 Machavaram

#### 4.2.15 Machavaram, Narla Vari Street

This is a residential building with Stilt + 5 floors on plain ground at a distance of about 100 m. away from Ryves Canal between Vijayawada Bypass Road and Eluru Road in Machavaram down locality. The Geographic Coordinates of this location are 16°31'24" NL and 80°39'13" EL. The soils met with for foundations are Black Cotton soil. The height of each floor is 3.00 m. The building shown in Fig. 2.16 is a Stilt +5 floors residential reinforced concrete building. The building is roughly 9 years old and a moment resisting frame type building. It has symmetry or regularity in its plan but has vertical irregularity. The building has an open ground storey which is used for the purpose of parking. This open ground storey leads to vertical irregularity. Moreover, the space between the adjacent buildings is very small and not as per the Codal provisions. This might lead to a pounding problem in the future.

## 4.2.16 Summary

The location of the selected buildings is shown in the following figure along with their coordinates.

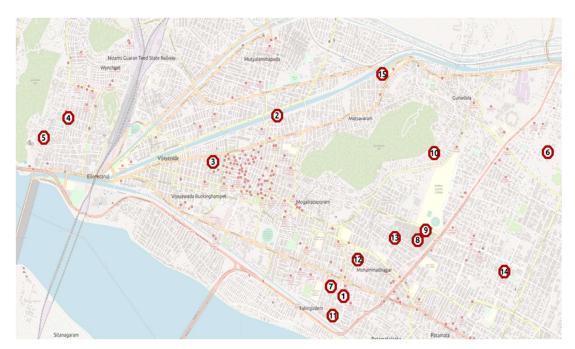


Fig. 4.17 Location of the surveyed building

S. No	Longitude	Latitude	Name
1	80.648333	16.498056	TSNo:147 Tickle Road
2	80.639444	16.518611	Hno:30-17-30 Durga Agraharam
3	80.630833	16.513333	Hno:29-3-8W-24Governorpet
4	80.611389	16.518333	Madapati Guest House Tarapet
5	80.608056	16.516111	O/o. A P Endowment Dept. Jammidoddi
6	80.675833	16.514444	Hno:48-19-17MahanaduRdGunadala
7	80.646667	16.499167	Hno:40-15/2-19/8ALabbipet
8	80.658333	16.504444	GPV-ECE Block
9	80.659444	16.505555	GPV- Hostel Block
10	80.660588	16.5143518	MARK Residency
11	80.646944	16.495833	AB Plaza
12	80.6502778	16.5022222	Ranganath Res. Bandar Road.
13	80.6552778	16.5047222	Chakradhar No.5 Route, ITI Road
14	80.67	16.5008333	V-Square, High School Road, Patamata
15	80.6536111	16.5233333	Machavaram, Narne Vari Street

#### 4.3 Rapid assessment of buildings

The rapid assessment of all 15 buildings was done using the FEMA154 RVS form. The assessment forms are shown in Annexure 1. In 1988, FEMA (Federal Emergency Management Agency) published the first edition of the FEMA-154 report that included a rapid visual screening procedure for identifying the buildings that might pose a severe risk of losing a life when a damaging earthquake occurs. The primary objective of this method is to identify if a particular building requires further evaluation to assess its seismic vulnerability. The method consists of two main factors: the basic score and score modifiers. The basic score is a generic score assigned to a building typology with no vulnerability present in it. A score modifier is a score given to those building vulnerable parameters which affects building performance during an earthquake. The advantage of using this method for assessment is that the method clearly defines the expected damage state of the building qualitatively, for example, slight damage, moderate damage, etc.

3	L	ocation / Hou	se No.	Bldg 1	Bldg 2	Bldg 3	Bldg 4	Bidg 5	Bldg 6	Bldg 7	Bldg 8	Bldg 9	Bldg 10	Bldg 11	Bldg 12	Bldg 13	Bldg 14	Bldg 15
÷	Y	ear of constru	uction.	1988	1997	2000	2003	2012	2012	2013	2002	2017	2015	2007	2008	2016	2016	2013
	n N	Jumber of Bui	ldings	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Collateral	Liquefaction		N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	Hazard	Land	dslide/Rock Fall	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
	nazaro	Fire		N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
_		Z	Cone Factor	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Hazard	Ground Shaking	Soil Type	Hard Rock (1), Medium Soil (1.33), Soft Soil (1.67)	1.67	1.67	1.67	1.67	1.33	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67
	19820000000	Spectral	No. of Stories	4	6	4	4	4	5	5	3	3	5	5	5	5	4	5
		Spectral	Min(20/N,2.5)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	н	azard Facto	or Actual	0.668	0.668	0.668	0.668	1	0.668	0.668	0.668	0.668	1	0.668	0.668	0.668	0.668	0.668
	Ha	zard Factor	Allowable	0.668	0.668	0.668	0.668	1	0.668	0.668	0.668	0.668	1	0.668	0.668	0.668	0.668	0.668
	mportance (I	Res.(1), Offic	e(1.25), Commercial	1	1	1	1	1.25	1	1	1.5	1.5	1	1	1	1.25	1.25	1
1.5	7	One Floor Bu	uilt Area in Sgm.	148.31	367.82	231.34	267.09	448.27	220.33	196.18	551.14	960.64	288.88	462.14	422.33	210.72	120.76	218.88
E I	Floor Area	Plot Size Ler	ngth in Mts.	22.36	24.68	25.74	26.70	34.83	20.60	22.70	61.34	46.48	32.46	28.83	28.73	24.08	18.33	29.41
Exposure		Plot Size (Wie	dth) Mts.	15.48	19.20	14.59	22.55	33.51	18.28	16.45	20.86	40.46	16.9	21.64	21.75	16.61	10.97	14.63
		I	FAR Actual	1.71	4.66	2.46	1.77	1.54	2.93	2.63	1.08	1.53	2.63	3.69	3.38	2.63	2.40	2.54
	7	F#	AR Allowable	2.71	2.87	2.34	2.28	2.71	2.34	2.29	2.21	5.00	2.16	2.38	2.62	2.70	2.35	2.68
	Exposure Actual			1.71	4.66	2.46	1.77	1.93	2.93	2.63	1.62	2.30	2.63	3.69	3.38	3.29	3.00	2.54
	E	Exposure Allowable		2.71	2.87	2.34	2.28	3.39	2.34	2.29	3.32	7.50	2.16	2.38	2.62	3.38	2.94	2.68
		Siting Issues		SAFE	UNSAFE	SAFE	SAFE	UNSAFE	UNSAFE	SAFE	SAFE							
	Life	Soil and Four	ndation Conditions	SAFE	UNSAFE	SAFE	SAFE	UNSAFE	UNSAFE	UNSAFE	UNSAFE	SAFE	UNSAFE	UNSAFE	UNSAFE	UNSAFE	UNSAFE	UNSAFE
-	Threatenin	Architectural	Features	SAFE	UNSAFE	SAFE	SAFE	UNSAFE	UNSAFE	UNSAFE	UNSAFE	UNSAFE	SAFE	SAFE	UNSAFE	UNSAFE	UNSAFE	UNSAFE
V ulne ra bility	g Factors	Structural As	pects	SAFE	SAFE	SAFE	SAFE	SAFE	SAFE									
ab	100 80 800 000 000 000 000 000 000 000 0	Construction	Details	SAFE	SAFE	SAFE	SAFE	SAFE	SAFE									
2		Sitting Issues	s (-5%)	5	N	5	5	N	N	N	N	-5	N	N	N	N	N	N
La la	Economic	Soil & Found	ation Condition (-5%)	0	-5	0	0	-5	-5	-5	-5	0	-5	-5	-5	-6	-5	-5
-	Losses	Architecture	Features (-50%)	0	-30	0	0	-50	-13	-13	-27	-47	-6	-7	-4	-22	-18	-37
	Factor	Structural As	pects (-20%)	0	-5	0	0	-5	-10	-10	0	-30	-5	-5	-5	-10	-5	-10
			Details (-20%)	0	-4	0	0	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4
	Vuln	erability Fa	ctor Actual	0.05	1	0.05	0.05	1	1		1	1	1	1	1	1	1	1
	Vulne		tor Allowable	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Risk Actu		0.06	3.11	0.08	0.06	1.93	1.96	1.76	1.08	1.53	2.63	2.46	2.26	2.20	2.00	1.70
		<b>Risk Allow</b> a	able	1.81	1.92	1.56	1.52	3.39	1.56	1.53	2.22	5.01	2.16	1.59	1.75	2.26	1.96	1.79

Fig. 4.18: Summary of assessment as per BMTPC Method

Moreover, the building information collected during the survey further used to calculate the risk of the building using the BMTPC method. BMTPC (Building Materials and Technology Promotion Council) in 2012 documented a methodology for the seismic safety assessment of typical housing typologies in India. The method is a result of an intensive field survey and a detailed study of historical documents. It provides a seismic safety index and performance rating to a building with respect to an ideal building of the same typology. Moreover, it divides all vulnerable parameters into two categories viz., life-threatening parameters and economic loss inducing parameters. Each economic loss inducing parameter has been assigned a score value or index values derived based on Delphi-Method. Delphi method is based on previous studies and the experience of the experts who assign scores to each parameter. As BMTPC (2012) method separates each factor into two sets, it becomes easy to determine the factors affecting life safety. But it has a few disadvantages over its use.

In BMTPC methods all the vulnerable parameters are categorized into 5 major factors: (i) Siting issue; (ii) Soil and foundation issue; (iii) Architectural issue; (iv) Structural issue and (v) Construction issue. Fig. 4.18 clearly shows that out of 5 buildings, 12 buildings have their risk level more than the allowable risk. This means that those 12 building will undergo major damage during any future major earthquake event. Moreover, this also implies that these 12 buildings need further detail evaluation to take necessary mitigation action.

## 4.4 Result analysis of rapid assessment

## 4.4.1 Result Analysis of BMTPC method

As mentioned in the previous section, the BMTPC method categories all the vulnerable parameters into five broad factors. Thus, after rapid survey, the data collected used to determine the risk of the building using BMTPC method. The Fig. 4.19 shows the contribution of each factor in overall risk of the building. It shows that the *Architectural issues* have highest contribution in overall risk of building followed by *Structural issues* and *Construction issues*.

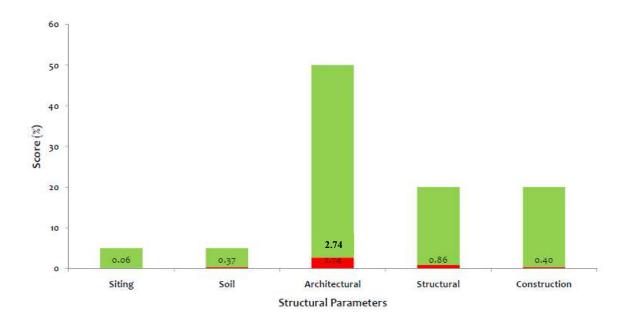


Fig. 4.19: Contribution of each factor in overall risk

After knowing the contribution of each factor in overall risk of building, the contribution of each vulnerable of each of the factor was determined. Fig. 4.20 shows the contribution of commonly present vulnerable parameters related architectural issues. It clearly shows that the majority of buildings have *elevation profile* issues with the highest contribution followed by *openings in walls*, *plan shape* and *parapet projections*.

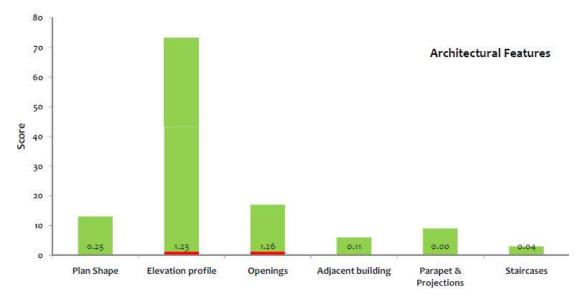


Fig. 4.20: Contribution of vulnerable parameters related architectural issues in overall risk of building

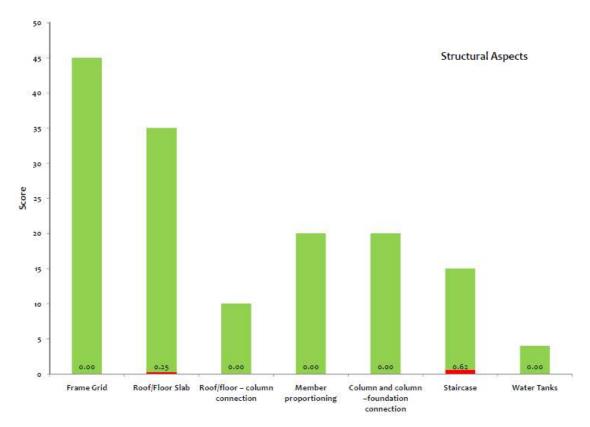


Fig. 4.21: Contribution of vulnerable parameters related structural issues in overall risk of building.

Fig. 4.21 shows the contribution of commonly present vulnerable parameters related structural issues. It shows that *frame grid*, *floor slab*, *member proportioning*, and *column-to-column* connection are most common parameters present in the buildings. Out of these frame grid and floor slab parameter has highest contribution in the risk of building.

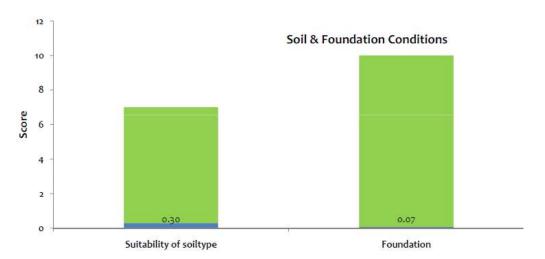


Fig. 4.22: Contribution of vulnerable parameters related soil issues in overall risk of building



Fig. 4.23: Contribution of vulnerable parameters related construction issues in overall risk of building

Similarly, Fig. 4.22 and Fig. 4.23 show the contribution of vulnerable parameters related to soil and construction issues respectively in overall risk of the buildings. Parameters such as *foundation, suitability of soil* and *materials* have more contributions in overall risk of surveyed buildings in Vijayawada.

## 4.5 Result analysis of detailed assessment

### 4.5.1 Data collection

For the purpose of detailed assessment, additional data such as structural drawings of building, compressive strength of structural members are collected. The objective of the detailed assessment is to understand the behavior of the buildings with irregularity. The data of drawings collected for buildings is shown in Annexure 2. Because detailed assessment involves numerical modeling and of buildings in sophisticated software, the data of compressive strength of structural members. These compressive strengths are determined using the NDT (Non-Destructive Testing or Rebound Hammer Test). The details of the ND Test collected for all buildings are shown in Annexure 3. For the non-destructive testing the readings were taken on each face of column at three levels of height (E, M, E) i.e., near 1<sup>st</sup> end, then at centre and then near opposite end as shown in Fig. 4.23.

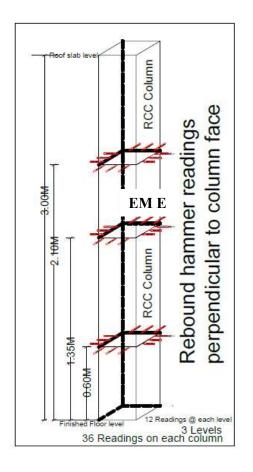
Earthquake resistant design requires calculation of earthquake forces on buildings and structures. The guide to earthquake resistant design of building and structures are given by IS 1893:2016 in India. The base shear calculation of all surveyed buildings is calculated using the collected information of each building.

First step to calculate earthquake loads on structure is to identify the earthquake zone for which structure needs to be designed. This earthquake zones are displayed in a map on page -11 of IS-1893:2016 Part I. After earthquake zone has been identified, the following steps are followed:

Step 1: Calculate design horizontal seismic coefficient, Ah which is given by

$$A_h = \frac{ZIS_a}{2Rg}$$

Here, Z is the zone factor, given in Table 3 of IS-1893:2016 Part I. I is the important factor of the structure depending on the function or use. This factor can be obtained from Table 8 of IS-1893:2016 Part I. R is response reduction factor. This value is obtained from Table 9 of IS-1893:2016 Part I. The value of 1/R shall not be more than 1.0.  $S_a/g$  is an average response acceleration coefficient. This value depends on time period of structure and on soil type and can be determined using Figure 2A of IS-1893:2016 Part I.



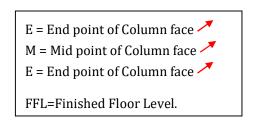
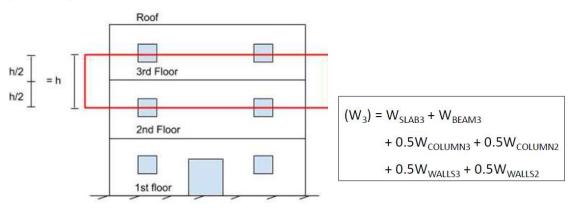


Fig. 4.24: Locations on structural members for doing NDT

Step 2: Calculate design seismic base shear for the structure (V<sub>B</sub>).

This is the total design lateral force along any principal direction. This is calculated as:  $V_B = A_h \times W$ . Where,  $A_h$  represents horizontal seismic coefficient, as discussed previously. W is total seismic weight of the structure. As per the Clause number 3.26 of IS-1893:2016 Part I seismic weight of the structure is defined as sum of: (i) dead load of the floor, (ii) appropriate contributions of weights of columns, (iii) walls and any other permanent elements from the storeys above and below, finishes and services, and (iv) appropriate amounts of specified imposed load on the floor. The pictorial representation of seismic weight calculation is shown in Fig below:



Step 3: Calculate distribution of design forces on the structure.

The seismic design base shear calculation as discussed previously is distributed on the structure as design seismic forces. This is calculated as below:

$$Q_i = V_B \frac{\frac{W_{ih}^2}{\sum\limits_{i=1}^{n} W_{ih}^2}}{\sum\limits_{i=1}^{n} W_{ih}^2}$$

Here,  $Q_i$  is design lateral force at floor *i*;  $W_i$  = seismic weight of the floor *i*;  $h_i$  = height of the floor *i* from the base; and *n* = number of storeys of the building at which masses are located.

### 4.5.2 Result analysis

To ascertain the compressive strength of the existing RCC columns, Rebound Hammer is used, and readings taken perpendicular (90°) to face of each column at three levels of height i.e., 0.60 m, 1.35 m and 2.10 m from finished floor level (FFL). At every level maximum 12 readings around the column i.e., 3 readings on each face of the column 4 faces are taken and average adopted for analysis.

In building 1 (Tickle road) There are 28 columns in each floor. Rebound Hammer readings are taken at 3 levels for each column wherever possible and average of 12 readings at each level are considered as one reading for analysis purpose. There are 84 readings in Stilt Floor and 74 readings for each upper floor, totaling to 309 readings in 4 floors. The boxplots are shown below.

The means in floors GF, F1, F2, and F3 are 38.16, 33.62, 33.97, and 34.08 respectively. The overall mean is 34.96. The means are shown in the bar graph below.

The significance test of the equality of floor means is also carried out by the analysis of variance and its result is shown in Table 4.2.

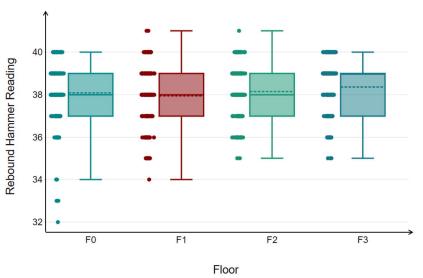


Fig. 4.25: Boxplot of NDT readings for building 1 (Tickle road)

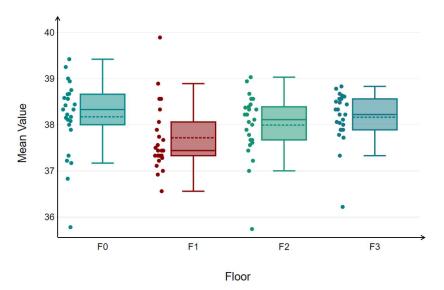


Fig. 4.26: Bar plot of NDT readings for building 1 (Tickle road)

	Estimate	Std. Error	t-value	p-value
GF	38.158	1.120	34.060	0
F1	-4.539	1.584	-2.865	0.00444
F2	-4.184	1.584	-2.641	0.00867
F3	-4.082	1.84	-2.576	0.01041

Table 4.2: Analysis of variance for building 1 (Tickle road)

Similarly, the analyses of other 14 buildings were also performed in the same fashion and its detailed results can be found in Annexure 4. Further, to understand the nonlinear behavior of the buildings, few buildings were selected, and a nonlinear static analysis was performed on a single frame of the building in both X and Y direction.

This nonlinear static analysis is also called *pushover* analysis. During this analysis, the control note is usually considered at the centre of mass of the roof of the building. Upon incorporating the material as well as geometric nonlinearity in a mathematical model of the structure, the structure is loaded monotonically with increasing loads. The model is loaded until either target displacement is reached or the structure reaches to collapse stage. Target displacement is maximum displacement that a structure is likely to experience during an earthquake. As the effects of inelastic material response are incorporated into the model, the procedure gives a fairly accurate estimate of the seismic response of the structure.

The nonlinear analysis was performed only on few selected buildings. The result of the analysis for the selected buildings is shown in Fig. 4.27, Fig. 4.28 and Fig. 4.29 respectively. The result of nonlinear static analysis is nothing but a plot of displacement of building vs. base shear. This is also called as *capacity curve (pushover curve)*. From the plot of capacity curve anyone can determine four important engineering parameters of the buildings like: initial stiffness, ultimate strength, ductility, and energy dissipation. The initial slope of any capacity curve shows the initial slope of the building. The highest point on any capacity curve represents the ultimate strength of the

building. The ratio of displacement at failure point and displacement at yield point represents the ductility of the building and lastly, the area under the curve shows the energy dissipation of the building.

Fig. 4.26 indicates that the initial stiffness of the 1<sup>st</sup> building along X direction is much higher that its initial stiffness in Y direction. Due to vulnerable parameters present in the building, its ultimate strength value varies for X as well as Y direction. Another major concern for 1<sup>st</sup> building is the ductility ratio along both directions. Due to presence of vulnerable parameter, the ductility of building along Y direction is more than ductility in X direction. This also implies that the building is comparatively more flexible along Y direction than X direction. The curve for X direction shows abrupt failure at displacement of 0.03 m which also shows a kind of brittle behavior of building post yielding.

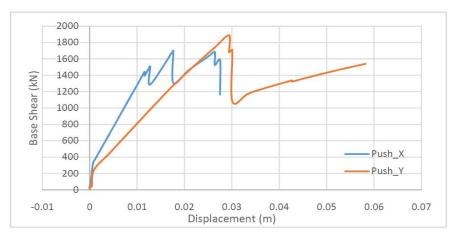


Fig. 4.27: Capacity curve of building 1 (Tickle road)

Fig. 4.28 shows that the initial stiffness of the 9<sup>th</sup> building along X direction is much higher that its initial stiffness in Y direction. Due to vulnerable parameters present in the building, its ultimate strength value varies for X as well as Y direction. The major concern for this building is also a ductility ratio along both directions. Due to presence of vulnerable parameter, the ductility of building along Y direction is more than ductility in X direction. This also implies that the building is comparatively more flexible along Y direction than X direction. Similar to the behavior of 1<sup>st</sup> building, the curve for X direction for this 9<sup>th</sup> building shows abrupt failure at displacement of 0.015 m which also shows a kind of brittle behavior of building post yielding.

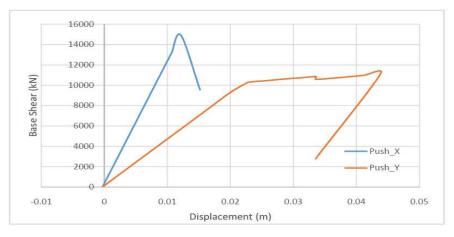


Fig. 4.28: Capacity curve of building 9 (GPV Hostel)

Similarly, Fig. 4.29 shows that the initial stiffness of the 10<sup>th</sup> building along X direction is much higher that its initial stiffness in Y direction. Due to vulnerable parameters present in the building, its ultimate strength value has a huge difference in its values for X as well as Y direction. The major concern for this building is also a ductility ratio along both directions. Due to presence of vulnerable parameter, the ductility of building along Y direction is more than ductility in X direction. This also implies that the building is comparatively more flexible along Y direction than X direction.

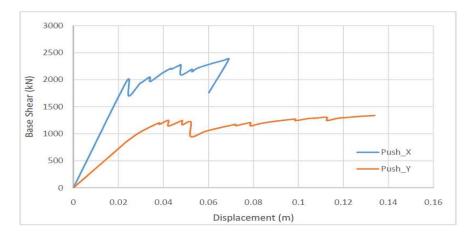


Fig. 4.29: Capacity curve of building 10 (Mark residency)

# 4.6 Summary

The assessment of selected buildings was divided in to two phases. In the first phase the rapid visual survey of building was performed using the RVS method developed by FEMA 154 as well as BMTPC. Later the results of BMTC method were used to perform the result analysis and to identify the parameters contributing most in the overall risk. In the second phase the detail information of buildings was collected, the numerical model was created, and a nonlinear static analysis was performed. The result of nonlinear analysis was helpful in understanding the nonlinear behavior of buildings.

--000--

# **Chapter 5**

# **Conclusion and Future Scope**

# 5.1 Conclusion

Total 15 reinforced concrete buildings were selected randomly from nearly 6 different locations in Vijayawada city. The rapid assessments of buildings have shown that the out of 15, 12 buildings have seismic risk more than the allowable risk limit. This implies many aspects about the current built scenarios not only in Vijayawada city but also in many other cities in India. It clearly implies that: (i) current construction industry is having a nun controlled growth; (ii) the construction practices must be regularly checked and evaluated; (iii) awareness about the seismic code provisions among the engineers and builders; (iv) awareness about the importance of engineer's input during design and construction of building; (v) awareness about the adverse effects of the vertical irregularities on building performance during earthquake; (vi) similarly, awareness about the adverse effects of the vertical irregularities on building performance during earthquake; (vii) awareness about the municipal guidelines for the construction; and many more.

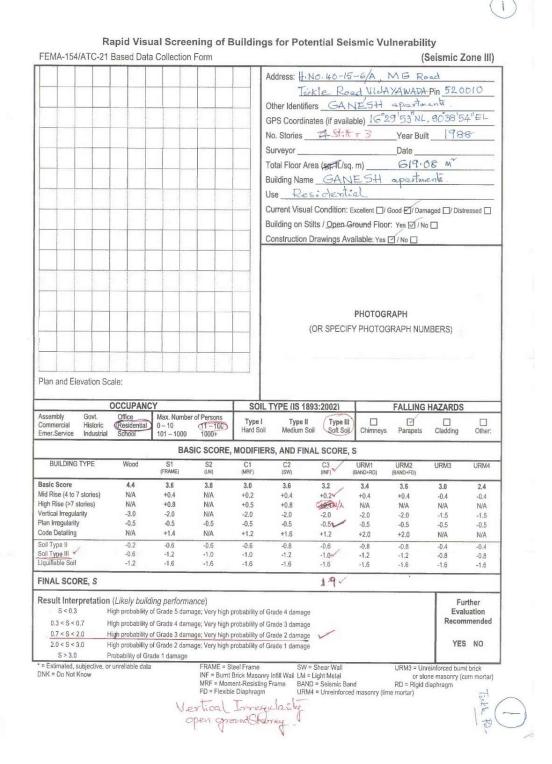
# 5.2 Future Scope

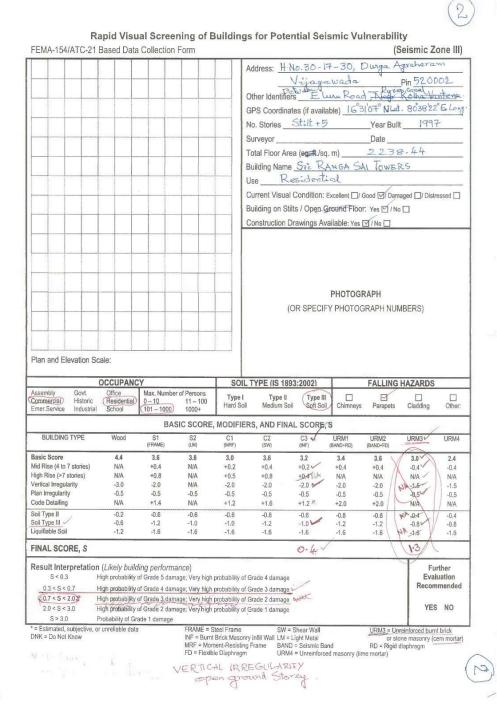
The present study can further be extended to perform rapid assessment of buildings in much larger scale. Moreover, the same can also be done in different cities in India, specifically in cities lying in higher seismic zones. This will help understand the overall risk different cities in India.

--000--

# Annexures

# **Annexure I: Rapid Visual Screening of Buildings**

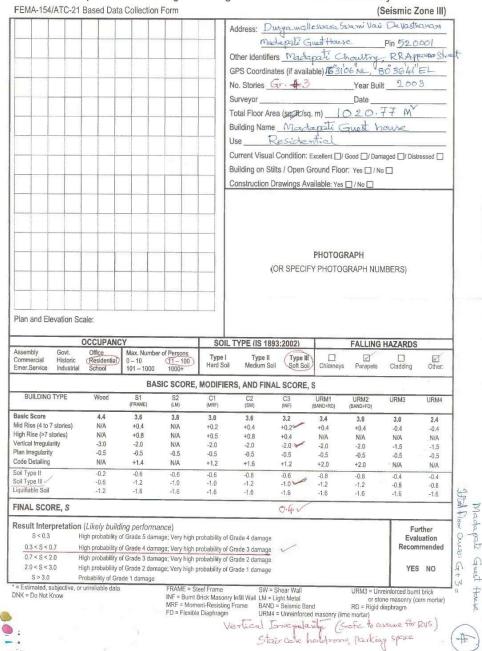




					Address: H-No	27-3-8	3. Venk	atesware	Rao Str	eet.
								A WADA		
					Other Identifiers	Ram	zich A	less Ro	ad	
					GPS Coordinate	es (if availai	ble) 1630	484"NL, 8	037'50.6	EL
					No. Stories <u>S</u>	tit 4	3	Year Buil	2000	)
		_			Surveyor			Date		
					Total Floor Area	(sa ft /sa	m) 95	5.87	N	
					Building Name		my <u></u>		1.1	
					Use Ra	sident	Cal			10
					Current Visual (					
					Building on Stilt					ressed 🔄
						S. (5)				
					Construction Dr	awings Ava	illable: Yes	🗹 / No 🗌		
Plan and Elevation						R SPECIF1	PHOTOGI Y PHOTOG	GRAPH NUN		
Assembly Govt.	OCCUPANC Office		15	SOIL	TYPE (IS 1893	:2002)		FALLING	HAZARDS	
Commercial Histor Emer.Service Indust	c (Residential)	Max. Number 0 – 10 101 – 1000	(11-100) 1000+	Type I Hard Soil	Type II Medium Soil	Type III Soft Soil	Chimneys	Parapets	Cladding	Other:
Second Marca and Second S		ALC: NOT THE OWNER.			RS, AND FINAL		5			
BUILDING TYPE	Wood	S1 (FRAME)	S2 (LM)	C1 (MRF)	C2 (SW)	C3 (INF) (	URM1 BAND+RD)	URM2 (BAND+FD)	URM3	URM4
Basic Score	4.4	3.6	3.8	3.0	3.6	3.2	3.4	3.6	3.0	2.4
vlid Rise (4 to 7 stories) ligh Rise (>7 stories)	N/A N/A	+0.4 +0.8	N/A N/A	+0.2 +0.5	+0.4 +0.8	+0.2	+0.4 N/A	+0.4 N/A	-0.4 N/A	-0.4 N/A
/ertical Irregularity	-3.0	-2.0	N/A	-2.0	-2.0	-2.0	-2.0	-2.0	-1.5	-1.5
Plan Irregularity	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Code Detailing	N/A	+1.4	N/A	+1.2	+1.6	+1.2	+2.0	+2.0	N/A	N/A
Soil Type II Soil Type III	-0.2 -0.6	-0.6 -1.2	-0.6 -1.0	-0.6 -1.0	-0.8 -1.2	-0.6	-0.8	-0.8	-0.4	-0.4
iquifiable Soil	-1.2	-1.6	-1.6	-1.6	-1.6	-1.6	-1.2	-1.2 -1.6	-0.8 -1.6	-0.8 -1.6
INAL SCORE, S						0-4-				
Result Interpretati S < 0.3 0.3 < S < 0.7 0.7 < S < 2.0 2.0 < S < 3.0 S > 3.0	High probability of	f Grade 5 dam f Grade 4 dam f Grade 3 dam f Grade 2 dam	age; Very high p age; Very high p age; Very high p	probability of probability of	Grade 3 damage 🗸 Grade 2 damage	/			Eval Recom	rther uation mended NO
= Estimated, subjective	e, or unreliable data	- 00	FRAME = St	eel Frame Brick Masoon	SW = SI y Infill Wall_LM = Lig	hear Wall	<u>11 - 21 -</u>	URM3 = Unr	einforced burn te masonry (cr	t brick
DNK = Do Not Know										

3

)



ş

FEMA-154/ATC-21 Based Data Collection Form (Seismic Zone III) Sai Durga Malle Sasamer Vella Dev Address: 10, Brahmana Veedhi, 1 520001 % Executive Officer Pin Other Identifiers Jammideddi Pump House 60 36° 29 EL GPS Coordinates (if available) 16 30 59"NL, 2012 No. Stories Still Gr. + 4 Year Built Surveyor \_\_\_\_\_ Date 1988.07 N Total Floor Area (se ft./sq. m) \_ Building Name Jammidoddi Pump House Use Gout. Offices Current Visual Condition: Excellent []/ Good []/ Damaged []/ Distressed [] Building on Stilts / Open Greund Floor: Yes 1 No Construction Drawings Available: Yes 🗹 / No 🗔 PHOTOGRAPH (OR SPECIFY PHOTOGRAPH NUMBERS) Plan and Elevation Scale: OCCUPANCY SOIL TYPE (IS 1893:2002) FALLING HAZARDS Assembly Commercial Emer.Service 
 Max. Number of Persons

 0-10
 11-100

 101-1000
 1000+
 Govt. Historic Office Residential Type I Hard Soil Type II Type III Medium Soil Soft Soil V Cladding Ciher: Chimnevs Parapets Industrial School BASIC SCORE, MODIFIERS, AND FINAL SCORE, S BUILDING TYPE Wood S1 (FRAME) S2 (LM) C1 (MRF) C2 (SW) C3 (INF) URM1 (BAND+RE URM2 (BAND+FD URM3 URM4 Basic Score 4.4 3.6 3.8 3.0 3.6 3.2 3.4 3.6 3.0 2.4 Mid Rise (4 to 7 stories) N/A +0.4 N/A +0.2 +0.4 +0.2 -+0.4 +0.4 -0.4 -0.4 High Rise (>7 stories) N/A +0.8 N/A +0.5 +0.8 +0.4 N/A N/A N/A N/A Vertical Irregularity -3.0 -2.0 N/A -2.0 -2.0 -2.0 🌭 -2.0 -2.0 -1.5 -1.5 Plan Irregularity -0.5 -0.5 🗸 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 Code Detailing N/A +1.4 N/A +1.2 +1.6 +1.2 +2.0 +2.0N/A N/A Soil Type II -0.6 🖌 -0.8 -1.2 -0.8 -0.8 -0.4 -0.4 Soil Type III Liquifiable Soil -0.6 -1.2 -12 -1.0 -1.6 -1.0 -1.6 1.2 -0.8 -0.8 -1.6 -1.6 -1.6 -16 -1.6 -1.6 -1.6 FINAL SCORE, S 0.3. Result Interpretation (Likely building performance) - selected to be on a Further High probability of Grade 5 damage, Very high probability of Grade 4 damage <u>S<0.3</u> 0.3<S<0.7 Evaluation Constradof 01325203 Enstradof 01325203 High probability of Grade 4 damage; Very high probability of Grade 3 damage Recommended 0.7 < S < 2.0 High probability of Grade 3 damage; Very high probability of Grade 2 damage High probability of Grade 2 damage; Very high probability of Grade 1 damage 2.0 < S < 3.0 YES NO FRAME = Steel Frame SW = Shear Wall URM3 = Unreinforced burnt brick INF = Burnt Brick Masony Infill Wall LM = Light Metal MRF = Moment Resisting Frame BAND = Selsmic Band RD = Rigid diaphragm FD = Flexible Diaphragm URM4 = Unreinforced masonry (lime mortar) Plan 'L' Strape Vertical energylant f, apen provid Strang W S>3.0 Probability of Grade 1 damage = Estimated, subjective, or unreliable data DNK = Do Not Know 5

5

			Donootion	Form					10	Seismic Z	one m
						Address: HNd	0.48-19	-17, Me	abaneder	-Road, (	Junad
		_				Other Identifiers	Virau	e wada		Pin 520	5004-
						01-11-16	A 1	LW	- 1111 R.a	Copp 10	-11-
						Other Identifiers	S CREARQU	-Kolkal	a NH, that	an Health	n Univer
						GPS Coordinate					
			1			No. Stories 🧾	Still +!	5	Year Buil	t_201	2
						Surveyor			Date		
						Total Floor Area	logation	m) /2	522 . (	69	
						Building Name		111 51	ITE A	MANES	
	-	_				Use Re	vanur	Ma EL	-ITE TI	1011100	
					( 1814 I						
	1					Current Visual (	Condition: E	Excellent []/ (	Good 🗹 Dam	naged 🔲 / Dist	ressed 🗌
						Building on Stilt	s / Open G	round Floor	r: Yes 🗹 / No		
						Construction Dr	awings Ava	ailable: Yes I			
	_	_									
			_					PHOTOGR	RAPH		
						10					
						(0	R SPECIF	1 PHOTOG	GRAPH NUM	WBERS)	
Plan and Elev	ation Sci	ale:									
	(	OCCUPANC	V		SOIL	TVDE /19 1903	2.2002)	T	FALLING	HAZADDO	
	Govt.	Office	Max. Numb	er of Persons		. TYPE (IS 1893			/	HAZARDS	
Commercial	A CONTRACTOR OF THE OWNER	and the second se	Max. Numb 0 - 10 101 - 1000	( <u>1-100</u> ) 1000+	Type I Hard Soil	Type II Medium Soil	Soft Soil	Chimneys	Y	HAZARDS Cladding	D Other:
Commercial Emer.Service	Govt. Historic Industrial	Office Residential School	Max. Numb 0 - 10 101 - 1000 BA	(1-100) 1000+ SIC SCORE,	Type I Hard Soil MODIFIEI	Type II Medium Soil RS, AND FINAI	Soft Soil	Chimneys	Y	Ø	
Commercial	Govt. Historic Industrial	Office (Residential)	Max. Numb 0 - 10 101 - 1000	( <u>1-100</u> ) 1000+	Type I Hard Soil	Type II Medium Soil	Soft Soil	Chimneys	Y	Ø	
Commercial Emer.Service BUILDING T Basic Score	Govt. Historic Industrial YPE	Office (Residential) School Wood 4,4	Max. Numbo 0 - 10 101 - 1000 BA S1 (FRAME) 3.6	(11-100) 1000+ SIC SCORE, (LM) 3.8	Type I Hard Soil MODIFIEI C1 × (MRF) 3.0	Type II Medium Soil RS, AND FINAI C2 (SW) 3.6	C3 (INF) 3.2	Chimneys S URM1	Parapets URM2	Cladding	Dther;
Commercial Erner.Service BUILDING T Basic Score Mid Rise (4 to 7 s	Govt. Historic Industrial YPE	Office (Residential) School Wood 4.4 N/A	Max. Numbr 0 - 10 101 - 1000 BA S1 (FRAME) 3.6 +0.4	(11-100) 1000+ SIC SCORE, (LM) 3.8 N/A	Type I Hard Soli MODIFIEI (MRF) 3.0 +0.2	Type II Medium Soil RS, AND FINAI C2 (SW) 3.6 +0.4	(INF) 3.2 +0.2	Chimneys S URM1 (BAND+RD) 3.4 +0.4	Parapels URM2 (BAND+FD) 3.6 +0.4	URM3 3.0 -0.4	URM4 2.4 -0.4
Commercial Emer.Service BUILDING T Basic Score	Govt. Historic Industrial YPE stories)	Office (Residential) School Wood 4,4	Max. Numbo 0 - 10 101 - 1000 BA S1 (FRAME) 3.6	(11-100) 1000+ SIC SCORE, (LM) 3.8	Type I Hard Soli MODIFIEI (MRF) 3.0 +0.2 +0.5	Type II Medium Soil RS, AND FINAI C2 (SW) 3.6 +0.4 +0.8	C3 (INF) 3.2 +0.2 +0.4	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A	Parapels URM2 (BAND+FD) 3.6 +0.4 N/A	URM3 3.0 -0.4 N/A	URM4 2.4 -0.4 N/A
Commercial Emer.Service BUILDING T Basic Score Mid Rise (4 to 7 s High Rise (>7 sto Vertical Irregularit Plan Irregularity	Govt. Historic Industrial YPE stories)	Office (Residential) School Wood 4.4 N/A N/A -3.0 -0.5	Max, Numbe 0 - 10 101 - 1000 BA S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5	SIC SCORE, SIC SCORE, (LM) 3.8 N/A N/A	Type I Hard Soli MODIFIEI (MRF) 3.0 +0.2	Type II Medium Soil RS, AND FINAI C2 (SW) 3.6 +0.4	(INF) 3.2 +0.2	Chimneys S URM1 (BAND+RD) 3.4 +0.4	Parapels URM2 (BAND+FD) 3.6 +0.4	URM3 3.0 -0.4	URM4 2.4 -0.4
Commercial Emer.Service BUILDING T Basic Score Mid Rise (4 to 7 s High Rise (>7 sto Vertical Iregulari Plan Irregularity Code Detailing	Govt. Historic Industrial YPE stories)	Office (Residential) School 4.4 N/A -3.0 -0.5 N/A	Max, Numbe 0 - 10 101 - 1000 BA S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4	1-100           1000+           SIC SCORE,           (LM)           3.8           N/A           N/A           N/A           -0.5           N/A	Type I Hard Soil MODIFIEI (MRF) 3.0 +0.2 +0.5 -2.0	Type II Medium Soil RS, AND FINAI C2 (SW) 3.6 +0.4 +0.8 -2.0	C3 (INF) 3.2 +0.2 +0.4 -2.0	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0	URM3 3.0 -0.4 N/A -1.5	URM4 2.4 -0.4 N/A -1.5
Commercial Emer.Service BUILDING T Basic Score Mid Rise (4 to 7 s High Rise (7 sto Vertical Irregularity Vertical Irregularity Code Detailing Soil Type II	Govt. Historic Industrial YPE stories)	Office (Residential) School Wood 4.4 N/A -3.0 -0.5 N/A -0.2	Max. Numbu 0 - 10 101 - 1000 BA S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6	11-100           1000+           SIC SCORE,           S2           (LM)           3.8           N/A           N/A           N/A           -0.5           N/A           -0.6	Type I Hard Soil MODIFIEI C1 (MRF) 3.0 +0.2 +0.5 +0.5 +0.5 +0.5 +1.2 -0.6	Type II Medium Soil RS, AND FINAI C2 (5W) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -0.8	C3 (INF) 3.2 +0.2 +0.4 -2.0 -0.5 +1.2 -0.6	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.8	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8	URM3 0.4 0.4 0.4 0.5 -0.5 N/A -0.4	URM4 2.4 -0.4 N/A -1.5 -0.5 N/A -0.4
Commercial Emer.Service BUILDING T Basic Score Migh Rise (4 to 7 s High Rise (47 sto Vertical Irregularity Code Detailing Soil Type II Soil Type II	Govt. Historic Industrial YPE stories)	Office (Residential) School Wood 4.4 N/A N/A -3.0 -0.5 N/A -0.5 N/A -0.2 -0.6	Max, Numbi 0 - 10 101 - 1000 BA S1 (FRAME) 3.6 +0.4 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6 -1.2	11-100           1000+           SIC SCORE,           S2           (LM)           3.8           N/A           N/A           N/A           -0.6           -1.0	Type I Hard Soil MODIFIEI C1 (MRF) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2 -0.6 -1.0	Type II Medium Soil           RS, AND FINAI           C2 (SW)           3.6 +0.4 +0.8 -2.0 -0.5 +1.6           -0.5 +1.6           -0.8 -1.2	Type III Soft Soil           Soft Soil           L SCORE, S           (INF)           3.2           +0.2           +0.4           -2.0           -0.5           +1.2           -0.6           -1.0	Chimneys S URM1 (8AND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.5 +2.0 -0.8 -1.2	URM2 ((BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	URM3 URM3 0.4 N/A -1.5 -0.5 N/A -0.4 -0.8	URM4 2.4 -0.4 -1.5 N/A -0.4 -0.4 -0.8
Commercial Emer.Service BUILDING T Basic Score Mid Rise (4 to 7 s High Rise (>7 sto Vertical Irregularity Plan Irregularity Pian Irregularity Code Detailing Soil Type II Soil Type II Liquifable Soil	Govt. Historic Industrial YPE stories) tries) ty	Office (Residential) School Wood 4.4 N/A -3.0 -0.5 N/A -0.2	Max. Numbu 0 - 10 101 - 1000 BA S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6	11-100           1000+           SIC SCORE,           S2           (LM)           3.8           N/A           N/A           N/A           -0.5           N/A           -0.6	Type I Hard Soil MODIFIEI C1 (MRF) 3.0 +0.2 +0.5 +0.2 +0.5 +1.2 -0.6 -1.0 -1.6	Type II Medium Soil           RS, AND FINAI           C2 (5W)           3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -1.2 -1.5	C3 (INF) 3.2 +0.2 +0.4 -0.5 +1.2 -0.6 -1.0 -1.6	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.8	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8	URM3 0.4 0.4 0.4 0.5 -0.5 N/A -0.4	URM4 2.4 -0.4 N/A -1.5 -0.5 N/A -0.4
Commercial Emer.Service BUILDING T Basic Score Mid Rise (4 to 7 s High Rise (7 sto Vertical Irregularity Plan Irregularity Plan Irregularity Code Detailing Soil Type II Soil Type II Soil Type II Liquifable Soil FINAL SCOR	Govt. Historic Industrial YPE stories) ty E, S	Office (Residential) School 4.4 N/A N/A N/A -0.5 N/A -0.5 N/A -0.5 N/A -0.6 -1.2	Max. Numb 0 - 10 101 - 1000 BA S1 (FRAME) 3.6 +0.4 +0.4 +0.4 +0.4 +0.4 +0.4 +0.5 +1.4 -0.5 +1.4 -0.6 -1.2 -1.6	SIC SCORE,           3.8           N/A           N/A           N/A           -0.6           -1.0           -1.6	Type I Hard Soil MODIFIEI C1 (MRF) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2 -0.6 -1.0	Type II Medium Soil           RS, AND FINAI           C2 (5W)           3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -1.2 -1.5	Type III Soft Soil           Soft Soil           L SCORE, S           (INF)           3.2           +0.2           +0.4           -2.0           -0.5           +1.2           -0.6           -1.0	Chimneys S URM1 (8AND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.5 +2.0 -0.8 -1.2	URM2 ((BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	URM3 3.0 -0.4 N/A -1.5 -0.5 N/A -0.5 N/A -0.6 -1.6	URM4 2.4 -0.4 N/A -1.5 -0.5 N/A -0.4 -0.8 -1.6
Commercial Emer.Service BUILDING T Basic Score Mid Rise (4 to 7 s High Rise (>7 sto Vertical Irregularity Code Detailing Soil Type II Soil Type II Liquifable Soil FINAL SCOR Result Interpr	Govt. Historic Industrial YPE stories) tries) ty E, S retation	Office (Residential) School 4.4 N/A N/A -0.2 -0.6 -1.2 (Likely build	Max. Numb 0 - 10 101 - 100 BA S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6 -1.2 -1.6 ing perform	(11-100) 1000+ SIC SCORE, SIC SCORE, SIC SCORE, SIC SCORE, NA NA N/A N/A N/A -0.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6	Type I Hard Soil MODIFIEI C1 & (MRF) 3.0 +0.2 +0.5 +1.2 -0.5 +1.2 -0.6 -1.0 -1.6	Type II Medium Soil RS, AND FINAI C2 (5W) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -1.2 -1.5 -1.2 -1.5 -1.2 -1.5	Type III, Soft Scill L SCORE, ( Soft Scill C3, (INF) 3.2 +0.2 +0.2 +0.4 -0.5 +1.2 -0.6 -1.0 -0.1	Chimneys S URM1 ((8AND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.5 +2.0 -0.8 -1.2 -1.2 -1.6	URM2 ((BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	Cladding URM3 0.04 -0.4 -1.5 -0.5 -0.5 N/A -0.8 -1.6 -1.6	URM4 2.4 -0.4 -1.5 -0.5 N/A -0.4 -0.4 -1.6 urther
Commercial Emer.Service BUILDING T Basic Score Mid Rise (4 to 7 s Hingh Rise (4 to 7 s Hingh Rise (4 to 7 s Hingh Rise (4 to 7 s Vertical Irregularity Code Detailing Soil Type II Soil Type II Soil Type II Soil Type II FINAL SCOR Result Interpi <u>S &lt; 0.3</u>	Govt. Historic Industrial YPE stories) ty E, S retation Hi	Office (Residential) School 4.4 N/A -3.0 -0.5 N/A -0.2 -0.6 -1.2 (Likely build gh probability c	Max. Numb 0 - 10 101 - 1000 BA S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6 -1.2 -1.6 -1.2 -1.6	(1-100) 1000+ SIC SCORE, (M) 3.8 N/A N/A N/A N/A -0.5 N/A N/A -0.5 N/A -0.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6	Type I Hard Soil           MODIFIE           0.1           0.0           0.0           0.0           0.0           0.0           -1.0           0.6           -1.0           0.6           -1.6           0.6           0.7           0.6           -1.6           0.6           0.6           0.6           0.6           0.6           0.6           0.6           0.6            0.6           0.7           0.6           0.7           0.8           0.9	Type II Medium Soil RS, AND FINAI C2 (5W) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -0.8 -1.2 -1.5 -1.2 -1.5 -1.2 -1.5 -1.2 -1.5 -1.2 -1.5 -1.2 -1.5 -1.2 -1.2 -1.2 -1.2 -1.2 -1.2 -1.2 -1.2	Type III, Soft Scill SCORE, 5 (INF) 3.2 +0.2 +0.4 -0.5 +0.4 -0.5 +1.2 -0.6 -1.0 -0.5 -0.1	Chimneys S URM1 ((8AND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.5 +2.0 -0.8 -1.2 -1.2 -1.6	URM2 ((BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	URM3 URM3 URM3 URM3 URM3 URM3 URM3 URM3	URM4 2.4 -0.4 N/A -1.5 -0.5 N/A -0.4 -0.8 -1.6
Commercial Emer.Service BUILDING T Basic Score Mid Rise (4 to 7 s High Rise (>7 sto Vertical Irregularity Code Detailing Soil Type II Soil Type II Liquifable Soil FINAL SCOR Result Interpr	Govt. Historic Industrial YPE stories) ty E, S retation Hi r Hi	Office (Residential) School 4.4 N/A N/A -0.5 N/A -0.5 N/A -0.5 -1.2 (Likely build gh probability c gh probability c	Max. Numb 0 - 10 101 - 10 BA S1 (FRAME) 3.6 +0.4 +0.8 -2.0 0.5 +1.4 -0.6 -1.2 -1.6 ing perform of Grade 5 dan of Grade 4 dan	(1-100) 1000+ SIC SCORE, SIC SCORE, (M) 3.8 N/A N/A -0.5 N/A -0.5 N/A -0.6 -1.0 -1.0 -1.0 -1.0 -1.0 -1.0 -1.0 -1.0	Type I Hard Soil           MODIFIEI           0.1           0.2           0.5           +0.5           -1.0           -1.6           wordsability of probability of	Type II Medium Soil           RS, AND FINAI           C2 (\$W)           3.6           +0.4           +0.8           -2.0           -5           +1.6           -0.8           -1.2           -1.6           Grade 4 damage           Grade 4 damage           Grade 3 damage	Type III, Soft Scill L SCORE, ( Soft Scill C3, (INF) 3.2 +0.2 +0.2 +0.4 -0.5 +1.2 -0.6 -1.0 -0.1	Chimneys S URM1 ((8AND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.5 +2.0 -0.8 -1.2 -1.2 -1.6	URM2 ((BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	URM3 URM3 URM3 URM3 URM3 URM3 URM3 URM3	URM4 2.4 -0.4 -1.5 -0.5 N/A -0.4 -0.4 -1.6 urther
Commercial Emer.Service BUILDING T Basic Score Mid Rise (4 to 7 s High Rise (7 to 7 s High Rise (7 to 7 s High Rise (7 to 10 Vertical Iregularity Code Detailing Soil Type II Soil Type II Soil Type II Liquifable Soil FINAL SCOR Result Interpr S < 0.3 0.3 < S < 0.7	Govt. Historic Industrial YPE stories) tries) ty E, S retation Hi r Hi 0 Hi	Office (Residential) School 4.4 N/A -3.0 -0.5 -1.2 (Likely build (Likely build (Likely build gh probability of gh probability of gh probability of	Max. Numb 0 - 10 101 - 10 BA S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6 -1.2 -1.6 -1.6 -1.2 -1.6 -1.6 -1.6 -1.6 -1.7 -1.6 -1.	(11-100) 1000+ SIC SCORE, (M) 3.8 N/A N/A N/A N/A N/A -0.5 N/A -0.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6	Type I Hard Soil           MODIFIEI           0.1           0.0           0.5           2.0           0.5           1.0           1.1.2           0.6           1.0           1.6           probability of	Type II Medium Soil RS, AND FINAI C2 (5W) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -0.8 -1.2 -1.6 -1.2 -1.6 -0.8 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6	Type III, Soft Scill           SCORE, S           3.2           +0.2           +0.4           -0.5           -1.0           -1.6           -0.1           5.74	Chimneys S URM1 ((8AND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.5 +2.0 -0.8 -1.2 -1.2 -1.6	URM2 ((BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	Cladding URM3 0.0 -0.4 N/A -1.5 -0.5 -0.7 -0.8 -1.6 -1.6 -1.6 -Eval Recon	URM4 2.4 -0.4 N/A -1.5 -0.5 N/A -0.4 -0.8 -1.6
Commercial Emer.Service           BUILDING T           Basic Score           Mid Rise (4 to 7 s           High Rise (7 to 7 s           High Rise (7 to 7 s           Vertical Irregularity           Code Detailing           Soil Type II           Soil Type II           Liquifiable Soil           FINAL SCOR           Result Interpr           S < 0.3	Govt. Historic Industrial YPE stories) ty E, S retation Hi C Hi Press Hi Press Hi Press Hi Press Historic Histo	Office (Residential) School 4.4 N/A N/A N/A -0.5 N/A -0.5 N/A -0.2 -0.6 -1.2 (Likely build gh probability of gh probability of gh probability of gh probability of	Max. Numb 0 – 10 101 – 1000 BA S1 (FRAME) 3.6 +0.4 +0.8 -2.0 0.5 +1.4 -0.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.0 -1.6 -1	(11-100) 1000+ SIC SCORE, (M) 3.8 N/A N/A N/A N/A N/A -0.5 N/A -0.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6	Type I Hard Soil           MODIFIEI           0.1           0.0           0.5           2.0           0.5           1.0           1.1.2           0.6           1.0           1.6           probability of	Type II Medium Soil           RS, AND FINAI           C2 (\$W)           3.6           +0.4           +0.8           -2.0           -5           +1.6           -0.8           -1.2           -1.6           Grade 4 damage           Grade 4 damage           Grade 3 damage	Type III, Soft Scill           SCORE, S           3.2           +0.2           +0.4           -0.5           -1.0           -1.6           -0.1           5.74	Chimneys S URM1 ((8AND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.5 +2.0 -0.8 -1.2 -1.6	URM2 ((BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	Cladding URM3 0.0 -0.4 N/A -1.5 -0.5 -0.7 -0.8 -1.6 -1.6 -1.6 -Eval Recon	URM4 2.4 -0.4 N/A -1.5 -0.5 N/A -0.8 -1.6 -1.6
Commercial Emer.Service BUILDING T Basic Score Mid Rise (4 to 7 s High Rise (7 sto Vertical Irregularity Plan Irregularity Code Détailing Soil Type II Liquifable Soil FINAL SCOR Result Interp 0.3 < 5 0.7 0.7 < S < 2.0 2.0 < S < 3.0 5 > 3.0 * = Estimated, sub	Govt. Historic Industrial YPE tories) tries) ty E, S retation Hi Projective, or	Office (Residential) School 4.4 N/A N/A N/A -0.5 N/A -0.5 N/A -0.2 -0.6 -1.2 (Likely build gh probability of gh probability of gh probability of gh probability of	Max. Numb 0 – 10 101 – 1000 BA S1 (FRAME) 3.6 +0.4 +0.8 -2.0 0.5 +1.4 -0.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.0 -1.6 -1	(1-10)           1000+           SIC SCORE,           SIC SCORE,           SIC SCORE,           3.8           N/A           N/A           -0.6           -1.0           -1.6           ance)           age; Very high p           age; Very high p           rage; Very high p           FRAME = SI	Type I Hard Soil MODIFIEN (URF) 3.0 +0.2 +0.5 +0.2 +0.5 +1.2 -0.6 +1.2 -0.6 +1.2 -0.6 +1.2 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6	Type II           Medium Soil           RS, AND FINAL           C2           (sw)           3.6           +0.4           +0.8           -2.0           >5.5           +1.6           -0.8           -1.2           -1.6           -6           Grade 4 damage           Grade 4 damage           Grade 1 damage           Stw = S	Cype III, Soft Scill           SCORE, S           3.2           +0.2           +0.4           -0.5           -1.0           -1.6           -0.1           5.7 UI	Chimneys S URM1 ((8AND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.5 +2.0 -0.8 -1.2 -1.6	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2 -1.6 -1.5	URM3 URM3 URM3 URM3 URM3 URM3 -0.4 -0.4 -0.5 -0.5 -0.5 N/A -0.4 -0.8 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6	URM4 2.4 -0.4 N/A -1.5 -0.5 -0.5 -0.5 -0.8 -0.8 -1.6 -0.8 -1.6 -0.8 -1.6 -0.8 -0.8 -0.8 -0.8 -0.8 -0.8 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5
Commercial Emer.Service BUILDING T Basic Score Mid Rise (4 to 7 s High Rise (4 to 7 s High Rise (4 to 7 s High Rise (4 to 7 s Vertical Irregularity Code Detailing Soil Type II Soil Type II Soil Type II Soil Type II Soil Type II Ciquifiable Soil FINAL SCOR Result Interpi S < 0.3 0.3 < S < 0.7 0.7 < S < 2.0 (2.0 < S < 3.0) S < 0.4 × 0.4	Govt. Historic Industrial YPE stories) vries) ty E, S retation Hi Projective, or	Office (Residentijal) School 4.4 N/A N/A N/A -0.5 -0.5 -1.2 (Likely build gh probability of gh probability of gh probability of gh probability of gh probability of gh probability of	Max. Numbo 0 - 10 101 - 10 BA S1 (FRAME) 3.6 +0.4 +0.8 -2.0 0.5 +1.4 -0.6 -1.2 -1.6 -1.2 -1.6 -1.2 -1.6 -1.2 -1.6 -1.0 -1.2 -1.6 -1.2 -1.5 -1.	(1-100)           1000+           SIC SCORE,           SIC SCORE,           3.8           N/A           .05           N/A           .05           N/A           .05           N/A           .06           -1.0           -1.6           ance)           age; Very high p           age; Very high p           age; Very high p           .00           .01           .02           .03           .04           .05           .05           .06           .1.0           .1.0           .1.0           .1.10           .1.20           .1.30           .1.40           .1.50	Type I Hard Soil MODIFIE (MPF) 3.0 +0.5 +0.5 +0.5 +1.2 -0.6 +1.2 -0.6 +1.2 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6	Type II Medium Soil           RS, AND FINAL           C2 (SW)           3.6           +0.4           +0.8           -2.0           -0.5           +1.6           -0.8           -1.2           +1.6           Grade 4 damage           Grade 4 damage           Grade 2 damage           Grade 1 damage           SW = S	Type III, Soft Scill           SCORE, S           03           40.2           +0.2           +0.4           -0.6           -1.0           -1.6           -0.6           -0.7           -0.6           -0.7           -0.6           -0.7           -0.6           -0.7           -0.6           -0.7           -0.6           -0.7           -0.6           -0.7           -0.6           -0.7           -0.6           -0.6           -0.7           -0.6           -0.7           -0.6           -0.7           -0.6           -0.7           -0.7           -0.7           -0.7           -0.7           -0.7           -0.7           -0.7           -0.7           -0.7           -0.7           -0.7           -0.7           -0.7           -0.7           -0.7	Chimneys S URM1 ((BARD+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2 -1.6 -0.8 -1.2 -1.6	URM2 (BAND+FD) 3.6 +0.4 -2.0 -0.5 +2.0 -0.8 -1.2 -1.6 -1.2 -1.6	URM3 URM4 URM3 URM4 URM3 URM3 URM4 URM3 URM4	URM4 2.4 -0.4 N/A -1.5 -0.5 -0.5 -0.5 -0.8 -0.8 -1.6 -0.8 -1.6 -0.8 -1.6 -0.8 -0.8 -0.8 -0.8 -0.8 -0.8 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5
Commercial Emer.Service BUILDING T Basic Score Mid Rise (4 to 7 s High Rise (4 to 7 s High Rise (4 to 7 s High Rise (4 to 7 s Vertical Irregularity Code Detailing Soil Type II Soil Type II Soil Type II Soil Type II Soil Type II Ciquifiable Soil FINAL SCOR Result Interpi S < 0.3 0.3 < S < 0.7 0.7 < S < 2.0 (2.0 < S < 3.0) S < 0.4 × 0.4	Govt. Historic Industrial YPE stories) vries) ty E, S retation Hi Projective, or	Office (Residentijal) School 4.4 N/A N/A N/A -0.5 -0.5 -1.2 (Likely build gh probability of gh probability of gh probability of gh probability of gh probability of gh probability of	Max. Numbo 0 - 10 101 - 10 BA S1 (FRAME) 3.6 +0.4 +0.8 -2.0 0.5 +1.4 -0.6 -1.2 -1.6 -1.2 -1.6 -1.2 -1.6 -1.2 -1.6 -1.0 -1.2 -1.6 -1.2 -1.5 -1.	(1-100)           1000+           SIC SCORE,           SIC SCORE,           3.8           N/A           .05           N/A           .05           N/A           .05           N/A           .06           -1.0           -1.6           ance)           age; Very high p           age; Very high p           age; Very high p           .00           .01           .02           .03           .04           .05           .05           .06           .1.0           .1.0           .1.0           .1.10           .1.20           .1.30           .1.40           .1.50	Type I Hard Soil MODIFIE (MPF) 3.0 +0.5 +0.5 +0.5 +1.2 -0.6 +1.2 -0.6 +1.2 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6	Type II Medium Soil           RS, AND FINAL           C2 (SW)           3.6           +0.4           +0.8           -2.0           -0.5           +1.6           -0.8           -1.2           +1.6           Grade 4 damage           Grade 4 damage           Grade 2 damage           Grade 1 damage           SW = S	Cype III, Soft Scill           SCORE, S           3.2           +0.2           +0.4           -0.5           -1.0           -1.6           -0.1           5.7 UI	Chimneys S URM1 (BAND+RD) 3.4 +0.4 +0.4 N/A -2.0 -0.5 +2.0 -0.5 +2.0 -0.5 +2.0 -0.8 -1.2 -1.6 -1.2 -1.6	URM2 (BAND+FD) 3.6 +0.4 -0.5 +2.0 -0.5 +2.0 -0.8 -1.2 -1.5 -1.5 -1.5	URM3 URM4 URM3 URM4 URM3 URM3 URM4 URM3 URM4	URM4 2.4 -0.4 N/A -1.5 -0.5 -0.5 -0.5 -0.8 -0.8 -1.6 -0.8 -1.6 -0.8 -1.6 -0.8 -0.8 -0.8 -0.8 -0.8 -0.8 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5
Commercial Emer.Service BUILDING T Basic Score Mid Rise (4 to 7 s High Rise (7 sto Vertical Irregularity Plan Irregularity Code Détailing Soil Type II Liquifable Soil FINAL SCOR Result Interp 0.3 < 5 0.7 0.7 < S < 2.0 2.0 < S < 3.0 5 > 3.0 * = Estimated, sub	Govt. Historic Industrial YPE stories) vries) ty E, S retation Hi Projective, or	Office (Residentijal) School 4.4 N/A N/A N/A -0.5 -0.5 -1.2 (Likely build gh probability of gh probability of gh probability of gh probability of gh probability of	Max. Numbo 0 - 10 101 - 10 BA S1 (FRAME) 3.6 +0.4 +0.8 -2.0 0.5 +1.4 -0.6 -1.2 -1.6 -1.2 -1.6 -1.2 -1.6 -1.2 -1.6 -1.0 -1.2 -1.6 -1.2 -1.5 -1.	(1-100)           1000+           SIC SCORE,           SIC SCORE,           3.8           N/A           .05           N/A           .05           N/A           .05           N/A           .06           -1.0           -1.6           ance)           age; Very high p           age; Very high p           age; Very high p           .00           .01           .02           .03           .04           .05           .05           .06           .1.0           .1.0           .1.0           .1.10           .1.20           .1.30           .1.40           .1.50	Type I Hard Soil MODIFIE (MPF) 3.0 +0.5 +0.5 +0.5 +1.2 -0.6 +1.2 -0.6 +1.2 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6	Type II Medium Soil           RS, AND FINAL           C2 (SW)           3.6           +0.4           +0.8           -2.0           -0.5           +1.6           -0.8           -1.2           +1.6           Grade 4 damage           Grade 4 damage           Grade 2 damage           Grade 1 damage           SW = S	Control         Control           Scores, sc	Chimneys S URM1 (BAND+RD) 3.4 +0.4 +0.4 N/A -2.0 -0.5 +2.0 -0.5 +2.0 -0.5 +2.0 -0.8 -1.2 -1.6 -1.2 -1.6	URM2 (BAND+FD) 3.6 +0.4 -0.5 +2.0 -0.5 +2.0 -0.8 -1.2 -1.5 -1.5 -1.5	URM3 URM4 URM3 URM4 URM3 URM3 URM4 URM3 URM4	URM4 2.4 -0.4 N/A -1.5 -0.5 -0.5 -0.5 -0.8 -0.8 -1.6 -0.8 -1.6 -0.8 -1.6 -0.8 -0.8 -0.8 -0.8 -0.8 -0.8 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5

(6)

#### FEMA-154/ATC-21 Based Data Collection Form (Seismic Zone III) Address: H-No. 40-15/2-19/3A, Brundaven Colony Sziram Machineni Venkatesvava Rea Str. Pin VUA - 5000 Other Identifiers MG Road GPS Coordinates (if available) 1629'57"NL, 8038'48" EL Year Built \_ 2013 No. Stories St. 117 4 Surveyor \_\_\_\_ Date Total Floor Area (sa K/sq. m) \_\_\_\_\_ 894.37 K Building Name VIJAYA RAGHAVAM Apothech Residential Use \_\_\_\_\_ Current Visual Condition: Excellent 🗍 / Good 🗹 Damaged 🗍 / Distressed 🗔 Building on Stilts / Open Ground Floor: Yes 1 No Construction Drawings Available: Yes 1 No PHOTOGRAPH (OR SPECIFY PHOTOGRAPH NUMBERS) Plan and Elevation Scale: OCCUPANCY SOIL TYPE (IS 1893:2002) FALLING HAZARDS Max. Number of Persons 0 - 10 (11 - 100) 101 - 1000 1000+ Govt. Historic Office Residential School Assembly Type I Type II Medium Soil Soft Soil Chimneys TY Cladding Other: Commercial Hard Soil Parapets Emer.Service Industrial BASIC SCORE, MODIFIERS, AND FINAL SCORE, S BUILDING TYPE Wood URM1 (BAND+RD) S1 (FRAME) S2 (LM) C1 (MRF C2 (SW) C3 -(INF) URM3 URM2 (BAND+FD) Basic Score 3.6 3.8 4.4 3.0 3.6 32 34 3.6 3.0 2.4 Mid Rise (4 to 7 stories) High Rise (>7 stories) N/A +0.4 N/A +0.2 +0.4 +0.2~ +0.4 +0.4 -0.4 -0.4 N/A +0.5 -2.0 +0.8 +0.8 N/A +0.4 N/A N/A N/A N/A Vertical Irregularity Plan Irregularity -3.0 -2.0 N/A -2.0% -2.0 -2.0 -1.5 -1.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 Code Detailing N/A +1.4 N/A +1.2 +1.6 +1.2 +2.0 +2.0 N/A N/A Soil Type II -0.2 -0.6 -0.8 -0.6 -0.6 -0.6 -0.8 -0.8 -0.4 -0.4 Soil Type II Liquifiable Soil -0.6 -1.2 -1.2 -1.6 -1.0 -1.0 -1.2 -1.2 -0.8 -0.8 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 FINAL SCORE, S 0.4 Result Interpretation (Likely building performance) Further S < 0.3 High probability of Grade 5 damage; Very high probability of Grade 4 damage Evaluation High probability of Grade 4 damage; Very high probability of Grade 3 damage - \*\* \* Recommended 0.3 < S < 0.7 High probability of Grade 3 damage; Very high probability of Grade 2 damage High probability of Grade 2 damage; Very high probability of Grade 1 damage 0.7 < S < 2.0 2.0 < S < 3.0 YES NO Q S > 3.0 Probability of Grade 1 damage FRAME = Steel Frame SW = Shear Wall URM3 = INF = Burnt Brick Massonry Infill Wall LM = Light Metal o MRF = Moment-Resisting Frame BAND = Seismic Band RD = Rit FD = Flexible Diaphragm URM4 = Unreinforced masonry (lime mortar) R \* = Estimated, subjective, or unreliable data DNK = Do Not Know URM3 = Unreinforced burnt brick or stone masonry (cem mortar) RD = Rigid diaphragm Fr For palking, Brundavi Stale + Ground Storey -For parking. Colony 4

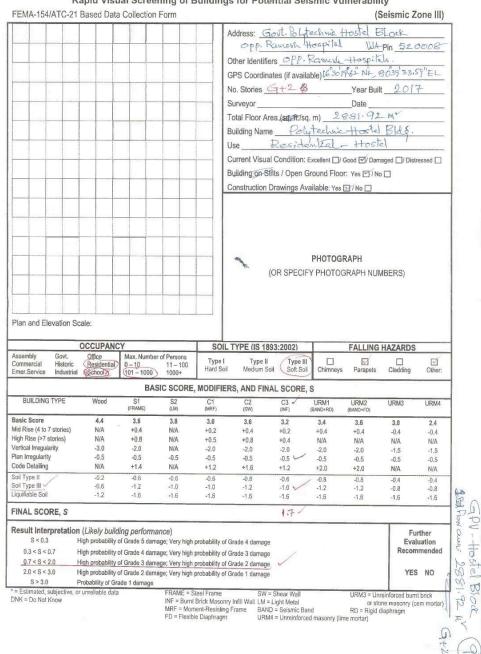
Rapid Visual Screening of Buildings for Potential Seismic Vulnerability

Ŧ

0.3 < S < 0 0.7 < S < 2 2.0 < S < 3 S > 3.0 = Estimated, st NK = Do Not K	.0 .0 	High probability of	of Grade 3 dama of Grade 2 dama ade 1 damage	ge; Very high ge; Very high FRAME = S	probability o probability o teel Frame Brick Masor tent-Resistir	nry Infill Wall LM = Li ng Frame BAND =	Seismic Ban	d I masonry (lim	or sto RD = Rigid o	YES reinforced burn	S NO
S < 0.3	1		of Grade 5 dama	ge; Very high	N	f Grade 4 damage				Eva	Inther Iuation Inmended
INAL SCOP	RE, S	1.00.000					2.2		(11) (11)	-	and the second
oil Type III iquifiable Soil		-0.6 -1.2	-1.2 -1.6	-1.0 -1.6	-1.0 -1.6	-1.2 -1.6	-1.0	-1.2 -1.6	-1.2 -1.6	-0.8 -1.6	-0.8 -1.6
oil Type II	/	-0.2	-0.6	-0.6	-0,6	-0.8	-0.6	-0.8	-0.8	-0.4	-0.4
lan Irregularity ode Detailing		-0.5 N/A	-0.5 +1.4	-0.5 N/A	-0.5 +1.2	-0.5 +1.6	-0.5 +1.2	-0.5 +2.0	-0.5 +2.0	-0.5 N/A	-0.5 N/A
ertical Irregular		-3.0	-2.0	N/A	-2.0	-2.0	-2.0	-2.0	-2.0	-1.5	-1.5
lid Rise (4 to 7 igh Rise (>7 st		N/A N/A	+0.4 +0.8	N/A N/A	+0.2 +0.5	+0.4 +0.8	+0.2 +0.4	+0.4 N/A	+0.4 N/A	-0.4 N/A	-0.4 N/A
asic Score	storic=)	4.4	3.6	3.8	3.0	3.6	3.2	3.4	3.6	3.0	2.4
BUILDING	TYPE	Wood	S1 (FRAME)	S2 (LM)	C1 (MRF)	C2 (SW)	C3 (INF)	URM1 (BAND+RD)	URM2 (BAND+FD)	URM3	URM4
			BAS	IC SCORE,	MODIFIE	ERS, AND FINAL	SCORE,	S			
ommercial mer.Service	Historic Industrial	Residential	0 - 10 101 - 1000	11 - 100 1000+	Type I Hard So	Type II Medium Soil	Type III Soft Soil	Chimneys	Parapets	Cladding	Other.
ssembly	Govt.	OCCUPANC Office	Y Max, Number	of Persons		L TYPE (IS 1893			/	HAZARDS	/
lan and Ele											
						(0	. 5. 201				
						(0			RAPH NUM	(BERS)	
			_					PHOTOGR	ADH		
_	-										
						Construction Dra				-	
						Building on Stilts					
						Current Visual C					
				-		Use	Fduce	linel	- cla	es Room	Λ.
						Building Name	F.C		BLock		
						Total Floor Area	loo Ar loo	m) 16		MY	
	_					Surveyor			Date		
						No. Stories	+2 B	ord <u>reac</u>	Year Built		
						GPS Coordinate	FT	has the ac	15.52" NIL	8239'21	D.DHEL
5_3						Other Identifiers				-	
						OPP. Dr.	Paurest 4	Inspital	NSH-16	Pin 520	8000

Rapid Visual Screening of Buildings for Potential Seismic Vulnerability

8



#### FEMA-154/ATC-21 Based Data Collection Form (Seismic Zone III) Address: H-Na. 52-4-19/A, AS. Ramarao Rd. Christinajupuran, Vijayavadapin 520008 Other Identifiers MARK Residence GPS Coordinates (if available) 8039 30 EL No. Stories Stilt + 5 2015 Year Built Surveyor Date Total Floor Area (sg At./sq. m) 1444.48 N Building Name MARK Residence Use \_\_\_\_ Residential. Current Visual Condition: Excellent / Good / Damaged / Distressed Building on Stilts / Open Ground Floor: Yes 1/ No Construction Drawings Available: Yes 🗹 / No 🔲 PHOTOGRAPH (OR SPECIFY PHOTOGRAPH NUMBERS) Plan and Elevation Scale: OCCUPANCY SOIL TYPE (IS 1893:2002) FALLING HAZARDS Assembly Govt. Max. Number of Persons Office Type I Hard Soil Type II Medium Soil Type III Soft Soil Chimneys 1 Commercial 11-100 Historic Residentia 0-10 Parapets Cladding Other Emer.Service School 101 - 1000 Industrial BASIC SCORE, MODIFIERS, AND FINAL SCORE, S BUILDING TYPE Wood S1 (FRAME) C1 (MRF) C2 (SW) URM1 (BAND+RD) URM2 (BAND+FD) S2 (LM) URM3 C3 (INF) Basic Score 4.4 3.6 3.8 3.0 3.6 3.2 3.6 3.4 3.0 2.4 Mid Rise (4 to 7 stories) N/A +0.4 N/A +0.2 +0.4 +0.2 +0.4 +0.4 -0.4 -0.4 High Rise (>7 stories) N/A +0.8 N/A +0.5 +0.8 +0.4 N/A N/A N/A N/A Vertical Irregularity -3.0 -2.0 N/A -2.0 -2.0 -2.0 2 -2.0 -20 -15 -1.5 Plan Irregularity -0.5 -0.5 -0.5 -0.5 -0.5 -0.52 -0.5 -0.5 -0.5 -0.5 Code Detailing N/A +1.4 N/A +1.2 +1.6 +1.2 +2.0 +2.0 N/A N/A Soil Type II -0.2 -0.6 -0.6 -0.6 -0.8 -0.6 -0.8 -0.8 -0.4 -0.4 Soil Type III -0.6 -1.2 -1.0 -1.0 -1.2 -1.0 % -1.2 -1.2 -0.8 -0.8 Liquifiable Soil -1.2 -1.6 -1.6 -1.6 -16 -1.6 -1.6 -1.6 -1.6 -1.6 FINAL SCORE, S Jo Tan Floor Result Interpretation (Likely building performance) Further S < 0.3 High probability of Grade 5 damage; Very high probability of Grade 4 damage Evaluation 0.3 < S < 0.7 Recommended High probability of Grade 4 damage; Very high probability of Grade 3 damage 0.7 < S < 2.0 High probability of Grade 3 damage; Very high probability of Grade 2 damage F High probability of Grade 2 damage; Very high probability of Grade 1 damage 2.0 < S < 3.0 YES NO 9 F S > 3.0 Probability of Grade 1 damage 00 \* = Estimated, subjective, or unreliable data DNK = Do Not Know FRAME = Steel Frame SW = Shear Wall URM3 = Unreinforced burnt brick or stone masonry (cem mortar) X INF = Burnt Brick Masonry Infill Wall LM = Light Metal MRF = Moment-Resisting Frame BAND = Seismic Band RD = Rigid diaphragm FD = Flexible Diaphragm URM4 = Unreinforced masonry (lime mortar) SHIL+

#### Rapid Visual Screening of Buildings for Potential Seismic Vulnerability

					Address: H · N	1 61-9/1 -	15/1 Pun	wechandre	aNapar	Katal
					Audress. H. 10	ug NH-16:	- 65 M2	Dananada	Di- 150 (	2013
					Other Identifiers	ATZ E	204, 44	- caylonna	-Pin <u>240</u>	2000
					GPS Coordinate					
					No. Stories <u>51</u>	tilt + 🐼	5	_Year Buil	t_200	7
			-		Surveyor			Date		
					Total Floor Area	a (sq ft./sq.	m) <u>22</u>	79.18 N	) <sup>r</sup>	
					Building Name	A	BPL	aza		
					Use	Res	idealt	20		
					Current Visual (	Condition: F		Food PI/Dam		ressed
					Building on Stilt		10100 (0100 00 00 00 00 00 00 00 00 00 00 00 00			00000
	+ + +									
					Construction Dr	awings Ava	Hable: Yes			
		-								
	+ + +						PHOTOGE	RAPH		
					(0	R SPECIFY	PHOTOG	RAPHNUM	(BERS)	
					1-	in or don i			noeno)	
Plan and Elevation S	Scale:									
	OCCUPANC			SOIL	TYPE /IS 1893	3:2002)		FALLING	HAZARDS	
Assembly Govt. Commercial Historic	Office Residential	Max. Number 0 – 10	r of Persons 11-100	Type 1	Type II	Type III		9		G
Emer.Service Industria	al School	(101-1000	) 1000+	Hard Soil	Medium Soil	Soft Soil	Chimneys	Parapets	Cladding	Oth
		BA	SIC SCORE,	MODIFIER	RS, AND FINAL	L SCORE, S	5			
BUILDING TYPE	Wood	S1 (FRAME)	S2 (LM)	C1 (MRF)	C2 (SW)	C3 (INF)	URM1 BAND+RD)	URM2 (BAND+FD)	URM3	URM
Basic Score	4.4	3.6	3.8	3.0	3.6	3.2	3.4	3.6	3.0	2.4
Mid Rise (4 to 7 stories) High Rise (>7 stories)	N/A	+0.4	N/A	+0.2	+0.4	+0.2	+0.4	+0.4	-0.4	-0.
Ventical Irregularity	N/A -3.0	+0.8 -2.0	N/A N/A	+0.5 -2.0	+0.8 -2.0	+0.4	N/A -2.0	N/A -2.0	N/A -1.5	N//
Plan Irregularity	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.
	N/A	+1.4	N/A	+1.2	+1.6	+1.2	+2.0	+2.0	N/A	N//
Code Detailing						-0.6	-0.8	-0.8	-0.4	-0.4
Soil Type II	-0.2	-0.6	-0.6	-0.6	-0.8		4.0		-0.8	-0.8
	-0.2 -0.6 -1.2	-0.6 -1.2 -1.6	-0.6 -1.0 -1.6	-0.6 -1.0 -1.6	-0.8 -1.2 -1.6	-1.0	-1.2 -1.6	-1.2 -1.6		-1.6
Soil Type II Soil Type III Liquifiable Soil	-0.6	-1.2	-1.0	-1.0	-1.2 -1.6	-1.0			-1.6	-1.(
Soil Type II Soil Type III Liquifiable Soil FINAL SCORE, S	-0.6 -1.2	-1.2 -1.6	-1.0 -1.6	-1.0	-1.2 -1.6	-1.0			-1.6	
Soil Type II Soil Type III Liquifiable Soil	-0.6 -1.2 on (Likely build	-1.2 -1.6	-1.0 -1.6 ance)	-1.0 -1.6	-1.2 -1.6	-1.0			-1.6	irther
	-0.6 -1.2	-1.2 -1.6 ing perform of Grade 5 dan	-1.0 -1.6 ance) iage; Very high (	-1.0 -1.6 probability of (	-1.2 -1.6 Grade 4 damage	-1.0			-1.6 Fu Eva	urther luation
$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	-0.6 -1.2 on ( <i>Likely build</i> High probability of High probability of High probability of	-1.2 -1.6 ing perform of Grade 5 dan of Grade 4 dan of Grade 3 dan	-1.0 -1.6 ance) kage; Very high p lage; Very high p lage; Very high p	-1.0 -1.6 probability of ( probability of ( probability of (	-1.2 -1.6 Grade 4 damage Grade 3 damage Grade 2 damage	-1.0			-1.6 Fu Eva Recon	luation nmende
$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	-0.6 -1.2 on ( <i>Likely build</i> High probability of High probability of High probability of High probability of	-1.2 -1.6 ing perform of Grade 5 dan of Grade 4 dan of Grade 4 dan of Grade 3 dan of Grade 2 dan	-1.0 -1.6 ance) kage; Very high p lage; Very high p lage; Very high p	-1.0 -1.6 probability of ( probability of ( probability of (	-1.2 -1.6 Grade 4 damage Grade 3 damage Grade 2 damage	-1.0			-1.6 Fu Eva Recon	urther luation
$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	-0.6 -1.2 on ( <i>Likely build</i> High probability of High probability of High probability of Probability of Gra	-1.2 -1.6 ing perform of Grade 5 dan of Grade 4 dan of Grade 4 dan of Grade 3 dan of Grade 2 dan	-1.0 -1.6 ance) lage; Very high p lage; Very high p lage; Very high p	-1.0 -1.6 probability of ( probability of ( probability of (	-1.2 -1.6 Grade 4 damage Grade 3 damage Grade 2 damage Grade 1 damage	-1.0 -1.6 - 0.4		-1.6	-1.6 Fu Eva Recon	Inther Iuation nmend S NO
$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	-0.6 -1.2 on ( <i>Likely build</i> High probability of High probability of High probability of Probability of Gra	-1.2 -1.6 ing perform of Grade 5 dan of Grade 4 dan of Grade 4 dan of Grade 3 dan of Grade 2 dan	-1.0 -1.6 ance) age; Very high ; age; Very high ; age; Very high ; age; Very high ; FRAME = Si INF = Burnt	-1.0 -1.6 probability of 1 probability of 2 probability of 2 probability of 2 eel Frame Brick Masonn	-1.2 -1.6 Grade 4 damage Grade 3 damage Grade 2 damage Grade 1 damage Stade 1 damage	-1.0 -1.6 - Oxf	-1.6	-1.6 URM3 = Unr	-1.6 Fu Eva Recon YES	Inther Iuation nmende 5 NO
Soil Type II Soil Type III Liquifeble Soil FINAL SCORE, S Result Interpretatio $\frac{S < 0.3}{0.3 < S < 0.7}$ 0.7 < S < 2.0 2.0 < S < 3.0 S > 3.0 * Estimated, subjective,	-0.6 -1.2 on ( <i>Likely build</i> High probability of High probability of High probability of Probability of Gra	-1.2 -1.6 ing perform of Grade 5 dan of Grade 4 dan of Grade 4 dan of Grade 3 dan of Grade 2 dan	-1.0 -1.6 ance) lage; Very high r lage; Very high r lage; Very high r FRAME = SI INF = Burnt MRF = Morn	-1.0 -1.6 probability of 1 probability of 6 probability o	-1.2 -1.6 Grade 4 damage Grade 3 damage Grade 2 damage Grade 1 damage Stade 1 damage Stade 1 damage Stade 1 damage Admage Stade 1 damage Stade 2 damage Stade 1 damage	-1.0 -1.6 - O. ( - Shear Wall light Metal = Seismic Banu	-1.6	-1.6 URM3 = Unn or sto RD = Rigid d	-1.6 Fu Eva Recon YES	Inther Iuation nmend 5 NO
Soil Type II Soil Type III Liquifeble Soil FINAL SCORE, S Result Interpretatio S < 0.3 0.3 < \$ < 0.7 0.7 < \$ < 2.0 2.0 < \$ < 3.0 \$ > 3.0 * Estimated, subjective,	-0.6 -1.2 on ( <i>Likely build</i> High probability of High probability of High probability of Probability of Gra	-1.2 -1.6 ing perform of Grade 5 dan of Grade 4 dan of Grade 4 dan of Grade 3 dan of Grade 2 dan	-1.0 -1.6 ance) age; Very high ; age; Very high ; age; Very high ; age; Very high ; FRAME = Si INF = Burnt	-1.0 -1.6 probability of 1 probability of 6 probability o	-1.2 -1.6 Grade 4 damage Grade 3 damage Grade 2 damage Grade 1 damage Stade 1 damage Stade 1 damage Stade 1 damage Admage Stade 1 damage Stade 2 damage Stade 1 damage	-1.0 -1.6 - Oxf	-1.6	-1.6 URM3 = Unn or sto RD = Rigid d	-1.6 Fu Eva Recon YES	urther luation nmend S NO

EMA-154/AT					3uildin	igs for Pot			(\$	Seismic Z	
						Address: ++-	VO. 60-3-	11/2, 17	+ Roaf,	Metrope	ATEM
						Hote	el Rd. 1	lijayaw	ada	Pin 52.0	0008
						Other Identifi	ers No. 5	Route		- 65-6165	
						GPS Coordin	ates (if availa	ble) 16'30'	17"NL, 80	3919"E	
						No. Stories	Stille	+5	Year Buil	t 201	6
				-		Surveyor			Date	57	
						Total Floor A	rea (se ft./sq.	m) 10	24.94		
						Building Nam	INIVIO	CON	1		
						Use Put C	Offices 8	L Resid	tence		
						Current Visua	al Condition: E	xcellent []/	Good 🗹 / Dam	aged []/ Dist	ressed 🗌
							tilts / Open-G		1	20	-
							Drawings Ava		/		
			-		-						
				+ +							
			-					PHOTOGI	RAPH		
							(OR SPECIF			(REDS)	1
								THOTOG		NOLINO)	
			++-								
											1
Plan and Elevation	on Sc	ale:									
	-	OCCUPANC	Y		SO	IL TYPE (IS 18	93:2002)	1	FALLING	HAZARDS	
and the second sec		Office	Max. Number 0 - 10	r of Persons 11 – 100 1000+	Type Hard S			Chimneys	Parapets	Cladding	Other:
ommercial His	toric ustrial	School	101-1000				the second se			1200	
ommercial His mer.Service Inde	ustrial	School	BAS				AL SCORE,	s			
ommercial His mer.Service Inde BUILDING TYPE	ustrial	Wood	BAS S1 (FRAME)	S2 (LM)	C1 (MRF)	C2 (SW)	C3	URM1 (BAND+RD)	URM2 (BAND+FD)	URM3	URM4
BUILDING TYPE	ustrial E	Wood 4,4	BAS S1 (FRAME) 3.6	S2 (LM) 3.8	C1 (MRF) 3.0	C2 (SW) 3.6	C3 (INF) 3.2	URM1 (BAND+RD) 3.4	(BAND+FD) 3.6	3.0	2.4
BUILDING TYPE asic Score id Rise (4 to 7 stories gh Rise (>7 stories	ustrial E es)	Wood	BAS S1 (FRAME)	S2 (LM)	C1 (MRF)	C2 (SW)	C3 (INF)	URM1 (BAND+RD)	(BAND+FD)	3.0 -0.4	<b>2.4</b> -0.4
ommercial His mer.Service Inde BUILDING TYPE asic Score id Rise (4 to 7 stori- igh Rise (7 stories ertical Irregularity	ustrial E es)	School Wood 4,4 N/A N/A -3.0	BAS (FRAME) 3.6 +0.4 +0.8 -2.0	S2 (LM) 3.8 N/A N/A N/A	C1 (MRF) 3.0 +0.2 +0.5 -2.0	C2 (SW) 3.6 +0.4 +0.8 -2.0	C3 (INF) 3.2 +0.2 +0.4 -2.0	URM1 (BAND+RD) 3.4 +0.4 N/A 2.0	(BAND+FD) 3.6 +0.4 N/A -2.0	3.0 -0.4 N/A -1.5	2.4 -0.4 N/A -1.5
BUILDING TYPE asic Score id Rise (4 to 7 stori- igh Rise (>7 stories ertical Irregularity an Irregularity	ustrial E es)	Wood 4.4 N/A N/A	BAS (FRAME) 3.6 +0.4 +0.8	S2 (LM) 3.8 N/A N/A	C1 (MRF) 3.0 +0.2 +0.5	C2 (SW) 3.6 +0.4 +0.8	C3 (INF) 3.2 +0.2 +0.4	URM1 (BAND+RD) 3.4 +0.4 N/A	(BAND+FD) 3.6 +0.4 N/A	3.0 -0.4 N/A	2.4 -0.4 N/A
mmercial His mer.Service Ind BUILDING TYPE asic Score id Rise (4 to 7 stories gh Rise (>7 stories etrical Irregularity de Detailing oil Type II	ustrial E es)	School Wood 4,4 N/A N/A -3.0 -0.5 N/A -0.2	BAS S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6	S2 (LM) 3.8 N/A N/A N/A -0.5 N/A -0.6	C1 (MRF) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2 -0.6	C2 (5W) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -0.8	C3 (NF) 3.2 +0.2 +0.4 -2.0 -0.5 +1.2 -0.6	URM1 (BAND+RD) 3.4 +0.4 N/A 2.0 -0.5 +2.0 -0.8	(BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8	3.0 -0.4 N/A -1.5 -0.5 N/A -0.4	2.4 -0.4 N/A -1.5 -0.5 N/A -0.4
ommercial His mer.Service lind BUILDING TYPE asic Score Iid Rise (4 to 7 stori- igh Rise (7 storis reical Irregularity an Irregularity ode Detailing oil Type II	ustrial E es)	School Wood 4,4 N/A N/A -3.0 -0.5 N/A	BAS S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4	S2 (LM) 3.8 N/A N/A N/A -0.5 N/A	C1 (MRF) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2	C2 (SW) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6	C3 (NF) 3.2 +0.2 +0.4 -2.0 -0.5 +1.2	URM1 (BAND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0	(BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	3.0 -0.4 N/A -1.5 -0.5 N/A -0.4 -0.8	2.4 -0.4 N/A -1.5 -0.5 N/A -0.4 -0.8
Commercial His immercial His immercial Indi BUILDING TYPE lasic Score tid Rise (4 to 7 stories ertical Irregularity lan Irregularity code Detailing oil Type II oil Type II	E es)	School Wood 4.4 N/A N/A -3.0 -0.5 N/A -0.2 -0.6	BAS S1 ((FRAME) 3.6 +0.4 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6 -1.2	S2 (LM) 3.8 N/A N/A N/A -0.5 N/A -0.6 -1.0	C1 (MRF) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2 -0.6 -1.0	C2 (5W) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -0.8 -1.2	C3 (MF) 3.2 +0.2 +0.4 -0.5 +1.2 -0.6 -1.0	URM1 (BAND+RD) 3.4 +0.4 N/A 2.0 -0.5 +2.0 -0.8 -1.2	(BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8	3.0 -0.4 N/A -1.5 -0.5 N/A -0.4	2.4 -0.4 N/A -1.5 -0.5 N/A -0.4
BUILDING TYPE BUILDING TYPE asic Score fiid Rise (4 to 7 storie artic Score erical Irregularity de Detailing oil Type II quifable Soil INAL SCORE,	E es) s)	School           Wood           4.4           N/A           N/A           -0.5           N/A           -0.2           -0.6           -1.2	BAS S1 ((FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6 -1.2 -1.6	S2 (LM) 3.8 N/A N/A -0.5 N/A -0.6 -1.0 -1.6	C1 (MRF) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2 -0.6 -1.0	C2 (5W) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -0.8 -1.2	C3 (NF) 3.2 +0.2 +0.4 -0.5 +1.2 -0.6 -1.0 -1.6	URM1 (BAND+RD) 3.4 +0.4 N/A 2.0 -0.5 +2.0 -0.8 -1.2	(BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	3.0 -0.4 N/A -1.5 -0.5 N/A -0.4 -0.8 -1.6	2.4 -0.4 N/A -1.5 -0.5 N/A -0.4 -1.6
ommercial His mer.Service Indi BUILDING TYPE asic Score Iid Rise (4 to 7 stori- igh Rise (>7 storis gin Ri	E E s) S ation	School           Wood         4.4           N/A         N/A           N/A         -0.5           N/A         -0.6           -1.2         (Likely build)	BAS S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6 -1.2 -1.6 -1.6 -1.6 -1.6	S2 (LM) 3.8 N/A N/A -0.5 N/A -0.6 -1.0 -1.6 ence) * age; Very high	C1 (MRP) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2 -0.6 -1.0 -1.6	C2 (6W) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -0.8 -1.2 -1.6 of Grade 4 damage	C3 (NF) 3.2 +0.2 +0.4 -2.0 -0.5 +1.2 -0.6 -1.0 -1.6 -0.1	URM1 (BAND+RD) 3.4 +0.4 N/A 2.0 -0.5 +2.0 -0.8 -1.2	(BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	3.0 -0.4 N/A -1.5 -0.5 N/A -0.4 -0.8 -1.6	2.4 -0.4 N/A -1.5 -0.5 N/A -0.8 -1.6 5 -0.4 -1.6 -1.6
ommercial     His       mmer.Service     Indi       BUILDING TYPE       asic Score       Iid Rise (4 to 7 stori- igh Rise (>7 storis- recial Irregularity       ode Detailing       oil Type II       oil Type II       valifable Soil       INAL SCORE,       esult Interpret       S < 0.3	E E ses) s) s ation F F	School           Wood         4,4           N/A         N/A           N/A         0.5           N/A         -0.5           N/A         -0.6           -1.2         -0.6           igh probability of         -0.6	BAS S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6 -1.2 -1.5 -1.5 -1.6 Grade 5 dam (Grade 5 dam	S2 (LM) 3.8 N/A N/A N/A -0.5 N/A -0.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.0 -1.6 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6	C1 (MRF) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2 -0.6 -1.0 -1.6	C2 (SW) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -0.8 -1.2 -1.6 of Grade 4 damage of Grade 3 damage	C3 (NF) 3.2 +0.2 +0.4 -0.5 +1.2 -0.6 -1.6 -0.1	URM1 (BAND+RD) 3.4 +0.4 N/A 2.0 -0.5 +2.0 -0.8 -1.2	(BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	3.0 -0.4 N/A -1.5 -0.5 N/A -0.4 -0.8 -1.6	2.4 -0.4 N/A -1.5 -0.5 N/A -0.4 -1.6
ommercial mer. Service         His mer. Service           BUILDING TYPE           asic Score           id Rise (4 to 7 stories           and regularity           an Irregularity           and Irregularity           add the Detailing           aid Type II           adfibele Soil           INAL SCORE,           esult Interpret           S < 0.3	E E s) s) s) F F F F F	School Wood 4,4 N/A N/A N/A -0.5 N/A -0.5 N/A -0.5 N/A -0.5 N/A -0.6 -1.2 (Likely build iligh probability o ligh probability o ligh probability o	BAS S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6 -1.2 -1.6 -1.6 -1.2 -1.6 -	S2 (.M) 3.8 N/A N/A N/A -0.5 N/A -0.6 -1.0 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6	C1 (MRF) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2 -0.6 -1.0 -1.6 probability probability probability	C2 (6W) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -0.8 -1.2 -1.6 of Grade 4 damage of Grade 3 damage	$\begin{array}{c} C3\\ (WF)\\ 3.2\\ +0.2\\ +0.2\\ +0.4\\ -2.0\\ +1.2\\ -0.5\\ +1.2\\ -0.6\\ -1.6\\ -1.6\\ -0.1\\ \end{array}$	URM1 (BAND+RD) 3.4 +0.4 N/A 2.0 -0.5 +2.0 -0.8 -1.2	(BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	3.0 -0.4 N/A -1.5 -0.5 N/A -0.8 -0.8 -1.6 Fu Recon	2.4 -0.4 N/A -1.5 -0.5 -1.5 -0.8 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6
Immercial         His mer.Service           BUILDING TYPE           asic Score           Idd Rise (4 to 7 stori- ligh Rise (57 stories erical Irregularity det Detailing oil Type III oil Type III quiftable Soil           INAL SCORE, esuit Interpret S < 0.3 0.3 < S < 0.7	E ees) s) F H H H	School Wood 4,4 N/A N/A N/A -0.5 N/A -0.5 N/A -0.5 N/A -0.5 N/A -0.6 -1.2 (Likely build iligh probability o ligh probability o ligh probability o	BAS S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6 -1.2 -1.6 I g performation ( Grade 5 dam ( Grade 4 dam ( Grade 2 dam) ( Grade 2 dam)	S2 (.M) 3.8 N/A N/A N/A -0.5 N/A -0.6 -1.0 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6	C1 (MRF) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2 -0.6 -1.0 -1.6 probability probability probability	C2 (SW) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -0.8 -1.2 -1.6 of Grade 4 damage of Grade 3 damage	$\begin{array}{c} C3\\ (WF)\\ 3.2\\ +0.2\\ +0.2\\ +0.4\\ -2.0\\ +1.2\\ -0.5\\ +1.2\\ -0.6\\ -1.6\\ -1.6\\ -0.1\\ \end{array}$	URM1 (BAND+RD) 3.4 +0.4 N/A 2.0 -0.5 +2.0 -0.8 -1.2	(BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	3.0 -0.4 N/A -1.5 -0.5 N/A -0.8 -0.8 -1.6 Fu Recon	2.4 -0.4 N/A -1.5 -0.5 N/A -0.8 -1.6 5 -0.4 -1.6 -1.6
Commercical         His           immersional         His           immersional         His           BUILDING TYPE           sasic Score           fild Rise (4 to 7 stories           fild Rise (4 to 7 stories           reduality           ode Detailing           soil Type II           fild Rise (4 to 7 stories           refuel Irregularity           fild Rise (4 to 7 stories           food Detailing           soil Type II           fild Rise (5 stories           FINAL SCORE,           Result Interpret           S < 0.3	E es) s) s) s) estion F H H H H H H	School Wood 4.4 N/A N/A -0.5 N/A -0.5 N/A -0.6 -0.6 -1.2 (Likely buildii ligh probability of ligh probability of ligh probability of	BAS S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6 -1.2 -1.6 I g performation ( Grade 5 dam ( Grade 4 dam ( Grade 2 dam) ( Grade 2 dam)	S2 (.M) 3.8 N/A N/A N/A -0.5 N/A -0.6 -1.0 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6	C1 (MRF) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2 -0.6 -1.0 -1.6 probability probability probability teel Frame	C2 (SW) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -0.8 -1.2 -1.6 of Grade 4 damage of Grade 3 damage of Grade 2 damage of Grade 1 damage	$\begin{array}{c} C3\\ (\text{INF})\\ 3.2\\ +0.2\\ +0.2\\ +0.4\\ -2.0\\ +1.2\\ -0.6\\ +1.2\\ -0.6\\ -1.6\\ -1.6\\ -1.6\\ -2.0\\ +1.2\\ -0.6\\ -3.0\\ -2.0\\ -3.0$	URM1 (BAND+RD) 3.4 +0.4 N/A 2.0 -0.5 +2.0 -0.8 -1.2	(BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2 -1.6 -0.8 -1.2 -1.6	3.0 -0.4 N/A -1.5 -0.5 N/A -0.4 -0.8 -1.6 Fu Eval Recon YES reinforced bur	2.4 -0.4 N/A -1.5 -0.5 N/A -0.8 -1.6 -1.6 -1.6 -1.6 -0.8 -1.6 -0.8 -1.6 -0.8 -0.8 -0.8 -0.8 -0.4 N/A -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5
Commercial         His           Immercial         His           Built DING TYPE           Basic Score           India Rise (4 to 7 stories)           Vertical Irregularity           Yaan Frequency           Sold Type II           Joid Type III           Joid Type III           Joid Type III           Sold Type III           Sold Sold           Concerts           Secult Interpret           S < 0.3	E es) s) s) s) estion F H H H H H H	School Wood 4.4 N/A N/A -0.5 N/A -0.5 N/A -0.6 -0.6 -1.2 (Likely buildii ligh probability of ligh probability of ligh probability of	BAS S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6 -1.2 -1.6 I g performation ( Grade 5 dam ( Grade 4 dam ( Grade 2 dam) ( Grade 2 dam)	S2 (.M) 3.8 N/A N/A N/A -0.5 N/A -0.6 -1.0 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6	C1 (MRF) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2 -0.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 Brick Masc	C2 (6W) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -0.8 -1.2 -1.6 of Grade 4 damage of Grade 3 damage of Grade 3 damage of Grade 1 damage SW wnry Infill Wall LM -	$\begin{array}{c} C3\\ (\text{INF})\\ 3.2\\ +0.2\\ +0.2\\ +0.4\\ -2.0\\ +1.2\\ -0.6\\ +1.2\\ -0.6\\ -1.6\\ -1.6\\ -1.6\\ -2.0\\ +1.2\\ -0.6\\ -3.0\\ -2.0\\ -3.0$	URM1 (BAND+RD) 3.4 +0.4 N/A N/A -2.0 -0.5 +2.0 -0.8 -1.2 -1.6	(BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2 -1.6 -0.8 -1.2 -1.6	3.0 -0.4 N/A -1.5 -0.5 -0.5 -0.4 -0.4 -0.8 -1.6 Fu Eval Recon YES reinforced burn ne masonry (c	2.4 -0.4 N/A -1.5 -0.5 N/A -0.8 -1.6 -1.6 -1.6 -1.6 -0.8 -1.6 -0.8 -1.6 -0.8 -0.8 -0.8 -0.8 -0.4 N/A -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5

201101				MRF = Mome FD = Flexible	Int-Resistin	ig Frame BAND =	Seismic Bar	ıd d masonry (lim	RD = Rigid d	ne masonry (c liaphragm	em mortar)
= Estimated, : NK = Do Not	subjeclive, o Know	unreliable data		FRAME = Ste INF = Burnt B		SW = S nry Infill Wall_LM = Lie	hear Wall			einforced burn	
S > 3.0	F	robability of Gra									
2.0 < S <	3.0 H					f Grade 1 damage				YES	NO
0.7 < S <						f Grade 2 damage					
0.3 < S <						f Grade 3 damage					mended
esult Intel S < 0.3	rpretation	(Likely build ligh probability o	ing performa of Grade 5 dam	nce) age; Very high pa	robability of	f Grade 4 damage 😘	/				rther uation
						-	-Orte				
INAL SCO		1.4	-1.0	-1.0	-1.0		-1.6	-1.0	-1.0	-1.6	-1.6
oil Type III		-0.6 -1.2	-1.2 -1.6	-1.0 -1.6	-1.0	-1.2 -1.6	-1.0	-1.2 -1.6	-1.2 -1.6	-0.8	-0.8
oil Type II	1	-0.2	-0.6	-0.6	-0.6	-0.8	-0.6	-0.8	-0.8	-0.4	-0.4
ode Detailing		N/A	+1.4	N/A	+1.2	+1.6	+1.2	+2.0	+2.0	N/A	N/A
an Irregularit		-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
ertical Irregul		-3.0	-2.0	N/A	-2.0	-2.0	-2.0	-2.0	-2.0	-1.5	-1.5
igh Rise (>7 :	stories)	N/A	+0.8	N/A	+0.5	+0.8	+0.4	N/A	N/A	-0.4 N/A	-0.4 N/A
id Rise (4 to	7 stories)	N/A	+0.4	3.6 N/A	+0.2	+0.4	+0.2	3.4 +0.4	3.6 +0.4	3.0	2.4 -0.4
asic Score		4.4	(FRAME) 3.6	(LM) 3.8	(MRF) 3.0	(SW)	(INF) 3.2	(BAND+RD) 3.4	(BAND+FD)	3.0	
BUILDING	TYPE	Wood	S1	S2	C1	C2	C3 -	URM1	URM2	URM3	URM4
		30.001		Cit oppose	MODIFIE	RS, AND FINAL	SCORE	<u>د</u>			
ommercial mer.Service	Historic Industrial	Kesidentiat	0 - 10 101 - 1000	11-100 1000+	Type I Hard So		Type III Soft Soil	Chimneys	Parapets	Cladding	Other:
ssembly	Govt.	OCCUPANC Office	Y Max, Number	of Persons		L TYPE (IS 1893	12		1	HAZARDS	
				14							
lan and El	evation Sc	ale:		i. i.							
						(0	R SPECIF	Y PHOTOC	BRAPH NUN	(BERS)	
								PHOTOGE			
					- I T		E.				
						Construction Dra	awings Ava	ailable: Yes			
						Building on Stilts	s / Open-G	reand Floor	": Yes 🗹 / No		
						Current Visual C					essed 🛄
				1 1					dence &	6	
						Building Name	V-	SQUA	RE		
						Total Floor Area				- M,	
						Surveyor	and the second of the second s		Date		
					_		1	-	-		
			1			No. Stories St.			Year Built		
						GPS Coordinate	s (if availa	ble) 16 30	O3 NL 8	304012	EL
						Other Identifiers	High	1 Scho	of Road		
							17×	XI I	awada	Pin <u>520</u>	008
						0	awala				
						Address: Plot	ITA AL	OD XI	apar.	High Sch	12.
											A

						3				24		
												(III
	R	anid Visu	al Screer	ning of B	uildin	gs for Poter	ntial Seis	smic Vu	Inerahili	tv		C
EEMA-154		Based Data		1.5	anom	90 101 1 0.01	itiai oon			s Seismic Z	Zone III)	
						Address: HIX	10.5	1- U.A	•			2
						Address: H,X	10-40-51	13-14 A,	· DYQNAN	rague, c	CERTE DU	grass
									jayawad		0010	
	_					Other Identifier						
						GPS Coordinat			GNL, 8	039B'E	·L	
						No. Stories	stilt &	55	_Year Buil	t_20	08	
-						Surveyor			_Date			
_						Total Floor Are	a (sq At./sq.	m)	102.7	IMY		
						Building Name	RAN	GANA	TH RA	s'dence	f	
						Use	F	Resideu	lial	,	,	
	_		_			Current Visual	Condition: E	xcellent []/	Good 🗹 Dam	aged 🔲 / Dis	tressed 🗌	
						Building on Stil	s / Open G	round Floo	T: Yes 1 / No			
						Construction D						1
				-				hat.				1
	_		-									h -
_				-				PHOTOG				
						10	POFOID			(DEDO)		
						10	IN SPEUIP	I PHUIUG	RAPH NUN	(BERS)		
				<u> </u>								
Plan and Eli	evation Sc	ale:										
Plan and El												
	26.7	OCCUPANC		of Persons	1	IL TYPE (IS 189			1	HAZARDS	3	
ssembly	Govt. Historic	OCCUPANC Office Residential	Max. Number 0 – 10	(11-100)	SO Type Hard Si	I Type II	3:2002) Type III Soft Soil	Chimneys	Ø		e	-
ssembly	Govt.	OCCUPANC Office	Max. Number 0 - 10 101 - 1000	11-100	Type Hard Si	I <b>Type II</b> oil Medium Soit	Type III Soft Soil	Chimneys	1		/	-
ssembly	Govt. Historic Industrial	OCCUPANC Office Residential	Max. Number 0 - 10 101 - 1000 BAS S1	(11-100) 1000+ IC SCORE, S2	Type Hard Si MODIFI	I Type II oil Medium Soil ERS, AND FINA C2	Type III Soft Soil	Chimneys	Parapets	Cladding	I Other:	-
ssembly ommercial mer.Service BUILDING	Govt. Historic Industrial	OCCUPANC Office Residential School	Max. Number 0 – 10 101 – 1000 BAS S1 (FRAME)	(11-100) 1000+ IC SCORE, S2 (LM)	Type Hard Sr MODIFI (MRF)	I Type II oil Medium Soit ERS, AND FINA C2 (SW)	Type III Soft Soil L SCORE, S C3 (INF)	Chimneys S URM1 (BAND+RD)	URM2 (BAND+FD)	Cladding URM3	Other:	-
ssembly ommercial mer.Service BUILDING asic Score	Govt. Historic Industrial TYPE	OCCUPANC Office Residential School	Max. Number 0 - 10 101 - 1000 BAS S1	(11-100) 1000+ IC SCORE, S2	Type Hard Si MODIFI	I Type II oil Medium Soil ERS, AND FINA C2	Type III Soft Soil L SCORE, S (INF) 3.2	Chimneys S URM1 (BAND+RD) 3.4	Parapets URM2 (BAND+FD) 3.6	Cladding URM3 3.0	URM4 2,4	-
ssembly commercial mer.Service BUILDING asic Score lid Rise (4 to 7 igh Rise (>7 s	Govt. Historic Industrial TYPE 7 stories) stories)	OCCUPANC Office Residential School Wood 4.4 N/A N/A	Max. Number 0 - 10 101 - 1000 BAS S1 (FRAME) 3.6 +0.4 +0.8	11-100 1000+ IC SCORE, S2 (LM) 3.8 N/A N/A	Type Hard Si MODIFI (MRF) 3.0 +0.2 +0.5	I Type II oil Medium Soit ERS, AND FINA C2 (SW) 3.6 +0.4 +0.8	Type III Soft Soil L SCORE, 5 (INF) 3.2 +0.2 +0.4	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A	URM2 (BAND+FD) 3.6 +0.4 N/A	Cladding URM3 3.0 -0.4 N/A	URM4 2.4 -0.4 N/A	-
ssembly commercial mer.Service BUILDING asic Score lid Rise (4 to 7 igh Rise (27 s ertical Irregula	Govt. Historic Industrial TYPE 7 stories) arity	OCCUPANC Office Residential School Wood 4.4 N/A N/A N/A -3.0	Max. Number 0 - 10 101 - 1000 BAS (FRAME) 3.6 +0.4 +0.8 -2.0	11-100 1000+ IC SCORE, S2 (LM) 3.8 N/A N/A N/A	Type Hard Si MODIFI (MRF) 3.0 +0.2 +0.5 -2.0	I Type II Medium Soil ERS, AND FINA C2 (SW) 3.6 +0.4 +0.8 -2.0	Type III Soft Soil L SCORE, 5 (INF) 3.2 +0.2 +0.4 -2.0	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0	Cladding URM3 -0.4 N/A -1.5	URM4 2.4 -0.4 N/A -1.5	-
ssembly commercial mer.Service BUILDING asic Score lid Rise (4 to 7 igh Rise (>7 ertical Irregularity lan Irregularity	Govt. Historic Industrial TYPE 7 stories) arity	OCCUPANC Office Residential School Wood 4.4 N/A N/A	Max. Number 0 - 10 101 - 1000 BAS S1 (FRAME) 3.6 +0.4 +0.8	11-100 1000+ IC SCORE, S2 (LM) 3.8 N/A N/A	Type Hard Si MODIFI (MRF) 3.0 +0.2 +0.5	I Type II oil Medium Soit ERS, AND FINA C2 (SW) 3.6 +0.4 +0.8	Type III Soft Soil L SCORE, 5 (INF) 3.2 +0.2 +0.4	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A	URM2 (BAND+FD) 3.6 +0.4 N/A	Cladding URM3 3.0 -0.4 N/A	URM4 2.4 -0.4 N/A	-
ssembly commercial mer.Service BUILDING tasic Score fid Rise (>7 s ertical Irregularity doe Detailing joil Type II	Govt. Historic Industrial TYPE 7 stories) stories) antty	OCCUPANC Office Residential School Wood 4.4 N/A N/A N/A -3.0 -0.5 N/A -0.2	Max. Number 0 - 10 101 - 1000 BAS S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6	11-100 1000+ IC SCORE, S2 (LM) 3.8 N/A N/A N/A N/A -0.5 N/A -0.6	Type Hard Si MODIFI C1 (MRF) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2 -0.6	I Type II Medium Soil ERS, AND FINA C2 (5W) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -0.8	Type III Soft Soil L SCORE, (INF) 3.2 +0.2 +0.4 -2.0 -0.5 +1.2 -0.6	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.5 +2.0 -0.8	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8	Cladding URM3 -0.4 N/A -1.5 -0.5 N/A -0.4	URM4 2.4 -0.4 N/A -1.5 -0.5 N/A -0.4	
ssembly ommercial mer.Service BUILDING asic Score fid Rise (4 to 1 ligh Rise (>7 s ertical Irregularit iode Detailling oid Type III	Govt. Historic Industrial TYPE 7 stories) stories) antty	OCCUPANC Office Residential School Wood 4.4 N/A N/A -3.0 -0.5 N/A	Max. Number 0-10 101-1000 BAS S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4	11 - 100 1000+ IC SCORE, S2 (LM) 3.8 N/A N/A N/A N/A N/A -0.5 N/A	Type Hard Si MODIFI C1 (MRF) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2	I Type II Medium Soit ERS, AND FINA C2 (sw) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6	Type III Soft Soil L SCORE, (INF) 3.2 +0.2 +0.4 -2.0 -0.5 +1.2	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0	Cladding URM3 3.0 -0.4 N/A -1.5 -0.5 N/A -0.4 -0.8	URM4 0/her: 2.4 -0.4 N/A -1.5 N/A -0.5 N/A -0.4 -0.8	AG
ssembly commercial merc.Service BUILDING asic Score lid Rise (4 to fild Rise (27 f ertical Iregularit dode Detailing oil Type III oil Type III	Govt. Historic Industrial TYPE 7 stories) stories) arity 7	OCCUPANC Office Residential School 4.4 N/A -3.0 -0.5 N/A -0.2 -0.6	Max. Number 0 - 10 101 - 1000 BAS S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6 -1.2	(11 - 100) 1000+ IC SCORE, S2 (LM) 3.8 N/A N/A N/A N/A N/A N/A -0.5 N/A -0.6 -1.0	Type Hard Sc MODIFI (MRF) 3.0 +0.2 +0.5 +2.0 -0.5 +1.2 -0.6 -1.0	I Type II Medium Soil ERS, AND FINA C2 (SW) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -0.8 -1.2	Type III Soft Soil L SCORE, . (1)NF) 3.2 +0.2 +0.4 -0.5 +1.2 -0.5 +1.2 -0.6 -1.0 -1.6	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.5 +2.0 -0.5 +2.0 -0.8 -1.2	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	Cladding URM3 -0.4 N/A -1.5 -0.5 N/A -0.4	URM4 2.4 -0.4 N/A -1.5 -0.5 N/A -0.4	Start
ssembly commercial mer.Service BUILDING tasic Score tid Rise (>7 s erfical fregut an fregutaris code Detailing coil Type II oil Type II quiffable Soil TINAL SCO	Govt, Historic Industrial TYPE 7 stories) stories) stories) antly 7 RE, S	OCCUPANC Office Residential Schoot 4.4 N/A N/A -3.0 -0.5 N/A -0.2 -0.6 -1.2	Max. Number D - 10 101 - 1000 BAS S1 (FRAME) 3.6 +0.4 +0.8 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6 -1.2 -1.6	(11-100) 1000+ IC SCORE, (M) 3.8 N/A N/A N/A N/A N/A -0.5 N/A -0.6 -1.0 -1.6	Type Hard Sc MODIFI (MRF) 3.0 +0.2 +0.5 +2.0 -0.5 +1.2 -0.6 -1.0	I Type II Medium Soil ERS, AND FINA C2 (SW) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -0.8 -1.2	Type III Soft Soil L SCORE, (INF) 3.2 +0.2 +0.4 -2.0 -0.5 +1.2 -0.6 -1.0	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.5 +2.0 -0.5 +2.0 -0.8 -1.2	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	Cladding URM3 3.0 -0.4 N/A -1.5 -0.5 N/A -0.5 N/A -0.8 -1.6	URM4 URM4 2.4 -0.4 N/A -1.5 -0.5 N/A -0.8 -1.6	Stal For
ssembly commercial mer.Service BUILDING tasic Score tid Rise (>7 s erfical fregut an fregutaris code Detailing coil Type II oil Type II quiffable Soil TINAL SCO	Govt. Historic Industrial TYPE 7 stories) tories) tories) antly 7 RE, S	OCCUPANC Office Residential School Wood 4.4 N/A N/A N/A -0.2 -0.6 -1.2 (Likely build	Мах. Number D – 10 101 – 1000 BAS S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 -1.2 -1.6 -1.2 -1.6	(11-100) 1000+ IC SCORE, (LM) 3.8 N/A N/A N/A -0.5 N/A -0.5 N/A -0.5 N/A -0.6 -1.0 -1.6	Type Hard Si MODIFI C1 (MRF) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2 -0.6 -1.0 -1.6	I Type II Medium Soit ERS, AND FINA C2 (SW) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -0.8 -1.2 -1.6	Type III Soft Soil L SCORE, . (1)NF) 3.2 +0.2 +0.4 -0.5 +1.2 -0.5 +1.2 -0.6 -1.0 -1.6	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.5 +2.0 -0.5 +2.0 -0.8 -1.2	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	Cladding URM3 3.0 -0.4 N/A -1.5 -0.5 N/A -0.8 -1.6 -1.6	URM4 2.4 -0.4 -1.5 -0.5 N/A -0.4 -1.6 -1.6	Stan Fuerro
ssembly ommercial mer.Service BUILDING asic Score lid Rise (4 to 1 igh Rise (>7 s erical Irregular iode Detailing oil Type II quifable Soil INAL SCO tesult Inter S < 0.3 0.3 < S < 1	Govt. Historic Industrial TYPE 7 stories) stories) antly 7 RE, S Pretation FD.7 +	OCCUPANC Office Residential Schoot Wood 4.4 N/A N/A N/A N/A N/A -0.5 N/A -0.5 N/A -0.5 N/A -0.5 N/A -0.5 (Likely build (Likely build) (Likely build) (Likely build) (Likely build)	Max. Number D = 10 101 - 1000 BAS S1 (FRAME) 3.6 +0.4 +0.8 +0.4 +0.8 +0.4 +0.8 +0.4 +0.8 +0.4 +0.8 +0.4 +0.8 +0.4 +0.6 -1.2 -1.6 -1.2 -1.6 -1.2 -1.6	(11-100) 1000+ IC SCORE, (LM) 3.8 NIA NIA -0.5 NIA -0.6 -1.0 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6	Type Hard Sr MODIFII (MRF) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2 -0.6 -1.0 -1.6	I         Type II Medium Soit           ERS, AND FINA           C2 (SW)           3.6 +0.4 +0.8 -2.0 -2.0 +1.6           -0.8 -1.2 -1.6           -1.6	Type III Soft Soil L SCORE, C3 +0.2 +0.2 +0.4 -2.0 -0.5 +1.2 -0.6 -1.0 -1.6 S, 4	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.5 +2.0 -0.5 +2.0 -0.8 -1.2	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	Cladding URM3 3.0 -0.4 -1.5 -0.5 N/A -0.8 -1.6 -0.8 -1.6 -0.8 -1.6	URM4 URM4 2.4 -0.4 N/A -1.5 -0.5 N/A -0.8 -1.6	Stal Flooren
BUILDING BUILDING asic Score tid Rise (4 to 1 igh Rise (>7 central for the second regulation of the second central Irregulation of Type II aufifable Soil INAL SCO in Type II cesult Inter S < 0.3 0.7 < S < 1	Govt. Historic Industrial TYPE 7 stories) itories) itories) arity 7 RE, S pretation P.2.7 H 2.0 H	OCCUPANC Office Residential Schoot 4.4 N/A N/A N/A N/A N/A -0.5 N/A N/A -0.5 N/A -0.5 N/A -0.5 N/A N/A N/A -0.5 N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	Max. Number D = 10 101 - 1000 BAS 3.6 +0.4 +0.8 +0.4 +0.8 +0.4 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6 -1.2 -1.6 Grade 5 dama Grade 3 dama Grade 3 dama	(11-100) 1000+ IC SCORE, S2 (LM) 3.8 N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	Type Hard So MODIFI (MRF) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2 -0.6 -1.0 -1.6	I         Type II Medium Soil           ERS, AND FINA           C2 (SW)           3.6           +0.4           +0.8           -2.0           -0.5           +1.6           -0.8           -1.2           -1.6           of Grade 4 damage           of Grade 3 damage, of Grade 2 damage	Type III Soft Soil L SCORE, C3 +0.2 +0.2 +0.4 -2.0 -0.5 +1.2 -0.6 -1.0 -1.6 S, 4	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.5 +2.0 -0.5 +2.0 -0.8 -1.2	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	Cladding URM3 3.0 -0.4 -1.5 -0.5 -0.6 -1.6 -1.6 -1.6 Fi Recor	URM4 2.4 -0.4 N/A -1.5 -0.5 N/A -0.4 -0.8 -1.6 -0.4 -1.6 -0.4 -1.6	Stal Floorceus .:
ssembly ommercial mer.Service BUILDING asic Score idid Rise (4 to 1 igh Rise (>7 s erical Irregut an Irregutant ode Detailing oil Type II oil Type II oil Type II INAL SCO tesuit Inter S < 0.3 0.3 < S < 0.3 < S < 2.0 < S < 2.0 < S <	Govt. Historic Industrial TYPE 7 stories) stories) anty 7 RE, S pretation 	OCCUPANC Office Residential Schoot 4.4 N/A N/A -3.0 -0.5 N/A -0.2 -0.6 -1.2 (Likely build iigh probability o liigh probability o liigh probability o	Max. Number D – 10 101 – 1000 BAS S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 -1.2 -1.6 -1.6 -1.2 -1.6 -1.6 -1.2 -1.6 -1.6 -1.6 -1.2 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.7 -1.7	(11-100) 1000+ IC SCORE, S2 (LM) 3.8 N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	Type Hard So MODIFI (MRF) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2 -0.6 -1.0 -1.6	I         Type II Medium Soit           ERS, AND FINA           C2 (SW)           3.6 +0.4 +0.8 -2.0 -2.0 +1.6           -0.8 -1.2 -1.6           -1.6	Type III Soft Soil L SCORE, C3 +0.2 +0.2 +0.4 -2.0 -0.5 +1.2 -0.6 -1.0 -1.6 S, 4	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.5 +2.0 -0.5 +2.0 -0.8 -1.2	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	Cladding URM3 3.0 -0.4 -1.5 -0.5 -0.6 -1.6 -1.6 -1.6 Fi Recor	URM4 URM4 2.4 -0.4 -1.5 -0.5 N/A -1.5 -0.5 N/A -0.8 -1.6 -0.4 -1.6	12
ssembly commercial mer.Service BUILDING tasic Score tid Rise (4 to 1 ligh Rise (>7 fertical Irregut an Irregutant code Detailing oid Type II iquifiable Soil TINAL SCO Result Inter S < 0.3 0.3 < S < 1 0.7 < S < 1 2.0 < S < 3 3 > 3.0 = Estimated, S	Govt. Historic Industrial TYPE 7 stories) arity 7 RE, S pretation P.0.7 F.2.0	OCCUPANC Office Residential Schoot 4.4 N/A N/A N/A N/A N/A -0.5 N/A N/A -0.5 N/A -0.5 N/A -0.5 N/A N/A N/A -0.5 N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	Max. Number D – 10 101 – 1000 BAS S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 -1.2 -1.6 -1.6 -1.2 -1.6 -1.6 -1.2 -1.6 -1.6 -1.6 -1.2 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.7 -1.7	(11-100) 1000+ IC SCORE, S2 (IM) 3.8 N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	Type Hard Si           MODIFII           C1 (MRF)           3.0           +0.2           +0.5           -2.0           -0.6           -1.6           probability or pobability or pobability or probability or probabi	I         Type II Medium Soil           ERS, AND FINA           C2 (SW)           3.6           +0.8           -2.0           -0.5           +1.6           -0.8           -1.2           -1.6           of Grade 4 damage           of Grade 3 damage           of Grade 2 damage           of Grade 1 damage           of Grade 1 damage	Type III Soft Soil UNF) 3.2 +0.2 +0.4 -2.0 +0.4 -0.5 +1.2 -0.6 -1.6 -1.6 -0.5 +1.2 -0.6 -1.6 -0.5 +1.2 -0.6 -1.6 -0.5 -1.6 -0.5 -1.6 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.5 +2.0 -0.5 +2.0 -0.8 -1.2	URM2 (BAND+FD) 3.6 +0.4 -1.2 -1.6 -1.5	Cladding URM3 3.0 -0.4 N/A -1.5 -0.5 -0.7 N/A -0.8 -1.6 Eva Recor YE:	URM4 2.4 -0.4 -1.5 -0.5 N/A -1.5 -0.5 N/A -0.8 -1.6 uuther uluation mmended S NO	12
ssembly commercial mer.Service BUILDING asic Score lid Rise (4 to 1igh Rise (>7 5 erical Irregularity ode Detailing oil Type II oil Type I Oil Score score 0.3 < 5 < 1 0.7 < 5 < 2 0.0 < 5 < 3 0.3 < 5 < 0 0.7 < 5 < 3 0.0	Govt. Historic Industrial TYPE 7 stories) arity 7 RE, S pretation P.0.7 F.2.0	OCCUPANC Office Residential Schoor Wood 4.4 N/A N/A N/A N/A N/A -0.5 N/A -0.5 N/A -0.5 -1.2 (Likely build figh probability of figh probability of Grav	Max. Number D – 10 101 – 1000 BAS S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 -1.2 -1.6 -1.6 -1.2 -1.6 -1.6 -1.2 -1.6 -1.6 -1.6 -1.2 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.7 -1.6 -1.6 -1.6 -1.6 -1.6 -1.7 -1.7	(11-100) 1000+ IC SCORE, S2 (LM) 3.8 N/A N/A N/A -0.5 -1.0 -1.6 N/A -0.6 -1.0 -1.6 Pg: Very high p ge: Very high p INF = Sunt INF = Sunt INF = Sunt	Type           Hard Si           MODIFI           0.6           +0.2           +0.5           +0.2           +0.5           +1.2           -0.6           -1.0           -1.6	I         Type II           I         Medium Soil           ERS, AND FINA         C2           (SW)         3.6           +0.4         +0.8           +0.5         +1.6           -0.5         +1.6           -0.8         -1.2           -1.6         -0.8           of Grade 4 damage         of Grade 2 damage           of Grade 1 damage         of Grade 1 damage           of Grade 1 damage         SW = 3           of Grade 1 damage         I damage	Type III Soft Soil USCORE, 5 (INF) 3.2 +0.2 +0.2 +0.4 -0.5 +1.2 -0.6 -1.0 -1.6 (INF) -0.5 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 -1.0 -1.0 -1.0 -1.0 -1.0 -1.0 -1.0 -1.0	Chimneys S URM1 (8AND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 2 -0.8 -1.2 -1.5	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2 -1.6 URM3 = Unr or sto	Cladding URM3 3.0 -0.4 -1.5 -0.5 -0.7 -0.8 -1.6 -0.8 -1.6 Eva Recor YE: einforced burn	URM4 0/her: URM4 -0.4 -0.4 -0.5 N/A -0.4 -0.8 -1.6 unther uluation mmended \$ NO nt brick	Stal Floorceus. 12 102.71
ssembly ommercial mer.Service BUILDING asic Score tid Rise (4 to 1 ligh Rise (>7 central for the second tid Rise (>1 to 1) erdical Irregula ian Irregularit ode Detailing oil Type II oil Type II oil Type II oil Type II oil Type II second test second test 0.7 c s c 2.0 c s c s > 3.0 e Estimated, s	Govt. Historic Industrial TYPE 7 stories) arity 7 RE, S pretation P.0.7 F.2.0	OCCUPANC Office Residential Schoor Wood 4.4 N/A N/A N/A N/A N/A -0.5 N/A -0.5 N/A -0.5 -1.2 (Likely build figh probability of figh probability of Grav	Max. Number D – 10 101 – 1000 BAS S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 -1.2 -1.6 -1.6 -1.2 -1.6 -1.6 -1.2 -1.6 -1.6 -1.6 -1.2 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.7 -1.6 -1.6 -1.6 -1.6 -1.6 -1.7 -1.7	(11-100) 1000+ IC SCORE, S2 (IM) 3.8 N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	Type Hard Si MODIFII C1 (MRF) 3.0 +0.2 +0.5 +0.2 -0.5 +1.2 -0.5 +1.2 -0.5 +1.2 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6	I         Type II           I         Medium Soit           ERS, AND FINA         C2           (SW)         3.6           +0.8         -0.4           +0.8         -0.5           +1.6         -0.6           -1.2         -1.6           of Grade 4 damage         of Grade 2 damage           of Grade 2 damage         of Grade 1 damage           of Grade 1 damage         SW = 5           mry Infill Wall LM = LM = L         BADD	Type III Soft Soil UNF) 3.2 +0.2 +0.4 -2.0 +0.4 -0.5 +1.2 -0.6 -1.6 -1.6 -0.5 +1.2 -0.6 -1.6 -0.5 +1.2 -0.6 -1.6 -0.5 -1.6 -0.5 -1.6 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5	Chimneys S URM1 (BAND+RD) 3.4 +0.4 +0.4 N/A -2.0 >-0.5 +2.0 >-0.5 +2.0 >-0.5 +2.0 >-1.2 -1.6	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2 -1.6 -1.2 -1.6 URM3 = Unr or sto RD = Rijdd	Cladding URM3 3.0 -0.4 -1.5 -0.5 -0.7 -0.8 -1.6 -0.8 -1.6 Eva Recor YE: einforced burn	URM4 2.4 -0.4 -1.5 -0.5 -0.5 N/A -0.8 -1.6 uurther iluation mmended S NO nt brick cem mortar)	12
ssembly ommercial mer.Service BUILDING asic Score tid Rise (4 to 1 ligh Rise (>7 central for the second tid Rise (>1 to 1) erdical Irregula ian Irregularit ode Detailing oil Type II oil Type II oil Type II oil Type II oil Type II second test second test 0.7 c s c 2.0 c s c s > 3.0 e Estimated, s	Govt. Historic Industrial TYPE 7 stories) arity 7 RE, S pretation P.0.7 F.2.0	OCCUPANC Office Residential Schoor Wood 4.4 N/A N/A N/A N/A N/A -0.5 N/A -0.5 N/A -0.5 -1.2 (Likely build figh probability of figh probability of Grav	Max. Number D – 10 101 – 1000 BAS S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 -1.2 -1.6 -1.6 -1.2 -1.6 -1.6 -1.2 -1.6 -1.6 -1.6 -1.2 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.7 -1.6 -1.6 -1.6 -1.6 -1.6 -1.7 -1.7	(11-100) 1000+ IC SCORE, (LM) 3.8 NIA NIA NIA -0.5 NIA -0.6 -1.0 -1.0 -1.6 -1.0 -1.6 -1.0 -1.6 FRAME = St INF = Burnt I MRF = Mon	Type Hard Si MODIFII C1 (MRF) 3.0 +0.2 +0.5 +0.2 -0.5 +1.2 -0.5 +1.2 -0.5 +1.2 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6	I         Type II           I         Medium Soit           ERS, AND FINA         C2           (SW)         3.6           +0.8         -0.4           +0.8         -0.5           +1.6         -0.6           -1.2         -1.6           of Grade 4 damage         of Grade 2 damage           of Grade 2 damage         of Grade 1 damage           of Grade 1 damage         SW = 5           mry Infill Wall LM = LM = L         BADD	Type III Soft Soil Soft Soil UNF) 3.2 +0.4 -2.0 +0.4 -2.0 +0.4 -0.5 +1.2 -0.5 +1.2 -0.5 +1.2 -0.5 -1.0 -1.6 -0.5 +1.2 -0.5 +1.2 -0.5 +1.2 -0.5 -1.6 -1.0 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6 -1.6	Chimneys S URM1 (BAND+RD) 3.4 +0.4 +0.4 N/A -2.0 >-0.5 +2.0 >-0.5 +2.0 >-0.5 +2.0 >-1.2 -1.6	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2 -1.6 -1.2 -1.6 URM3 = Unr or sto RD = Rijdd	Cladding URM3 3.0 -0.4 -1.5 -0.5 -0.7 -0.8 -1.6 -0.8 -1.6 Eva Recor YE: einforced burn	URM4 0/her: URM4 -0.4 -0.4 -0.5 N/A -0.4 -0.8 -1.6 unther uluation mmended \$ NO nt brick	12

FEMA-154/ATC-	21 Based Data	Collection	Form						Seismic 2	
						7.No.31-1				
						Machav	arom		Pin 520	0004
					Other Ident	ifiers	0 1	11	o th	
					GPS Coord	linates (if availa	able) <u>163</u>	24 NL . 8	0 39 13 1	EL
					No. Stories	Stilt +59	6	Year Buil	t_201	14
					Surveyor			Date		
					Total Floor	Area (sq. ft./sq	. m) <u>     </u>	09,18	MY	
					Building Na	ime	0-1			
					Use	Resid	deulial			
			-		Current Vis	ual Condition: E	Excellent []/	Good 🗹/ Dam	naged 🔲/ Disl	tressed 🔲
					Building on	Stilts / Open G	Found Floo	r: Yes 🗹 / No		
					Constructio	n Drawings Ava	ailable: Yes			
lan and Elevation										
	OCCUPANO		or of Persons		TYPE (IS	A			HAZARDS	12
sembly Govt. mmercial Histor	OCCUPANC Office c (Residential)		er of Persons (11 - 100) 1000+	SON Type I Hard So	Туре	II Type III			HAZARDS Cladding	S Other:
sembły Govt. mmercial Histor	OCCUPANC Office c (Residential)	Max. Numbe 0 – 10 101 – 1000	( <u>11-100</u> ) 1000+	Type I Hard So	Type I Medium	II Type III	Chimneys			Ø
sembły Govt. mmercial Histor	OCCUPANC Office c (Residential)	Max. Numbe 0 – 10 101 – 1000	( <u>11-100</u> ) 1000+	Type I Hard So	Type I Medium	II Type III Soil Soft Soil	Chimneys			Ø
ssembly Govt. ommercial Histor mer.Service Indust BUILDING TYPE asic Score	OCCUPANC Office Residential School Wood 4.4	Max. Numbe 0 - 10 101 - 1000 BA S1 (FRAME) 3.6	(11-100) 1000+ SIC SCORE, (LM) 3.8	Type I Hard So MODIFIE (MRF) 3.0	Type Medium RS, AND FI C2 (SW) 3.6	INAL SCORE,	Chimneys S URM1 (BAND+RD) 3.4	Parapets URM2 (BAND+FD) 3.6	Cladding URM3 3.0	URM4
ssembly Govt, mmercial Histor ner.Service Indust BUILDING TYPE ssic Score d Rise (4 to 7 stories)	OCCUPANC Office Residential School Wood 4.4	Max. Numbe 0 - 10 101 - 1000 BA S1 (FRAME)	(11-100) 1000+ SIC SCORE, (LM) 3.8 N/A	Type I Hard So MODIFIE (MRF) 3.0 +0.2	Type Medium RS, AND FI C2 (SW) 3.6 +0.4	INAL SCORE, C3 (INF) 3.2 +0.2	Chimneys S URM1 (BAND+RD) 3.4 +0.4	URM2 (BAND+FD) 3.6 +0.4	Cladding URM3 3.0 -0.4	URM4 2.4 -0.4
sembly Govt, mmercial Histor ner.Service Indust BUILDING TYPE ssic Score d Rise (4 to 7 stories) gh Rise (>7 stories)	OCCUPANC Office Residential School Wood 4.4 N/A N/A N/A -3.0	Max. Numbe 0 - 10 101 - 1000 BA S1 (FRAME) 3.6 +0.4 +0.8 -2.0	(11-100) 1000+ SIC SCORE, (LA) 3.8 N/A N/A N/A N/A	Type I Hard So MODIFIE (MRF) 3.0 +0.2 +0.5 -2.0	Type Medium RS, AND Fi C2 (SW) 3.6 +0.4 +0.8 -2.0	II Type III's Soft Soft Soft Soft Soft INAL SCORE, C3 (NNF) 3.2 +0.2 +0.2 +0.2 +0.2 -2.0	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0	Cladding URM3 3.0	URM4
ssembly Govt. mmercial Histor mer.Service Indust BUILDING TYPE asic Score d Rise (4 to 7 stories) phrtical Irregularity an Irregularity	OCCUPANC Office (Residentia) School Wood 4.4 N/A	Max. Numbe 0 - 10 101 - 1000 BA S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5	(11-100) 1000+ SIC SCORE, (LM) 3.8 N/A N/A N/A N/A N/A -0.5	Type I Hard So MODIFIE C1 (MRF) 3.0 +0.2 +0.5 -2.0 -0.5	Type Medium RS, AND F( C2 (SW) 3.6 +0.4 +0.4 +0.8 -2.0 -0.5	II Type III's Soil Soil Soil Soil Soil Soil (MAL SCORE, C3 (MF)) 3.2 +0.2 - 40.3 - 40.4 - 40.	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0 -0.5	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0 -0.5	Cladding URM3 -0.4 N/A -1.5 -0.5	URM4 2.4 -0.4 N/A -1.5 -0.5
ssembly Govt. mmerc3en/service Indust BUILDING TYPE asic Score id Rise (4 to 7 stories; drikse (4 to 7 stories; partical Irregularity an Irregularity de Detailing oil Type II	OCCUPANC Office C Residential School Wood 4.4 N/A N/A -3.0 -0.5 N/A -0.2	Max. Numbe 0 - 10 101 - 1000 BA S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6	(11-100) 1000+ SIC SCORE, (LA) 3.8 N/A N/A N/A N/A	Type I Hard So MODIFIE (MRF) 3.0 +0.2 +0.5 -2.0	Type Medium RS, AND Fi C2 (SW) 3.6 +0.4 +0.8 -2.0	II Type III's Soft Soft Soft Soft Soft INAL SCORE, C3 (NNF) 3.2 +0.2 +0.2 +0.2 +0.2 -2.0	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0	Cladding URM3 3.0 -0.4 N/A -1.5	URM4 2.4 -0.4 N/A -1.5
ssembly Govt. mmercial Histor BUILDING TYPE asic Score d Rise (4 to 7 stories) ph Rise (27 stories) relical mregularity an Irrogularity de Detailing vil Type III	OCCUPANC Office CResidential School 4.4 N/A N/A N/A N/A N/A -0.5 N/A -0.2 -0.6	Max. Numbe 0 - 10 101 - 1000 BA S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6 -1.2	(11-100) 1000+ SIC SCORE, (LM) 3.8 N/A N/A N/A N/A N/A N/A N/A N/A N/A -0.5 -0.6 -1.0	Type I Hard So MODIFIE C1 (MRF) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2 -0.6 -1.0	Type Medium RS, AND Ff C2 (SW) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -0.8 -1.2	II Type III Soil Soil Soil IIIAL SCORE, IIIAL SCORE, 0.2. 0.0.	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	Cladding URM3 3.0 -0.4 N/A -1.5 -0.5 N/A -0.4 -0.8	URM4 0.4 -0.4 N/A -1.5 -0.5 N/A -0.4 -0.8
ssembly Govi. mmercial Histor mer.Service Indust BUILDING TYPE asic Score di Rise (4 to 7 stories) gh Rise (7 stories) gh Rise (	OCCUPANC Office C Residential School Wood 4.4 N/A N/A -3.0 -0.5 N/A -0.2	Max. Numbe 0 - 10 101 - 1000 BA S1 (FRAME) 3.6 +0.4 +0.8 -2.0 -0.5 +1.4 -0.6	(11-100) 1000+ SIC SCORE, SZ (LM) 3.8 N/A N/A N/A N/A N/A -0.5 N/A -0.6	Type I Hard So MODIFIE C1 (MRF) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2 -0.6	Type Medium <b>RS, AND F</b> C2 (SW) <b>3.6</b> +0.4 +0.8 -2.0 -0.5 +1.6 -0.8	II Type III Soil Soil Soil Soil Soil Soil Soil Soil	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.8	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8	Cladding URM3 3.0 -0.4 N/A -1.5 -0.5 N/A -0.4	URM4 2.4 -0.4 N/A -1.5 -0.5 N/A -0.4
sembly Govt. Histor mmercial Histor Histor Indust BUILDING TYPE sic Score d Rise (4 to 7 stories) gh Rise (>7 stories) gh Rise (>1 stories) hitting Rise (>1	OCCUPANC Office c (Residential) School 4.4 N/A N/A -3.0 -0.5 N/A -0.2 -0.6 -1.2	Max. Number 0 - 10 101 - 1000 BA S1 (FRMME) 3.6 +0.4 +0.4 +0.4 +0.4 +0.4 +0.5 +1.4 -0.5 +1.4 -0.5 +1.2 -1.5	(11-108) 1000+ SIC SCORE, (M) 3.8 N/A N/A N/A N/A -0.5 N/A -0.5 N/A -0.5 N/A -0.6 -1.0 -1.6	Type I Hard So MODIFIE C1 (MRF) 3.0 +0.2 +0.5 -2.0 -0.5 +1.2 -0.6 -1.0	Type Medium RS, AND Ff C2 (SW) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -0.8 -1.2	II Type III Soil Soil Soil Soil Soil Soil Soil Soil	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	URM3 3.0 -0.4 N/A -1.5 -0.5 N/A -0.5 N/A -0.8 -1.6	URM4 0.4 -0.4 -1.5 -0.5 N/A -0.4 -0.8 -1.6
ssembly Govi. ommercial Histor mer.Service Indust BUILDING TYPE asic Score Itid Rise (4 to 7 stories) igh Rise (4 to 7 stories) igh Rise (7 stories) igh Rise (7 stories) igh Rise (7 stories) igh Rise (7 stories) of Type III of Type III of Type III ut Type III valitable Soil INAL SCORE, S esuit Interpretat S < 0.3 0.3 < S < 0.7 0.7 < S < 2.0 2.0 < S < 3.0	OCCUPANC Office c Residential School Wood 4.4 N/A N/A -3.0 -0.5 N/A -0.2 -0.6 -1.2	Max. Number           0 - 10           101 - 100           BA           3.6           +0.4           -0.5           -1.2           -1.6	(11-108) 1000+ SIC SCORE, (M) 3.8 N/A N/A N/A N/A N/A -0.5 N/A -0.6 -1.0 -1.0 -1.0 -1.0 -1.0 -1.0 -1.0 -1.0	Type I Hard So           MODIFIE           0,0           0,0           0,0           -0.5           +1.2           -0.6           -1.6	Type Medium RS, AND FI C2 (5W) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -0.8 -1.2 -1.6 Grade 4 dama Grade 3 dama Grade 2 dama	II Type III Soil Soil Soil Soil Soil Soil INAL SCORE, Soil (INF) 3.2 +0.2 - 4047 W/A - 2.0 - 4047 W/A - 4047	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	URM2 (BAND+FD) 3.6 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	Cladding URM3 3.0 -0.4 -1.5 -0.5 N/A -1.5 -0.5 N/A -0.8 -1.6 -0.8 -1.6 -1.6	URM4 0.4 -0.4 -1.5 -0.5 N/A -0.4 -0.6 -1.6 urther iluation mmended
Commercial immercial         Histor Histor           BUILDING TYPE         Indust           BUILDING TYPE         Indust           asic Score         Mid Rise (4 to 7 stories)           Mid Rise (4 to 7 stories)         Indust           Infight Rise (7 stories)         Infight Rise (7 stories)           Infight Rise (7	OCCUPANC Cffice CResidential School Wood 4.4 N/A N/A N/A N/A -0.5 -0.5 N/A -0.5 -0.5 N/A -0.5 N/A -0.5 N/A -0.5 N/A -0.5 N/A -0.5 N/A -0.5 -0.5 N/A -0.5 -0.5 N/A -0.5 -	Max. Numbe           0 - 10           101 - 100           BA           3.6           +0.4           +0.8           -2.0           -0.5           +1.4           -1.6           Iing perform           of Grade 2 dan           of Grade 3 dan           of Grade 3 dan           of Grade 3 dan           of Grade 3 dan           of Grade 1 damage	(11-108) 1000+ SIC SCORE, (M) 3.8 N/A N/A N/A N/A N/A -0.5 N/A -0.6 -1.0 -1.0 -1.0 -1.0 -1.0 -1.0 -1.0 -1.0	Type I Hard So           MODIFIE           C1 (MRF)           3.0           +0.2           +0.5           -2.0           -1.0           -1.6           probability of probability of probability of	Type Medium RS, AND FI C2 (5%) 3.6 +0.4 +0.8 -2.0 -0.5 +1.6 -0.8 -1.2 -1.6 Grade 4 dama Grade 3 dama Grade 2 dama Grade 1 dama	II Type III Soil Soil Soil Soil Soil Soil INAL SCORE, Soil (INF) 3.2 +0.2 - 4047 W/A - 2.0 - 4047 W/A - 4047	Chimneys S URM1 (BAND+RD) 3.4 +0.4 N/A -2.0 -0.5 +2.0 -0.8 -1.2	URM2 (BAND+FD) 3.6 +0.4 -0.7 +2.0 -0.8 -1.2 -1.6	Cladding URM3 .0.4 .0.4 .0.8 .1.5 .0.5 .0.8 .1.6 Ft Recor	URM4 0.ther: URM4 2.4 -0.4 -1.5 -0.5 N/A -0.4 -0.8 -1.6 urther uluation mmended S NO

· · · ·

## **Summary of Annexure 1:**

Sl. No.	Building Name	Final Score (S)	Damage Grade	Recommendation for Further Evaluation
1	TSNo:147 Tickle Road	1.9	Grade 3	No
2	Hno:30-17-30 Durga Agraharam	0.4	Grade 4	No
3	Hno:29-3-8W-24Governorpet	0.4	Grade 4	No
4	Madapati Guest House Tarapet	0.4	Grade 4	No
5	O/o. A P Endowment Dept. Jammidoddi	0.3	Grade 5	Yes
6	Hno:48-19-17MahanaduRdGunadala	-0.1	Grade 5	Yes
7	Hno:40-15/2-19/8ALabbipet	0.4	Grade 4	No
8	GPV-ECE Block	2.2	Grade 2	No
9	GPV- Hostel Block	1.7	Grade 3	No
10	MARK Residency	-0.1	Grade 5	Yes
11	AB Plaza	-0.1	Grade 5	Yes
12	Ranganath Res. Bandar Road.	-0.1	Grade 5	Yes
13	Chakradhar No.5 Route, ITI Road	-0.1	Grade 5	Yes
14	V-Square, High School Road, Patamata	0.4	Grade 4	No
15	Machavaram, Narne Vari Street	-0.2	Grade 5	Yes

The S represents the final score of the building which is a quantitative assessment. Moreover, for better and easier understanding, the method has also defined the range of score values to interpret the result based on qualitative assessment. This qualitative assessment ranges from *Damage Grade 1* up to *Damage Grade 5*. Here *Damage Grade 1* represents the lowest damage state or negligible damage state whereas *Damage Grade 5* represents the very severe damage state of the building. Therefore, when the surveyed building has a damage grade of 5, the surveyor recommends the further evaluation as Yes. This means that further detailed assessment of the building is necessary.

--000—

#### 4 5 6 LOEM Wite Balcony 4 5 6 -1 0 . 11 . . LOOUL 1.10.00 MAR'10 MP and July (33) Line 10 ( 10 10 ( 10 жароон Жароон .6Y.U uni 10(11) THE THE PARTY IN THE PARTY INTERPARTY 10 YX 0 0 i. Juña N -1680 48 53.9 0.840 4.157.11 DHP3.(4) 0.640 4.45.141 Januar N . . Jaans Di Jan Jie Jie Jie Jie Jie 3.00M 4 40% 1.10° 4.0 1001 BD Roade AL YAN ICHROOP ANY SAL 10100 -----HE FOOL ٠ ор 🧰 и 🖂 1.D) M Wede Bal n de e calentaria 1.00 M Wite Baleny 1.DD 1 Wide Balcomy 1.D) M Wae Ba 3.00M. 1.00 M Wide Balcony 1. Disting Blog. 0+3 in TS No. 117, Tikkle Fozo, Vjayzura-la 10. xistingBildg, G+3 n TS No. 147, Tikke Rook, Vijayawaka 13 1:1 FLOOR PLAY 2-3 ROOR MA 16.37N BETICN AT 'AA' Į ł γc 1.00 14 v tot Dak Π Π онт 1 ALLY NYDEN JAR 10 เม้น E>100 PARKING HE FOOL 1.20 NCMDI MUCHDI NYCICH LA YAU E0-6006-PARKING ìc 1000 C PARKING 4.47.11 1000 Jabus 1 405 1.10 4a 21855 110 4au E BD Roale MUI AL 34.4 10100 HALL 10,000 101 10.3 55 PERKING PARKING 1.DC M Wae Bakar 1.00 M Wae Ba 1.00 M Wae Bakany ExistingBkig C+3 n TS No.147, Tikke Roan Vijayawaca-10. Existing Blog. 0+3 in TS No. 147, Tikkle Foac, V(a GROUND FL 34 F.OOR PLAN Housesite of Sri A.K.Mahan Rao 39.65 M ELEVATION

N

13.71 M wide road

15.47 Mts.

6.000

# Annexure II: Detailed Building Plans with Sections & Elevations

SITE PLAN of TS No.147, Tikkle Road, Vijayawada-10.

3.068.

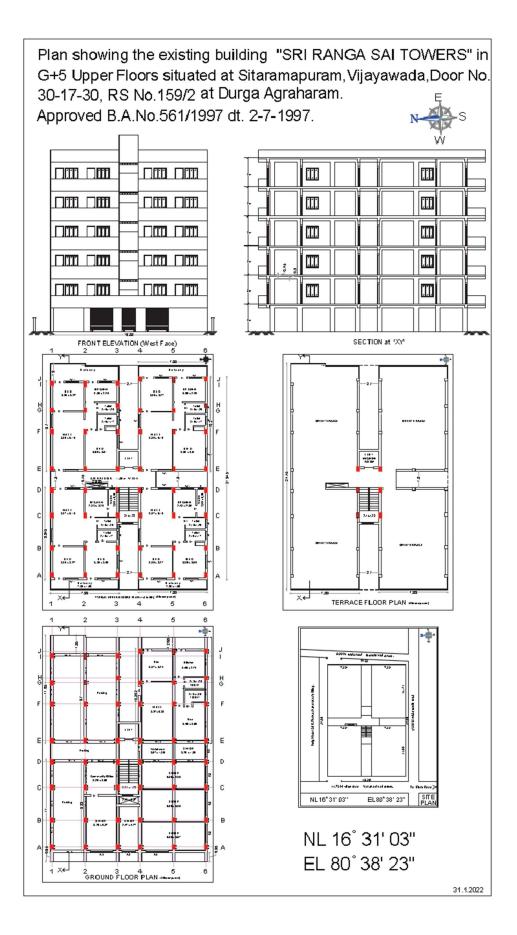
37.51 M

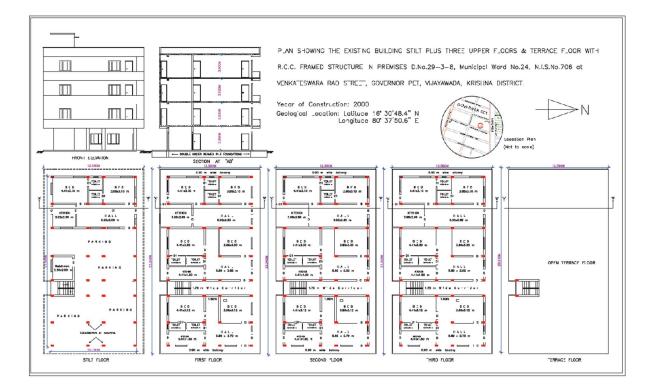
2118.

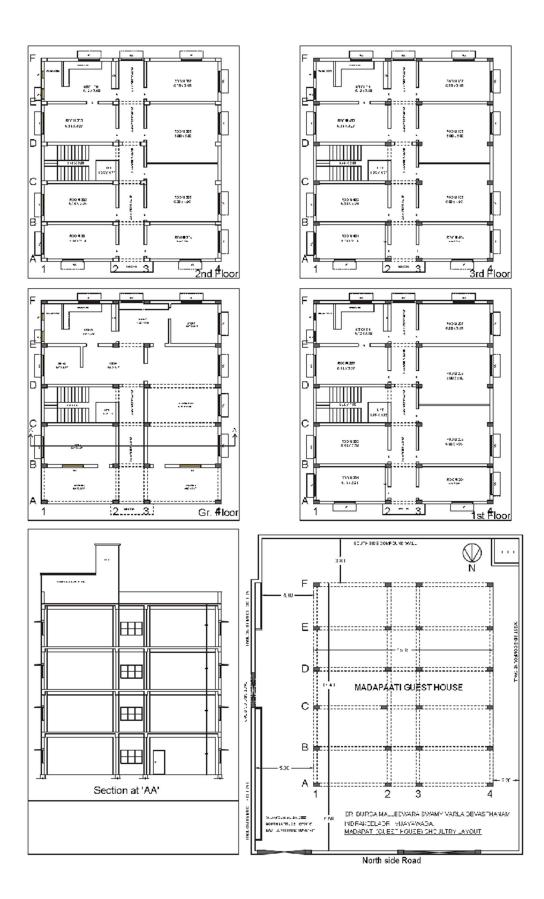
H No.40 15 6/A, MG Road.

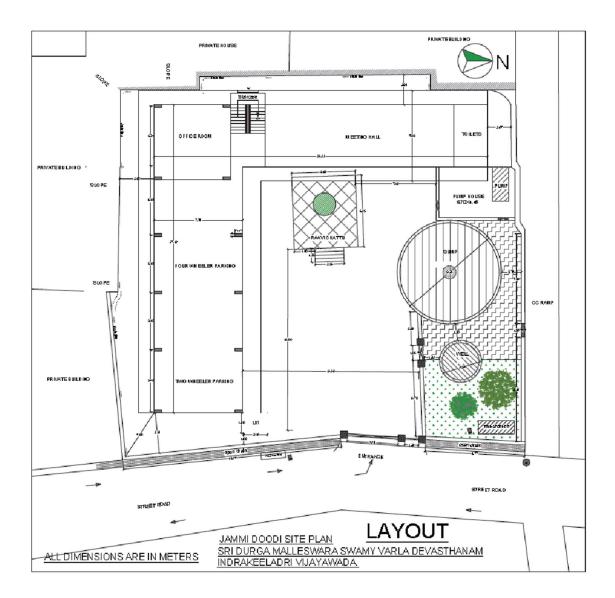
16°29 53" NL 80°38 54" FI Year of Construction: 1988.

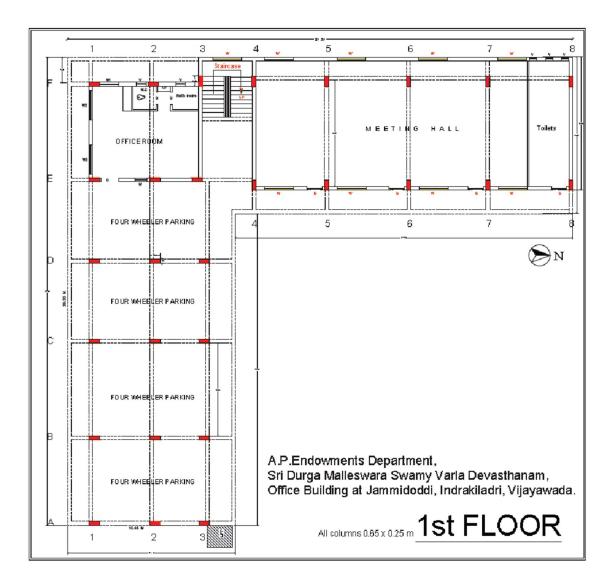
19.81 M

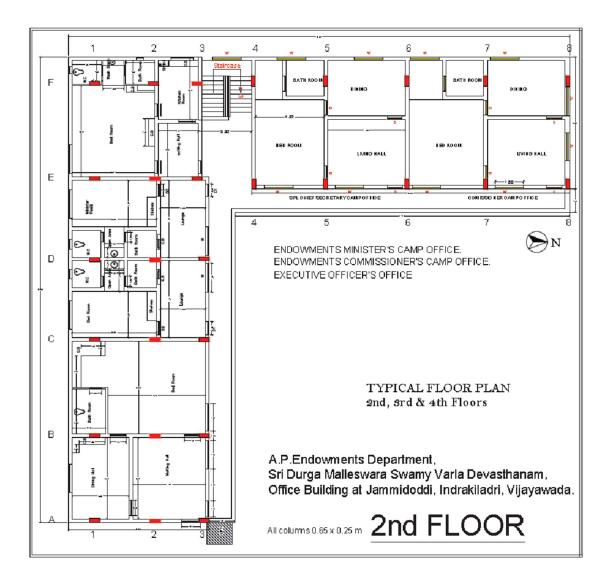


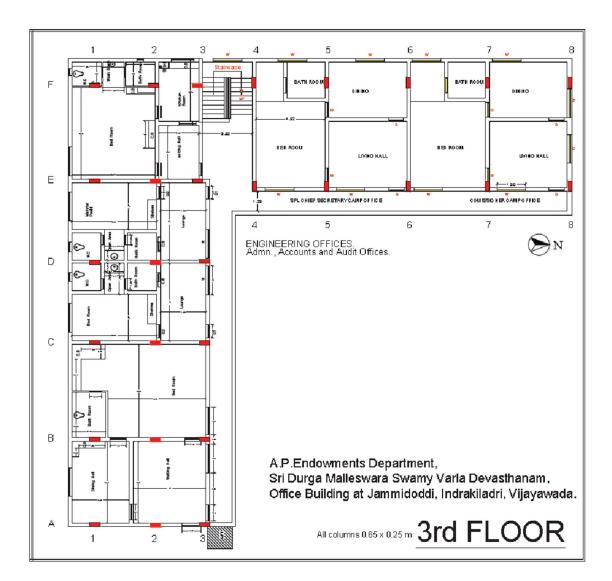


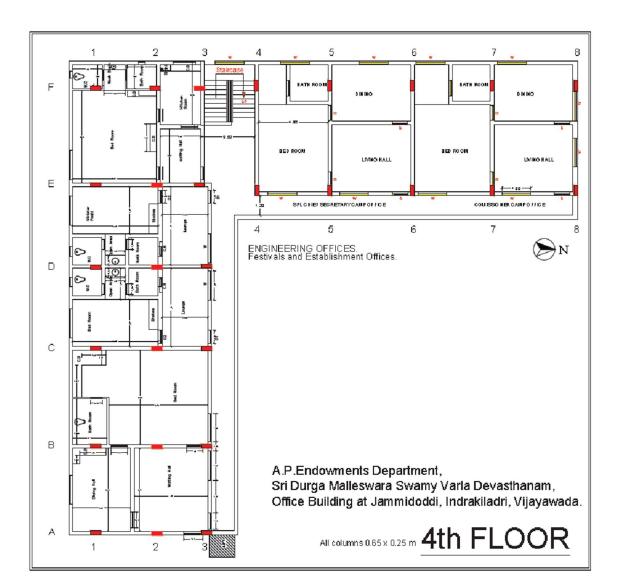


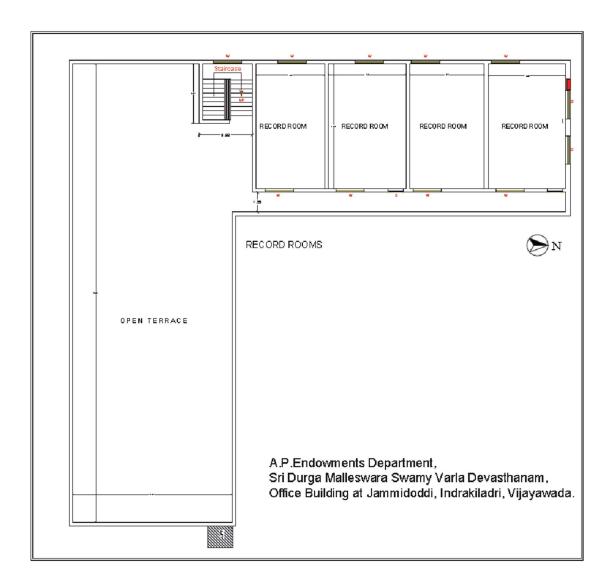


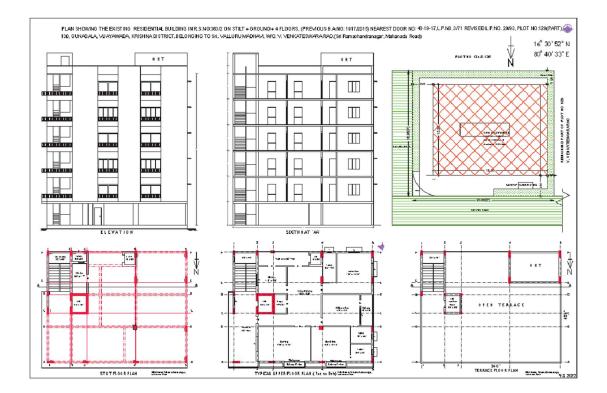


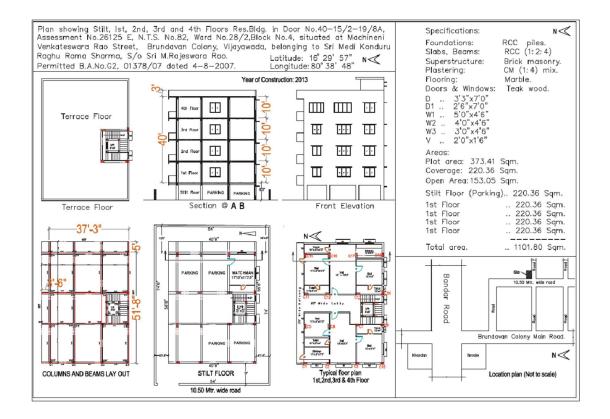


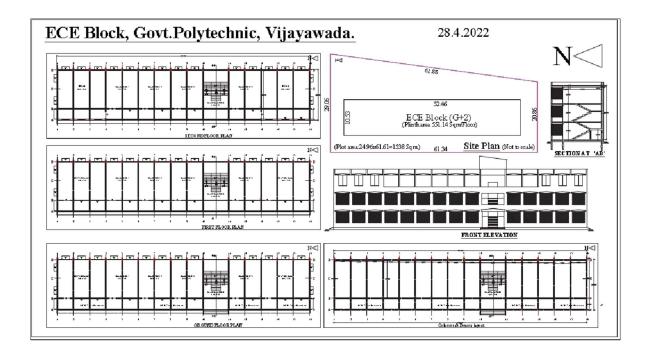


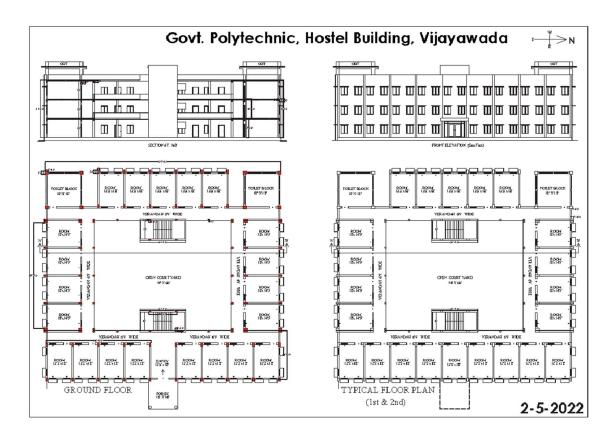


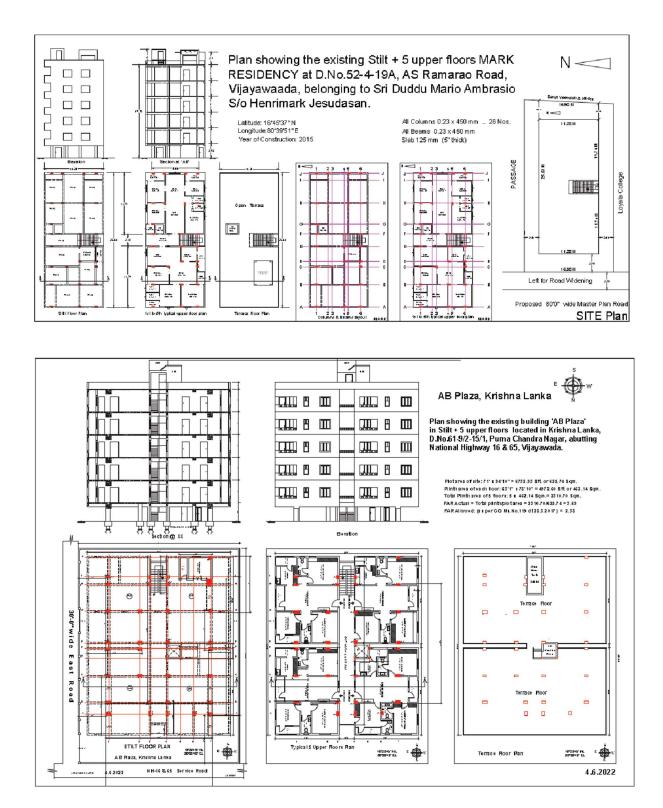


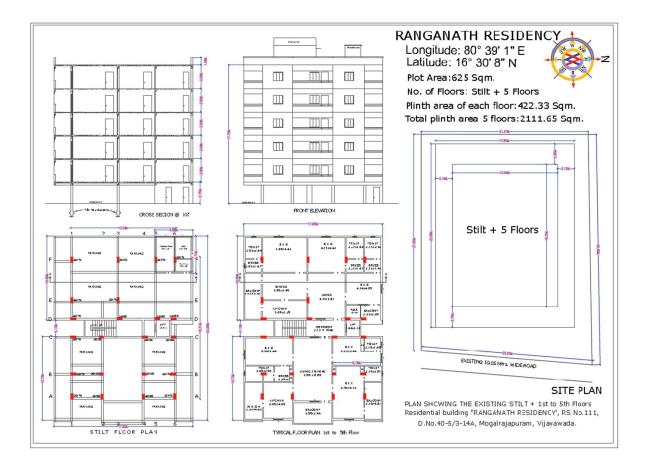




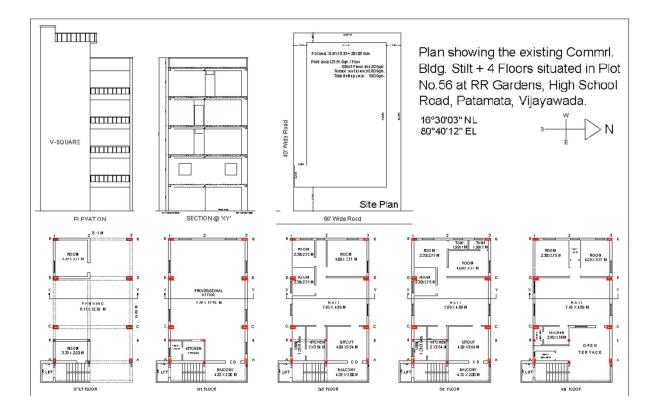


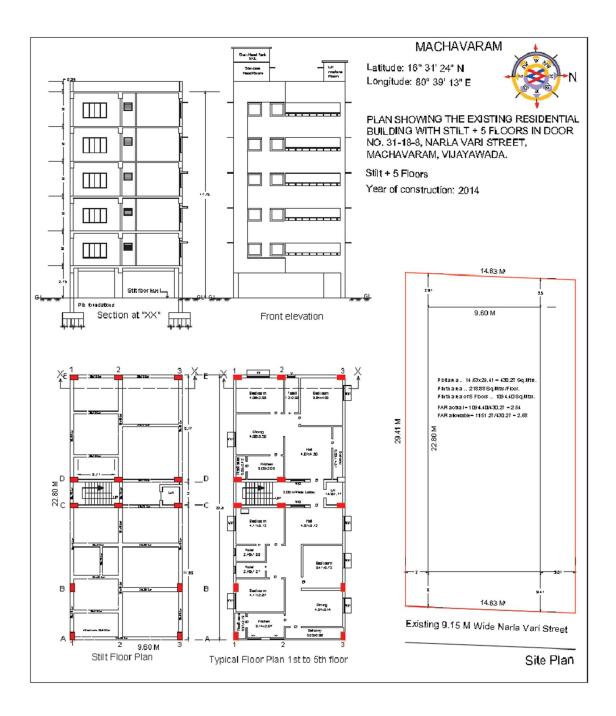












--000---

## Annexure III: R-Values of Columns

Latitude: 1	6° 29' 53" N	V				Lor	ngituc	le: 80	° 38'	54" ]	E				
Year of co	nstruction: 1	988													
Floor Heig	ht:				G	roun	d Flo	or (	3.00	Mts.	Ht.)				
	R Value				R	Value	e of C	Colum	n fac	e					Avg. R
Col. No.	location	Ν	North			East			South	ı		West	t	Avg.	Value
& Size	from FFL	E	M	E	E	M	E	E	М	E	E	М	E	Values	of Col.
	2.10 M	37	33	36	37	38	38							36.50	
A1	1.35 M	36	40	34	36	39	37		overe			over		37.00	37.22
230x230	0.60 M	37	38	38	38	40	38		y wa	11	t	oy wa	11	38.17	1
	2.10 M	38	33	36										35.67	
A2	1.35 M	32	36	34		overe			overe			over		34.00	35.78
230x230	0.60 M	39	38	36		oy wa	11		y wa	11	t	oy wa	.11	37.67	1
	2.10 M	38	40	39							37	37	38	38.17	
A4 230x230	1.35 M	39	39	38		overe			overe		39	40	37	38.67	38.56
230x230	0.60 M	38	40	39		oy wa	11		y wa	11	39	39	38	38.83	1
	2.10 M	36	39	37	37	38	38				37	37	36	37.22	
A6	1.35 M	40	38	38	38	39	37		overe		39	38	40	38.56	38.22
230x230	0.60 M	38	40	39	40	39	38		y wa	11	40	39	37	38.89	1
	2.10 M		37	I		37	1		39			37		37.50	
A8 300 dia.	1.35 M		40			39			40			40		39.75	38.75
300 dia.	0.60 M		40			38			39			39		39.00	1
	2.10 M		37			40			39			40		39.00	
A9 300 dia.	1.35 M		40			41			40			39		40.00	39.42
500 ula.	0.60 M		39			40			38			40		39.25	1
	2.10 M				37	41	38							38.67	
B1 230x230	1.35 M		overed y wall		36	38	39		overe y wa			cover by wa		37.67	38.44
230x230	0.60 M	U	y wan		39	40	38		'y wa	11		y wa	11	39.00	1
	2.10 M	_						39	40	38	38	39	39	38.83	
B2 230x230	1.35 M		overed y wall			overe by wa		37	39	37	39	40	38	38.33	38.66
2307230	0.60 M		, wall			, y wa		39	39	38	40	39	38	38.83	
D.1	2.10 M				39	39	40	37	39	40			1	39.00	
B4 230x230	1.35 M		overed y wall		38	39	39	40	38	39		over by wa		38.83	38.94
	0.60 M		,		40	38	39	39	40	38		-y wa	**	39.00	
	2.10 M	~					1	37	39	39	37	39	36	37.83	
B6 230x230	1.35 M		overed y wall			overe by wa		38	40	39	38	37	39	38.50	38.33
2308230	0.60 M		,			-y wa		39	40	38	37	40	38	38.67	
<b>D</b> 0	2.10 M		37			38			38			40		38.25	
B8 300 dia.	1.35 M		39			40			41			39		39.75	39.00
500 uiu.	0.60 M		38			39			40			39		39.00	
B9	2.10 M		38			39			39			40		39.00	39.25
300 dia.	1.35 M		40			39			40			39		39.50	37.23

	0.60 M		39			40			40			38		39.25	
	2.10 M				39	38	36							37.67	
C1	1.35 M		verec		36	38	38		overe			Cover		37.33	37.56
230x230	0.60 M	by	v wall		37	39	37	b	y wa	11		oy wa	.11	37.67	-
	2.10 M	38	38	39	36	38	37				39	36	36	37.44	
C2	1.35 M	39	41	38	40	39	38		overe		40	38	39	39.11	38.15
230x230	0.60 M	37	39	36	37	39	39	b	y wa	11	38	39	37	37.89	-
	2.10 M		38			37			38			36		37.25	
C8	1.35 M		39			39			40			38		39.00	38.58
300 dia.	0.60 M		39			40			39			40		39.50	-
	2.10 M		36			39			39			39		38.25	
C9	1.35 M		38			37			38			37		37.50	38.42
300 dia.	0.60 M		40			39			40			39		39.50	-
	2.10 M				37	38	38							37.67	
D2	1.35 M		verec		36	39	38		overe			Cover		37.67	37.89
230x230	0.60 M	бу	v wall		40	39	36	D	y wa	11		oy wa	.11	38.33	-
	2.10 M	38	38	39										38.33	
D3	1.35 M	38	39	37		overe			overe			over		38.00	38.33
230x230	0.60 M	40	40	36		y wa	11	U	y wa	11		oy wa	.11	38.67	
D5	2.10 M			1							36	39	39	38.00	
230x230	1.35 M		Covered by wall			overe y wa			overe y wa		38	40	37	38.33	38.11
•	0.60 M	Uy				y wa	11	U	y wa	11	40	38	36	38.00	1
	2.10 M		38			38			38			38		38.00	
D7 300 dia.	1.35 M		39			36			35			39		37.25	38.17
500 uia.	0.60 M		39			39			39			40		39.25	7
	2.10 M		38			38			35			39		37.50	
D8 300 dia.	1.35 M		39			39			39			38		38.75	38.08
500 ula.	0.60 M		37			40			38			37		38.00	
	2.10 M			_	36	39	37	37	39	39				37.83	
E1 230x230	1.35 M		verec v wall		38	40	37	38	40	38		Cover by wa		38.50	38.11
2507250	0.60 M	09	wan		37	40	38	38	37	38		y wa	.11	38.00	
	2.10 M										39	37	38	38.00	
E2 230x230	1.35 M		vered wall			overe y wa			overe y wa		36	39	38	37.67	38.00
2508250	0.60 M	0,	wan			<i>y</i> a			y wa		38	38	39	38.33	
E2	2.10 M	C		1							37	39	38	38.00	
E3 230x230	1.35 M		vered wall			overe y wa			overe y wa		39	39	38	38.67	38.67
2501250	0.60 M	J				<i>y</i> a			y na		40	38	40	39.33	
	2.10 M	C		1							37	37	39	37.67	
E5 230x230	1.35 M		Covered by wall			overe y wa			overe y wa		39	40	38	39.00	38.44
	0.60 M					J			J		39	38	39	38.67	
	2.10 M		36			36			36			36		36.00	
E7 300 dia.	1.35 M		39			39			38			37		38.25	37.33
200 414.	0.60 M		37			40			37			37		37.75	
E8	2.10 M		36			38			34			36		36.00	37.17
300 dia.	1.35 M		38			39			38			39		38.50	57.17

E9 300 dia.	1.35 M 0.60 M	38 36	38 36	39 40	38 36	38.25 37.00	36.83
					Average		38.16
			84 Readin	gs			

					1 <sup>st</sup> Fl	oor (	(3.00	Mts.	Ht.)						
	R Value				R	Valu	e of C	Colum	n face	e					Ave.
Col. No. & Size	location	Ι	North			East			South	1		West		Avg. Values	R Value
a size	from FFL	E	M	E	E	М	E	E	M	E	E	M	E	1 11105	of Col.
	2.10 M	39	37	38										38.00	
A1 230x230	1.35 M	39	40	36	N	o acce	ess		Covere by wal			Covere by wal		38.33	38.56
2501250	0.60 M	40	40	38					, , , , , , , , , , , , , , , , , , ,			, , , , , , , , , , , , , , , , , , ,		39.33	
	2.10 M	38	37	38										37.67	
A2 230x230	1.35 M	39	40	37	-	overe by wal			Covere by wal		-	Covere by wal		38.67	38.56
2501250	0.60 M	39	41	38		.j ma			,			,		39.33	
	2.10 M	38	39	38							38	37	36	37.67	
A4 230x230	1.35 M	39	40	37		overe by wal			Covere by wal		38	40	37	38.50	38.06
2307230	0.60 M	40	39	36		y wa	.1		Jy wa	.1	36	39	38	38.00	
	2.10 M	38	37	36	38	37	36							37.00	
A6 230x230	1.35 M	36	40	38	39	38	40		Covere by wal			Covere by wal		38.50	37.89
2307230	0.60 M	38	39	36	37	39	40		Jy wa	.1		Jy wa		38.17	
	2.10 M	38	35	36										36.33	
A8 230x230	1.35 M	39	38	39	Covered by wall				Covere by wal			Covere by wal		38.67	37.44
2307230	0.60 M	36	39	37	by wall				Jy wa			Jy wa		37.33	
	2.10 M	39	35	37							38	39	36	37.33	
A9 230x230	1.35 M	39	39	38		overe by wal			Covere by wal		40	38	38	38.67	38.11
2307230	0.60 M	37	39	40		y wa	.1		Jy wa	.1	36	39	39	38.33	
	2.10 M	_													
B1 230x230	1.35 M		overed y wall		N	o acce	ess		Covere by wal			Covere by wal			0.00
230A230	0.60 M		y wan	L					<i>y</i>			<i>y</i>			
5.4	2.10 M							36	35	34	37	35	36	35.50	
B2 230x230	1.35 M		overe y wall			overe by wal		36	40	38	36	39	38	37.83	37.00
2307230	0.60 M		y wan	L		y wa		37	39	38	37	38	37	37.67	
54	2.10 M				36	34	36	37	36	38				36.17	
B4 230x230	1.35 M		overed y wall		36	37	36	36	37	36		Covere by wal		36.33	37.28
2307230	0.60 M		y wan	L	39	38	40	40	39	40		Jy wa		39.33	
Dí	2.10 M				_		1	37	39	35	38	38	36	37.17	
B6 230x230	1.35 M		overed y wall			overe v wal		36	39	37	38	40	37	37.83	37.56
2307230	0.60 M		y wall	L		y wa		37	38	38	36	39	38	37.67	
-	2.10 M	-			39	38	38	37	38	39				38.17	
B8 230x230	1.35 M		overed y wall		39	40	39	40	41	39		Covere by wal		39.67	38.89
2308230	0.60 M		y wall	L	38	39	39	39	40	40		sy wa	11	39.17	
B9	2.10 M	37	38	36	37	39	38	38	39	37	C	Covere	ed	37.67	38.56

230x230	1.35 M	36	40	39	39	39	39	37	40	38	ł	oy wal	1	38.56	
-	0.60 M	38	39	38	41	40	40	39	40	39		2		39.33	
	2.10 M	50	57	50			10	55	10	57				57.55	
C1	1.35 M		overed		N	o acce	88	-	overe			Covere			0.00
230x230	0.60 M	b	y wall					b	oy wal	1	ł	oy wal	1		
	2.10 M	38	36	37	36	39	37				37	39	37	37.33	
C2	1.35 M	37	38	36	37	40	38		overe		37	39	39	37.89	37.74
230x230	0.60 M	36	39	38	37	39	36		oy wal	1	39	40	38	38.00	
	2.10 M	37	38	37	36	38	37				37	36	38	37.11	
C8 230x230	1.35 M	36	39	39	37	39	39		overe		39	36	39	38.11	37.67
230x230	0.60 M	37	40	38	38	37	39		oy wal	11	35	38	38	37.78	
	2.10 M										37	38	36	37.00	
C9 230x230	1.35 M		overed y wall			overe v wal			overe vy wal		36	38	39	37.67	37.44
230X230	0.60 M		y wan		L	y wai	1		y wai	11	37	39	37	37.67	
	2.10 M				37	38	36							37.00	
D2 230x230	1.35 M		overed y wall		36	40	38		overe by wal			Covere by wal		38.00	37.44
2307230	0.60 M		y wan		37	39	36		y wai	.1	Ľ	Jy wai	1	37.33	
	2.10 M	36	38	37										37.00	
D3 230x230	1.35 M	38	38	37	-	overe v wal			overe vy wal		-	Covere by wal		37.67	37.33
2508250	0.60 M	37	39	36		<i>y</i>			<i>y</i>			Jy wa		37.33	
	2.10 M			1	Covered										
D5 230x230.	1.35 M		overed y wall			Covered by wall			Covere by wal			Covere by wal			0.00
2508250	0.60 M		,			by wall			/ <b>j</b> // di			, , , , , , , , , , , , , , , , , , ,			
D7	2.10 M	36	37	35			1			1		۹	1	36.00	
D7 230x230	1.35 M	37	40	37		overe v wal			overe by wal			Covere by wal		38.00	37.11
20011200	0.60 M	38	38	36					, <b>j</b>					37.33	
D8	2.10 M	C		J		overe	J		1		37	39	38	38.00	
230x230	1.35 M		overed y wall			overe vy wal			overe vy wal		35	38	37	36.67	37.33
	0.60 M		, 			<u> </u>				I	36	40	37	37.67	
E1	2.10 M	C	overed	1				35	39	35		Covere	d	36.33	
230x230	1.35 M		y wall		N	o acce	ss	38	38	36		by wal		37.33	37.22
	0.60 M							37	39	38		<u> </u>		38.00	
E2	2.10 M	C	overed	4	6	overe	A	38	37	35		Covere	A	36.67	
230x230	1.35 M		y wall			by wal		35	39	36		by wal		36.67	37.33
	0.60 M					<u> </u>		38	39	39		<u> </u>		38.67	
E3	2.10 M	C	overed	4	6	overe	A	38	39	37		Covere	d	38.00	
230x230	1.35 M		y wall			by wal		37	40	38		by wal		38.33	38.33
	0.60 M							39	38	39		<u> </u>		38.67	
E5	2.10 M	C	overed	4	Correct		đ	37	35	38		Covere	đ	36.67	
230x230	1.35 M		y wall		Covered by wall			38	39	37		by wal		38.00	37.33
	0.60 M				by wall			37	38	37		-		37.33	
E7	2.10 M	C	overed	4	ſ	overe	d	35	38	34	C	Covere	d	35.67	
230x230	1.35 M		y wall			by wal		36	37	36		by wal		36.33	36.56
	0.60 M					<u> </u>		38	38	37		-		37.67	
E8	2.10 M	C	overed	1	C	overe	d	37	36	38	35	38	35	36.50	37.50

230x230	1.35 M	b	y wall		ł	oy wal	1	38	40	39	38	39	35	38.17	
	0.60 M							37	39	38	39	38	36	37.83	
	2.10 M	37	36	37	36	36	35	36	35	34	35	34	37	35.67	
E9 230x230	1.35 M	38	38	36	39	38	36	36	40	38	34	39	35	37.25	36.92
2307230	0.60 M	39	36	38	38	36	39	38	39	38	37	36	40	37.83	
											A	verag	ge		33.61
			7	5 Re	eading	gs									

Γ

	D 17-1				k	R Valu	e of C	Colun	ın fac	e					Ave.
Col. No.	R Value location		North	ı		East	ie og i		South			West		Avg.	R
& Size	from FFL	E	M	E	E	M	E	E	M	E	E	M	E	Values	Value of Col.
A 1	2.10 M	36	38	38					overe		C	overe	a	37.33	
A1 230x230	1.35 M	37	39	36	N	o acce	ess		overe vy wal			overe vy wal		37.33	37.67
2308230	0.60 M	38	40	37					<i>y</i>			.y		38.33	
A2	2.10 M	38	37	37		Covere	d		overe	d		overe	A	37.33	
230x230	1.35 M	37	38	37		by wal			by wal			by wal		37.33	37.89
	0.60 M	39	40	38		5			<u> </u>					39.00	
	2.10 M	38	38	39							39	37	36	37.83	
A4 230x230	1.35 M	38	39	36		overe by wal			overe v wal		36	39	37	37.50	35.74
2307230	0.60 M	36	39	36		y wa	.1		y wa		38	39	39	37.83	
	2.10 M	38	37	36	38	37	38							37.33	
A6	1.35 M	36	40	38	40	38	40		overe			overe		38.67	38.56
230x230	0.60 M	38	39	36	37	39	40		oy wal	LI .		y wal	LI .	38.17	
	2.10 M	38	36	36			1							36.67	
A8	1.35 M	39	40	39	Covered				overe			overe		39.33	38.22
230x230	0.60 M	40	39	37	by wall			ť	y wal	ll	b	y wal	ll	38.67	
	2.10 M	39	35	38							36	37	36	36.83	
A9	1.35 M	40	39	37		overe			overe		40	38	38	38.67	38.06
230x230	0.60 M	37	40	40		oy wal	ll		y wal	ll	36	39	40	38.67	
	2.10 M		I									I			
Bl	1.35 M		overe		N	o acce	ess		overe			overe			0.00
230x230	0.60 M	-  <sup>t</sup>	oy wal	11					y wal	11		y wal	LI .		
	2.10 M							36	35	36	37	37	36	36.17	
B2	1.35 M		overe			overe		36	39	37	40	39	38	38.17	37.61
230x230	0.60 M	-  t	oy wal	11		oy wal	11	40	39	38	37	38	39	38.50	
	2.10 M	1			37	34	36	37	36	36		1		36.00	
B4	1.35 M		overe		35	39	36	36	40	39		overe		37.50	37.44
230x230	0.60 M	-  <sup>t</sup>	oy wal	11	39	38	40	39	39	38		y wal	LI .	38.83	
	2.10 M	1						37	39	38	38	39	36	37.83	
B6	1.35 M		overe			overe		40	39	37	38	40	38	38.67	38.33
		-  <sup>t</sup>	by wa	11	t	oy wal	LI .	37	38	39	40	39	38	38.50	
230x230	0.60 M														
B8	0.60 M 2.10 M		overe	h	36	38	38	37	38	39	C	overe		37.67	38.94

	0.60 M				40	39	40	40	40	39				39.67	
	2.10 M	37	38	38	37	39	40	38	39	39				38.33	
B9	1.35 M	39	40	39	40	39	39	40	40	38		overe		39.33	39.03
230x230	0.60 M	40	39	38	41	40	40	38	40	39	- t	y wa	1	39.44	
	2.10 M		1			1	1		1	I					
C1	1.35 M		overe		N	o acce	ess		overe			overe			0.00
230x230	0.60 M	-  t	oy wal	ll					by wa	II	b	y wa	l		
	2.10 M	38	39	37	36	39	38				37	39	38	37.89	
C2	1.35 M	37	40	36	37	40	38		overe		40	39	39	38.44	38.37
230x230	0.60 M	40	39	38	39	39	36		oy wa	11	39	40	39	38.78	
	2.10 M	39	38	39	38	38	37				37	39	38	38.11	
C8 230x230	1.35 M	38	40	39	37	39	40		overe		39	40	39	39.00	38.56
250x250	0.60 M	39	40	38	39	37	39		oy wa	11	39	38	38	38.56	
	2.10 M		1				1				39	38	36	37.67	
C9 230x230	1.35 M	-	overe			overe by wal		-	overe		36	40	39	38.33	38.11
230X230	0.60 M		oy wal	11		by wa	11		oy wa	11	37	39	39	38.33	
	2.10 M				39	38	39							38.67	
D2 230x230	1.35 M		overe by wal		36	40	38	-	overe by wa		-	overe vy wal		38.00	38.44
230x230	0.60 M		Jy wa	11	40	39	37		Jy wa	11		y wa	11	38.67	
	2.10 M	36	38	37										37.00	
D3 230x230	1.35 M	40	39	37		overe			lovere by wal			overe by wal		38.67	37.78
2307230	0.60 M	37	40	36	by wall				y wa	11		y wa		37.67	
	2.10 M														
D5 230x230.	1.35 M		overe by wal			overe by wal			overe by wa			overe by wal			0.00
2307230.	0.60 M	] '	y wa	11		y wa	11		y wa	11		y wa	.1		
	2.10 M	36	37	38										37.00	
D7 230x230	1.35 M	37	40	37		overe by wa			overe by wa			overe by wal		38.00	37.67
2307230	0.60 M	39	38	37		y wa	11		y wa	11		y wa	.1	38.00	
	2.10 M								_		38	39	38	38.33	
D8 230x230	1.35 M		overe by wal		-	overe by wal			lovere by wal		37	39	39	38.33	38.00
2307230	0.60 M	] '	y wa	11		y wa	11		y wa	11	36	39	37	37.33	
	2.10 M							36	39	37				37.33	
E1 230x230	1.35 M		overe by wal		N	o acce	ess	38	40	39		overe vy wal		39.00	38.33
2508250	0.60 M		, y					39	39	38		, y wa		38.67	
	2.10 M							38	37	38			1	37.67	
E2 230x230	1.35 M		overe by wal			overe by wal		40	39	36		overe vy wal		38.33	38.22
2508250	0.60 M		, y			y wa		38	38	40		, y wa		38.67	
<b>F</b> 2	2.10 M							38	39	37			1	38.00	
E3 230x230	1.35 M		overe by wal			overe by wal		38	40	39		overe vy wal		39.00	38.67
	0.60 M		. ya.			. ya.		40	38	39		. j a.	-	39.00	
	2.10 M						.1	36	35	38				36.33	
E5 230x230	1.35 M		overe by wal			overe by wal		37	38	37		overe by wal		37.33	37.00
	0.60 M		. ya.			. ya.		37	38	37		. j a.	-	37.33	
E7	2.10 M		overe			overe		35	38	36	-	overe		36.33	37.22
230x230	1.35 M	ł	oy wal	11	ŀ	oy wal	11	36	39	36	b	y wa	1	37.00	31.22

			7	5 Re	eading	gs									
											A	vera	ge		33.92
2508250	0.60 M	40	36	38	38	38	40	38	39	40	37	38	40	38.50	
E9 230x230	1.35 M	39	39	39	39	40	38	38	40	38	38	39	38	38.75	38.39
	2.10 M	37	38	40	38	38	37	37	39	38	37	39	37	37.92	
2507250	0.60 M		, wa	.1		, wa		40	39	38	37	38	40	38.67	
E8 230x230	1.35 M	-	overe by wal		-	overe by wa		37	40	36	38	40	37	38.00	37.56
FO	2.10 M							35	36	35	37	38	35	36.00	
	0.60 M							38	38	39				38.33	

					3 <sup>rd</sup> F	loor	(3.00	) Mts	. Ht.)						
<i></i>	R Value				ŀ	R Valu	e of <b>(</b>	Colun	nn fac	e.					Ave.
Col. No. & Size	location		North	ı		East			South	!		West		Avg. Values	R Value
Size	from FFL	E	M	E	E	M	E	E	M	E	E	M	E	r uiues	of Col.
	2.10 M	36	38	37										37.00	
A1 230x230	1.35 M	39	40	39	N	o acce	ess		overe by wal			overe v wal		39.33	38.22
2508250	0.60 M	38	40	37					y wa	.1		y wa	u	38.33	
	2.10 M	36	37	39			1			1			1	37.33	
A2 230x230	1.35 M	39	38	37		lovere by wal			overe by wal			overe by wal		38.00	37.78
2508250	0.60 M	37	39	38		, y , n u			y wa			, y 11 a	u	38.00	
	2.10 M	39	38	39							39	37	38	38.33	
A4 230x230	1.35 M	40	39	39		overe by wa			overe by wal		38	40	37	38.83	38.83
2507250	0.60 M	40	39	40		y wa			y wa		39	39	39	39.33	
	2.10 M	38	37	38	39	37	38						1	37.83	
A6 230x230	1.35 M	39	40	38	40	38	39		overe by wal			overe by wal		39.00	38.44
2307230	0.60 M	38	39	37	38 39 40				y wa	11		y wa		38.50	
	2.10 M	38	37	39										38.00	
A8 230x230	1.35 M	39	40	39	Covered by wall				overe by wal			overe v wal		39.33	38.78
2307230	0.60 M	40	39	38	'	y wa			y wa			y wa		39.00	
	2.10 M	39	39	38					_		39	37	36	38.00	
A9 230x230	1.35 M	40	39	38		lovere by wal			overe by wal		38	39	40	39.00	38.50
2308230	0.60 M	37	40	39		Jy wa	11		Jy wa	11	36	39	40	38.50	
	2.10 M														
B1 230x230	1.35 M		overe v wa		N	o acce	ess		overe by wa			overe v wal			0.00
2308230	0.60 M		y wa	11					Jy wa	11		y wa	u		
	2.10 M							36	35	37	36	37	35	36.00	
B2 230x230	1.35 M		overe by wa			lovere by wal		36	40	39	40	39	39	38.83	37.89
230X230	0.60 M		y wa	11		by wa	11	40	39	38	37	40	39	38.83	
	2.10 M				37	38	36	37	38	36				37.00	
B4 230x230	1.35 M		overe by wa		35	39	37	37	40	39		overe		37.83	38.00
230X230	0.60 M		by wa	11	40	38	40	40	39	38		y wal	u	39.17	
	2.10 M					•		35	39	36	38	39	36	37.17	
B6 230x230	1.35 M		overe			overe		40	40	39	38	40	38	39.17	38.33
2308230	0.60 M		oy wa	11		oy wa	11	37	40	39	40	39	38	38.83	1
B8	2.10 M	C	overe	ed	36	38	38	37	38	37	C	overe	d	37.33	38.61

230x230	1.35 M	b	oy wa	11	38	40	39	39	39	39	b	y wa	11	39.00	
	0.60 M	-	5		40	39	40	39	40	39	1	5		39.50	
	2.10 M	39	38	37	37	36	40	37	39	38				37.89	
B9	1.35 M	38	40	39	40	39	39	40	38	37	C	overe	ed	38.89	38.63
230x230	0.60 M	39	39	37	39	40	40	39	40	39	b	y wa	11	39.11	56.05
	2.10 M	57	57	57	57	40	10	57	10	57				57.11	
C1	1.35 M		overe		N	o acce	200	C	overe	ed	C	overe	ed		0.00
230x230	0.60 M	- t	oy wa	11	1		200	ł	oy wa	11	b	y wa	11		0.00
	2.10 M	36	39	38	38	39	38				38	39	38	38.11	
C2	1.35 M	37	40	39	37	40	39		overe		40	39	40	39.00	38.48
230x230	0.60 M	37	39	38	39	40	36	ł	by wa	11	39	38	39	38.33	20.10
	2.10 M	36	38	39	37	38	39				37	36	38	37.56	
C8	1.35 M	38	39	36	38	40	40		overe		38	38	37	38.22	38.04
230x230	0.60 M	37	40	38	40	37	39	l t	by wa	11	39	37	38	38.33	
	2.10 M										38	38	37	37.67	
C9	1.35 M		overe			overe			overe		39	40	39	39.33	38.67
230x230	0.60 M	- t	oy wa	11		by wa	II	ľ	by wa	11	38	40	39	39.00	
	2.10 M				38	37	39							38.00	
D2	1.35 M		overe		39	40	38		overe			overe		39.00	38.56
230x230	0.60 M	- c	oy wa	11	39	39	38		by wa	11		y wa	11	38.67	
	2.10 M	36	36	37			1							36.33	
D3 230x230	1.35 M	39	39	40		Covere			overe			overe		39.33	37.89
230x230	0.60 M	38	40	36		by wa	11		by wa	11		y wa	11	38.00	
	2.10 M														
D5 230x230.	1.35 M		overe by wa			Covere by wa			overe by wa			overe v wa			0.00
230x230.	0.60 M		y wa	11		Jy wa	11		Jy wa	11		iy wa	11		
	2.10 M	38	37	39										38.00	
D7 230x230	1.35 M	40	38	37		Covere by wa			overe by wa			overe v wa		38.33	38.33
2307230	0.60 M	39	40	37	'	Jy wa	11		y wa	11		y wa	11	38.67	
	2.10 M									_	36	39	37	37.33	
D8 230x230	1.35 M		overe by wa			Covere by wa			overe by wa		35	39	40	38.00	38.11
2307230	0.60 M		y wa			y wa			y wa		40	39	38	39.00	
	2.10 M							35	39	36				36.67	
E1 230x230	1.35 M		overe by wa		N	o acce	ess	38	40	39		overe y wa		39.00	37.89
2308230	0.60 M		, y , n u					37	40	37		.y wa		38.00	
F.2	2.10 M			.1			.1	36	37	39				37.33	
E2 230x230	1.35 M		overe by wa			Covere by wa		40	39	38		overe y wa		39.00	38.56
	0.60 M		. j. 170.			., <b>.</b> , ., u	-	40	38	40		<i></i>		39.33	
E2	2.10 M					1		36	36	37				36.33	
E3 230x230	1.35 M		overe by wa			Covere by wa		40	38	39		overe y wa		39.00	38.22
	0.60 M		<u> </u>			<u> </u>		40	38	40		<u> </u>		39.33	
E5	2.10 M		overe	h		Covere	h	36	36	38		overe	d	36.67	
E3 230x230	1.35 M		overe oy wa			by wa		37	38	35		overe y wa		36.67	37.33
	0.60 M		<u> </u>					39	40	37				38.67	
E7	2.10 M	C	overe	ed	C	Covere	ed	35	37	34	C	overe	ed	35.33	36.22

230x230	1.35 M	ŀ	oy wa	11	ł	oy wa	11	36	38	36	ŀ	y wa	11	36.67	
	0.60 M							36	38	36				36.67	
	2.10 M							35	37	35	37	38	36	36.33	
E8 230x230	1.35 M		overe by wa		-	lovere by wal		36	40	39	38	40	37	38.33	37.72
2307230	0.60 M		y wa	11		y wa	11	40	39	37	37	39	39	38.50	
	2.10 M	39	38	40	37	38	37	36	39	37	37	35	34	37.25	
E9 230x230	1.35 M	37	40	39	37	40	38	39	40	38	38	40	38	38.67	38.06
2307230	0.60 M	40	36	39	38	37	39	38	39	39	36	38	40	38.25	
											A	verag	ge		34.07
			7	5 Re	eading	gs									

	de: 16 29' 53" Nof construction:					
		1900	Average R V	alue of colum	ns in each Flo	oor.
Sl. No.	Col. No. & size	Gr. Floor	1st Floor	2nd Floor	3rd Floor	Average
1	A1 230x230	37.22	38.56	37.67	38.22	37.92
2	A2 230x230	35.78	38.56	37.89	37.78	37.50
3	A4 230x230	38.56	38.06	35.74	38.83	37.80
4	A6 230x230	38.22	37.89	38.56	38.44	38.28
5	A8 230x230	38.75	37.44	38.22	38.78	38.30
6	A9 230x230	39.42	38.11	38.06	38.50	38.52
7	B1 230x230	38.44	0.00	0.00	0.00	9.61
8	B2 230x230	38.66	37.00	37.61	37.89	37.79
9	B4 230x230	38.94	37.28	37.44	38.00	37.92
10	B6 230x230	38.33	37.56	38.33	38.33	38.14
11	B8 230x230	39.00	38.89	38.94	38.61	38.86
12	B9 230x230	39.25	38.56	39.03	38.63	38.87
13	C1 230x230	37.56	0.00	0.00	0.00	9.39
14	C2 230x230	38.15	37.74	38.37	38.48	38.19

15	C8 230x230	38.58	37.67	38.56	38.04	38.21
16	C9 230x230	38.42	37.44	38.11	38.67	38.16
17	D2 230x230	37.89	37.44	38.44	38.56	38.08
18	D3 230x230	38.33	37.33	37.78	37.89	37.83
19	D5 230x230.	38.11	0.00	0.00	0.00	9.53
20	D7 230x230	38.17	37.11	37.67	38.33	37.82
21	D8 230x230	38.08	37.33	38.00	38.11	37.88
22	E1 230x230	38.11	37.22	38.33	37.89	37.89
23	E2 230x230	38.00	37.33	38.22	38.56	38.03
24	E3 230x230	38.67	38.33	38.67	38.22	38.47
25	E5 230x230	38.44	37.33	37.00	37.33	37.53
26	E7 230x230	37.33	36.56	37.22	36.22	36.83
27	E8 230x230	37.17	37.50	37.56	37.72	37.49
28	E9 230x230	36.83	36.92	38.39	38.06	37.55
		38.16	33.61	33.92	34.07	34.94

Residentia	l Building. (	(Sri R	anga	Sai '	Towe	rs) <mark>G</mark>	round	1 + 5 1	Uppeı	Floc	ors.				
Latitude: 1	.6° 31' 03"	N													
Longitude	: 80° 38' 23	" E													
Year of co	nstruction:	1997													
Floor Heig	t:					(	Grou	nd Fl	oor (3	3.00 I	Mts.H	[t.)			
C	R Value				R				nn fa						Ave.
Col. No.	location	1	North	1		East			South			West		Avg	R
& size	from FFL	E	Μ	Е	E	Μ	E	E	M	E	E	М	E	values	Value of Col.
	2.10 M	32	31	30	31	32	32	32	34	33	33	31	34	32.08	
A1 500x300	1.35 M	31	33	33	30	35	31	33	31	32	39	31	38	33.08	32.53
500x300	0.60 M	32	32	31	32	33	32	32	32	34	33	34	32	32.42	
	2.10 M	31	32	32		I		32	33	31			1	31.83	
A2 500x300	1.35 M	30	33	31		overe		34	31	32		overe		31.83	32.06
300x300	0.60 M	32	34	32	D	y wal	11	31	32	34		oy wa	11	32.50	
	2.10 M	33	31	32				30	32	29				31.17	
A3 500x300	1.35 M	34	31	35		overe		30	33	31		overe by wa		32.33	32.00
300x300	0.60 M	33	33	32	D	y wal	11	32	34	31		by wa	11	32.50	
	2.10 M	31	32	31				30	32	32				31.33	
A4 500x300	1.35 M	30	35	34		overe		31	34	33		overe		32.83	32.11
300x300	0.60 M	31	33	30	D	y wal	11	32	33	34		oy wa	11	32.17	
	2.10 M	31	33	30				32	31	30				31.17	
A5 500x300	1.35 M	29	34	30		overe y wal		32	33	32		overe by wa		31.67	31.72
J00X300	0.60 M	30	34	32		y wa	11	31	34	33		y wa	11	32.33	
	2.10 M	30	31	29				31	33	30				30.67	
A6 500x300	1.35 M	29	33	32		overe y wal		32	34	31		overe by wa		31.83	31.56
J00X300	0.60 M	31	34	32		y wa	11	32	33	31		y wa	11	32.17	
	2.10 M	31	32	31	37	31	31	30	31	31	31	33	31	31.67	
B1 500x300	1.35 M	33	34	32	32	33	29	33	32	30	30	34	32	32.00	32.03
5002500	0.60 M	31	33	30	33	34	31	32	34	32	33	34	32	32.42	
	2.10 M	31	33	30		•		30	31	30				30.83	
B2 500x300	1.35 M	32	33	31		overe y wal		33	32	32		overe by wal		32.17	31.67
2007200	0.60 M	31	33	31		y wa	11	32	34	31		y wa	ш	32.00	
	2.10 M	29	31	32				29	30	29			_	30.00	
B3 500x300	1.35 M	32	33	32		overe y wal		31	32	31		overe by wa		31.83	31.28
2007200	0.60 M	32	34	31		y wa	11	30	33	32		y wa	ш	32.00	
	2.10 M	30	32	30	_									30.67	
B4 500x300	1.35 M	30	33	31		overe y wal			overe y wal			lovere by wal		31.33	31.89
2004200	0.60 M	34	34	33		y wal	11		y wal	u		y wa		33.67	
_	2.10 M				30	33	31			_	31	32	31	31.33	
B5 500x300	1.35 M		overe y wal		31	34	30		overe y wal		30	33	32	31.67	32.00
JUUAJUU	0.60 M	ן ט	y wal	u	33	34	33		y wal	11	32	34	32	33.00	

	2.10 M							31	31	30				30.67	
B6	1.35 M		overe			overe		30	33	30		overe		31.00	31.33
500x300	0.60 M	b	y wa	11	b	y wal	1	32	34	31	ť	oy wal	ll	32.33	
	2.10 M	29	31	30	29	30	29	30	32	30	29	31	31	30.08	
C1	1.35 M	30	32	29	31	32	31	31	34	31	34	34	33	31.83	31.58
500x300	0.60 M	33	33	32	30	33	32	33	34	33	34	35	32	32.83	
	2.10 M	31	31	30				31	32	31				31.00	
C2	1.35 M	33	33	31		overe		33	33	32		overe		32.50	32.06
500x300	0.60 M	31	34	32	D	y wal	1	32	34	33	ľ	oy wal	11	32.67	
	2.10 M	30	30	31				31	32	31				30.83	
C3 500x300	1.35 M	30	31	31		overe y wal		N				lovere by wal		30.67	31.17
J00X300	0.60 M	32	33	32		y wai	1	No	o acce	ess	ι	y wa	11	32.33	
	2.10 M	32	33	32										32.33	
C4 500x300	1.35 M	NI.				overe y wal			overe y wal			lovere by wal			32.33
3002300	0.60 M		) acce	ess		y wai	u .		y wa			y wa			
~ •	2.10 M	~			30	31	30				31	32	30	30.67	
C5 500x300	1.35 M		overe y wal		30	33	29		overe y wal		32	33	32	31.50	31.78
000000	0.60 M	Ū	<i>y</i> a.		32	34	31		y na		32	35	35	33.17	
	2.10 M							30	32	29			1	30.33	
C6 500x300	1.35 M		overe y wal			overe y wal		32	33	31		overe by wal		32.00	31.56
2004200	0.60 M		<i>j</i> a.			j na		32	32	33		/ <b>j</b> ///a		32.33	
DI	2.10 M	29	31	29	31	32	31	32	33	32	31	31	30	31.00	
D1 500x300	1.35 M	34	33	33	30	33	30	30	33	31	30	32	32	31.75	32.03
2004200	0.60 M	34	35	32	34	33	34	33	34	31	33	33	34	33.33	
D2	2.10 M	30	29	31	31	33	31			1			1	30.83	
D2 500x300	1.35 M	32	33	31	33	33	32		overe y wal			overe by wal		32.33	32.33
	0.60 M	33	34	33	34	35	34					5		33.83	
D3	2.10 M	C	overe	d	31	33	31	30	33	32	6	overe	A	31.67	
500x300	1.35 M		y wal		32	34	34	30	34	33		by wal		32.83	32.61
	0.60 M		-		32	34	33	33	34	34		-		33.33	
D4	2.10 M		32	30	C	overe	đ	C	overe	d	C	overe	Ы	30.67	
500x300	1.35 M	32	33	30		y wal			y wal			by wal		31.67	31.67
	0.60 M	32	34	32					-			-	1	32.67	
D5	2.10 M	C	overe	ed	C	overe	d	C	overe	ed	31	32	32	31.67	
500x300	1.35 M		y wal			y wal			y wal		34	34	33	33.67	33.00
	0.60 M										33	35	33	33.67	
D6	2.10 M	С	overe	ed	С	overe	d	30	30	31	C	overe	d	30.33	
500x300	1.35 M		y wal			y wal		30	31	30		by wal		30.33	31.22
	0.60 M		•				•	33	34	32				33.00	
E1	2.10 M	29	30	29	29	31	30	32	33	33	31	32	32	30.92	
500x300	1.35 M	33	32	32	30	32	29	33	34	32	34	33	32	32.17	32.06
	0.60 M	33	34	33	30	33	32	33	34	31	34	35	35	33.08	
E2	2.10 M	30	31	30	31	32	32	31	32	31	32	33	32	31.42	<b></b>
500x300	1.35 M	30	32	31	34	34	33	32	33	32	31	33	32	32.25	32.17
	0.60 M	31	33	32	35	35	35	33	34	32	32	30	32	32.83	

	2.10 M	29	31	30				31	32	32	32	32	31	31.11	
E3	1.35 M	30	32	30		overe		32	32	32	32	33	32	31.67	31.85
500x300	0.60 M	30	32	32	b	y wal	1	33	34	33	33	34	34	32.78	01100
	2.10 M	32	30	30				30	32	31	31	34	31	31.25	
E4	1.35 M	30	31	30		overe		32	33	31	34	35	32	32.00	32.38
500x300	0.60 M	33	34	33	b	y wal	1	33	34	34	34	35	35	33.89	
	2.10 M	32	33	34	30	33	32	31	35	31	32	33	34	32.50	
E5	1.35 M	35	33	35	32	34	34	32	34	33	31	32	32	33.08	32.97
500x300	0.60 M	31	35	32	31	34	33	33	35	32	35	34	35	33.33	
	2.10 M	31	32	31	34	35	34	34	32	34	34	31	32	32.83	
E6 500x300	1.35 M	33	35	33	32	34	35	32	33	31	32	35	33	33.17	33.06
300x300	0.60 M	32	34	32	33	33	34	31	32	32	34	36	35	33.17	
	2.10 M	29	30	32	31	34	32	31	32	31	31	34	32	31.58	
F1 500x300	1.35 M	31	34	30	33	34	31	31	34	33	33	34	31	32.42	32.47
300x300	0.60 M	33	32	33	32	32	33	34	33	34	34	36	35	33.42	
	2.10 M	33	34	34	34	35	34	32	33	34	31	34	32	33.33	
F2 500x300	1.35 M	32	35	33	33	34	35	33	34	32	33	34	32	33.33	33.25
5002500	0.60 M	32	34	33	31	35	34	32	32	33	32	35	34	33.08	
	2.10 M	32	32	32	32	34	32	32	32	33	32	34	32	32.42	
F3 500x300	1.35 M	32	34	33	34	35	34	33	34	31	32	35	33	33.33	32.92
500A500	0.60 M	33	33	32	32	34	33	32	32	34	34	33	34	33.00	
	2.10 M	29	33	30	0			31	31	33				31.17	
F4 500x300	1.35 M	33	34	32		overe y wal		32	34	32		overe by wal		32.83	32.39
500A500	0.60 M	34	33	34		<i>y</i>		33	32	33		y wa		33.17	
	2.10 M	32	31	32	33	31	30	31	30	30	32	33	32	31.42	
F5 500x300	1.35 M	30	32	30	33	34	33	32	34	33	33	34	31	32.42	32.17
	0.60 M	32	33	31	34	32	34	33	32	32	32	34	33	32.67	
Eć	2.10 M	30	34	30	C		J	30	34	33		1	.a	31.83	
F6 500x300	1.35 M	33	35	33		overe y wal		32	34	31		overe by wal		33.00	32.47
	0.60 M		addir	<u> </u>				33	32	33				32.67	
G1	2.10 M	32	33	31	31	33	32	32	32	31	31	29	30	31.42	
500x300	1.35 M	33	34	32	32	34	32	32	33	32	31	33	32	32.50	32.08
	0.60 M	32	34	31	31	33	31	31	34	32	32	34	33	32.33	
G2	2.10 M	31	30	31	30	33	30	33	32	32	31	32	31	31.33	
500x300	1.35 M	32	34	32	32	33	32	31	33	32	30	34	31	32.17	32.06
	0.60 M	32	32	34	30	32	31	33	34	33	34	33	34	32.67	
G4	2.10 M	30	30	31	C	overe	d	33	30	32	C	overe	d	31.00	
500x300	1.35 M	31	32	32		y wal		32	34	30		by wal		31.83	32.11
	0.60 M	32	34	33				33	35	34		-	1	33.50	
G5	2.10 M	31	31	32	32	33	32	32	31	32	30	32	31	31.58	
500x300	1.35 M	32	33	34	33	34	31	30	34	33	31	33	32	32.50	32.22
	0.60 M	32	34	33	32	34	32	31	33	32	32	34	32	32.58	
НЗ	2.10 M	31	32	31	31	32	32	32	33	31	32	32	31	31.67	
500x300	1.35 M	32	32	33	32	33	31	32	33	32	33	34	32	32.42	32.19
	0.60 M	34	33	32	33	34	32	31	32	32	32	32	33	32.50	

	2.10 M	31	33	31			_	31	33	32			_	31.83	
H6 500x300	1.35 M	32	32	33		overe y wal		33	34	32		overe by wal		32.67	32.40
5002500	0.60 M	C	laddii	ıg		y wa	u	32	34	33	, i	y wa	u	33.00	
11	2.10 M	32	32	31	31	34	30	31	32	31	32	32	33	31.75	
I1 500x300	1.35 M	32	33	32	32	35	32	32	34	32	33	34	32	32.75	32.50
00011000	0.60 M	34	33	34	31	34	32	33	31	33	34	33	34	33.00	
10	2.10 M	32	31	32	31	32	32	30	31	31	30	32	33	31.42	
I2 500x300	1.35 M	32	33	31	32	34	33	33	34	33	31	33	32	32.58	32.11
00011000	0.60 M	31	33	32	33	33	32	32	34	32	32	31	33	32.33	
12	2.10 M	34	31	32	31	32	31	31	32	32	31	32	31	31.67	
I3 500x300	1.35 M	33	35	34	31	35	32	32	35	32	30	35	33	33.08	32.25
	0.60 M	33	33	32	32	33	32	31	33	31	31	31	32	32.00	
J4	2.10 M	32	31	32	30	32	30			1			1	31.17	
500x300	1.35 M	32	35	34	31	35	31		overe y wal			overe by wal		33.00	32.33
00011000	0.60 M	31	34	32	33	34	33		J					32.83	
15	2.10 M			1	31	32	31			1	31	32	32	31.50	
J5 500x300	1.35 M	-	overe y wal		33	35	33	-	overe y wal		32	34	33	33.33	32.39
00011000	0.60 M		J		32	34	32				32	32	32	32.33	
I.	2.10 M				32	32	31	31	31	32			1	31.50	
J6 500x300	1.35 M		overe y wal		33	34	33	32	33	34	-	overe by wal		33.17	32.56
2001200	0.60 M				32	34	32	33	34	33		.,u		33.00	
															32.14
					14	2 R	eadin	igs							

					1 <sup>st</sup> I	Floor (	3.00 N	Mts.H	t.)						
	R Value				R	Value	of Co	olumn	face						Ave.
Col. No.	location		North			East			South			West	t	Avg	R Value
& size	from FFL	E	М	Е	E	М	E	E	М	E	Е	М	E	values	of Col.
	2.10 M					~		29	31	29			1	29.67	
A1 500x300	1.35 M	N	o acce	SS		Covere by wal		31	32	30	-	Covere by wa		31.00	31.11
2004200	0.60 M					og mai	•	32	33	33		, , , , , , , , , , , , , , , , , , ,		32.67	
	2.10 M	30	31		31	30	31				30.67				
A2 500x300	1.35 M	32	33	29	33	32	32	33	32	33	-	Covere by wa		32.11	32.00
500A500	0.60 M	33	34	32	34	34	34	32	34	32		<i>y</i>		33.22	
	2.10 M	29	31	29		~								29.67	
A3 500x300	1.35 M	33	33	31		Covere by wal		N	o acce	SS	-	Covere by wa		32.33	31.67
2004200	0.60 M	32	34	33		oy wai	•					<i>y</i>		33.00	
	2.10 M					~		30	31	29				30.00	
A4 500x300	1.35 M	N	o acce	SS		Covere by wal		33	33	32	-	Covere by wa		32.67	31.89
500A500	0.60 M					oy wai		34	34	31		<i>y</i>		33.00	
	2.10 M	29	32	31	30	30	31	29	31	29				30.22	
A5 500x300	1.35 M	32	33	32	32	33	34	29	31	30	-	Covere by wa		31.78	31.52
5002500	0.60 M	32	34	31	33	35	34	31	32	31		, wa		32.56	

	2.10 M							30	32	30				30.67	
A6	1.35 M		Covere			Covere		33	32	31	N	o acce	222	32.00	32.11
500x300	0.60 M	ł	oy wal	1	1	by wal	1	33	34	34		Jucci	000	33.67	52.11
	2.10 M							30	32	31				31.00	
B1	1.35 M	N	o acce	\$5		Covere		31	32	30		overe		31.00	31.44
500x300	0.60 M		o ucce	55	1	by wal	1	31	34	32	b	y wa	11	32.33	51.11
	2.10 M	30	31	30	29	31	30	30	32	30	31	32	33	30.75	
B2		30	32	30	31	33	31	33	34	31	32	34	32	32.42	32.17
500x300	1.35 M 0.60 M	33	34	33	34	33	32	33	34	33	32	35	32	33.33	32.17
		29	31	29	54	55	52	55	54	55	55	55	55	29.67	
B3	2.10 M	30	33	32		Covere		N	o acce	cc		overe		31.67	31.22
500x300	1.35 M 0.60 M	31	34	32	1	by wal	1	1		33	b	y wa	11	32.33	51.22
	2.10 M	51	51	52				30	31	31				30.67	
B4	1.35 M	N	o acce	cc		Covere		32	31	32		overe		31.67	31.89
500x300	0.60 M		o dece	55	1	by wal	1	32	33	35	b	y wa	11	33.33	51.09
	2.10 M	32	31	32	30	31	31	31	32	30	30	31	29	30.83	
B5	1.35 M	31	33	32	32	33	33	32	33	30	29	32	31	31.75	31.94
500x300	0.60 M	34	34	35	35	33	34	33	35	33	30	31	32	33.25	01171
	2.10 M	30	31	29										30.00	
B6	1.35 M	32	33	29		Covere		N	o acce	SS		overe		31.33	31.78
500x300	0.60 M	34	33	35		by wal	l				b	y wa	II	34.00	
	2.10 M	_						30	31	29				30.00	
C1	1.35 M	N	o acce	SS		Covere		31	32	30		overe		31.00	31.22
500x300	0.60 M					by wal	l	32	33	33	b	y wa	11	32.67	
	2.10 M	29	30	29	30	31	29	29	31	30	30	32	30	30.00	
C2	1.35 M	32	33	31	33	34	33	30	33	32	30	33	29	31.92	31.61
500x300	0.60 M	33	35	32	34	33	33	32	34	32	31	34	32	32.92	
	2.10 M	30	29	31		1		30	31	29		1	1	30.00	
C3	1.35 M	31	33	31		Covere		31	33	32		overe		31.83	31.39
500x300	0.60 M	32	34	32		by wal	I	33	31	32		y wa	11	32.33	
	2.10 M	30	31	30				29	32	30				30.33	
C4 500x300	1.35 M	32	34	33		Covere by wal		32	33	32		overe vy wa		32.67	32.11
500x500	0.60 M	33	35	33		by war	L	32	34	33		iy wa	11	33.33	
~ -	2.10 M	30	31	31	30	32	31	29	32	32	30	31	33	31.00	
C5 500x300	1.35 M	29	34	32	32	35	33	33	34	33	33	32	32	32.67	32.39
5007500	0.60 M	32	34	33	31	35	33	34	35	34	33	34	34	33.50	
	2.10 M	31	32	32		~					-			31.67	
C6 500x300	1.35 M		المطالبة ا	~		Covere by wal		N	o acce	SS		overe vy wa			31.67
500,500	0.60 M		laddin	g		- wai	•					., wa			
DI	2.10 M				29	31	29	30	33	29	_		.1	30.17	
D1 500x300	1.35 M	N	o acce	SS	31	32	32	32	34	32		overe y wa		32.17	31.78
2001000	0.60 M				32	33	34	32	33	34		,u		33.00	
	2.10 M		1. Arrent	J	28	30	31		10777 ···	J	31	31	29	30.00	
D2 500x300	1.35 M		Covered by wall		31	33	32		overe by wal		30	32	30	31.33	31.17
2 2 0 1 2 0 0 0	0.60 M		5an		32	34	32				31	33	31	32.17	

	2.10 M				30	32	30	29	31	29				30.17	
D3	1.35 M		Covered		31	34	30	30	33	31		overe		31.83	31.61
500x300	0.60 M	1	oy wall	l	32	35	33	32	33	32	b	y wa	11	32.83	51.01
	2.10 M	29	32	30	30	31	29	30	33	30				30.44	
D4	1.35 M	31	33	31	31	32	30	30	34	29		overe		31.44	31.41
500x300	0.60 M	33	35	30	32	33	33	33	32	30	b	oy wa	11	32.33	51.11
	2.10 M	30	30	31	52	55	55	31	32	29	30	31	31	30.56	
D5	1.35 M	31	33	31	N	o acce	ss	33	34	33	34	33	32	32.67	32.15
500x300	0.60 M	32	34	32				32	35	33	34	35	32	33.22	02.10
	2.10 M	31	34	30				52	55	55			-	31.67	
D6	1.35 M		1		N	o acce	SS	N	o acce	SS		overe			31.67
500x300	0.60 M	C	laddin	g							b	oy wa	11		
	2.10 M							30	31	31	30	32	29	30.50	
E1	1.35 M	N	o acces	SS		Covere		32	33	30	31	32	31	31.50	31.28
500x300	0.60 M				l	by wal	l	31	34	31	30	34	31	31.83	
	2.10 M	30	30	29	29	31	30	31	32	31	31	32	30	30.50	
E2 500x300	1.35 M	31	33	29	32	34	32	33	33	32	32	33	32	32.17	31.69
300x300	0.60 M	31	32	30	33	33	34	34	32	34	31	34	31	32.42	
	2.10 M	29	30	28				30	32	30	29	30	29	29.67	
E3 500x300	1.35 M	31	32	30		Covere by wal		33	34	32	32	33	32	32.11	31.41
3002300	0.60 M	32	33	32		by wai	L	31	33	32	32	34	33	32.44	
	2.10 M	30	32	29		7		29	31	30	28	29	28	29.56	
E4 500x300	1.35 M	32	33	33		Covere by wal		32	34	31	32	35	32	32.67	31.85
5002500	0.60 M	31	35	32		by war		33	35	34	33	34	33	33.33	
	2.10 M	29	31	29	30	31	29	30	31	31				30.11	
E5 500x300	1.35 M	30	31	30	31	33	29	30	33	30	No	o acce	ess	30.78	31.04
00011000	0.60 M	32	33	32	32	34	30	31	34	32				32.22	
EC	2.10 M	30	31	29		۹	ı							30.00	
E6 500x300	1.35 M	29	33	31		Covere by wal		N	o acce	SS	No	o acce	ess	31.00	31.11
	0.60 M	31	34	32			_							32.33	
E1	2.10 M					·	L	28	30	28			. 1	28.67	
F1 500x300	1.35 M	N	o acces	SS		Covere by wal		30	33	31		overe by wa		31.33	30.89
	0.60 M					-		32	34	32		-	1	32.67	
F2	2.10 M	29	30	30	29	31	30	30	31	31	31	32	30	30.33	
500x300	1.35 M	32	33	32	29	34	32	33	34	32	32	35	32	32.50	31.78
	0.60 M	33	32	33	30	32	31	31	35	32	33	35	33	32.50	
F3	2.10 M	31	30	30	C	Covere	h					overe	•d	30.33	
500x300	1.35 M	32	32	31		by wal		N	o acce	SS	1	by wa		31.67	31.56
	0.60 M	33	34	31		-			1					32.67	
F4	2.10 M				C	Covere	h	30	30	31		overe	•d	30.33	
500x300	1.35 M	N	o acces	SS		by wal		31	33	30	1	y wa		31.33	31.33
	0.60 M			1		-		32	34	31		1	1	32.33	
F5	2.10 M	30	29	30	30	32	31	30	32	29	29	32	30	30.33	
500x300	1.35 M	28	30	29	32	32	31	31	32	33	31	34	32	31.25	31.39
	0.60 M	31	30	30	33	34	33	34	33	34	32	34	33	32.58	

	2.10 M	28	30	29										29.00	
F6	1.35 M	31	33	31		Covere		N	o acce	SS		overe		31.67	31.22
500x300	0.60 M	33	34	32		by wal	1				b	y wa	11	33.00	
	2.10 M		5.	02				30	32	30				30.67	
G1 500x300	1.35 M	N	o acce	SS		Covere		32	33	30		overe		31.67	31.89
300x300	0.60 M					by wal	1	33	34	33		y wa	11	33.33	
	2.10 M	29	31	29	28	30	30	30	31	29	32	32	30	30.08	
G2 500x300	1.35 M	32	33	30	30	32	31	32	33	30	32	34	31	31.67	31.44
300x300	0.60 M	33	34	32	32	33	32	33	33	34	31	33	31	32.58	
	2.10 M							29	32	29				30.00	
G4 500x300	1.35 M	N	o acce	SS		Covere by wal		33	34	32		overe y wa		33.00	31.89
5002500	0.60 M					by wai	1	32	34	32		y wa	11	32.67	
	2.10 M	29	30	29	30	32	32	30	31	29	30	30	29	30.08	
G5 500x300	1.35 M	32	32	32	31	33	31	30	33	30	31	33	29	31.42	31.42
5002500	0.60 M	31	35	33	33	34	32	31	34	31	33	34	32	32.75	
	2.10 M	31	33	29							~			31.00	
H3 500x300	1.35 M		1	~		Covere by wal		N	o acce	SS		overe y wa			31.00
2001200	0.60 M		laddin	g		oy war	•					<i>y</i>			
ш	2.10 M	31	34	30		~	1							31.67	
H6 500x300	1.35 M		laddin	a		Covere by wal		N	o acce	SS		overe y wa			31.67
2004200	0.60 M	C	lauuiii	g			•					<i>y</i>			
11	2.10 M				30	32	29	29	31	30			.1	30.17	
I1 500x300	1.35 M	N	o acce	SS	31	33	32	31	32	32		overe y wa		31.83	31.27
	0.60 M				32	33	31	32	33	30		J		31.83	
12	2.10 M	30	32	31	29	31	30	30	31	29	30	32	30	30.42	
500x300	1.35 M	31	32	30	29	32	29	30	32	31	30	33	31	30.83	31.03
	0.60 M	33	33	30	32	34	30	31	32	31	32	34	30	31.83	
13	2.10 M	31	31	30	29	31	30				C	overe	d	30.33	
500x300	1.35 M	31	32	31	31	33	31	N	o acce	SS	-	overe v wa		31.50	31.17
	0.60 M	32	34	30	32	32	30			1				31.67	
J4	2.10 M				30	31	31	29	31	31	C	overe	d	30.50	
500x300	1.35 M	N	o acce	SS	31	33	31	30	32	31		overe y wa		31.33	31.06
	0.60 M				30	32	31	31	32	32		-		31.33	
J5	2.10 M	31	32	31	30	31	29	29	31	29	30	32	31	30.50	
500x300	1.35 M	30	34	30	31	32	31	30	34	30	30	32	31	31.25	31.36
	0.60 M	32	33	32	31	34	31	32	33	32	32	34	32	32.33	
J6	2.10 M	31	33	32	29	31	30				C	overe	h	31.00	
500x300	1.35 M	C	laddin	g	30	32	31	N	o acce	SS		y wa		31.00	31.08
	0.60 M			0	31	33	30			1		-		31.33	
															31.54
					136	Read	ings								

					2 <sup>nd</sup>	Floor	· (3.0	0 Mts	.Ht.)						
	R Value	R Value of Column face           North         East         South         West					_	Ave. R							
Col. No.	location	1	North	1		East	I		South	1		West	;	Avg	K Value
& size	from FFL	E	М	E	E	Μ	Е	E	М	E	E	М	Е	values	of Col.
A 1	2.10 M						1	29	30	29			1	29.33	
A1 500x300	1.35 M	No	o acce	ess		overe v wal		31	32	31		overe by wa		31.33	31.00
00011000	0.60 M							32	33	32				32.33	
	2.10 M	30	30	31	30	30	29	29	30	30				29.89	
A2 500x300	1.35 M	29	32	29	32	33	32	32	33	32		overe by wa		31.56	31.41
2008200	0.60 M	32	34	31	33	34	33	33	34	31		, ya		32.78	
	2.10 M	30	31	29										30.00	
A3 500x300	1.35 M	32	32	31		overe y wal		N	o acce	ess		overe by wa		31.67	31.56
500,500	0.60 M	32	34	33		y wa	.1					,y wa		33.00	
	2.10 M							29	31	29				29.67	
A4 500x300	1.35 M	No	o acce	ess		overe y wal		32	33	31		overe by wa		32.00	31.44
500x500	0.60 M	]				y wa	11	32	35	31		y wa	11	32.67	
	2.10 M	29	32	29	30	30	31	30	31	29			_	30.11	
A5 500x300	1.35 M	31	33	32	32	33	33	29	33	30		overe by wa		31.78	31.41
300x300	0.60 M	32	35	31	32	34	32	30	34	31		y wa	11	32.33	
	2.10 M						1	29	31	30				30.00	
A6 500x300	1.35 M		overe			overe		31	35	31	No	o acce	ess	32.33	31.78
300x300	0.60 M		y wa	11		y wa	11	33	34	32				33.00	
	2.10 M							30	32	30				30.67	
B1 500x300	1.35 M	No	o acce	ess		overe y wal		31	32	29		overe by wa		30.67	31.33
300x300	0.60 M					iy wa	11	32	34	32		y wa	11	32.67	
	2.10 M	30	31	29	29	31	30	30	32	29	29	32	30	30.17	
B2 500x300	1.35 M	31	31	32	31	32	31	33	33	31	32	34	32	31.92	31.19
300x300	0.60 M	30	34	31	30	32	32	31	34	30	31	32	31	31.50	
	2.10 M	29	31	30			I			1		I		30.00	
B3	1.35 M	31	33	32		overe		N	o acce	ess		overe		32.00	31.56
500x300	0.60 M	31	35	32		y wa	ll				t	oy wa	11	32.67	
	2.10 M							30	30	29				29.67	
B4	1.35 M	No	o acce	ess		overe		32	33	32		overe		32.33	31.89
500x300	0.60 M				C	y wal	11	34	33	34		oy wa	11	33.67	
	2.10 M	31	31	30	30	31	30	29	32	30	29	31	29	30.25	
B5	1.35 M	31	33	32	32	33	32	31	33	31	29	33	31	31.75	31.72
500x300	0.60 M	34	35	33	35	34	34	33	34	33	30	34	29	33.17	
	2.10 M	30	31	30		I	I		1	<u> </u>		I	I	30.33	
B6	1.35 M	32	33	30		overe		N	o acce	ess		overe		31.67	31.44
500x300	0.60 M	31	33	33	b	y wa	11					oy wa	11	32.33	
	2.10 M			1				29	31	29				29.67	
C1	1.35 M	No	o acce	ess		overe		32	32	30		overe		31.33	31.33
500x300	0.60 M				b	y wa	11	32	34	33	t	oy wa	11	33.00	- 1.00
C2	2.10 M	29	31	30	30	31	29	29	31	30	29	30	29	29.83	31.44

500x300	1.35 M	32	33	31	33	35	33	30	33	32	30	32	30	32.00	
	0.60 M	34	34	32	34	32	33	31	32	32	31	33	32	32.50	
	2.10 M	30	29	29	51	52	55	29	31	29	51	55	52	29.50	
C3	1.35 M	31	33	30		overe		31	33	32		overe		31.67	31.11
500x300	0.60 M	31	32	32	b	y wa	1	33	34	31	b	y wal	11	32.17	51.11
	2.10 M	30	31	31				31	32	30				30.83	
C4	1.35 M	32	35	33		overe		31	33	31		overe		32.50	32.06
500x300	0.60 M	32	34	32	b	y wa	1	32	34	33	b	y wal	11	32.83	52.00
	2.10 M	30	32	29	29	32	30	29	32	31	29	31	30	30.33	
C5	1.35 M	31	34	31	32	34	33	32	33	32	33	33	32	32.50	32.03
500x300	0.60 M	32	34	32	31	33	33	34	36	34	32	34	34	33.25	02.00
	2.10 M	30	32	31								•		31.00	
C6	1.35 M		-	-		overe		N	o acce	ess		overe			31.00
500x300	0.60 M	C	laddiı	ng	b	y wa	l				b	y wal	ll		
	2.10 M				29	30	29	30	33	30				30.17	
D1	1.35 M	No	o acce	ess	31	32	31	32	33	32		overe		31.83	31.61
500x300	0.60 M	1			32	34	33	32	32	34	b	y wal	ll	32.83	_
	2.10 M				28	30	29		1	1	30	31	29	29.50	
D2	1.35 M	1	overe		30	31	32		overe		30	33	31	31.17	30.89
500x300	0.60 M	b	oy wa	11	31	34	31	l t	y wa	11	31	33	32	32.00	
	2.10 M				29	31	30	30	31	29				30.00	
D3	1.35 M		overe		31	33	32	30	32	31		overe		31.50	31.28
500x300	0.60 M		oy wa	11	31	35	31	31	34	32	0	y wal	LI .	32.33	
	2.10 M	29	32	31	30	30	29	30	32	30				30.33	
D4	1.35 M	31	32	30	31	32	30	32	33	31		overe		31.33	31.11
500x300	0.60 M	32	35	30	31	33	31	31	32	30		y wal	II	31.67	
	2.10 M	30	30	29				30	31	29	30	30	31	30.00	
D5	1.35 M	30	33	31	No	o acce	ss	33	34	33	32	33	31	32.22	31.59
500x300	0.60 M	32	34	31				31	33	32	34	34	32	32.56	
	2.10 M	31	32	30										31.00	
D6 500x300	1.35 M	G			No	o acce	ss	N	o acce	ess		overe y wal			31.00
300x300	0.60 M		laddiı	ng							U	iy wal	11		
	2.10 M							29	31	30	30	31	29	30.00	
E1 500x300	1.35 M	No	o acce	ess		overe y wal		32	32	30	30	32	31	31.17	31.00
500,500	0.60 M	1				y wa	u	32	34	31	30	33	31	31.83	
	2.10 M	29	30	29	30	31	30	30	32	30	29	31	29	30.00	
E2 500x300	1.35 M	31	32	29	32	33	32	31	32	32	32	32	30	31.50	31.17
5004500	0.60 M	30	31	30	33	33	32	33	34	33	31	33	31	32.00	
52	2.10 M	29	30	29				30	31	29	29	30	30	29.67	
E3 500x300	1.35 M	32	31	30		overe y wal		33	32	32	32	34	32	32.00	31.11
500/200	0.60 M	32	32	31				30	33	32	31	33	31	31.67	
<b>F</b> 4	2.10 M	30	32	30			1	29	31	29	29	30	28	29.78	
E4 500x300	1.35 M	32	33	32		overe y wal		31	33	31	32	34	32	32.22	31.48
2001200	0.60 M	31	34	32		<i>,</i>		33	34	32	32	33	31	32.44	
E5	2.10 M	30	31	29	30	30	28	29	31	30	No	o acce	ess	29.78	31.00

500x300	1.35 M	30	33	31	31	34	29	30	33	30				31.22	
	0.60 M	32	32	32	32	32	30	31	35	32				32.00	
	2.10 M	30	30	29			00	01		02				29.67	
E6	1.35 M	29	33	30		overe		N	o acce	288	N	o acce	ess	30.67	30.89
500x300	0.60 M	31	35	31	b	y wa	11		Juce		1	s ucce		32.33	50.07
	2.10 M	51	55	51				29	31	28				29.33	
F1	1.35 M	No	o acce	ess		overe		30	35	31		overe		32.00	31.67
500x300	0.60 M				b	y wa	11	32	35	34	b	y wa	1	33.67	01107
	2.10 M	29	31	30	30	31	30	30	31	30	31	31	30	30.33	
F2	1.35 M	30	33	32	29	34	31	32	33	32	31	35	32	32.00	31.61
500x300	0.60 M	32	34	32	30	33	31	31	35	32	33	34	33	32.50	
	2.10 M	29	30	30			I							29.67	
F3	1.35 M	32	33	31		overe		N	o acce	ess		overe		32.00	31.11
500x300	0.60 M	31	34	30		y wa	11				C	y wa	LI .	31.67	
	2.10 M							30	30	29				29.67	
F4 500x300	1.35 M	No	o acce	ess		overe y wal		29	33	30		overe y wa		30.67	30.44
300x300	0.60 M				U	iy wa	11	31	32	30		y wa	11	31.00	
	2.10 M	29	30	30	30	31	30	29	30	28	29	31	30	29.75	
F5 500x300	1.35 M	29	32	29	32	33	31	31	34	33	31	35	32	31.83	31.28
5002500	0.60 M	31	31	30	31	34	31	34	33	34	32	34	32	32.25	
	2.10 M	28	29	29										28.67	
F6 500x300	1.35 M	30	33	31		overe v wal		N	o acce	ess		overe v wa		31.33	30.89
3002300	0.60 M	31	35	32		y wa						y wa	.1	32.67	
~ 1	2.10 M							29	32	30				30.33	
G1 500x300	1.35 M	No	o acce	ess		overe y wal		32	33	29		overe by wa		31.33	31.33
500/2500	0.60 M					.y .ru		32	33	32		, y wa		32.33	
	2.10 M	30	30	29	29	30	30	29	31	29	30	31	29	29.75	
G2 500x300	1.35 M	32	32	31	30	33	30	32	31	32	32	34	32	31.75	31.39
2004200	0.60 M	32	35	32	31	34	32	32	34	32	33	32	33	32.67	
C1	2.10 M						1	29	31	29			1	29.67	
G4 500x300	1.35 M	No	o acce	ess	-	overe v wal		31	34	32		overe v wa		32.33	31.67
	0.60 M		-					32	35	32			-	33.00	
G5	2.10 M	30	30	29	30	32	29	30	31	30	30	31	29	30.08	
500x300	1.35 M	31	33	32	31	32	30	30	33	32	30	32	31	31.42	31.11
	0.60 M	32	34	31	30	33	30	31	32	32	33	33	31	31.83	
НЗ	2.10 M	31	33	31		overe	d					overe	d	31.67	
500x300	1.35 M	C	laddiı	ıg		overe y wal		N	o acce	ess		overe oy wa			31.67
	0.60 M		-	-											
H6	2.10 M	30	34	31	C	overe	d					overe	d	31.67	
500x300	1.35 M	C	laddii	ng		y wal		N	o acce	ess		by wa			31.67
	0.60 M			0		-						•			
I1	2.10 M				30	32	29	30	31	29		overe	bd	30.17	
500x300	1.35 M	No	o acce	ess	31	34	32	30	32	31		by wa		31.67	31.11
	0.60 M				31	33	31	31	33	30		-		31.50	
I2	2.10 M	30	31	30	30	31	29	30	31	30	30	31	29	30.17	31.31

500x300	1.35 M	30	32	30	29	33	30	31	34	30	33	32	32	31.33	
	0.60 M	31	34	32	31	34	31	32	35	32	31	35	31	32.42	
	2.10 M	31	30	29	30	31	29							30.00	
I3 500x300	1.35 M	31	33	31	31	33	30	N	o acce	ess	-	overe v wal		31.50	31.11
500,500	0.60 M	32	33	31	31	34	30					, y wa		31.83	
TA	2.10 M				30	30	30	29	31	30			1	30.00	
J4 500x300	1.35 M	No	o acce	ess	32	32	33	30	33	31	-	overe v wal		31.83	31.39
500,500	0.60 M				30	35	31	31	35	32		, y wa		32.33	
	2.10 M	29	32	30	30	30	29	30	30	29	29	32	30	30.00	
J5 500x300	1.35 M	31	33	30	31	33	32	29	33	29	30	34	32	31.42	31.33
500,500	0.60 M	33	34	31	32	34	32	32	35	32	31	34	31	32.58	
I.C.	2.10 M	31	33	31	31	32	30						1	31.33	
J6 500x300	1.35 M	C	laddia		30	33	31	N	o acce	ess		overe v wal		31.33	31.42
500,500	0.60 M		laddii	ig	31	34	30					, y wa		31.67	
															31.34
					1.	36 Re	eading	gs							

				3rd	Floo	r (3.0	0 Mt	s.Ht.)						
<u>a</u> L N	R Value				R	Valu	ie of (	Colur	nn fa	ce				Ave.
Col. No. & size	location from	]	North	1		East			South	1		West	t.	R Value
CC SIZC	FFL	Е	М	E	E	М	Е	Е	М	E	Е	M	E	of Col.
	2.10 M							30	30	29			1	
A1 500x300	1.35 M	N	o acce	ess		overe y wa		33	33	32	-	lover by wa		31.44
	0.60 M							32	32	32		, <b>j</b>		
A2	2.10 M	29	30	30	30	31	29	30	30	29			. 1	
A2 500x300	1.35 M	29	33	29	32	32	33	32	34	33	-	lover by wa		31.70
	0.60 M	33	34	32	34	34	33	33	34	34		· · · ·		
4.2	2.10 M	29	31	30			. 1					1	1	
A3 500x300	1.35 M	32	33	32		overe v wa		N	o acce	ess		over v wa		31.78
	0.60 M	32	34	33			••					, <b>j</b>		
A4	2.10 M						.1	29	30	29			. 1	
A4 500x300	1.35 M	N	o acce	ess	-	overe v wa		31	34	30		overe by wa		31.22
	0.60 M					J		33	34	31		· · · ·		
A5	2.10 M	30	30	29	30	31	30	30	31	31		lover	. 1	
A3 500x300	1.35 M	31	33	31	31	34	33	29	32	31		overo vy wa		31.30
	0.60 M	32	34	31	32	30	32	32	33	32		5		
A6	2.10 M		overe			overe	. 1	29	32	31				
A6 500x300	1.35 M	-	overe oy wa		-	overe v wa		31	33	30	N	o acco	ess	31.56
	0.60 M		J			<u> </u>		32	34	32				
D1	2.10 M						. 1	29	32	29		1	. 1	
B1 500x300	1.35 M	N	o acce	ess	-	overe v wa		31	33	30	-	over v wa		31.22
	0.60 M		1	I		<u> </u>		31	34	32			1	
B2	2.10 M	30	31	30	30	31	31	29	31	29	30	32	30	31.56

500x300	1 25 M	32	33	32	31	33	32	32	35	31	32	33	31	
	1.35 M 0.60 M	35	34	34	31	32	31	31	33	30	30	33	31	
		29	31	29	51	32	51	51	55	50	50	55	51	
B3	2.10 M	32	34	32	C	overe	ed	N	o acce		C	overe	ed	31.89
500x300	1.35 M 0.60 M	33	35	32	b	y wa	11	110		288	b	y wa	11	31.89
		33	35	32				20	31	29				
B4	2.10 M				C	overe	d	29	-		C	overe	ed	21.70
500x300	1.35 M	INC	o acce	ess	b	y wa	11	32	35	32	b	y wa	11	31.78
	0.60 M	20	21	20	20	21	20	32	33	33	20	20	20	
B5	2.10 M	29	31	30	30	31	29	29	30	30	29	30	29	21.50
500x300	1.35 M	31	33	31	32	33	32	31	32	32	29	33	31	31.50
	0.60 M	32	35	33	33	35	34	33	34	33	31	35	29	
B6	2.10 M	31	32	30	C	overe	d					overe	h	
500x300	1.35 M	31	33	31		y wa		N	o acce	ess		y wa		31.78
	0.60 M	32	34	32					1					
C1	2.10 M	-			C	overe	b	30	29	29	C	overe	ed	
500x300	1.35 M	No	o acce	ess		y wa		31	33	30		y wa		30.78
	0.60 M					-		31	32	32		-		
C2	2.10 M	29	31	30	29	31	29	31	31	30	29	31	29	
500x300	1.35 M	33	31	32	33	34	30	30	34	31	30	35	30	31.33
	0.60 M	32	34	32	30	33	29	31	35	32	31	34	32	
C2	2.10 M	29	29	30				30	30	29				
C3 500x300	1.35 M	30	33	31		overe y wa		31	32	32		overe v wa		31.06
	0.60 M	31	34	32		J		32	33	31		J		
<u>.</u>	2.10 M	29	31	30				30	32	29				
C4 500x300	1.35 M	31	35	32		overe y wa		30	34	31		overe v wa		31.50
500A500	0.60 M	30	35	31		.y wa		31	34	32		.y wa		
	2.10 M	30	32	31	29	29	30	29	30	31	29	30	30	
C5 500x300	1.35 M	32	34	31	32	33	33	31	32	32	32	31	32	31.42
5004500	0.60 M	29	32	30	30	32	32	33	34	33	32	35	34	
	2.10 M	31	33	31										
C6 500x300	1.35 M	C	1 1 1.		-	overe y wa		N	o acce	ss		overe y wa		31.67
500,500	0.60 M		laddii	ng		y wa						y wa		
DI	2.10 M				30	31	29	29	32	29			1	
D1 500x300	1.35 M	No	o acce	ess	30	31	31	32	32	32		overe y wa		31.11
500000	0.60 M				31	33	32	32	33	31				
	2.10 M				29	30	29				30	29	29	
D2 500x300	1.35 M		overe y wa		30	33	32		overe by wal		30	34	32	31.22
5001300	0.60 M		y wa	u	32	35	31		y wa	u	31	33	33	
	2.10 M	_		1	29	30	30	30	31	30	-		1	
D3 500x300	1.35 M		overe y wa		31	33	32	30	34	31		overe y wa		31.39
5004500	0.60 M		y wa	u	32	34	31	31	34	32		y wa	11	
	2.10 M	30	31	30	29	31	30	30	29	30				
D4 500x300	1.35 M	32	33	32	31	33	32	31	34	32		overe y wa		31.48
3002300	0.60 M	33	33	32	31	35	31	31	32	32		y wa	11	
D5	2.10 M	29	30	29		o acce	•	29	31	30	29	30	29	31.48

$\begin{array}{c c c c c c c c c c c c c c c c c c c $	31         32         31.33         29         31         30         30         30         30         30         30         30         30         30         30         30         30         31
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	31.33       29       31       30       30       30       30       30       30       30       30       30       30       30       30       30       30       30       30       30       30       30
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	29     30.94       31     30.94       31     30.94       30     31.33       30     30.94       32     30.96
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	29     30.94       31     30.94       31     30.94       30     31.33       30     30.94       32     30.96
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	31     30.94       31     30.94       31     30       30     31.33       30     30       32     30.96
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	31     30.94       31     30.94       31     30       30     31.33       30     30       32     30.96
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	31       29       30     31.33       30       30       30       32       30.96
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	29         31.33           30         31.33           30         30           32         30.96
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	30     31.33       30     31.33       30     30       32     30.96
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	30       30       30       32     30.96
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	30 32 30.96
E3       2110 M       32       30       29       Covered by wall       33       31       32       33       31       32       33       33       31       32       33       33       31       32       33       31       32       33       31       32       33       31       32       33       31       32       33       31       32       33       33       31       32       33       33       31       32       33       33       31       32       33       33       31       32       33       33       31       32       33       33       31       32       33       33       31       32       33       33       31       32       33       33       31       32       33       33       31       32       33       33       32       33       33       33       31       32       33       33       32       33       33       33       32       33       33       33       32       33       33       33       32       33       33       33       33       33       33       33       33       33       33       33       33       33	32 30.96
S00x300         Internet         Store	
E4         2.10 M         29         31         30         29         32         30         29         30         20         31         34         31         32         33         33           500x300         1.35 M         30         33         31         34         31         32         33         33	51
E4         1.35 M         30         33         31         Covered         31         34         31         32         33         3	29
500x300 by wall	32 31.15
	31
2.10 M         29         31         29         29         30         28         30         31         29	51
E5 125 x 20 24 21 21 22 20 20 22 20 No 2000	30.96
500x300 1.35 M 30 34 31 31 35 30 30 32 30 0.60 M 32 32 33 33 32 30 31 35 31	
2.10 M 30 30 29	
E6 1 25 M 23 23 21 Covered No access No access	31.33
500x300 1.35 M 35 35 31 by wall http://www.cecss.com/acces.com/access.com/acces.com/access.com/access.com/access.com/acce	, 51.55
2.10 M 29 30 29	
F1 No access Covered 20 22 21 Covered	30.78
500x300         1.33 M         Ho access         by wall         30         32         31         by wall           0.60 M         32         33         31         31         32         33         31	
	30
$F_2$	32 31.25
300X300	31
2.10 M 30 29 30	
F3 Covered No access Covered	31.33
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	
2.10 M 29 31 30	
F4 500x3001.35 MNo accessCovered by wall313332Covered by wall	31.56
0.60 M 32 34 32	
2.10 M 29 30 30 29 31 29 29 30 28 30 31 3	30
F5	31 30.97
	33
2.10 M 28 30 29	
F6CoveredNo accessCovered500x3001.35 M303432by wallNo accessby wall	30.67
0.60 M 29 33 31	
2.10 M 29 30 29	
G1 500x3001.35 MNo accessCovered by wall303129Covered by wall	30.11
S00x300         By wall         31         32         30	
G2 2.10 M 28 29 29 29 30 29 29 31 30 30 30 2	29 31.03

500x300	1.35 M	30	32	30	31	33	30	32	33	31	32	35	31	
	0.60 M	31	34	32	30	33	30	31	35	32	31	32	33	
	2.10 M					•		29	30	29				
G4 500x300	1.35 M	No	o acce	ess		overe		31	33	30	1	overe		30.78
300x300	0.60 M					by wa	11	32	32	31		oy wa	11	
~ •	2.10 M	28	30	30	29	31	29	30	29	30	29	31	29	
G5 500x300	1.35 M	31	35	32	32	34	31	30	34	32	30	33	30	31.17
J00XJ00	0.60 M	31	34	31	31	33	30	33	32	33	32	32	31	
	2.10 M	33	32	31										
H3 500x300	1.35 M	G				overe by wa		N	o acce	ess		overe by wa		32.00
J00XJ00	0.60 M		laddir	ng		y wa	11					y wa	11	
	2.10 M	31	32	31										
H6 500x300	1.35 M	C	1. 1.1.			overe by wa		N	o acce	ess		overe by wa		31.33
5002500	0.60 M		laddir	ng		y wa	11					y wa	11	
	2.10 M				29	30	29	30	31	29				
I1 500x300	1.35 M	No	o acce	ess	31	32	30	30	32	31	1	overe by wa		30.67
5000000	0.60 M					32	31	30	34	30		, y		
	2.10 M	29	31	29	30	30	29	29	31	28	30	30	29	
I2 500x300	1.35 M	29	33	30	29	32	30	30	32	30	29	32	32	30.75
0001000	0.60 M	32	34	31	30	34	31	31	33	32	31	34	31	
12	2.10 M	29	30	30	29	31	29							
I3 500x300	1.35 M	31	32	29	31	33	30	N	o acce	ess	1	overe v wa		30.94
5008500	0.60 M	32	33	31	31	34	32			-		, y ma		
TA	2.10 M				28	30	30	28	31	29				
J4 500x300	1.35 M	No	o acce	ess	31	34	31	30	32	31	-	overe by wa		31.06
0001000	0.60 M				30	35	31	31	35	32				
10	2.10 M	29	31	28	30	31	29	30	31	29	29	31	29	
J5 500x300	1.35 M	30	32	30	29	33	29	31	34	32	32	32	31	30.97
	0.60 M	30	34	31	30	32	31	33	34	32	30	35	31	
	2.10 M	29	30	30	30	29	30		_	_				
J6 500x300	1.35 M	C	laddir	חמ	30	32	31	N	o acce	ess		overe by wa		30.67
	0.60 M		iauuii	18	32	34	31					J		
														31.23
					1	36 <u>R</u> e	eading	gs						

				4 <sup>tl</sup>	<sup>h</sup> Floc	or (3.0	)0 Mt	s.Ht.)	)					
	R Value				R	Valu	e of (	Colun	ın fac	e				Ave.
Col. No. & size	location from	ľ	North	l		East		;	South	1		West		R Value of Col.
et size	FFL	Е	M	E	E	M	E	E	M	E	Е	Μ	Е	
	2.10 M							28	30	31		7		
A1 500x300	1.35 M	No	o acce	SS		Covere by wa		31	32	32		Covere by wa		31.00
500/500	0.60 M					<i>y</i>		32	32	31		oy wa		
A2	2.10 M	29	31	30	30	29	30	30	30	29	(	Covere	d	31.59
500x300	1.35 M	30	32	31	31	32	33	32	33	32				51.39

	0.60 M	33	34	32	34	34	33	33	34	32				
	2.10 M	29	30	30		I	1							
A3	1.35 M	31	33	30		overe		No	o acce	ess		Covere		31.11
500x300	0.60 M	31	34	32		y wa	11				t	oy wa	11	
	2.10 M							28	30	29				
A4	1.35 M	No	acce	SS		overe		31	32	30		Covere		31.00
500x300	0.60 M				ľ	oy wa	11	33	34	32		by wa	11	
	2.10 M	29	30	30	30	29	30	30	31	29				
A5	1.35 M	30	29	31	31	33	32	30	32	31		Covere		30.96
500x300	0.60 M	31	33	31	33	31	32	32	34	32		oy wa	11	
	2.10 M		1	1				29	32	31				
A6 500x300	1.35 M		overe			overe		31	32	30	N	o acce	ess	31.00
300x300	0.60 M		y wal	1	L	oy wa	11	32	31	31	1			
	2.10 M							30	31	30				
B1 500x300	1.35 M	No	acce	SS		overe by wa		31	33	31		Covere by wa		31.33
3004300	0.60 M	1				y wa	11	30	33	33		oy wa	11	
	2.10 M	30	31	30	29	31	30	29	31	30	28	30	29	
B2 500x300	1.35 M	30	31	31	31	33	30	31	34	31	32	32	31	30.92
5002500	0.60 M	32	34	32	30	33	31	31	33	30	30	33	29	
	2.10 M	29	31	30										
B3 500x300	1.35 M	29	34	32		overe v wa		No	o acce	ess		Covere by wal		31.44
5002500	0.60 M	32	35	31		y wa	11				Ľ	Jy wa	11	
D.4	2.10 M							28	30	29		~		
B4 500x300	1.35 M	No	acce	SS		overe by wa		32	34	32		Covere by wa		31.56
500A500	0.60 M					,, ,, ,, ,, ,, ,, ,, ,, ,, ,, ,, ,, ,,		32	34	33		oy wa		
	2.10 M	29	31	30	29	30	28	29	30	30	29	29	28	
B5 500x300	1.35 M	28	30	29	33	32	31	31	32	32	29	31	29	30.58
5002500	0.60 M	29	32	31	33	34	34	31	33	31	30	34	30	
Dí	2.10 M	31	32	29								,		
B6 500x300	1.35 M	30	32	31		overe v wa		No	o acce	ess		Covere by wal		31.33
500A500	0.60 M	32	33	32		, y wa						<i></i>		
CI	2.10 M						1	28	30	29		۹	.1	
C1 500x300	1.35 M	No	acce	SS		overe by wa		29	32	30		Covere by wa		30.44
	0.60 M			-				31	33	32				
~~	2.10 M	29	30	28	29	30	29	29	31	29	29	31	28	
C2 500x300	1.35 M	31	30	32	33	31	30	30	34	33	31	34	30	31.00
2001200	0.60 M	30	34	31	30	32	31	32	36	32	31	34	32	
<u></u>	2.10 M	29	29	28				30	30	29			1	
C3 500x300	1.35 M	29	34	29		overe by wa		31	30	29		Covere by wal		30.33
	0.60 M	30	33	31		Ja.	-	32	32	31			-	
C4	2.10 M	29	29	28				30	30	29		1	. I	
C4 500x300	1.35 M	30	30	29		overe v wa		31	34	32		Covere by wal		30.72
	0.60 M	30	34	31				32	33	32		,		
C5	2.10 M	30	31	31	29	29	28	29	30	31	29	30	29	31.14
500x300	1.35 M	32	31	29	32	32	33	31	33	29	32	31	32	51.14

	0.60 M	30	32	30	31	33	32	32	34	33	32	36	33	
~ (	2.10 M	32	31	29		overe by wa		N	o acce	ess		overe v wa		30.67
C6 500x300	1.35 M					y wa						y wa		
0001200	0.60 M	Cl	addin	g										
	2.10 M				29	31	29	29	31	30				
D1 500x300	1.35 M	Nc	acce	SS	30	32	30	32	33	32		overe by wa		31.17
5002500	0.60 M				31	34	31	32	34	31		y wa	11	
Da	2.10 M			1	28	30	29			1	30	29	30	
D2 500x300	1.35 M		overe y wal		30	34	31	1	overe by wa		30	33	32	31.06
	0.60 M		5		33	35	31		, ,	1	31	33	30	
D3	2.10 M	C	overe	d	29	30	28	29	31	30		overe	d	
500x300	1.35 M		y wal		29	31	30	30	34	31		y wa		30.72
	0.60 M				32	33	31	31	33	31				
D4	2.10 M	30	29	30	29	30	30	30	29	29	C	overe	ed	
500x300	1.35 M	33	32	33	31	34	32	30	34	32		y wa		31.26
	0.60 M	31	34	32	30	34	31	31	33	31	20	20	20	
D5	2.10 M	30	30	31	N			29	31	29	29	30 32	30	21.44
500x300	1.35 M 0.60 M	33	32	32	INC	o acce	ess	33	33	30	31 33	35	33 32	31.44
	0.00 M	30	33	30				31	34	33		overe	-	
D6	2.10 M	29	31	32	No	o acce	ess	N	o acce	ess		y wa		30.67
500x300	1.35 M	CI	addin	a										
	0.60 M	CI	auum	g										
E1	2.10 M					overe	d	29	31	29	30	30	29	
500x300	1.35 M	Nc	acce	SS		by wa		31	33	30	32	33	31	31.00
	0.60 M		1			-		31	33	32	30	34	30	
E2	2.10 M	29	30	29	30	31	29	29	31	30	30	29	30	
500x300	1.35 M	30	31	30	29	33	31	32	34	32	32	34	31	31.19
	0.60 M	31	33	31	32	34	33	32	35	31	31	34	30	
E3	2.10 M	29	30	29	C	overe	ed	30	30	29	29	29	30	• • • • •
500x300	1.35 M	30	32	29		oy wa		31	32	32	32	31	32	30.89
	0.60 M	30	33	31				31	33	31	32	34	33	
E4	2.10 M	29	29 33	28 30	C	overe	ed	30 31	32 32	30	29	30	29	20.95
500x300	1.35 M 0.60 M	30 31	33	30	b	y wa	11	30	32 32	31 32	32	34	32	30.85
		30	31	29	29	31	28	30	31	29	30	32	30	
E5	2.10 M 1.35 M	30	32	29	31	33	31	30	33	32	No	o acce	288	31.00
500x300	0.60 M	32	33	32	32	32	30	31	35	31	110			21.00
	2.10 M	29	30	29										
E6	1.35 M	32	33	32		overe		N	o acce	ess	No	o acce	ess	31.22
500x300	0.60 M	32	34	30	b	y wa	11							<b>-</b>
	2.10 M		I	I				30	30	29				
F1	1.35 M	Nc	acce	SS		overe		31	32	30		overe		30.89
500x300	0.60 M					oy wa	11	31	33	32		oy wa	11	
F2	2.10 M	30	31	30	30	32	30	29	30	31	29	30	30	31.36

500x300	1.35 M	29	34	30	29	34	32	32	33	31	30	32	31	
	0.60 M	32	35	31	32	33	31	32	34	33	31	35	31	
	2.10 M	29	28	31	52	55	51	32	34	33	51	33	31	
F3	1.35 M	32	33	30		overe		N	o acce	-99		overe		31.22
500x300	0.60 M	32	34	32	ł	oy wa	11		o ucce		b	y wal	11	51.22
	2.10 M	32	51	32				29	30	28				
F4	1.35 M	No	acce	ss		Covere		31	33	30		overe		30.67
500x300	0.60 M				ł	oy wa	11	31	32	32	ł	oy wal	11	20107
	2.10 M	29	29	28	29	30	29	30	29	31	29	31	30	
F5	1.35 M	30	33	30	30	32	30	31	33	32	31	33	30	30.83
500x300	0.60 M	31	32	31	31	33	31	30	33	30	32	34	33	
	2.10 M	29	30	29	-		-	50	55	50	52	54	55	
F6	1.35 M	33	34	33		overe		N	o acce	ess		overe		31.33
500x300	0.60 M	29	34	31	ł	by wa	11				b	y wal	11	
	2.10 M			51				29	30	30				
G1	1.35 M	No	acce	SS		Covere		30	32	29		overe		30.56
500x300	0.60 M	-			t	oy wa	11	31	33	31	t	oy wal	11	
	2.10 M	28	30	29	30	30	29	29	30	30	30	30	28	
G2	1.35 M	29	32	30	31	34	30	32	34	32	33	35	31	31.06
500x300	0.60 M	31	33	29	30	33	30	31	35	32	31	34	33	
	2.10 M	51	00	27	50	55	50	28	29	28			1	
G4	1.35 M	No	acce	SS		overe		30	32	30		overe		30.11
500x300	0.60 M	-			l t	oy wa	II	31	32	31	- t	oy wal	11	
	2.10 M	28	30	29	29	31	30	30	31	30	29	31	30	
G5 500x300	1.35 M	31	33	32	32	34	31	31	34	32	31	33	30	31.36
300x300	0.60 M	30	34	31	30	35	30	33	33	33	32	34	32	
						overe		N	o acce	ess		overe		31.33
H3	2.10 M	30	34	30	ł	oy wa	11	1.			b	y wal	11	51.55
500x300	1.35 M	Cl	addin	ıg										
	0.60 M					overe	d					overe		
H6	2.10 M	31	33	31		by wa		N	o acce	ess		by wal		31.67
500x300	1.35 M		1.1.	•										
	0.60 M		addin	ıg										
	2.10 M				28	30	29	30	30	29			_	
I1 500x300	1.35 M	No	acce	SS	30	31	30	29	32	30		overe by wal		30.22
5007500	0.60 M	1			31	32	30	30	33	30		y wa	11	
	2.10 M	29	30	29	31	30	30	30	31	28	30	30	28	
I2 500x300	1.35 M	30	32	31	29	32	32	30	33	30	29	33	31	30.67
5002500	0.60 M	30	32	31	31	33	31	31	33	30	31	32	31	
	2.10 M	31	30	30	29	31	30							
I3 500x300	1.35 M	31	32	30	31	32	31	N	o acce	ess		overe by wal		31.22
5002500	0.60 M	32	34	31	31	34	32					y wal	11	
J4	2.10 M	ъ.т.			28	31	30	28	31	30	C	overe	ed	21.44
500x300	1.35 M		acce	SS	32	34	33	30	33	30		oy wa		31.44
	1.35 IVI	I			52	57	55	50	55	50		*		1

					1	36 Re	ading	gs						
														31.01
	0.60 M	C	laddin	ıg	32	34	33							
500x300	1.35 M	C		_	33	32	31							
J6	2.10 M	30	30	31	30	29	31	N	o acce	ess		overe by wa		31.33
500/500	0.60 M	32	33	31	31	33	31	32	34	32	30	34	31	
J5 500x300	1.35 M	30	32	31	29	33	30	31	33	32	33	32	32	31.19
	2.10 M	30	31	29	30	30	29	30	31	31	29	31	30	
	0.60 M				32	34	31	32	35	32				

					5th	Floo	r (3.0	00 Mt	s.Ht.	)				
	R Value				R	Valu	e of (	Colur	nn fa	ce				Ave.
Col. No. & size	location from	]	North	1		East		5	South	ı		West	;	R Value
a size	FFL	Е	Μ	E	E	M	E	E	Μ	E	Е	M	E	of Col.
	2.10 M							28	30	29				
A1 500x300	1.35 M	No	o acce	ess		overe y wa		31	31	32		overe by wa		30.44
500,500	0.60 M					y wa	11	30	32	31		, y wa		
4.2	2.10 M	30	31	29	29	29	30	30	31	29				
A2 500x300	1.35 M	30	32	30	32	32	31	30	33	31		overe by wa		31.22
500,500	0.60 M	33	33	32	34	33	33	31	33	32		, y wa		
	2.10 M	29	30	28										
A3 500x300	1.35 M	29	33	30		overe y wa		No	acce	ess		overe by wa		30.56
500,500	0.60 M	31	33	32		y wa	11					y wa	11	
	2.10 M							28	31	29	0 Covere			
A4 500x300	1.35 M	No	o acce	ess		overe y wa		29	32	30	0 Covere by wal			30.67
200/200	0.60 M					.y wa		32	33	32		, y , n u		
	2.10 M	29	31	30	30	31	30	30	31	30				
A5 500x300	1.35 M	30	30	31	32	33	31	30	33	31		overe by wa		31.07
5008500	0.60 M	29	32	30	33	33	32	32	34	31		,y wa		
	2.10 M							30	32	31				
A6 500x300	1.35 M		overe vy wa			overe y wa		29	30	30	No	o acce	ess	30.67
500000	0.60 M		.yu			.y wa		30	33	31				
54	2.10 M				~			30	29	30				
B1 500x300	1.35 M	No	o acce	ess		overe y wa		31	33	29		overe v wa		30.89
200/200	0.60 M					.y wa		30	34	32		, y u		
DO	2.10 M	30	31	30	29	30	30	29	30	30	29	31	29	
B2 500x300	1.35 M	29	32	30	30	33	30	31	32	31	30	30	31	30.69
	0.60 M	32	33	32	30	34	31	32	33	30	29	32	30	
DA	2.10 M	29	32	30							_			
B3 500x300	1.35 M	30	34	33		overe y wa		No	o acce	ess	Covered by wall		31.78	
2007200	0.60 M	33	34	31		y wa					by wal			
B4	2.10 M	NL	o acce	200	C	overe	ed	29	30	29	C	overe	ed	31.44
500x300	1.35 M	INC	Jacce	588	b	y wa	11	32	34	32	b	oy wa	11	51.44

0.60 M							31	34	32				
2.10 M	29	30	30	28	30	29	29	31	30	30	29	28	
-	-											-	30.61
													50.01
				51	55	32	32	55	51	30	54	30	
		-		С	overe	ed	NL			С	overe	ed	20.79
				b	y wal	11	INC	acce	ess	b	y wa	11	30.78
	31	32	32				20	20	20				
				С	overe	ed				С	overe	ed	20.00
1.35 M	No	acce	ess										30.89
0.60 M													
2.10 M										-		28	
1.35 M		30	32			30	32	34	33		34	30	31.11
0.60 M	29	32	31	32	32	31	32	34	33	33	34	32	
2.10 M	29	30	28			.1	28	30	29			1	
1.35 M	28	30	29				29	31	29				29.61
0.60 M	30	31	29				30	32	31		J		
2.10 M	30	29	29				28	30	29	~			
1.35 M	29	30	28				31	32	31				30.44
0.60 M	30	33	31		y wa	11	33	33	32	U	y wa	11	
2.10 M	29	31	30	29	29	30	29	30	30	29	30	30	
		30		32	32	33	31	32	29	33	31	32	30.94
0.60 M				30	32	32	31	34	33	32	35	33	
2 10 M													
		-	-				No	acce	ess				29.67
	Cl	laddir	ng	b	y wa	ll				b	y wa	II	_,,
				20	20	28	20	21	20				
	Nc	2006		-		-	-	-		C	overe	ed	30.89
	110	, acce								b	y wa	11	50.07
							31	33	30	21	20	20	
	С	overe	d				C	overe	ed				20.92
	b	y wal	11				b	y wa	11				30.83
										31	34	30	
	С	overe	ed							C	overe	ed	20.17
													30.17
	20	20	20	31									
										С	overe	ed	<b>a</b> .
1.35 M							30	34	31				31.07
				30	34	31	30	32	31				
2.10 M	30	30	31				29	30	29				
1.35 M	33	32	32	No	o acce	ess	33	34	32	33	32	34	31.56
0.60 M	30	33	30				31	33	33	32	34	33	
	29	31	31								overe		
2.10 M	2)										overe	201	
2.10 M 1.35 M			חמ	No	o acce	ess	NO	acce	ess	h			30.33
		laddir	ıg	No	o acce	ess	No		ess	b	y wa		30.33
1.35 M	Cl		<u> </u>		o acce		No 29	30	29	b 30			30.33
	0.60 M 2.10 M 1.35 M 0.60 M 2.10 M	0.60 M         29           2.10 M         29           1.35 M         30           0.60 M         31           2.10 M         30           1.35 M         30           0.60 M         31           2.10 M         1           1.35 M         30           0.60 M         29           1.35 M         30           0.60 M         29           2.10 M         29           1.35 M         28           0.60 M         30           2.10 M         29           1.35 M         29           0.60 M         30           2.10 M         30           1.35 M         31           0.60 M         30           2.10 M         30           1.35 M         0           0.60 M         2           2.10 M         0           1.35 M         0           0.60 M         2           1.35 M         0           0.60 M         2           2.10 M         30           1.35 M         31           0.60 M         32           2.10 M	1.150 M       29       31 $0.60 M$ 29       32 $1.35 M$ 30       32 $1.35 M$ 30       32 $0.60 M$ 31       32 $2.10 M$ 31       32 $2.10 M$ 1.32 $2.10 M$ 29       30 $1.35 M$ 30       30 $0.60 M$ 29       32 $2.10 M$ 29       30 $1.35 M$ 30       30 $0.60 M$ 29       32 $2.10 M$ 29       30 $1.35 M$ 28       30 $0.60 M$ 30       31 $2.10 M$ 30       31 $2.10 M$ 29       31 $1.35 M$ 31       30 $0.60 M$ 30       31 $2.10 M$ 30       31 $2.10 M$ 30       31 $2.10 M$ 30       29 $1.35 M$ 0.60 M       20 $2.10 M$ 30       29 $1.35 M$ 30       29	1.150 M       29       31       30 $0.60 M$ 29       32       29 $1.35 M$ 30       32       30 $0.60 M$ 31       32       32 $2.10 M$ 31       32       32 $2.10 M$ 31       32       32 $2.10 M$ 1.35 M       No access       30 $0.60 M$ 29       30       29 $1.35 M$ 30       30       32 $0.60 M$ 29       32       31 $2.10 M$ 29       30       28 $1.35 M$ 28       30       29 $0.60 M$ 30       31       29 $2.10 M$ 30       29       29 $1.35 M$ 29       30       28 $0.60 M$ 30       31       30 $2.10 M$ 30       31       32 $0.60 M$ 20       29       29 </td <td>1.150 M       29       31       30       31         <math>2.10 M</math>       29       32       29      </td> <td>1.15 M       29       31       30       31       33         <math>0.60 M</math>       29       32       29      </td> <td><math display="block">\begin{array}{c c c c c c c c c c c c c c c c c c c </math></td> <td><math display="block">\begin{array}{c c c c c c c c c c c c c c c c c c c </math></td> <td><math display="block">\begin{array}{c c c c c c c c c c c c c c c c c c c </math></td> <td><math display="block">\begin{array}{c c c c c c c c c c c c c c c c c c c </math></td> <td><math display="block">\begin{array}{c c c c c c c c c c c c c c c c c c c </math></td> <td><math display="block">\begin{array}{c c c c c c c c c c c c c c c c c c c </math></td> <td><math display="block"> \begin{array}{ c c c c c c c c c c c c c c c c c c c</math></td>	1.150 M       29       31       30       31 $2.10 M$ 29       32       29	1.15 M       29       31       30       31       33 $0.60 M$ 29       32       29	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$

	0.60 M							31	32	30	31	34	32	
	2.10 M	29	30	30	29	30	28	28	30	30	30	34 31	<u>32</u> 29	
E2	-	29	30	31	30	33	31	32	34	31				30.33
500x300	1.35 M 0.60 M	30	30	29	31	33	32	31	33	30	32	32	31	50.55
		28	30	29	51	33	32	29	30	29	20	31	30	
E3	2.10 M	30	30	30	C	overe	ed	31	30	30	28	29	28	30.59
500x300	1.35 M	31	34	31	b	y wa	11	30	34	31	32	31	32	50.59
	0.60 M										31	33	32	
E4	2.10 M	29	28	28	C	overe	ed	29	32	29	28	30	29	20.20
500x300	1.35 M	29	32	30	b	y wa	11	32	31	31	32	33	29	30.30
	0.60 M	31	31	30	• •		• •	30	32	32	29	32	30	
E5	2.10 M	29	30	29	29	31	28	29	30	29				
500x300	1.35 M	28	31	29	29	32	32	30	33	30	No	o acce	ess	30.37
	0.60 M	31	30	32	30	32	31	31	34	31				
E6	2.10 M	29	30	29		overe	ьd							
500x300	1.35 M	30	33	30		y wa		No	o acce	ess	No	acce	ess	31.00
	0.60 M	32	35	31		<u> </u>								
F1	2.10 M					overe	d	29	30	29	C	overe	d	
500x300	1.35 M	No	o acce	ess		y wa		31	33	30		y wa		31.11
	0.60 M		1			-		32	34	32		-		
F2	2.10 M	29	31	30	31	29	30	29	30	29	29	29	30	
F2 500x300	1.35 M	30	31	30	29	32	32	31	33	29	30	32	29	30.75
500A500	0.60 M	32	33	32	31	33	31	32	33	30	31	34	31	
	2.10 M	29	28	29									_	
F3 500x300	1.35 M	31	32	30		overe y wa		No	o acce	ess		overe y wa		30.77
5002500	0.60 M	32	33	33		y wa	11					y wa	11	
	2.10 M							29	29	28				
F4 500x300	1.35 M	No	o acce	ess		overe		31	33	31		overe v wa		30.89
300x300	0.60 M	1			U	y wa	11	33	32	32	U	y wa	11	
	2.10 M	29	30	28	28	30	29	28	29	31	29	31	29	
F5	1.35 M	29	31	30	31	32	30	31	34	32	31	34	31	30.81
500x300	0.60 M	31	33	31	31	34	31	30	33	31	32	34	31	
	2.10 M	29	30	28		1	1	50	55	51	22	57	1 21	
F6	1.35 M	32	34	33		overe		No	o acce	ess		overe		31.11
500x300	0.60 M	29	35	30	b	y wa	11			-	b	y wa	11	*
	2.10 M	27	55	50				29	31	30				
G1	1.35 M	No	o acce	ess		overe		30	32	29		overe		30.77
500x300	0.60 M				b	y wa	11	31	34	31	b	y wa	11	20111
	2.10 M	29	30	29	29	29	29	29	28	31	30	30	29	
G2	1.35 M	29 29	30	31	31	34	30	32	33	32	30	33	31	30.97
500x300	0.60 M	30	32	29	31	34	30	31	34	32	31	35	32	50.77
		50	52	29	51	34	52	29	29	28	51	55	52	
G4	2.10 M	N	o acce	200		overe		30	32	28	C	overe	ed	30.22
500x300	1.35 M 0.60 M	INC		-99	b	y wa	11	30	31	32	b	y wa	11	50.22
~-											•	<u>a</u> :		
G5 500x300	2.10 M	28	29	29	29	30	30	29	31	30	29	31	29	30.81
2008200	1.35 M	29	30	31	30	34	31	31	34	30	31	33	30	

	0.60 M	30	32	30	29	33	29	33	34	33	31	35	32		
	2.10 M	29	33	31									1		
H3 500x300	1.35 M	C	laddii	• •		overe y wa		No	o acce	ess		overe y wa		31.00	
500/1500	0.60 M		laddii	ig		y wa						y wa			
Ш	2.10 M	30	33	31			1						1		
H6 500x300	1.35 M	C	laddii	20	-	overe y wa		No	o acce	ess		overe y wa		31.33	
2004200	0.60 M		lauun	ng		<i>y</i>						<i>y</i>			
11	2.10 M				30	30	29	28 31 29							
I1 500x300	1.35 M	No	o acce	ess	28	31	31	29	32	31	Covered by wall			30.39	
2004200	0.60 M		-	-	32	31	30	32	33	30		<i>y</i>			
	2.10 M	28	30	29	29	30	30	29	31	28	30	30	29		
12 500x300	1.35 M	29	30	28	29	32	30	30	33	29	20	34	30	30.03	
2004200	0.60 M	28	32	30	31	33	31	31	34	30	31	32	31		
	2.10 M	31	29	29	29	30	28								
I3 500x300	1.35 M	32	32	30	30	35	31	No access				overe	31.00		
2004200	0.60 M	31	33	31	31	34	32				by wall				
T	2.10 M				28	31	30	28	31	30					
J4 500x300	1.35 M	No	o acce	ess	32	33	33	30	33	30		overe y wa		31.17	
2004200	0.60 M				31	32	30	32	35	32		y na			
1.5	2.10 M	28	30	29	29	30	29	30	31	29	29	32	29		
J5 500x300	1.35 M	31	32	30	31	33	31	31	34	33	33	32	32	30.83	
5000500	0.60 M	29	31	30	30	29	30	32	33	32	30	35	31		
	2.10 M	28	29	28	28	29	30								
J6 500x300	1.35 M	C			32	34	32	No	o acce	ess	-	overe v wa		30.33	
200/200	0.60 M		laddii	ng	30	33	31				by wall				
														30.75	
					136 Readings										

House No. & Location	n: H.No.30-17-30, R.S.No.159/2, Sitarampuram,
Durga Agraharam,	Vijayawada.

Residential Building. (Sri Ranga Sai Towers) Ground + 5 Upper Floors.

Latitude: 16 31' 03" N

Longitude: 80 38' 23" E

Year of construction: 1997

Height of the Building: 18.00 Mtrs.

Average R Value of columns in each Floor.

			Ave	age K valu	le of column	is in each r	1001.	
S.No.	Col. No. & size	Gr. Floor	1st Floor	2nd Floor	3rd Floor	4th Floor	5th Floor	Average
1	A1 500x300	32.53	31.11	31.00	31.44	31.00	30.44	31.25
2	A2 500x300	32.06	32.00	31.41	31.70	31.59	31.22	31.66
3	A3 500x300	32.00	31.67	31.56	31.78	31.11	30.56	31.45
4	A4 500x300	32.11	31.89	31.44	31.22	31.00	30.67	31.39
5	A5 500x300	31.72	31.52	31.41	31.30	30.96	31.07	31.33
6	A6 500x300	31.56	32.11	31.78	31.56	31.00	30.67	31.45
7	B1 500x300	32.03	31.44	31.33	31.22	31.33	30.89	31.37
8	B2 500x300	31.67	32.17	31.19	31.56	30.92	30.69	31.37
9	B3 500x300	31.28	31.22	31.56	31.89	31.44	31.78	31.53
10	B4 500x300	31.89	31.89	31.89	31.78	31.56	31.44	31.74
11	B5 500x300	32.00	31.94	31.72	31.50	30.58	30.61	31.39

12	B6 500x300	31.33	31.78	31.44	31.78	31.33	30.78	31.41
13	C1 500x300	31.58	31.22	31.33	30.78	30.44	30.89	31.04
14	C2 500x300	32.06	31.61	31.44	31.33	31.00	31.11	31.43
15	C3 500x300	31.17	31.39	31.11	31.06	30.33	29.61	30.78
16	C4 500x300	32.33	32.11	32.06	31.50	30.72	30.44	31.53
17	C5 500x300	31.78	32.39	32.03	31.42	31.14	30.94	31.62
18	C6 500x300	31.56	31.67	31.00	31.67	30.67	29.67	31.04
19	D1 500x300	32.03	31.78	31.61	31.11	31.17	30.89	31.43
20	D2 500x300	32.33	31.17	30.89	31.22	31.06	30.83	31.25
21	D3 500x300	32.61	31.61	31.28	31.39	30.72	30.17	31.30
22	D4 500x300	31.67	31.41	31.11	31.48	31.26	31.07	31.33
23	D5 500x300	33.00	32.15	31.59	31.48	31.44	31.56	31.87
24	D6 500x300	31.22	31.67	31.00	31.33	30.67	30.33	31.04
25	E1 500x300	32.06	31.28	31.00	30.94	31.00	30.67	31.16
26	E2 500x300	32.17	31.69	31.17	31.33	31.19	30.33	31.31

27	E3 500x300	31.85	31.41	31.11	30.96	30.89	30.59	31.14
28	E4 500x300	32.38	31.85	31.48	31.15	30.85	30.30	31.34
29	E5 500x300	32.97	31.04	31.00	30.96	31.00	30.37	31.22
30	E6 500x300	33.06	31.11	30.89	31.33	31.22	31.00	31.44
31	F1 500x300	32.47	30.89	31.67	30.78	30.89	31.11	31.30
32	F2 500x300	33.25	31.78	31.61	31.25	31.36	30.75	31.67
33	F3 500x300	32.92	31.56	31.11	31.33	31.22	30.77	31.49
34	F4 500x300	32.39	31.33	30.44	31.56	30.67	30.89	31.21
35	F5 500x300	32.17	31.39	31.28	30.97	30.83	30.81	31.24
36	F6 500x300	32.47	31.22	30.89	30.67	31.33	31.11	31.28
37	G1 500x300	32.08	31.89	31.33	30.11	30.56	30.77	31.12
38	G2 500x300	32.06	31.44	31.39	31.03	31.06	30.97	31.33
39	G4 500x300	32.11	31.89	31.67	30.78	30.11	30.22	31.13
40	G5 500x300	32.22	31.42	31.11	31.17	31.36	30.81	31.35
41	H3 500x300	32.19	31.00	31.67	32.00	31.33	31.00	31.53

42	H6 500x300	32.40	31.67	31.67	31.33	31.67	31.33	31.68
43	I1 500x300	32.50	31.27	31.11	30.67	30.22	30.39	31.03
44	I2 500x300	32.11	31.03	31.31	30.75	30.67	30.03	30.98
45	I3 500x300	32.25	31.17	31.11	30.94	31.22	31.00	31.28
46	J4 500x300	32.33	31.06	31.39	31.06	31.44	31.17	31.41
47	J5 500x300	32.39	31.36	31.33	30.97	31.19	30.83	31.35
48	J6 500x300	32.56	31.08	31.42	30.67	31.33	30.33	31.23
Ave	erage	32.14	31.54	31.34	31.23	31.02	30.75	31.34

House No. & Location: D.No.29-3-8, Venkateswara Rao Street, Governor Pet, Vijayawada.
Stilt + 3 Floors

Latitude: 16° 30'48.4" N

Longitude: 80° 37'50.6" E

Floor: Col. No. & size	R Value location					C+:	lt Flo								
& size					_										1
& size	location								nn fa			~		Avg	Ave. R
	from FFL		North			East			West			South		Values	Value of Col.
	HOMFFL	Е	M	E	E	М	E	E	M	E	Е	M	E		01 C01.
Al	2.10 M	24	24	31	31	25	27	29	28	29	28	29	28	27.75	-
0.23x0.38	1.35 M	25	28	25	26	27	26	27	26	27	26	27	26	26.33	26.86
	0.60 M	26	26	24	26	27	28	26	28	26	26	28	27	26.50	
A2	2.10 M	25	26	25	25	26	28	28	29	28	28	27	28	26.92	
$0.23 \times 0.38$	1.35 M	26	25	26	25	25	26	26	28	27	27	28	27	26.33	26.55
	0.60 M	27	28	26	26	28	26	25	26	25	26	28	26	26.42	
A 2	2.10 M	26	27	26	30	31	29	29	30	26	26	29	31	28.33	
A3 0.23x0.38	1.35 M	26	28	27	27	28	27	27	27	27	28	30	28	27.50	27.55
	0.60 M	25	26	25	25	27	26	26	27	31	30	28	26	26.83	
	2.10 M	25	26	27	26	26	26	25	26	25	26	26	25	25.75	
A4 0.23x0.38	1.35 M	25	26	25	25	26	25	26	26	26	27	26	27	25.83	26.36
0.2580.50	0.60 M	26	28	26	26	30	27	29	27	28	28	27	28	27.50	
DI	2.10 M	26	26	26	25	26	26	25	25	25	25	26	26	25.58	
B1 0.23x0.38	1.35 M	27	28	26	26	27	26	26	26	26	27	26	26	26.42	26.39
0.2580.50	0.60 M	28	30	28	26	27	28	27	27	25	26	27	27	27.17	
Da	2.10 M	26	26	26	26	27	26	26	25	26	26	26	26	26.00	
B2 0.23x0.38	1.35 M	25	26	25	26	26	26	27	26	25	25	27	27	25.92	26.30
0.23X0.30	0.60 M	26	30	26	26	29	26	28	28	25	26	28	26	27.00	
	2.10 M	25	28	27	26	26	25	26	28	27	26	26	27	26.42	
B3 0.23x0.38	1.35 M	26	28	27	26	27	26	27	28	25	26	27	27	26.67	26.86
0.23x0.38	0.60 M	27	28	28	27	27	26	29	30	26	27	28	27	27.50	
	2.10 M	26	28	25	26	28	27	26	28	27	26	28	29	27.00	
B4 0.23x0.38	1.35 M	26	28	28	26	27	28	27	28	29	26	28	26	27.25	27.42
0.23X0.30	0.60 M	27	28	27	26	28	26	29	30	29	28	30	28	28.00	
	2.10 M				26	26	26	26	26	26	26	26	27	26.11	
C1 0.23x0.38	1.35 M	Co	vered wall	by	26	26	26	25	26	25	26	27	26	25.89	26.96
0.23x0.38	0.60 M		wan		29	30	29	29	30	28	28	29	28	28.89	
	2.10 M	25	26	24	25	25	24	25	26	25	26	27	26	25.33	
C2	1.35 M	26	27	26	26	27	25	26	27	26	27	28	26	26.42	26.47
0.23x0.38	0.60 M	27	28	27	28	28	28	27	28	28	27	28	28	27.67	
	2.10 M	26	26	25	25	26	24	26	27	26	25	26	24	25.50	
C3	1.35 M	26	27	26	26	27	25	27	28	26	26	27	26	26.42	26.38
0.23x0.38	0.60 M	27	27	26	27	28	27	27	28	28	27	28	27	27.25	1
C4	2.10 M	24	26	26	25	26	25	25	25	24	26	27	25	25.33	
0.23x0.38	1.35 M	25	27	27	26	27	26	26	27	27	27	27	27	26.58	26.38

	0.60 M	26	28	26	27	28	26	27	28	27	28	28	28	27.25	
	2.10 M	20	20	20	24	27	25	27	20	21	20	27	26	25.50	
D1	1.35 M	Co	vered	by	25	28	26	Co	vered	by	27	28	26	26.67	27.11
0.23x0.38	0.60 M	-	wall		23	30	20		wall		27	31	20	29.17	27.11
		25	26	25	28	25	29	26	27	26	25	26	25	25.33	
D2	2.10 M		20	23	24		24	26	27	20	23	20	25		26.28
0.23x0.38	1.35 M	26		-	-	26		-	-		20		-	26.25	26.28
	0.60 M	27	28	28	26	27	26	27	29	28		28	26	27.25	
D3	2.10 M	24	27	26	25	26	24	25	27	27	26	27	25	25.75	
0.23x0.38	1.35 M	26	28	27	26	28	26	27	28	28	27	28	27	27.17	26.86
	0.60 M	27	28	28	27	28	27	28	28	28	28	27	28	27.67	
D4	2.10 M	25	27	25	26	27	27	26	28	26	27	27	27	26.50	
0.23x0.38	1.35 M	27	28	26	27	28	27	27	29	27	28	28	28	27.50	27.44
	0.60 M	28	28	28	27	29	28	28	29	28	29	29	29	28.33	
E1	2.10 M	Co	vered	hy	Co	vered	hv	25	26	24	24	27	26	25.33	
0.23x0.38	1.35 M		wall	Uy		wall	Uy	26	28	26	27	28	26	26.83	26.83
	0.60 M		1	1				27	28	27	28	31	29	28.33	
E2	2.10 M	24	25	24	26	27	25	24	27	25	26	27	25	25.42	
E2 0.23x0.38	1.35 M	25	26	25	27	27	27	25	28	26	27	27	27	26.42	26.56
0.20110100	0.60 M	26	27	26	28	28	28	28	30	29	28	28	28	27.83	
50	2.10 M	24	27	25	25	26	24	25	27	27	24	27	26	25.58	
E3 0.23x0.38	1.35 M	25	28	26	26	27	26	27	28	28	27	28	26	26.83	26.94
0.2370.30	0.60 M	28	30	29	27	28	27	28	28	28	28	31	29	28.42	
	2.10 M	27	28	28	28	28	27	28	29	27	29	30	29	28.17	
E4 0.23x0.38	1.35 M	26	28	27	28	28	28	29	30	28	29	29	28	28.17	28.44
0.23X0.38	0.60 M	29	30	29	28	30	28	28	30	29	28	30	29	29.00	
	2.10 M				26	27	27				24	26	25	25.83	
F1	1.35 M	Co	vered		27	28	27	Co	vered	by	25	28	26	26.83	27.11
0.23x0.38	0.60 M	1	wall		28	29	28		wall		28	30	29	28.67	
	2.10 M				25	26	24	25	26	24				25.00	
F2	1.35 M	Co	vered		26	27	26	26	27	25	Co	vered	l by	26.17	26.00
0.23x0.38	0.60 M	1	wall		27	28	27	26	27	26	ł	wall		26.83	
	2.10 M				26	28	26	27	27	27				26.83	
F3	1.35 M	Co	vered		27	28	27	28	27	28	Co	vered	-	27.50	27.78
0.23x0.38	0.60 M	-	wall		28	30	28	29	30	29	1	wall		29.00	
	2.10 M	2	27	26	26	26	26							22.17	
F4	1.35 M	27	28	20	20	26	20	Co	vered	by	Co	vered	-	27.00	25.72
0.23x0.38	0.60 M	28	30	28	26	28	28		wall			wall		28.00	23.12
		20	50	20	20	20	20				27	28	28	27.67	
G1	2.10 M	Co	vered	•	Co	vered	by	Co	vered	by	27	28	27	27.00	28.00
0.23x0.38	1.35 M 0.60 M	-	wall			wall			wall		20	30	27	29.33	20.00
					25	26	24				27	50	27	29.33	
G2	2.10 M	Co	vered	by	23	20	24	Co	vered	by	Co	vered	l by		26.22
0.23x0.38	1.35 M	-	wall	-					wall	-		wall	-	26.33	26.22
~ •	0.60 M				27	28	27				-			27.33	
G3 0.23x0.38	2.10 M		vered wall		26	27	25	Co	vered wall		Co	vered wall	-	26.00	27.00
0.2310.30	1.35 M	L	wall		27	27	27		wall		L	wall		27.00	l

	0.60 M				28	28	28							28.00	
<b>C</b> 4	2.10 M										26	26	25	25.67	
G4 0.23x0.38	1.35 M	Co	vered wall	•	Co	vered wall	2	Co	vered wall	2	27	28	26	27.00	26.67
0.25 X0.50	0.60 M		wan			wan			wan		27	28	27	27.33	
	2.10 M							25	26	26	25	26	25	25.50	
H1 0.23x0.38	1.35 M	Co	vered wall	•	Co	vered wall		27	28	26	26	27	27	26.83	26.56
0.25 X0.50	0.60 M		wan			wan		28	28	28	26	28	26	27.33	
	2.10 M	~			~			26	27	26	~			26.33	
H2 0.23x0.38	1.35 M	Co	vered wall	•	Co	vered wall		27	28	28	Co	vered wall	-	27.67	27.56
0.2570.50	0.60 M		wan			wan		28	30	28		wan		28.67	
	2.10 M							26	27	26				26.33	
H3 0.23x0.38	1.35 M	Co	vered wall	•	Co	vered wall	•	27	28	27	Covered by wall			27.33	27.11
0.2570.50	0.60 M		wan			wan		27	28	28	wall			27.67	
	2.10 M	27	28	28				26	28	26				27.17	
H4 0.23x0.38	1.35 M	27	29	27		vered wall		26	28	26	Co	vered wall	•	27.17	27.50
0.23X0.30	0.60 M	28	30	28	wall			27	29	27	Ī	vv all		28.17	
															26.89
						96	Read	lings							

							1 <sup>st</sup> Fl	oor							
	R Value				R	Valu	e of (	Colui	nn fa	ce					Ave. R
Col. No. & size	location from	ľ	Nortl	h		East			West			South	1	Avg Values	Value of
C SIZC	FFL	E	Μ	E	Е	Μ	E	E	М	E	E	М	E	v aiues	Col.
	2.10 M				26	28	27				25	28	27	26.83	
A1 0.23x0.38	1.35 M	Co	vered wall		27	28	27	Co	vered wall	by	28	30	28	28.00	27.11
0.2540.50	0.60 M		wan		26	27	26		wan		26	28	26	26.50	
	2.10 M				27	28	27							27.33	
A2 0.23x0.38	1.35 M	Co	vered wall		27	29	27		vered wall	by	Co	vered wall		27.67	27.66
0.2540.50	0.60 M				27	30	27		wan			wan		28.00	
	2.10 M	~	Covered b		26	28	27	27	28	28	~			27.33	
A3 0.23x0.38	1.35 M	Co	vered wall	-	27	28	28	28	29	28	Co	vered	~	28.00	28.16
0.2370.30	0.60 M		wan		29	29	29	29	30	29	8 wall		29.17		
	2.10 M	25	26	24	25	25	24	~			~			24.83	
A4 0.23x0.38	1.35 M	26	28	28	26	28	26		vered wall	by	Co	vered wall	~	27.00	26.50
0.2370.30	0.60 M	27	28	27	28	28	28	]	wan			wan		27.67	
	2.10 M	~			~			~			25	27	26	26.00	
B1 0.23x0.38	1.35 M	Co	vered wall	-	Co	vered wall	l by	Co	vered wall	by	26	28	25	26.33	26.67
0.2370.30	0.60 M		wan			wan			wan		27	29	27	27.67	
	2.10 M	26	27	26										26.33	
B2 0.23x0.38	1.35 M	27	29	27		vered wall	l by	Co	Covered by Covered b wall wall	~	27.67	27.44			
0.2310.30	0.60 M	28	29	28		wall			wall			wall		28.33	
	2.10 M		27	27.50											
B3 0.23x0.38	1.35 M	Co	vered wall		28	28	27	Co	vered wall	by	27	28	28	27.67	27.72
0.2340.30	0.60 M	1	wall		28	28	28	1	wall		28	29	27	28.00	1

D	2.10 M	C		1.1			1			1	26	28	26	26.67	
B4 0.23x0.38	1.35 M	Co	vered wall		Co	vered wall	•	Co	vered wall	by	28	28	27	27.67	27.77
0.2570.50	0.60 M		wan			wan			wan		29	29	29	29.00	
	2.10 M	25	26	25				26	28	27				26.17	
C1 0.23x0.38	1.35 M	26	26	26	Co	vered wall		27	28	28	Co	vered wall	•	26.83	26.89
0.23X0.38	0.60 M	27	28	27	1	wan		28	28	28		wall		27.67	
	2.10 M			1				26	29	28				27.67	
C2	1.35 M	Co	vered		Co	vered	•	27	29	28	Co	vered	-	28.00	27.89
0.23x0.38	0.60 M		wall			wall		27	30	27		wall		28.00	
	2.10 M							25	27	28				26.67	
C3	1.35 M	Co	vered		Co	vered	•	26	29	28	Co	vered		27.67	27.67
0.23x0.38	0.60 M		wall			wall		27	30	29		wall		28.67	
	2.10 M	26	28	26				25	27	28				26.67	
C4	1.35 M	27	28	27	Co	vered	•	26	27	27	Co	vered	l by	27.00	27.22
0.23x0.38	0.60 M	28	28	27	1	wall		27	30	28		wall		28.00	
	2.10 M			1	27	28	27		I		28	28	27	27.50	
D1 0.23x0.38	1.35 M	Co	vered wall		28	28	28	Co	vered wall	by	29	28	27	28.00	27.89
0.23X0.38	0.60 M	İ	wan		29	28	29	1	wall		28	27	28	28.17	
	2.10 M				26	27	28					1		27.00	
D2	1.35 M	Co	vered		27	29	28	Co	vered	by	Co	vered	-	28.00	28.00
0.23x0.38	0.60 M	İ	wall		28	30	29	1	wall			wall		29.00	
	2.10 M				28	29	28	27	28	27				27.83	
D3	1.35 M	Co	vered		29	28	29	27	29	28	Co	vered	l by	28.33	28.39
0.23x0.38	0.60 M		wall		29	30	29	28	29	29		wall		29.00	
	2.10 M	28	27	28	28	29	29							28.17	
D4	1.35 M	27	28	27	27	29	29	Co	vered	by	Co	vered	•	27.83	28.05
0.23x0.38	0.60 M	28	29	28	28	28	28		wall			wall		28.17	
	2.10 M										26	28	26	26.67	
E1	1.35 M	Co	vered		Co	vered		Co	vered	by	27	28	28	27.67	27.88
0.23x0.38	0.60 M		wall			wall			wall		29	30	29	29.33	
	2.10 M	28	28	27							-		-	27.67	
E2	1.35 M	28	29	27	Co	vered		Co	vered	by	Co	vered	l by	28.00	27.77
0.23x0.38	0.60 M	27	28	28	1	wall			wall			wall		27.67	_,,,,
	2.10 M		-	1	26	28	27				27	28	28	27.33	
E3	1.35 M	Co	vered		27	29	28	Co	vered	by	28	29	27	28.00	28.28
0.23x0.38	0.60 M		wall		29	30	30	1	wall		29	30	29	29.50	20.20
	2.10 M	27	28	27		1	I					1		27.33	
E4	1.35 M	28	29	27	Co	vered		Co	vered	by	Co	vered	•	28.00	28.00
0.23x0.38	0.60 M	27	30	29	1	wall			wall			wall		28.67	
	2.10 M							27	27	27	27	28	27	27.17	
F1 0.23x0.38	1.35 M	Co	vered wall		Co	vered wall		27	29	28	28	29	28	28.17	28.06
0.23X0.38	0.60 M		wall			wall		28	29	28	29	30	29	28.83	
	2.10 M							26	28	27				27.00	
F2	1.35 M	Co	vered		Co	vered	•	28	28	28	Co	vered	•	28.00	27.44
0.23x0.38	0.60 M		wall			wall		27	28	27		wall		27.33	
L		I			I			I	, , ,		I				

	2.10 M							28	29	28				28.33	
F3 0.23x0.38	1.35 M	Co	vered wall		Co	vered wall	by	27	29	28	Co	vered wall	by	28.00	28.44
0.23X0.36	0.60 M	1	wall			wall		28	30	29		wall		29.00	
	2.10 M	28	29	27										28.00	
F4 0.23x0.38	1.35 M	28	30	28	Co	vered wall	by	Co	vered wall	by	Co	vered wall	by	28.67	28.66
0.23x0.38	0.60 M	29	30	29		wan			wan			wall		29.33	
<u></u>	2.10 M				29	29	28				28	29	29	28.67	
G1 0.23x0.38	1.35 M	Co	vered wall		30	30	29	Co	vered wall	by	29	30	30	29.67	29.22
0.2580.50	0.60 M		wan		29	30	29		wan		29	30	29	29.33	
	2.10 M		,		27	29	28			1		1	1	28.00	
G2 0.23x0.38	1.35 M		vered wall		27	28	27		vered wall	ву	Co	vered wall	ву	27.33	27.88
0.20110100	0.60 M				28	29	28							28.33	
C2	2.10 M	Co		11	27	29	27	Co		1	Co		1	27.67	
G3 0.23x0.38	1.35 M		vered wall	by	28         28         28           28         30         28			vered wall	ву	Co	vered wall	ву	28.00	28.11	
0.20110100	0.60 M				28	30	28							28.67	
G4	2.10 M	28	29	28	Car		he.	Ca		1	Co		1	28.33	
0.23x0.38	1.35 M	29	30	28		vered wall	бу		vered wall	ы		vered wall	бу	29.00	28.89
	0.60 M	29	30	29										29.33	
H1	2.10 M	Co	vered	l h	Co	vered	hri	28	28	28	28	29	27	28.00	
$0.23 \times 0.38$	1.35 M		wall	-		wall	бу	29	29	28	28	29	28	28.50	28.66
	0.60 M							29	30	29	29	30	30	29.50	
110	2.10 M			11	C		1	26	26	26	C		1	26.00	
H2 0.23x0.38	1.35 M		vered wall	-		vered wall	ву	26	30	27	0	vered wall	ву	27.67	27.44
	0.60 M							28	30	28				28.67	
112	2.10 M	Co		1.1	Car		<b>b</b>	28	29	28	Co		1	28.33	
H3 0.23x0.38	1.35 M		vered wall			vered wall	бу	29	29	29		vered wall	бу	29.00	28.88
	0.60 M							29	30	29				29.33	
TT4	2.10 M	28	29	28	C		les-	29	29	28	C		les-	28.50	
H4 0.23x0.38	1.35 M	29	28	27	Co	vered wall	bу	28	29	29	0	vered wall	by	28.33	28.72
	0.60 M	29	29	29			-	30	30	29				29.33	
															27.92
					96	Read	ings								

						Sec	ond	Floor	•						
	R Value				R	Valu	e of (	Colun	nn fa	се					Ave. R
Col. No.	location		North	า		East			West			South	า	Avg	Value
& size	from FFL	E	м	E	E	м	E	E	м	E	E	м	E	Values	of Col.
1	2.10 M	6			28	28	27	6.00			27	28	27	27.50	
A1 0.23x0.38	1.35 M		Covered by		28	29	27		vered wall	· · ·	28	29	28	28.17	28.05
0.2310.30	0.60 M		wall		28	29	28		wan		28	30	28	28.50	
	2.10 M				28	29	28							28.33	
A2 0.23x0.38	1.35 M	0	vered wall		28	30	28		vered wall	· ·	CO	verec wall		28.67	28.77
0.2380.30	0.60 M		wan		29	30	29		wan			wan		29.33	
A3	2.10 M	Cov	vered	l by	25	26	24	25	25	24	Cov	verec	l by	24.83	26.72
0.23x0.38	1.35 M		wall		26	28	28	26	28	26		wall		27.00	20.72

A4 0.23x0.38 0	2.10 M	20													
0.23x0.38		26	28	27	27	28	28				_			27.33	
0.23x0.38	1.35 M	27	28	28	28	29	28	<u></u> Cov	/ered	by	Со	/ered	by	28.00	28.16
	0.60 M	29	29	29	29	30	29		wall			wall		29.17	
2	2.10 M										27	27	28	27.33	
B1 1	1.35 M		vered	by		/ered		Cov	/ered	by	27	28	29	28.00	27.89
0.23x0.38	0.60 M		wall			wall			wall		28	29	28	28.33	
2	2.10 M	27	27	27										27.00	
B2 1	1.35 M	27	28	28		/ered	by	<u></u> Cov	/ered	by	Со	/ered	by	27.67	27.55
0.23x0.38	0.60 M	28	28	28		wall			wall			wall		28.00	
2	2.10 M				27	28	27				27	28	28	27.50	
B3 1	1.35 M		/ered	by	27	28	28		/ered	by	29	28	29	28.17	28.05
0.23x0.38	0.60 M		wall		28	29	28		wall		28	29	29	28.50	
2	2.10 M										27	28	27	27.33	
B4 1	1.35 M		vered	by		/ered	l by	Co	/ered	by	28	28	27	27.67	27.66
U.23XU.38	0.60 M		wall			wall			wall		28	28	28	28.00	
2	2.10 M	27	27	27				28	29	27				27.50	
C1 1	1.35 M	29	30	28		/ered	by	28	29	27	Со	/ered	by	28.50	28.33
0.23x0.38	0.60 M	28	30	29		wall		29	30	28		wall		29.00	
2	2.10 M							26	27	26				26.33	
C2 1	1.35 M		vered	by		/ered	by	26	28	26	Ο Ο Ι	/ered	by	26.67	27.00
0.23x0.38	0.60 M		wall			wall		27	30	27		wall		28.00	
2	2.10 M							27	28	27				27.33	
C3 1	1.35 M		vered	by		/ered	by	28	28	28	<u></u>	/ered	by	28.00	28.22
+ 0.23X0.38	0.60 M		wall			wall		29	30	29		wall		29.33	
2	2.10 M	28	28	27	_			28	28	28	_			27.83	
C4 1	1.35 M	29	30	29		/ered	-	28	29	28	<u></u>	/ered	by	28.83	28.72
0.23x0.38	0.60 M	30	30	30		wall		28	30	29		wall		29.50	
2	2.10 M	1			27	29	27				28	28	28	27.83	
D1 1	1.35 M		vered	by	28	28	28	Со	/ered	by	28	29	28	28.17	28.27
0.23x0.38	0.60 M		wall		28	29	28		wall		29	30	29	28.83	
2	2.10 M	_			27	28	27							27.33	
D2	1.35 M		/ered	by	27	27	27		/ered	by	Со	/ered	by	27.00	27.55
0.23x0.38	0.60 M		wall		28	29	28		wall			wall		28.33	
2	2.10 M	_			27	27	26	28	28	27				27.17	
D3 1	1.35 M		/ered	by	27	28	28	28	28	28	Co۱	/ered	by	27.83	27.61
0.23x0.38	0.60 M		wall		28	28	28	27	29	27		wall		27.83	
2	2.10 M	28	28	27	27	27	27				_			27.33	
D4 1	1.35 M	28	30	29	28	28	28	<u></u> Cov	/ered	by	Со	/ered	by	28.50	28.44
+ 0.23X0.38	0.60 M	29	30	30	29	30	29		wall			wall		29.50	
2	2.10 M	_						_			26	27	27	26.67	
E1 1	1.35 M		vered	by		/ered	by		/ered	by	27	28	28	27.67	27.77
+ 0.23x0.38 ⊢	0.60 M		wall			wall			wall		28	30	29	29.00	
	2.10 M	26	27	27	Сол	/ered	l by	Со	/ered	by	Со	/ered	by	26.67	26.00
	1.35 M	27	28	26		wall			wall			wall		27.00	26.89

	0.60 M	27	27	27										27.00	
	2.10 M	_			26	28	27	_			26	27	26	26.67	
E3	1.35 M	Co۱	/ered		28	29	28	Cov	verec	•	27	27	27	27.67	27.72
0.23x0.38	0.60 M		wall		29	30	29		wall		28	29	28	28.83	
	2.10 M	26	29	28										27.67	
E4	1.35 M	27	28	27	<u></u>	/ered	l by	Cov	vered		Со	vered	by	27.33	27.77
0.23x0.38	0.60 M	28	29	28		wall			wall			wall		28.33	
	2.10 M				_			27	29	27	27	27	27	27.33	
F1	1.35 M		/ered	l by	<b>Co</b> ν	/ered	by	27	29	28	28	28	27	27.83	27.88
0.23x0.38	0.60 M		wall			wall		28	30	28	28	29	28	28.50	
	2.10 M				_			27	28	27				27.33	
F2	1.35 M		/erec		Со	/ered	by	28	28	28	Co	vered	by	28.00	28.33
0.23x0.38	0.60 M		wall			wall		29	30	30		wall		29.67	
	2.10 M				_			27	28	28				27.67	
F3 0.23x0.38	1.35 M	Co\	/erec wall	Гру	Cov	/ered wall	by	28	28	28	Cov	vered wall	by	28.00	28.11
U.23XU.38	0.60 M	1	wall			wall		29	29	28		wall		28.67	
F 4	2.10 M	27	27	27	_		L I.	_			~			27.00	
F4 0.23x0.38	1.35 M	28	29	27	Cov	/ered wall	by	CO	vered wall	l by	Cov	vered wall	бу	28.00	27.77
0.23X0.38	0.60 M	28	29	28		Wall			Wdll			Wall		28.33	
61	2.10 M	6			27	28	27	<b>C</b>		L I	27	28	27	27.33	
G1 0.23x0.38	1.35 M		/erec wall		28	29	27		vered wall		27	29	27	27.83	27.88
0.2380.38	0.60 M		wan		28	30	28		wan		28	29	28	28.50	
G2	2.10 M	Co	(orod	lbu	27	29	27	Co		lbu	Car	(orod	hu	27.67	
0.23x0.38	1.35 M		/erec wall	i by	28	28	28		vered wall	i by		vered wall	бу	28.00	28.11
0.2370.30	0.60 M		wan		28	30	28		wan			wan		28.67	
G3	2.10 M		/ered	lby	26	27	26	Co	vered	lby	Co	vered	by	26.33	
0.23x0.38	1.35 M		wall	-	27	27	27		wall			wall	Бу	27.00	26.88
0.23×0.30	0.60 M		wan		27	28	27		wan			wan		27.33	
G4	2.10 M	26	26	26	Co	/ered	bu	Co	vered	lby	Co	vered	bu	26.00	
0.23x0.38	1.35 M	26	30	27		wall	IJу		wall	гру		wall	Бу	27.67	27.44
5.2570.50	0.60 M	28	30	28		wun			wun			wun		28.67	
H1	2.10 M	6	vered	l by	Car	/ered		27	27	27	26	27	27	26.83	
0.23x0.38	1.35 M		wall			wall	БУ	27	28	28	27	28	27	27.50	27.50
0.200.00	0.60 M		wan			wan		28	28	29	28	28	28	28.17	
uл	2.10 M	Co	orod	lbu	Co	urad	bu	27	28	27	Con	iorod	bu	27.33	
H2 0.23x0.38	1.35 M		/erec wall			/ered wall	ыу	27	27	27	01	vered wall		27.00	27.55
5.2570.50	0.60 M		wuit			wun		28	29	28		wun		28.33	
บว	2.10 M	6	loro	l by	Car		l by	26	27	27	Ca	(orod	by	26.67	
H3 0.23x0.38	1.35 M		/erec wall		Covered by	27	28	27		vered wall	ыу	27.33	27.22		
5.2570.50	0.60 M		wuit			wun		27	28	28		wun		27.67	
Ц.4	2.10 M	27	28	27	<u> </u>	io ro -	hu	27	28	27	<u> </u>	ioro-	hu	27.33	
H4 0.23x0.38	1.35 M	28	28	28	0	/ered wall	ыу	28	29	28	0	vered wall		28.17	28.16
0.2380.30	0.60 M	29	30	29		vvdii		29	29	28		vvdii		29.00	
															27.81
							96	Read	lings						

			Third Floor R Value of Column face												
C.I.N.	R Value				R	Valu	e of (	Colui	nn fa	ice	r			<b>A</b>	Ave. R
Col. No. & size	location from	1	Nortl	ı		East			West	t	;	South	1	Avg Values	Value of
CC SIZE	FFL	E	М	Е	Е	Μ	E	E	Μ	E	Е	Μ	E	v arues	Col.
	2.10 M				25	28	25				25	28	25	26.00	
A1 0.23x0.38	1.35 M		vered wall	l by	27	28	28	Co	vered wall	•	27	28	28	27.67	27.61
0.2570.50	0.60 M		wan		29	30	29		wan		29	29	29	29.17	
	2.10 M				25	28	25	~			~			26.00	
A2 0.23x0.38	1.35 M	Co	vered wall	l by	26	29	26	Co	vered wall	l by	Co	vered wall	l by	27.00	27.44
0.2370.30	0.60 M		wan		29	30	29		wan			wan		29.33	
	2.10 M				26	27	26	26	27	26	~			26.33	
A3 0.23x0.38	1.35 M	Co	vered wall		28	29	27	27	29	26	Co	vered wall	-	27.67	27.50
0.2570.56	0.60 M		wan		28	29	28	28	30	28		wan		28.50	
	2.10 M	26	27	27	26	27	26							26.50	
A4 0.23x0.38	1.35 M	28	29	27	28	29	27	Co	vered wall		Co	vered wall	-	28.00	27.94
0.2370.30	0.60 M	29	30	28	29	31	29		wan			wan		29.33	
	2.10 M	~			~			~			26	27	27	26.67	
B1 0.23x0.38	1.35 M	Co	vered wall	l by	Co	vered wall		Co	vered wall	l by	26	28	28	27.33	27.22
0.2570.50	0.60 M		wan			wan			wan		28	28	27	27.67	
50	2.10 M	27	28	27							0			27.33	
B2 0.23x0.38	1.35 M	27	28	28		vered wall			vered wall		Co	vered wall		27.67	27.77
0.2570.50	0.60 M	28	29	28		wan			wan			wan		28.33	
D.	2.10 M				26	27	26				26	27	26	26.33	
B3 0.23x0.38	1.35 M		vered wall	l by	26	28	26	Co	vered wall	l by	26	29	26	26.83	26.94
0.2570.50	0.60 M		wan		27	28	27		wan		28	29	27	27.67	
54	2.10 M										26	27	26	26.33	
B4 0.23x0.38	1.35 M		vered wall	•	Co	vered wall		Co	vered wall	•	26	29	26	27.00	27.33
0.2570.50	0.60 M		wan			wan			wan		28	30	28	28.67	
~	2.10 M	26	28	26	~			26	27	26	~			26.50	
C1 0.23x0.38	1.35 M	27	28	28	Co	vered wall		27	28	28	Co	vered wall		27.67	27.56
0.2570.50	0.60 M	28	30	28		wan		28	29	28		wan		28.50	
	2.10 M				0			26	27	26				26.33	
C2 0.23x0.38	1.35 M		vered wall		Co	vered wall		27	28	28	Co	vered wall		27.67	27.78
0.2370.30	0.60 M		wan			wan		29	30	29		wan		29.33	
~	2.10 M				~			27	27	26	~			26.67	
C3 0.23x0.38	1.35 M		vered wall	l by	Co	vered wall		27	28	28	Co	vered wall		27.67	27.67
0.2370.30	0.60 M		wan			wan		28	30	28		wan		28.67	
	2.10 M	26	27	26				27	27	26				26.50	
C4 0.23x0.38	1.35 M	26	27	26	Co	vered wall	-	26 29 26	Co	vered wall		26.67	27.05		
0.2340.30	0.60 M	27	28	27		vv 411		28	30	28		vv 411		28.00	
-	2.10 M				27	27	27				27	27	27	27.00	
D1 0.23x0.38	1.35 M	Co	vered wall		28	28	28	Covered by	28	29	28	28.17	27.89		
0.2370.30	0.60 M	]	vv all		28	29	28		vv a 11		28	30	28	28.50	
D2	2.10 M	Co	vered	l by	26	27	26	Co	vered	l by	Co	vered	l by	26.33	27.00
0.23x0.38	1.35 M		wall		26	29	26	1	wall	•		wall		27.00	27.00

	0.60 M				27	29	27							27.67	
	2.10 M				26	27	26	26	27	26				26.33	
D3	1.35 M	Co	vered		26	29	26	27	29	27	Co	vered	by	27.33	27.39
0.23x0.38	0.60 M	1	wall		28	30	28	28	29	28	1	wall		28.50	
	2.10 M	26	28	26	26	27	26							26.50	
D4	1.35 M	27	29	26	27	29	28	Co	vered		Co	vered	by	27.67	27.72
0.23x0.38	0.60 M	29	30	28	29	29	29		wall			wall		29.00	
	2.10 M		1			1					26	27	26	26.33	
E1 0.23x0.38	1.35 M	Co	vered wall		Co	vered wall	by	Co	vered wall	l by	27	29	28	28.00	27.88
0.23X0.38	0.60 M	1	wall			wall			wall		29	30	29	29.33	
	2.10 M	26	27	26										26.33	
E2 0.23x0.38	1.35 M	26	28	27	Co	vered wall	by	Co	vered wall		Co	vered wall		27.00	27.00
0.23X0.36	0.60 M	27	28	28	1	wall			wall			wall		27.67	
	2.10 M				26	27	26				26	27	26	26.33	
E3 0.23x0.38	1.35 M	Co	vered wall		27	29	28	Co	vered wall		28	28	27	27.83	27.78
0.23X0.38	0.60 M		wall		28	30	28		wan		28	31	30	29.17	
	2.10 M	26	28	26										26.67	
E4 0.23x0.38	1.35 M	28	29	27	Co	vered wall	by	Co	vered wall	l by	Co	vered wall	by	28.00	27.77
0.23X0.30	0.60 M	28	30	28		wall			wan			wall		28.67	
	2.10 M	~			~			26	28	26	26	28	26	26.67	
F1 0.23x0.38	1.35 M	Co	vered wall		Co	vered wall	by	28	29	28	28	29	28	28.33	28.05
0.23X0.30	0.60 M		wan			wan		29	30	29	29	30	28	29.17	
	2.10 M							26	28	26				26.67	
F2 0.23x0.38	1.35 M		vered wall	•	Co	vered wall	by	28	30	28	Co	vered wall	by	28.67	28.22
0.2570.50	0.60 M		wan			wan		28	31	29		wan		29.33	
	2.10 M							26	27	26				26.33	
F3 0.23x0.38	1.35 M	Co	vered wall	•	Co	vered wall	by	28	29	28	Co	vered wall		28.33	27.77
0.2580.50	0.60 M		wan			wan		28	29	29		wan		28.67	
Ε4	2.10 M	26	28	26		1					C	,	1	26.67	
F4 0.23x0.38	1.35 M	27	29	27	Co	vered wall	by	Co	vered wall		Co	vered wall	бу	27.67	27.66
0.20110100	0.60 M	28	29	29										28.67	
G1	2.10 M	Car	vered	lbu	26	27	26	Co	vered	lby	26	28	26	26.50	
0.23x0.38	1.35 M		wall		27	28	27		wall		27	29	29	27.83	27.72
	0.60 M				28	30	28				28	30	29	28.83	
G2	2.10 M		vered	lby	26	27	26	Co	vered	l by	Co	vered	by	26.33	
0.23x0.38	1.35 M		wall	•	27	28	27		wall			wall		27.33	27.22
	0.60 M				27	30	27							28.00	
G3	2.10 M	Co	vered	lby	26	27	26	Co	vered	l by	Co	vered	by	26.33	
0.23x0.38	1.35 M		wall		27 28 27		wall			wall		27.33	27.67		
	0.60 M		1	1	29	30	29							29.33	
G4	2.10 M	26	27	26	Co	vered	hv	Co	vered	l by	Co	vered	by	26.33	
0.23x0.38	1.35 M	27	28	27		wall	Uy		wall	-		wall	Uy	27.33	27.33
	0.60 M	27	30	28						1		1	1	28.33	
H1	2.10 M	Co	vered		Co	vered	by	26	27	26	26	27	26	26.33	27.56
0.23x0.38	1.35 M		wall			wall		27	28	27	27	28	27	27.33	2,.00

	0.60 M						29	30	29	28	30	28	29.00	
110	2.10 M				~		27	27	26	0			26.67	
H2 0.23x0.38	1.35 M		vered wall	by	Covere wa		27	28	27	Co	vered wall		27.33	27.55
0.23X0.30	0.60 M		wan		wa		28	30	28		wan		28.67	
110	2.10 M						27	27	27				27.00	
H3 0.23x0.38	1.35 M	Co		by	Covere wa		27	29	28	Co	vered wall		28.00	28.22
0.25X0.50	0.60 M		Covered by wall	, wa		29	31	29		wan		29.67		
114	2.10 M	27	27	28			27	27	27	0		. 1	27.17	
H4 0.23x0.38	1.35 M	27	29	27	Covere wa		27	29	27	Co	vered wall		27.67	27.83
0.2580.50	0.60 M	27	29	28	, na		29	30	29		un		28.67	
														27.60
				96	Reading	s								

		R Value	of each col	lumn		
		Ave.R v	alue of colu	imns in eac	h floor	A
S. No.	Column No. and size	Stilt Floor	1st Floor	2nd Floor	3rd Floor	Average of each column
1	A1 0.23x0.38	26.86	27.11	28.05	27.61	27.41
2	A2 0.23x0.38	26.55	27.66	28.77	27.44	27.61
3	A3 0.23x0.38	27.55	28.16	26.72	27.50	27.48
4	A4 0.23x0.38	26.36	26.50	28.16	27.94	27.24
5	B1 0.23x0.38	26.39	26.67	27.89	27.22	27.04
6	B2 0.23x0.38	26.30	27.44	27.55	27.77	27.27
7	B3 0.23x0.38	26.86	27.72	28.05	26.94	27.39
8	B4 0.23x0.38	27.42	27.77	27.66	27.33	27.55
9	C1 0.23x0.38	26.96	26.89	28.33	27.56	27.44

10	C2 0.23x0.38	26.47	27.89	27.00	27.78	27.29
11	C3 0.23x0.38	26.38	27.67	28.22	27.67	27.49
12	C4 0.23x0.38	26.38	27.22	28.72	27.05	27.34
13	D1 0.23x0.38	27.11	27.89	28.27	27.89	27.79
14	D2 0.23x0.38	26.28	28.00	27.55	27.00	27.21
15	D3 0.23x0.38	26.86	28.39	27.61	27.39	27.56
16	D4 0.23x0.38	27.44	28.05	28.44	27.72	27.91
17	E1 0.23x0.38	26.83	27.88	27.77	27.88	27.59
18	E2 0.23x0.38	26.56	27.77	26.89	27.00	27.06
19	E3 0.23x0.38	26.94	28.28	27.72	27.78	27.68
20	E4 0.23x0.38	28.44	28.00	27.77	27.77	28.00
21	F1 0.23x0.38	27.11	28.06	27.88	28.05	27.78
22	F2 0.23x0.38	26.00	27.44	28.33	28.22	27.50
23	F3 0.23x0.38	27.78	28.44	28.11	27.77	28.03
24	F4 0.23x0.38	25.72	28.66	27.77	27.66	27.45

25	G1 0.23x0.38	28.00	29.22	27.88	27.72	28.21
26	G2 0.23x0.38	26.22	27.88	28.11	27.22	27.36
27	G3 0.23x0.38	27.00	28.11	26.88	27.67	27.42
28	G4 0.23x0.38	26.67	28.89	27.44	27.33	27.58
29	H1 0.23x0.38	26.56	28.66	27.50	27.56	27.57
30	H2 0.23x0.38	27.56	27.44	27.55	27.55	27.53
31	H3 0.23x0.38	27.11	28.88	27.22	28.22	27.86
32	H4 0.23x0.38	27.50	28.72	28.16	27.83	28.05
	Ave.	26.89	27.92	27.81	27.60	27.55

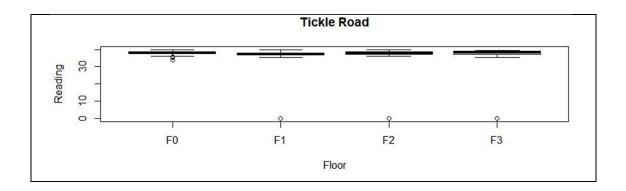
--000---

# **Annexure IV: Concrete Testing**

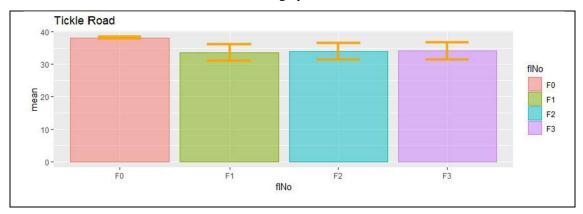
#### 1. Tickle Road, Valluru Purnachandra Rao Road

This is a residential building with Stilt + 3 Floors, located on plain ground facing Tickle Road near by Benz Circle with Geographic Coordinates  $16^{\circ}29'53''$  N and  $80^{\circ}38'54''$  E. Krishna River is 1.00 km away and Bandar Canal is 0.50 km from this building. The soils met with for foundations are Black Cotton soils. The height of each floor is 3.00 m.

To ascertain the compressive strength of the existing RCC columns, Rebound Hammer is used and readings taken perpendicular (90°) to face of each column at three levels of height i.e., 0.60 m, 1.35 m and 2.10 m from finished floor level. At every level maximum 12 readings all-round the column i.e., 3 readings on each face of the column 4 faces are taken and average adopted for analysis. There are 28 columns in each floor. Rebound Hammer readings are taken at levels for each column wherever possible and average of 12 readings at each level are considered as one reading for analysispurpose. There are 84 readings in Stilt Floor and 75 readings for each upper floor, totaling to 309 readings in 4 floors. The box plots are shown below.



The means in floors GF, F1, F2, and F3, are 38.16, 33.62, 33.97, and 34.08 respectively. The overall mean is 34.96. The means are shown in the bar graph below.



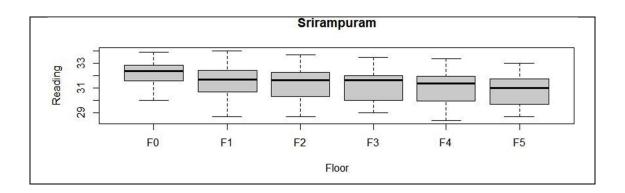
	Estimate	Std. Error	t-value	p-value	
GF	38.158	1.120	34.060	0	
F1	-4.539	1.584	-2.865	0.00444	
F2	-4.184	1.584	-2.641	0.00867	
F3	-4.082	1.584	-2.576	0.01041	

The significance test of the equality of floor means is carried out by analysis of variance.

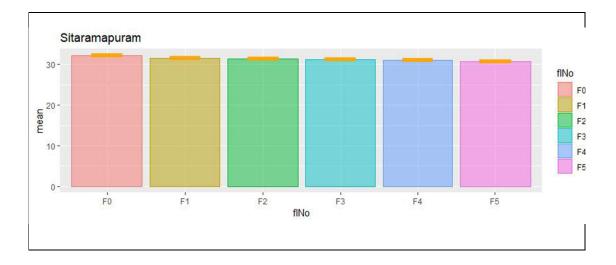
# 2. Sitarampuram (Durga Agraharam)

This is a residential Building bearing H. No. 30-17-30 in Sitarampuram area with Stilt + 5 floors located on plain ground near Eluru Road (Kothavanthena Centre). The Geographic Coordinates of this building are  $16^{\circ}31'07"$  N and  $80^{\circ}38'22"$  E. Ryves canal is 0.30 km from this building. The soils are Black Cotton expansive soils. The height of each floor is 3.00 m.

To ascertain the compressive strength of the existing RCC columns, Rebound Hammer is used, and readings taken perpendicular (90°) to face of each column at three levels of height i.e., 0.60 m, 1.35 m and 2.10 m from finished floor level. At every level maximum 12 readings all-round the column i.e., 3 readings on each face of the column 4 faces are taken and average adopted for analysis. There are 48 columns in each floor. Rebound Hammer readings are taken at 3 levels on each column face wherever possible and an average of 12 readings at each level are considered as one reading for analysis purpose. There are 142 readings for the Stilt floor and 136 readings for each upper floor, totaling to 822 readings in 6 floors. The box plots are shown below.



The means in floors GF, F1, F2, F3, F4, and F5 are 32.15, 31.54, 31.34, 31.24, 31.03, and 30.76 respectively. The overall mean for the building is 31.34. The means are shown in the bar graph below.



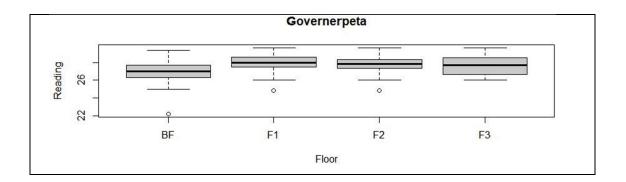
The significance test of the equality of floor means is carried out by analys is of variance.

	Estimate	Std. Error	t-value	p-value
GF	32.14764	0.08982	357.926	0
F1	-0.61083	0.12702	-4.809	0
F2	-0.80653	0.12702	-6.350	0
F3	-4.082	1.584	-2.576	0.01041
F4	-0.90708	0.12702	-7.141	0
F5	-1.11681	0.12702	-8.792	0
F6	-1.38799	0.12702	-10.927	0

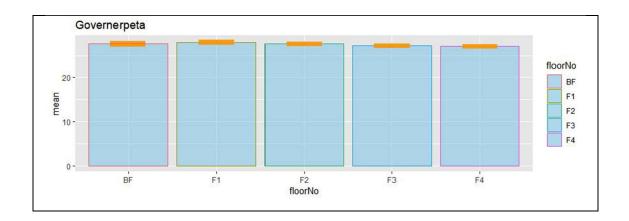
# 3. Governerpet (Venkateswara Rao Street)

This is a residential building H. No. 29-3-8 in Ward No. 24 in Governorpet area with Geographic Coordinates 16°30'48" N and 80°37'51" E. The Ryves canal is about 0.50 km from this building. The foundations are met with Black Cotton soils. The height of each floor is 3.00 m.

To ascertain the compressive strength of the existing RCC columns, Rebound Hammer is used and readings taken perpendicular  $(90^{\circ})$  to face of each column at three levels of height i.e., 0.60 m, 1.35 m and 2.10 m from finished floor level. At every level maximum 12 readings allround the column i.e., 3 readings on each face of the column 4 faces are taken and average adopted for analysis. There are 31 columns in each floor. Rebound Hammer readings are taken at 3 levels on each column face wherever possible and average of 12 readings at each level are considered as one reading for analysis purpose. There are 96 readings for each floor, totaling to 384 readings for 4 floors. The box plots for the data are shown below.



The means in floors BF, F1, F2, and F3, are 26.92, 27.94, 27.83, and 27.62 respectively. The overall mean for the building is 27.58. The means are shown in the bar graph below.



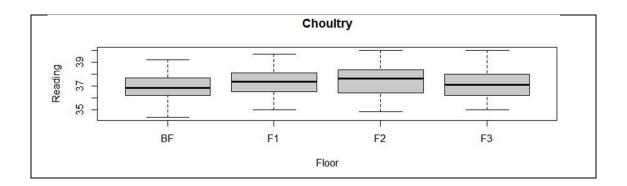
The significance test of the equality of floor means is carried out by analys is of variance.

	Estimate	Std. Error	t-value	p-value
GF	26.91990	0.09944	270.727	0
F1	1.01948	0.14062	7.250	0
F2	0.90792	0.14062	6.456	0
F3	0.70333	0.14062	5.002	0

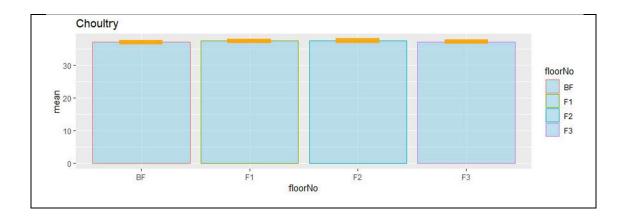
## 4. Choultry (Madapati Guest House) Tarapet.

This is a commercial building being used as a Guest House with Stilt + 3 floors, located in Commercial area of Vijayawada Old town near Railway Station. The Geographic Coordinates of this building are 16°31'06" N and 80°36'41" E. The soils met with are Black cotton soils. The height of each floor is 3.66 m. To ascertain the compressive strength of the existing RCC columns, Rebound Hammer is used and readings taken perpendicular (90°) to face of each column at three levels of height i.e., 1.00 m, 2.00 m and 3.00 m from finished floor level. At every level maximum 12 readings alround the column i.e., 3 readings on each face of the column 4 faces are taken and average adopted for analysis.

There are 24 columns in each floor. Rebound Hammer readings are taken at 3 levels on each column face wherever possible and average of 12 readings at each level are considered as one reading for analys is purpose. There are 72 readings for each floor, totaling to 288 readings in 4 floors. The box plots are shown below.



The means in floors BF, F1, F2, and F3, are 36.96, 37.36, 37.43, and 37.13, respectively. The overall mean for the building is 37.22. The means are shown in the bar graph below.



The significance test of the equality of floor means is carried out by analysis of variance.

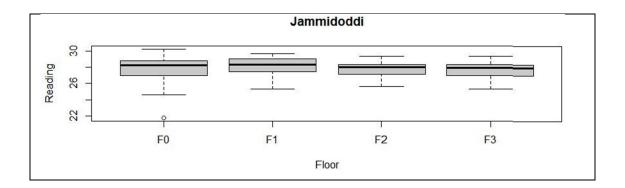
	Estimate	Std. Error	t-value	p-value	
GF	36.9644	0.1390	265.94	0	
F1	0.3921	0.1966	1.995	0.0470	
F2	0.4633	0.1966	2.357	0.0191	
F3	0.1696	0.1966	0.863	0.3890	

### 5. Jammidoddi (Endowments Dept. Office)

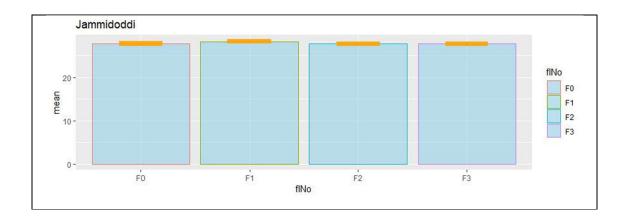
This is an office building of Endowments Department with Stilt + 3 floors, located in old town of Vijayawada in hill slope of Indra Keeladdri Hill. The Geographic Coordinates of this building are  $16^{\circ}30'58''$  N and  $80^{\circ}40'33''$  E. The soils met within foundations are hard gravel/murram. The height of each floor is 3.66 m sliding of hill slopes are common during rainy season in this area.

To ascertain the compressive strength of the existing RCC columns, Rebound Hammer is used and readings taken perpendicular  $(90^\circ)$  to face of each column at three levels of height i.e., 1.00 m, 2.00 m and 3.00 m from finished floor level. At every level maximum 12 readings alround the column i.e., 3 readings on each face of the column 4 faces are taken and average adopted for analysis.

There are 28 columns in each floor. Rebound Hammer readings are taken at 3 levels on each column face wherever possible and anaverage of 12 readings at each level are considered as one reading for analysis purpose. There are 84 readings in Stilt Floor and 80 readings for each upper floor, totaling to 324 readings for 4 floors. The box plots are shown below.



The means in floors GF, F1, F2, and F3 are 27.82, 28.24, 27.75, and 27.75 respectively. The overall mean is 27.89. The means are shown in the bar graph below.



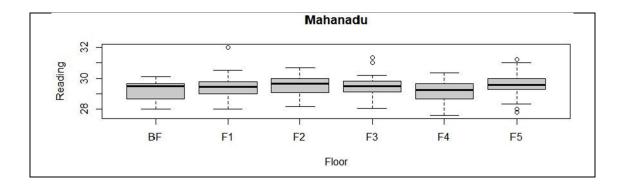
	Estimate	Std. Error	t-value	p-value	
GF	27.82083	0.11625	239.316	0	
F1	0.41488	0.16440	2.524	0.0121	
F2	-0.07143	0.16440	-0.434	0.6642	
F3	-0.07321	0.16440	-0.445	0.6564	

The significance test of the equality of floor means is carried out by analysis of variance.

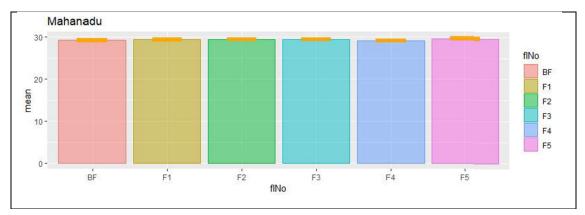
# 6. Mahanadu Road, Gunadala

This is a residential building H. No. 48-19-17, with Stilt + 5 floors, located in Gunadala area of Vijayawada city close to Mahanadu Road. The Geological Coordinates of this building are 16°30'52" N and 80°40'33" E. The soils met within foundations are pure Black cotton soils. These were all agricultural land still 20 years back. The roof height of each floor is 3.00 m.

To ascertain the compressive strength of the existing RCC columns, Rebound Hammer is used and readings taken perpendicular (90°) to face of each column at three levels of height i.e., 0.60 m, 1.35 m and 2.10 m from finished floor level. At every level maximum 12 readings all-round the column i.e., 3 readings on each face of the column 4 faces are taken and average adopted for analysis. There are 15 columns on each floor. Rebound Hammer readings are taken at 3 levels on each column face wherever possible and average of 12 readings at each level are considered as one reading for analysis purpose. There are 45 readings in Stilt floor and 43 readings for each upper floor, totaling to 260 readings for 6 floors. The box plots are shown below.



The means in floors BF, F1, F2, F3, F4, and F5 are 29.24, 29.41, 29.52, 29.44, 29.16 and 29.63 respectively. The overall mean for the building is 29.40. The means are shown in the bar graph below.

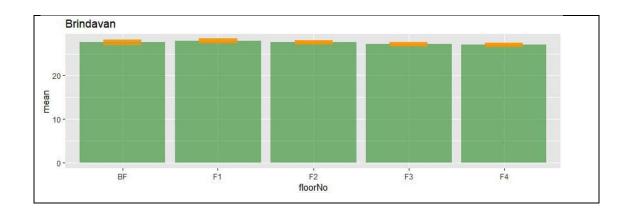


The significance test of the equality of floor means is carried out by analysis of variance.

	Estimate	Std. Error	t-value	p-value
GF	29.23911	0.09638	303.376	0
F1	0.17089	0.13630	1.254	0.21104
F2	0.28289	0.13630	2.075	0.03891
F3	0.20378	0.13630	1.495	0.13609
F4	-0.07844	0.13630	-0.576	0.56543
F5	0.39400	0.13630	2.891	0.00416

### 7. Brindavan (Labbipet)

This is a residential building in Brindavan Nagar of Labbipet area H. No. 40-15/2-19/8Anear Benz Circle with Stilt + 4 floors. The Geological Coordinates of this building are  $16^{\circ}29'57''$ N and  $80^{\circ}38'48''$  E. Krishna River is 1.00 km away and Bandar Canal is 0.50 km from this building. The soils met with for foundations are Black Cotton. The height of each floor is 3.00 m. To ascertain the compressive strength of the existing RCC columns, Rebound Hammer is used and readings taken perpendicular ( $90^{\circ}$ ) to face of each column at three levels of height i.e., 0.60 m, 1.35 m and 2.10 m from finished floor level. At every level maximum 12 readings alround the column i.e., 3 readings on each face of the column 4 faces are taken and average value adopted for analysis. There are 20 columns in each floor. Rebound Hammer readings are taken at levels for each column wherever possible and average of 12 readings at each level are considered as one reading for analysis purpose. There are 60 readings for each floor, totaling to 300 readings for the 5 floors. The means in floors BF, F1, F2, F3, and F4 are 27.62, 27.91, 27.60, 27.19, and 27.08 respectively. The overall mean for the building is 27.48. A bar graph for the means is shown below.



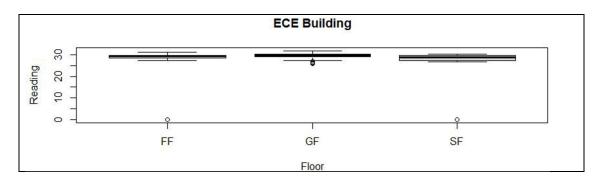
The significance test of the equality of floor means is carried out by analysis of variance.

	Estimate	Std. Error	t-value	p-value
GF	27.62050	0.12459	221.684	0
F1	0.29433	0.17620	1.670	0.09590
F2	-0.01917	0.17620	-0.109	0.91345
F3	-0.43017	0.17620	-2.441	0.01522
F4	-0.54283	0.17620	-3.081	0.00226

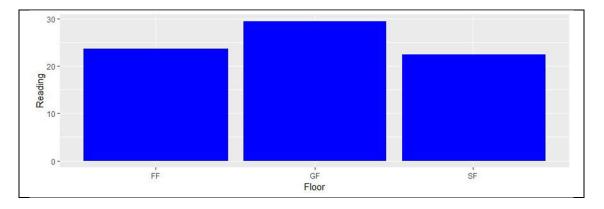
# 8. GPV-ECE Block (Benz Circle Flyover)

This is the Govt. Polytechnic Building for Electronics & Communications Engineering Lab in Ground + 2 Floors facing Ring Road Benz Circle Flyover on NH-16. The Geographic Coordinates of this building are  $16^{\circ}30'16''$  N and  $80^{\circ}39'30''$  E. The soil is Black Cotton. The roof height of each floor is 3.60 m. To ascertain the compressive strength of the existing RCC columns, Rebound Hammer is used, and readings taken perpendicular (90°) to face of each column at three levels of height i.e., 0.60 m, 1.35 m and 2.10 m from finished floor level. At every level maximum 12 readings all-round the column i.e., 3 readings on each face of the column 4 faces are taken and average adopted for analysis. There are 50 columns in each floor. Rebound Hammer readings are taken at 3 levels on each column face wherever possible and an average of 12 readings at each level are considered as one reading for analysis purpose.

There are 150 readings In Ground Floor, 121 for F1 and 115 for F2 floor, totaling to 386 readings in 3 floors. The box plots are shown below. The means in floors FF, GF & SF are 23.68, 29.52 & 22.44, respectively. The overall mean for the building is 25.2.



The means are shown in the bar graph below.



The significance test of the equality of floor means is carried out by analysis of variance.

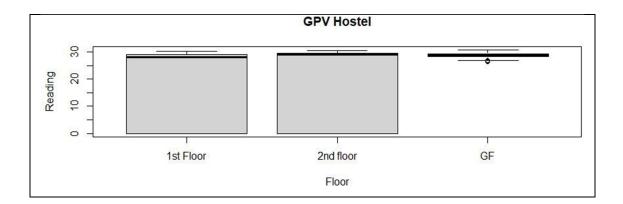
	Estimate	Std. Error	t-value	p-value
GF	23.6847	0.7974	29.701	0
GF	5.8341	1.1278	5.173	0
SF	-1.2472	1.1278	-1.106	0.269

# 9. GPV Hostel Block, Benz Circle Flyover.

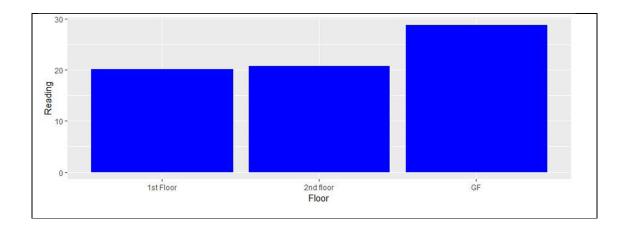
This is Govt. building with G+3 floors, located facing Benz Circle Flyover on NH-16 opp. to Ramesh Hospitals, used for Polytechnic Students Hostel. The Geographic Coordinates of this building are 16°30'20" N Land 80°39'34" E. The soils are Black Cotton. Roof height of each floor is 3.00 m.

To ascertain the compressive strength of the existing RCC columns, Rebound Hammer is used, and readings taken perpendicular  $(90^\circ)$  to face of each column at three levels of height i.e., 0.60 m, 1.35 m and 2.10 m from finished floor level. At every level maximum 12 readings all-round the column i.e., 3 readings on each face of the column 4 faces are taken and average adopted for analysis.

There are 94 columns in each floor. Rebound Hammer readings are taken at levels for each column wherever possible and average of 12 readings at each level are considered as one reading for analysis purpose. There are 282 readings in Ground floor, 192 in F1 and 189 in F2 floor, readings, totaling to 663 readings in 3 floors. The box plots are shown below.



The range of the readings in first floor is 0.00 to 30.33, in second floor is 0.00 to 30.50, and in ground floor is 26.44 to 30.67, while the median in these floors is 28.17, 29.00, and 28.89, respectively. The means in the floors first, second & ground are 20.16, 20.70, & 28.79, respectively. The overall mean for the building is 23.54. The means are shown in the bar graph below.



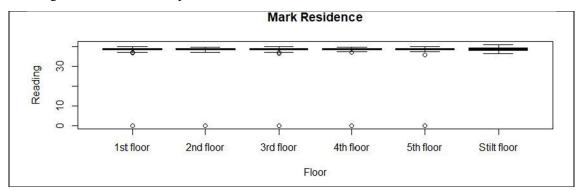
The significance test of the equality of floor means is carried out by analysis of variance.

	Estimate	Std. Error	t-value	p-value
GF	20.1622	0.6336	31.823	0
GF	0.5407	1.0063	0.537	0.591
SF	8.6290	0.8960	9.630	0

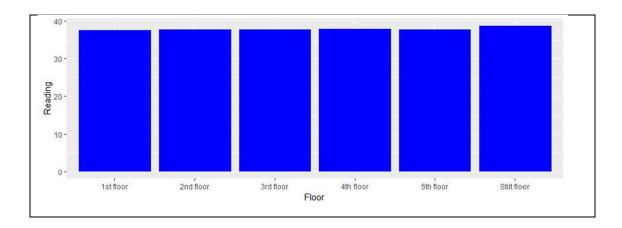
### 10. MARK Residency, A. S. Ramarao Road Gunadala.

This is a residential building with Stilt+5 floors located in Moghalrajpuram East Hillslope area abutting A.S.Ramarao Road. The soils are Black cotton. Landslides during rainy season in this area are common. Geographic Coordinates of this building are 16°30'15" N and 80°39'30" E. The roof height of each floor is 3.00 m.

To ascertain the compressive strength of the existing RCC columns, Rebound Hammer is used and readings taken perpendicular (90°) to face of each column at three levels of height i.e., 0.60 m, 1.35 m and 2.10 m from finished floor level. At every level maximum 12 readings all around the column i.e., 3 readings on each face of the column 4 faces are taken and average adopted for analysis. There are 26 columns in each floor. Rebound Hammer readings are taken at levels for each column wherever possible and average of 12 readings at each level are considered as one reading for analysis purpose. There are 78 readings for Stilt Floor and 76 readings each in upper floors, totaling to 458 readings in 6 floors. The box plots are shown below.



The means in first, second, third, fourth, fifth, and stilt floors are 37.66, 37.83, 37.72, 37.83, 37.79, and 38.79, respectively. The overall mean for the building is 37.94. The means are shown in the bar graph below.



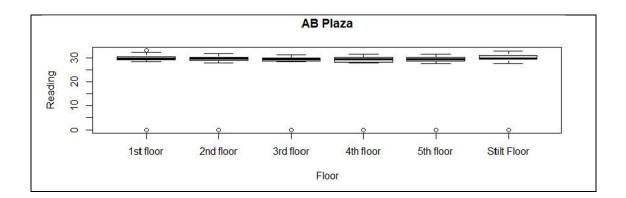
The significance test of the equality of floor means is carried out by analysis of variance.

	Estimate	Std. Error	t-value	p-value
GF	37.65772	0.63373	59.243	0
F1	0.16873	0.89623	0.188	0.851
F2	0.06354	0.89623	0.071	0.944
F3	0.17557	0.89623	0.196	0.845
F4	0.13228	0.89623	0.148	0.883
F5	1.13215	0.89623	1.263	0.207

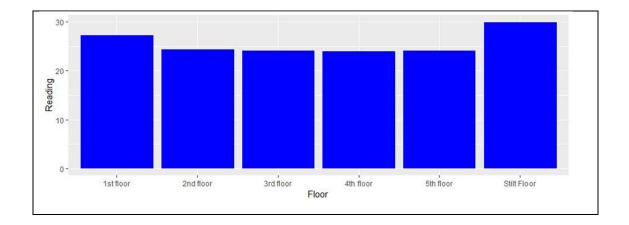
#### 11. AB Plaza, Krishna Lanka, NH-16 & 65

This is a residential building with Stilt+5 floors, located in Krishna Lanka flood-affected area in between Krishna River and Bandar Canal abutting NH-16 & 65. The soil is black cotton/soft. The Geographic Coordinates of this building are 16°29'45" N and 80°38'49" E. The roof height of each floor is 3.00 m.

To ascertain the compressive strength of the existing RCC columns, Rebound Hammer is used and reading taken perpendicular (90°) to face of each column at three levels of height i.e., 0.60 m, 1.35 m and 2.10 m from finished floor level. At every level maximum 12 readings all around the column i.e., 3 readings on each face of the column 4 faces are taken and average adopted for analysis. There are 35 columns in Stilt floor and 33 columns each in F1 to F5 floors. Rebound Hammer readings are taken at 3 levels for each column wherever possible and an average of 12 readings at each level are considered as one reading for analysis purpose. There are 105 readings on the Stilt floor, 96 readings each in F1 and F5 upper floors, totaling to 545 readings in 6 floors. The box plots are shown below.



The means in first, second, third, fourth, fifth, and stilt floors are 27.28, 24.38, 24.07, 24.03, 24.12, and 29.96, respectively. The overall mean for the building is 25.64. The means are shown in the bar graph below.



	Estimate	Std. Error	t-value	p-value
GF	27.277	1.013	26.940	0
F1	-2.896	1.432	-2.022	0.0436
F2	-3.212	1.432	-2.243	0.0252
F3	-3.251	1.432	-2.270	0.0235
F4	-3.159	1.432	-2.206	0.0277
F5	2.683	1.432	1.874	0.0614

The significance test of the equality of floor means is carried out by analysis of variance.

### 12. Ranganath Residency, Bandar Road, Mogalrajpuram.

This is a residential building with Stilt+5 floors, located on plain ground in Mogalrajpuram near Bandar Road. The Geographic Coordinates of this building are 16°30'08" N and 80°39'01" E. The roof height of each floor is 3.00 m.

To ascertain the compressive strength of the existing RCC columns, Rebound Hammer is used and reading taken perpendicular (90°) to face of each column at three levels of height i.e., 0.60 m, 1.35 m and 2.10 m from finished floor level. At every level maximum 12 readings all around the column i.e., 3 readings on each face of the column 4 faces are taken and average adopted for analysis. There are 22 columns on the Stilt floor and 22 columns each in F1 to F5 floors. Rebound Hammer readings are taken at 3 levels for each column wherever possible and an average of 12 readings at each level are considered as one reading for analysis purposes. There are 648 readings on the Stilt floor, 376 in each upper floor totaling 2528 readings in 6 floors.

## 13. Chakradhar, No. 5 Route, ITI Road.

This is an office building with Stilt+5 floors, located in Ramachandra Nagar, facing ITI Road. The soil is black cotton/soft. The Geographic Coordinates of this building are 16°30'17"N and 80°39'19"E. The roof height of each floor is 3.00 m.

To ascertain the compressive strength of the existing RCC columns, Rebound Hammer is used, and reading taken perpendicular (90°) to face of each column at three levels of height i.e., 0.60 m, 1.35 m and 2.10 m from finished floor level. At every level maximum 12 readings all around the column i.e., 3 readings on each face of the column 4 faces are taken and average adopted for analysis. There are 12 columns on the Stilt floor and 12 columns each in F1 to F5 floors. Rebound Hammer readings are taken at 3 levels for each column wherever possible and an average of 12 readings at each level are considered as one reading for analysis purposes. There are 387 readings on the Stilt floor, 153 in F1, 154 in F2, 153 in F3, and 147 each in F4 and F5 upper floors, totaling 1141 readings in 6 floors.

### 14. High School Road, Patamata.

This is an office-cum-residential building with stilt+4 floors located on plain ground facing High School Road in Auto Nagar area of Patamata with Geographic coordinates 16°30'03''N and 80°40'12''E. The roof height of each floor is 3.00 m.

To ascertain the compressive strength of the existing RCC columns, Rebound Hammer is used, and reading taken perpendicular  $(90^\circ)$  to face of each column at three levels of height i.e., 0.60 m, 1.35 m, and 2.10 m from finished floor level. At every level maximum 12 readings all around the column i.e., 3 readings on each face of the column 4 faces are taken and average adopted for analysis. There are 11 columns on the Stilt floor and 11 columns each in F1 to F4

floors. Rebound Hammer readings are taken at 3 levels for each column wherever possible and an average of 12 readings at each level are considered as one reading for analysis purpose. There are 297 readings on the Stilt floor, 177 in F1, 179 in F2, 208 in F3, and 182 in F4, totaling 1043 readings in 5 floors.

#### 15. Machavaram, Narla Vari Street.

This is a residential building with Stilt+5 floors on plain ground at a distance of about 100m away from Ryves Canal between Vijayawada Bypass Road and Eluru Road in Machavaram down locality. The Geographic Coordinates of this location are 16°31'24" N and 80°39'13" E. The soils met with for foundations are Black Cotton soils. The height of each floor is 3.00 m. To ascertain the compressive strength of the existing RCC columns, Rebound Hammer is used, and reading taken perpendicular (90°) to face of each column at three levels of height i.e., 0.60 m, 1.35 m, and 2.10 m from finished floor level. At every level maximum 12 readings all around the column i.e., 3 readings on each face of the column 4 faces are taken and average adopted for analysis.

There are 13 columns in Stilt floor and 13 columns each in F1 to F5 floors. Rebound Hammer readings are taken at 3 levels for each column wherever possible and an average of 12 readings at each level are considered as one reading for analysis purpose. There are 411 readings on the Stilt floor and 216 readings each in F1 to F5 floors totaling to 1491 readings in 6 floors.

--000--

# Annexure V (Seismic Weight and Base Shear Calculations)

1. TICKLE RO	AD Canad	Anartma	ate VIIAVA	WADA		
			Calculations	AWADA		
Seismic weight of a floor (W1) (Cl. 3.26)	0					
It is the sum of dead load of the floor, approprimate elements from the storeys above imposed load on the floor.	priate contri	butions of v				
• Seismic weight of a Structure (W) (Cl.:	3.27, IS 189	3:2016)				
It is the sum of seismic weights of all floors.						
W1 = Dead load of floor 1 +						
Weight of Beams (1) +						
Weight of Slabs (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Columns (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Columns (2) +						
<sup>1</sup> / <sub>2</sub> Weight of Walls (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Walls (2) +						
Appropriate imposed (Live) Load.						
Base Shear (VB) (Cl.4.7 IS 1893:2016						
It is the horizontal lateral force in the consid designed for.	ered direction	on of earthq	uake shaking	that the stu	ructure shall	be
VB = Ah x W & Ah = Z/2 x I/R x Sa/g						
Considerations:						
External wall thickness: 230 mm						
Internal wall thickness: 230 mm						
Specific weight of RCC: 25 KN / Cum						
Specific weight of infill wall:20 KN / Cum						
Type of soil: Medium						
Size of columns:230 x 230 mm & 300 mm d	1a.					
Size of Beams: 230 x 425 mm						
Response spectra: IS 1893(Part 1) : 2002 Assumption: Live Load 3.00 KN/ Sqm						
<u>^</u>	D 04 1		0.1	11 1 0 50	,	
Referring to Table 8, IS 1893:2002; Cl.7.3.1	. Page 24; th	ne percentag	ge of impose	d load 25%	0	
Step 1: CACULATIO W1	N OF SEIS	MIC WEI	GHT OF	1	lst FLOOR	
Height of wall:						
$= \frac{1}{2} x$ Ht.of wall of Fl.1 + $\frac{1}{2} x$ Ht.of wall of	`F1.2					
= $\frac{1}{2} x (3.00-0.425) + \frac{1}{2} x (3.00-0.425) = 1$	2.58 M					
Height of Column:						
$=\frac{1}{2} x$ Ht. of Col. in Fl.1 + $\frac{1}{2} x$ Ht. of Col.in	F1.2					
$= (\frac{1}{2} \times 3.00) + (\frac{1}{2} \times 3.00) = 3.00 \text{ M}$						1
<b>Description of Items</b>	Nos.	Width M	Length M	Height M	Sp.Wt. KN/Cum	Total Wt. KN
Weight of Slab	1.00	16.37	11.06	0.125	25.00	565.79
Weight of columns 230x230 mm	17.00	0.23	0.23	3.00	25.00	67.45
300 mm dia.	11.00	3.14	0.023	3.00	25.00	58.34
Weight of Beams:						0.00
All beams in X-direction	3.00	0.23	16.37	0.425	25.00	120.01
All Leaves 's XZ d'and'	1.00	0.23	13.34	0.425	25.00	32.60
All beams in Y-direction	5.00	0.23	11.06	0.425	25.00	135.14

	1.00	0.23	2.72	0.425	25.00	6.65
	1.00	0.23	4.49	0.425	25.00	10.97
Weight of imposed Live Load (25%)	0.25	11.06	16.37	0.00	3.00	135.79
Weight of walls:	0.25	11.00	10.57	0.00	5.00	155.77
All walls in X=direction:						
	1.00	0.23	5.14	2.58	20.00	61.00
Internal walls:	1.00	0.23	7.12	2.58	20.00	84.50
	1.00	0.23	6.06	2.58	20.00	71.92
External walls:	1.00	0.23	7.12	2.58	20.00	84.50
All walls in Y-direction:	1.00	0.25	/.12	2.50	20.00	04.30
An wans in 1-direction.	1.00	0.23	9.06	2.58	20.00	107.52
Internal walls:	1.00	0.23	1.26	2.58	20.00	14.95
	1.00	0.23	4.26	2.58	20.00	50.56
External walls:	2.00	0.23	9.06	2.58	20.00	
	2.00	0.25	9.00	W1	20.00	215.05
Total weight of 1st floor in KN :				W I		1822.74
Star 2: CACULATION OF SEISMIC W	FIGUT	OF 1	102.1014			
Step 2: CACULATION OF SEISMIC W			<b>d &amp; 3rd FL</b>		W2 & W3	565 70
Weight of slab: (same as 1st floor)	1.00	16.37	0.23	0.125	25.00 25.00	565.79
Weight of columns: (same as 1st floor)	17.00	0.23		3.00		67.45
W'14 CD	11.00	3.14	0.023	3.00	25.00	58.34
Weight of Beams:	2.00	0.00	16.05	0.425	22.00	0.00
All beams in X-direction	3.00	0.23	16.37	0.425	25.00	120.01
	1.00	0.23	13.34	0.425	25.00	32.60
All beams in Y-direction	5.00	0.23	11.06	0.425	25.00	135.14
	1.00	0.23	2.72	0.425	25.00	6.65
	1.00	0.23	4.49	0.425	25.00	10.97
Weight of imposed Live Load: (same as 1st floor)	0.25	11.06	16.37	0.00	3.00	135.79
Weight of walls:						
All walls in X=direction:						
Internal walls:	1.00	0.23	15.37	2.58	20.00	182.41
	1.00	0.23	9.31	2.58	20.00	110.49
External walls:	2.00	0.23	15.37	2.58	20.00	364.82
All walls in Y-direction:						
Internal walls:	3.00	0.23	9.06	2.58	20.00	322.57
	2.00	0.23	1.26	2.58	20.00	29.91
	1.00	0.23	3.03	2.58	20.00	35.96
External walls:	2.00	0.23	9.06	2.58	20.00	215.05
Total weight of 2nd & 3rd floors each in KN	:	W	V2 = W3	=	1	2393.95
Step 3: CALCULATION OF SEISMIC	WEIGH	ГOF 4	th Floor	W4		
Weight of slab: (same as 1st floor)	1.00	16.37	11.06	0.125	25.00	565.79
Weight of Columns: = $(\frac{1}{2} \times 3.00 \text{ Ht.})$ in floor 4	17.00	0.23	0.23	1.50	25.00	33.72
1/2 x 300mm dia.CS	11.00	3.14	0.023	1.50	25.00	29.17
Weight of beams: (same as 1st floor)						
<b>e</b>	3.00	0.23	16.37	0.425	25.00	120.01
All beams in X-direction	1.00	0.23	13.34	0.425	25.00	32.60
	5.00	0.23	11.06	0.425	25.00	135.14
All beams in Y-direction	1.00	0.23	2.72	0.425	25.00	6.65
	1.00	0.20	2.12	0.740	20.00	1 0.05

Weight of imposed Live Load: (same as 1st floor)	0.25	11.06	16.37	0.00	3.00	135.79
Weight of walls:						
All walls in X=direction:						
	1.00	0.23	15.37	1.29	20.00	91.21
Internal walls: (½ x 2.58 Ht.) in floor 4	1.00	0.23	9.31	1.29	20.00	55.25
External walls: (1/2 x 2.58 Ht.) in floor 4	2.00	0.23	15.37	1.29	20.00	182.41
All walls in Y-direction:						
	3.00	0.23	9.06	1.29	20.00	161.29
Internal walls: (1/2 x 2.58 Ht.)in floor 4	2.00	0.23	1.26	1.29	20.00	14.95
	1.00	0.23	3.03	1.29	20.00	17.98
External walls: (1/2 x 2.58 Ht.)in floor 4	2.00	0.23	9.06	1.29	20.00	107.52
Total weight of 4th floor in KN :	•				W4 =	1700.45
Total seismic weight of the Building of all 4	floors	W1	W2	W3	W4	0211.00
5	110015	=			=	0211.00
in KN		1822.74	2393.95	2393.95	1700.45	8311.09
in KN		1822.74	2393.95	2393.95	1700.45	8311.09
	ULATIO			2393.95	1700.45	8311.09
Step 4: CALC	$\frac{\text{ULATIO}}{\text{Ah} = \mathbf{Z}/\mathbf{A}}$	ON OF Ah		2393.95	1700.45	8311.09
Step 4:CALCDesign horizontal seismic coefficient:Zone Factor:Z = 0.16 (Ref:H	Ah = Z/ Fig.1, Pag	DN OF Ah 2 x I/R x Sa	ı/g		1700.45	8311.09
Step 4:CALCDesign horizontal seismic coefficient:Zone Factor:Z = 0.16(Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1)	Ah = Z/ Fig.1, Page	DN OF Ah 2 x I/R x Sa e 5 of IS 189	a/g 93:2002 (Par	t 1)		8311.09
Step 4:CALCDesign horizontal seismic coefficient:Zone Factor:Z = 0.16 (Ref:H	<b>Ah = Z</b> / Fig.1, Pag f: Table 6	<b>DN OF</b> Ah <b>2 x I/R x Sa</b> e 5 of IS 189 5, Cl.6.4.2 o	<b>1/g</b> 93:2002 (Par f IS 1893:2	t 1) 2002 (Part 1)		8311.09
Step 4:CALCDesign horizontal seismic coefficient:Zone Factor: $Z = 0.16$ (Ref:(Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor: $I = 1.00$ (Ref	<b>Ah = Z</b> / Fig.1, Pag f: Table 6	<b>DN OF</b> Ah <b>2 x I/R x Sa</b> e 5 of IS 189 5, Cl.6.4.2 o	<b>1/g</b> 93:2002 (Par f IS 1893:2	t 1) 2002 (Part 1)		8311.09
Step 4:CALCDesign horizontal seismic coefficient:Zone Factor:Z = 0.16 (Ref: (Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Refine Response Reduction Factor:R = 5.00	<b>Ah</b> = <b>Z</b> / Fig.1, Pag f: Table 6 (Ref: Tab	<b>DN OF</b> Ah <b>2 x I/R x Sa</b> e 5 of IS 189 5, Cl.6.4.2 o	<b>1/g</b> 93:2002 (Par f IS 1893:2	t 1) 2002 (Part 1)		8311.09
Step 4:CALCDesign horizontal seismic coefficient:Zone Factor:Z = 0.16 (Ref: (Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Re Response Reduction Factor:R = 5.00Fundamental Time Period:	Ah = Z/ Fig.1, Pag f: Table 6 (Ref: Tab c.	<b>DN OF</b> Ah <b>2 x I/R x Sa</b> e 5 of IS 189 5, Cl.6.4.2 o	<b>1/g</b> 93:2002 (Par f IS 1893:2	t 1) 2002 (Part 1)		8311.09
Step 4:CALCDesign horizontal seismic coefficient:Zone Factor:Z = 0.16(Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00(Response Reduction Factor:R = 5.00Fundamental Time Period:Tx = 0.09h/ $\sqrt{dx} = 0.09x12/\sqrt{15.37} = 0.275$ Se	Ah = Z/ Fig.1, Pag f: Table 6 (Ref: Table c. c.	<b>DN OF</b> Ah <b>2 x I/R x Sa</b> e 5 of IS 189 5, Cl.6.4.2 o ble 7, Cl.6.4.	a/g 93:2002 (Par f IS 1893:2 2 of IS 18	t 1) 2002 (Part 1)		8311.09
Step 4:       CALC         Design horizontal seismic coefficient:       Z         Zone Factor:       Z       = 0.16       (Ref: H)         (Ref: Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))       Importance Factor:       I       = 1.00       (Ref: H)         Importance Factor:       I       = 1.00       (Ref: H)         Fundamental Time Period:       R = 5.00         Tx = 0.09h/ $\sqrt{dx}$ = 0.09x12/ $\sqrt{15.37}$ = 0.275       See         Ty = 0.09h/ $\sqrt{dy}$ = 0.09x12/ $\sqrt{9.06}$ = 0.359       See	Ah = Z/ Fig.1, Pag f: Table 6 (Ref: Table c. c. c. b. 6 of IS 18	<b>DN OF</b> Ah <b>2 x I/R x Sa</b> e 5 of IS 189 5, Cl.6.4.2 o ble 7, Cl.6.4. 893:2002 (1)	a/g 93:2002 (Par f IS 1893:2 2 of IS 18	t 1) 2002 (Part 1) 93:2002(1)		8311.09
Step 4:       CALC         Design horizontal seismic coefficient:       Z         Zone Factor:       Z       = 0.16       (Ref: I         (Ref: Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))       Importance Factor:       I       = 1.00       (Ref         Importance Factor:       I       = 1.00       (Ref       Response Reduction Factor:       R = 5.00         Fundamental Time Period:       Tx       0.09h/ $\sqrt{dx}$ = 0.09x12/ $\sqrt{15.37}$ = 0.275 Second	Ah = Z/ Fig.1, Pag f: Table 6 (Ref: Table c. c. c. b. 6 of IS 18	<b>DN OF</b> Ah <b>2 x I/R x Sa</b> e 5 of IS 189 5, Cl.6.4.2 o ble 7, Cl.6.4. 893:2002 (1)	a/g 93:2002 (Par f IS 1893:2 2 of IS 18	t 1) 2002 (Part 1) 93:2002(1)		8311.09
Step 4:       CALC         Design horizontal seismic coefficient:       Z         Zone Factor:       Z       = 0.16       (Ref: I         (Ref: Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))       Importance Factor:       I       = 1.00       (Ref         Importance Factor:       I       = 1.00       (Ref       Response Reduction Factor:       R = 5.00         Fundamental Time Period:       Tx       0.09h/ $\sqrt{dx}$ = 0.09x12/ $\sqrt{15.37}$ = 0.275 Second	Ah = Z/ Fig.1, Page f: Table 6 (Ref: Table c. c. c. 6 of IS 18 Ah = 0.1	<b>DN OF</b> Ah <b>2 x I/R x Sa</b> e 5 of IS 189 5, Cl.6.4.2 o ble 7, Cl.6.4. 893:2002 (1)	a/g 93:2002 (Par f IS 1893:2 2 of IS 18	t 1) 2002 (Part 1) 93:2002(1)		8311.09
Step 4:       CALC         Design horizontal seismic coefficient:       Z         Zone Factor:       Z       = 0.16 (Ref:H         (Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))         Importance Factor:       I       = 1.00 (Ref         Response Reduction Factor:       R       = 5.00         Fundamental Time Period:       Tx       = 0.09h/ $\sqrt{dx}$ = 0.09x12/ $\sqrt{15.37}$ = 0.275 Se         Ty = 0.09h/ $\sqrt{dy}$ = 0.09x12/ $\sqrt{9.06}$ = 0.359 Sec       (Sa/g)x = (Sa/g)y = 2.5 (Ref:Cl.6.4.5, Page 1)         Therefore	Ah = Z/ fig.1, Pag f: Table 6 (Ref: Table c. c. 6 of IS 18 Ah = 0.1 HEAR	<b>DN OF</b> Ah <b>2 x I/R x Sa</b> e 5 of IS 189 5, Cl.6.4.2 o ble 7, Cl.6.4. 893:2002 (1) 6/2 x 1.0/5.0	a/g 93:2002 (Par f IS 1893:2 2 of IS 18	t 1) 2002 (Part 1) 93:2002(1)		

2. SITARAMPURAM, (Durga				WADA		
Seismic weight & Base		alculation	ons			
• Seismic weight of a floor (W1) (Cl. 3.26, IS 1893:2016	· · · · · · · · · · · · · · · · · · ·					
It is the sum of dead load of the floor, appropriate contributi						
permanent elements from the storeys above and below, finis imposed load on the floor.	shes and s	services,	& appro	priate an	nounts of	specified
· Seismic weight of a Structure (W) (Cl.3.27, IS 1893:20	016)					
It is the sum of seismic weights of all floors.						
W1 = Dead load of floor 1 +						
Weight of Beams (1) +						
Weight of Slabs (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Columns (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Columns (2) +						
<sup>1</sup> / <sub>2</sub> Weight of Walls (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Walls (2) +						
Appropriate imposed (Live) Load.						
· Base Shear (VB) (Cl.4.7 IS 1893:2016)						
It is the horizontal lateral force in the considered direction o	of earthou	ake shak	ing that	the struc	ture shall	he
designed for.	i curuiqu	une snur	ing that	, the struc	iture situri	
VB = Ah x W & Ah = Z/2 x I/R x Sa/g						
Considerations:						
External wall thickness: 230 mm						
Internal wall thickness: 230 mm & 115 mm						
Specific weight of RCC: 25 KN / Cum						
Specific weight of infill wall: 20 KN / Cum						
Type of soil: Medium						
Size of columns: 300x400 mm, 300x500 mm and 300x650						
Size of Beams: 300 x 450 mm	111111.					
Response spectra: IS 1893(Part 1) : 2002Assumption: Live Load3.00 KN / Sqm						
Referring to Table 8, IS 1893:2002; Cl.7.3.1. Page 24; the p	ercentag	e of impo	osed load	1		
Step 1: CACULATION OF SEISMIC WEIGHT OF 1st	t FLOOF	2	W1			
Height of wall:						
$= \frac{1}{2} \text{ x Ht.of wall of Fl.1} + \frac{1}{2} \text{ x Ht.of wall of Fl.2}$						
$= \frac{1}{2} \times (3.00-0.45) + \frac{1}{2} \times (3.00-0.45) = 2.55 \text{ M}$						
Height of Column:						
$=\frac{1}{2} x$ Ht. of Col. in Fl.1 + $\frac{1}{2} x$ Ht. of Col.in Fl.2						
$=\frac{1}{2} \times 3.00 + \frac{1}{2} \times 3.00 = 3.00 \text{ M}$						
					Sp.Wt	
Description of Itoms	Neg	Widt	Leng	Heig	•	Total Wt.
Description of Items	Nos.	h M	th M	ht M	KN/C	KN
					um	
Weight of Slab	1.00	16.88	24.21	0.15	25.00	
	1.00	2.10	0.87	0.15	25.00	1525.64
(-)						<b>54</b> 00
	6.00	0.30	0.40	3.00	25.00	54.00
Weight of columns	40.00	0.30	0.50	3.00	25.00	450.00
	2.00	0.30	0.65	3.00	25.00	29.25
Weight of Beams:						0.00
All beams in X-direction	4.00	0.30	16.88	0.45	25.00	227.88
	2.00	0.30	7.46	0.45	25.00	50.36

			1.00	0.30	2.70	0.45	25.00	9.11
			4.00	0.30	24.21	0.45	25.00	326.84
All beams in Y-direction			2.00	0.30	11.00	0.45	25.00	74.25
All beams in 1-direction			2.00	0.30	11.65	0.45	25.00	78.64
Weight of imposed Live Load (25%)			0.25	0.00	0.00	0.00	1525.6 4	381.41
Weight of walls:							4	0.00
All walls in X=direction:								0.00
			2.00	0.23	6.86	2.55	20.00	160.94
			4.00	0.23	2.24	2.55	20.00	105.10
Internal walls:			3.00	0.12	6.86	2.55	20.00	120.70
			1.00	0.12	5.58	2.55	20.00	32.73
			1.00	0.23	13.53	2.55	20.00	158.71
External walls:			1.00	0.23	7.46	2.55	20.00	87.51
All walls in Y-direction:								0.00
			2.00	0.23	22.05	2.55	20.00	517.29
Internal walls:			2.00	0.23	9.83	2.55	20.00	230.61
External walls:			1.00	0.23	22.05	2.55	20.00	258.65
Total weight of 1st floor in KN :				1		W1		4879.60
Step 2: CACULATION OF SEISMIC WEIG	GHT (	OF 2n	d, 3rd, 4	th & 5th			, W3, W4	& W5
Weight of slab: (same as 1st floor)			1.00	16.88	24.21	0.15	25.00	
(-)			1.00	2.35	0.45	0.15	25.00	1532.33
			6.00	0.30	0.40	3.00	25.00	54.00
Weight of columns: (same as 1st floor)		40.00	0.30	0.50	3.00	25.00	450.00	
			2.00	0.30	0.65	3.00	25.00	29.25
Weight of beams: (same as 1st floor)								0.00
			4.00	0.30	16.88	0.45	25.00	227.88
All beams in X-direction			2.00	0.30	7.46	0.45	25.00	50.36
			1.00	0.30	2.70	0.45	25.00	9.11
			4.00	0.30	24.21	0.45	25.00	326.84
All beams in Y-direction			2.00	0.30	11.00	0.45	25.00	74.25
			2.00	0.30	11.65	0.45	25.00	78.64
Weight of imposed Live Load: 25% (same as	l st flo	or)	0.25	0.00	0.00	0.00	1532.3 3	
Weight of walls:								0.00
All walls in <b>X=direction:</b>			r					0.00
			4.00	0.12	7.39	2.55	20.00	173.37
Internal walls:			4.00	0.12	5.56	2.55	20.00	130.44
			2.00	0.23	16.88	2.55	20.00	396.00
External walls:			2.00	0.23	16.88	2.55	20.00	396.00
All walls in <b>Y-direction:</b>			I .					0.00
			4.00	0.12	9.49	2.55	20.00	222.52
			2.00	0.12	3.17	2.55	20.00	37.13
Internal walls:			2.00	0.12	2.90	2.55	20.00	34.02
			2.00	0.23	9.95	2.55	20.00	233.31
			1.00	0.23	9.70	2.55	20.00	113.78
			1.00	0.23	10.20	2.55	20.00	119.65
			2.00	0.23	9.95	2.55	20.00	233.31
External walls:			1.00	0.23	9.70	2.55	20.00	113.78
		7.5.1	1.00	0.23	10.20	2.55	20.00	119.65
Total weight of 2nd, 3rd, 4th & 5th floor ea	ch in	KN :			W2=	W3=W4	=W5=	5155.60

Step 3: CALCULATION OF SEISMIC WEIGHT (			W6	0.15	25.00	
Weight of slab: (same as 1st floor)	1.00	16.88	24.21	0.15	25.00	1522.22
(-)	1.00	2.35	0.45	0.15	25.00	1532.33
	6.00	0.30	0.40	1.50	25.00	27.00
Weight of columns: (same as 1st floor)	40.00	0.30	0.50	1.50	25.00	225.00
-	2.00	0.30	0.65	1.50	25.00	14.63
Weight of beams: (same as 1st floor)						0.00
	4.00	0.30	16.88	0.45	25.00	227.88
All beams in X-direction	2.00	0.30	7.46	0.45	25.00	50.36
	1.00	0.30	2.70	0.45	25.00	9.11
	4.00	0.30	24.21	0.45	25.00	326.84
All beams in Y-direction	2.00	0.30	11.00	0.45	25.00	74.25
	2.00	0.30	11.65	0.45	25.00	78.64
Weight of imposed Live Load: 25% (same as 1st floor)	0.25	0.00	0.00	0.00	1532.3 3	
Weight of walls:			I	I	I	0.00
All walls in <b>X=direction</b> :						0.00
	4.00	0.12	7.39	1.28	20.00	86.68
Internal walls:		0.12	5.56	1.28	20.00	65.22
	2.00	0.23	16.88	1.28	20.00	198.00
External walls:	2.00	0.23	16.88	1.28	20.00	198.00
All walls in <b>Y-direction</b> :		1				0.00
	4.00	0.12	9.49	1.28	20.00	111.26
	2.00	0.12	3.17	1.28	20.00	18.56
T ( 1 11	2.00	0.12	2.90	1.28	20.00	17.01
Internal walls:	2.00	0.23	9.95	1.28	20.00	116.65
	1.00	0.23	9.70	1.28	20.00	56.89
	1.00	0.23	10.20	1.28	20.00	59.82
	2.00	0.23	9.95	1.28	20.00	116.65
External walls:	1.00	0.23	9.70	1.28	20.00	56.89
	1.00	0.23	10.20	1.28	20.00	59.82
Total weight of 6th floor:				-	W6 =	3727.50
Total seismic weight of the Building of all 4	W2	W3	W4	W5	W6	
floors in KN 4879.6	5155.	5155.	5155.	5155.	3727.5	29229.50
U	60	60 (/2 1/D	60	60	0	
Design horizontal seismic coefficient: Zone Factor: Z = 0.16 (Ref:Fig.1, Page 5		$\frac{Z}{2 \times I/R}$	0	Ref·Tab	le 2 Cl 6	42 of IS
1893:2002 (Part 1)	0110109	3.2002 (	1 411 1) (	1001.140	10 2, 01.0.	1.2 01 15
<b>Importance Factor:</b> $I = 1.00$ (Ref: Table 6, C	1.6.4.2 o	f IS 189	93:2002 (	Part 1)		
<b>Response Reduction Factor:</b> $\mathbf{R} = 5.00$ (Ref: Table				· · · · · · · · · · · · · · · · · · ·		
Fundamental Time Period:						
$Tx = 0.09h/\sqrt{dx} = 0.09x18/\sqrt{16.88} = 0.394$ Sec.						
$Ty = 0.09h/\sqrt{dy} = 0.09x18/\sqrt{21.95} = 0.346$ Sec.						
(Sa/g)x = (Sa/g)y = 2.5 (Ref:Cl.6.4.5, Page 16 of IS 1893)	:2002 (1)					
Therefore $Ah = 0.16/7$	2 x 1.0/5.0	x 2.5 =	0.04			
Therefore $Ah = 0.16/2$						
Step 5: CALCULATION OF BASE SHEAR (	VB)					
	VB)					

#### 3. GOVERNOR PET, Venkateswara Rao Street, VIJAYAWADA Seismic weight & Base Shear Calculations

#### Seismic weight of a floor (W1) (Cl. 3.26, IS 1893:2016)

It is the sum of dead load of the floor, appropriate contributions of weights of columns, walls and any other permanent elements from the storeys above and below, finishes and services, & appropriate amounts of specified imposed load on the floor.

#### Seismic weight of a Structure (W) (Cl.3.27, IS 1893:2016)

It is the sum of seismic weights of all floors.

W1 = Dead load of floor 1 +

Weight of Beams (1) +

Weight of Slabs (1) + <sup>1</sup>/<sub>2</sub> Weight of Columns (1) +

 $\frac{1}{2}$  Weight of Columns (1) +  $\frac{1}{2}$  Weight of Columns (2) +

 $\frac{1}{2}$  Weight of Walls (1) +

 $\frac{1}{2}$  Weight of Walls (2) +

Appropriate imposed (Live) Load.

• Base Shear (VB) (Cl.4.7 IS 1893:2016)

It is the horizontal lateral force in the considered direction of earthquake shaking that the structure shall be designed for.

### VB = Ah x W & Ah = Z/2 x I/R x Sa/g

**Considerations:** 

External wall thickness: 230 mm

Internal wall thickness: 230 mm

Specific weight of RCC: 25 KN / Cum

Specific weight of infill wall: 20 KN / Cum

Type of soil: Medium

Size of columns: 230 x 380 mm

Size of Beams: 230 x 355 mm

Response spectra: IS 1893(Part 1): 2002

Assumption: Live Load 3.00 KN / Sqm

Referring to Table 8, IS 1893:2002; Cl.7.3.1. Page 24; the percentage of imposed load

# Step 1: CACULATION OF SEISMIC WEIGHT OF1st FLOORW1Height of wall:

=  $\frac{1}{2}$  x Ht.of wall of Fl.1 +  $\frac{1}{2}$  x Ht.of wall of Fl.2

=  $\frac{1}{2} x (3.00-0.355) + \frac{1}{2} x (3.00-0.355) = 2.645 M$ Height of Column:

Height of Column:

 $=\frac{1}{2} \text{ x Ht. of Col. in Fl.1} + \frac{1}{2} \text{ x Ht. of Col. in Fl.2}$  $= (\frac{1}{2} \text{ x } 3.00) + (\frac{1}{2} \text{ x } 3.00) = 3.00 \text{ M}$ 

Description of Items	Nos.	Width M	Length M	Height M	Sp.Wt. KN/Cum	Total Wt. KN
Weight of Slab	1.00	12.59	23.24	0.13	25.00	914.35
Weight of columns	32.00	0.23	0.38	3.00	25.00	209.76
Weight of Beams:						0.00
All beams in X-direction	8.00	0.23	12.59	0.38	25.00	220.07
All beams in Y-direction	4.00	0.23	23.24	0.38	25.00	203.12
Weight of imposed Live Load (25%)	0.25	12.59	23.24	0.00	3.00	219.44
Weight of walls:						
All walls in X=direction:						

Total weight of 1st floor in KN :				W1		2610.34
External wans:	1.00	0.23	6.48	2.65	20.00	78.84
External walle	1.00	0.23	8.59	2.65	20.00	104.51
External walls: All walls in Y-direction: Internal walls: External walls:	2.00	0.23	3.10	2.65	20.00	75.44
	1.00	0.23	6.64	2.65	20.00	80.79
All walls in Y-direction:						
External wans.	1.00	0.23	10.79	2.65	20.00	131.28
External walle	1.00	0.23	2.73	2.65	20.00	33.22
xternal walls: Il walls in Y-direction:	1.00	0.12	1.73	2.65	20.00	10.52
Internal walls:	2.00	0.23	10.79	2.65	20.00	262.56
	2.00	0.23	2.73	2.65	20.00	66.43

Step 2: CACULATION OF SEISMIC WI	EIGHT (	)F 2r	nd & 3rd	FLOORS	W2 &	W3	
Weight of slab: (same as 1st floor)	1.00	12.59	23.24	0.13	25.00	914.35	
Weight of columns: (same as 1st floor)	32.00	0.23	0.38	3.00	25.00	209.76	
	8.00	0.23	12.59	0.38	25.00	220.07	
Weight of beams: (same as 1st floor)	4.00	0.23	23.24	0.38	25.00	203.12	
Weight of imposed Live Load: (same as 1st floor)	0.25	12.59	23.24	0.00	3.00	219.44	
Weight of walls:							
All walls in X=direction:							
	6.00	0.23	10.79	2.65	20.00	787.69	
Internal walls:	2.00	0.23	4.41	2.65	20.00	107.52	
	1.00	0.12	1.73	2.65	20.00	10.54	
External walls:	2.00	0.23	10.79	2.65	20.00	263.06	
All walls in Y-direction:							
Internal walls:	1.00	0.23	17.05	2.65	20.00	207.45	
	1.00	0.23	11.57	2.65	20.00	141.04	
	1.00	0.23	5.00	2.65	20.00	60.95	
External walls:	1.00	0.23	17.05	2.65	20.00	207.84	
	1.00	0.23	19.74	2.65	20.00	240.63	
Total weight of 2nd & 3rd floors each in KN : W2 = W3 =							

Step 3: CALCULATION OF SEISMIC W	VEIGHT	OF	4th Floor	W4	Ļ	
Weight of slab: (same as 1st floor)	1.00	12.59	23.24	0.13	25.00	914.35
Weight of heaven (some as let floor)	8.00	0.23	12.59	0.38	25.00	220.07
Weight of beams: (same as 1st floor)	4.00	0.23	23.24	0.38	25.00	203.12
Weight of imposed Live Load: (same as 1st floor)	0.25	12.59	23.24	0.00	3.00	219.44
Weight of Columns: = $(\frac{1}{2} \times 3.00 \text{ Ht.})$ in floor 4	32.00	0.23	0.38	1.50	25.00	104.88
All walls in X=direction:						
	6.00	0.23	10.79	1.33	20.00	394.59
Internal walls: (1/2 x 2.65 Ht.)in floor 4	2.00	0.23	4.41	1.33	20.00	53.76
	1.00	0.23	1.73	1.33	20.00	10.54
External walls: (1/2 x 2.65 Ht.)in floor 4	2.00	0.23	10.79	1.33	20.00	131.53
All walls in Y-direction:						
	1.00	0.23	17.05	2.65	20.00	207.45
Internal walls: ( <sup>1</sup> / <sub>2</sub> x 2.65 Ht.)in floor 4	1.00	0.23	11.57	2.65	20.00	141.04
	1.00	0.23	5.00	2.65	20.00	60.95
External walls: (1/2 x 2.65 Ht.)in floor 4	1.00	0.23	17.05	2.65	20.00	207.84

ſ

	1.00	0.23	19.74	2.65	20.00	240.63	
Total weight of 4th floor in KN :				•	W4 =	3110.19	
		W1	W2	W3	W4	13307.45	
Total seismic weight of the Building all 4 flo	oors	2610.3	3793.5	3793.5	3110.19	KN	
Step 4: CALCULATI	ON OF	4 h					
Step 4: CALCULATI	UNUF	All					
Design horizontal seismic coefficient:	h = Z/2	2 x I/R x \$	Sa/g				
<b>Zone Factor:</b> $\mathbf{Z} = 0.16$ (Ref:Fig	1 Dage	5 of IS 1	803.2002	(Part 1)			
(Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1)	,.1, 1 age	5 01 15 1	075.2002	(1 alt 1)			
<b>Importance Factor:</b> $I = 1.00$ (Ref:	Table 6.	Cl.6.4.2	of IS 18	93:2002 (I	Part 1)		
<b>Response Reduction Factor:</b> $\mathbf{R} = 5.00$ (F							
Fundamental Time Period:							
$Tx = 0.09h/\sqrt{dx} = 0.09x12.00/\sqrt{10.79} = 0.329$ Set	ec.						
$Ty = 0.09h/\sqrt{dy} = 0.09x12.00/\sqrt{21.44} = 0.233$ Set	ec.						
(Sa/g)x = (Sa/g)y = 2.5 (Ref:Cl.6.4.5, Page 16)	of IS 189	93:2002 (	1)				
Therefore Ah =	= 0.16/2	x 1.0/5.0	x 2.5 = 0	.04			
Step 5: CALCULATION OF BASE SH	EAR	(VB)					
(VB)x = W x Ah(x) = 13307.45 x 0.04 = 532	2.30 KN	I					
(VB)y = 532.30  KN							

4. MADAPATI CHOULT				30th Ju	n.2022	
Seismic weight			lculations			
• Seismic weight of a floor (W1) (Cl. 3.26, IS						
It is the sum of dead load of the floor, appropriate						
permanent elements from the storeys above and b specified imposed load on the floor.	elow, III	insnes and	services, a	appropriat	le amounts c	01
	10 1002.	2016)				
• Seismic weight of a Structure (W) (Cl.3.27, It is the sum of seismic weights of all floors.	15 1893:	2016)				
W1 = Dead load of floor $1 +$						
Weight of Beams (1) +						
Weight of Slabs (1) +						
$\frac{1}{2}$ Weight of Columns (1) +						
$\frac{72}{2}$ Weight of Columns (1) + $\frac{1}{2}$ Weight of Columns (2) +						
$\frac{1}{2}$ Weight of Walls (1) +						
$\frac{1}{2}$ Weight of Walls (1) + $\frac{1}{2}$ Weight of Walls (2) +						
Appropriate imposed (Live) Load.						
Base Shear (VB) (Cl.4.7 IS 1893:2016)						
It is the horizontal lateral force in the considered	diraction	of ourtha	ulto choltin	a that the	structure ch	ll ba
designed for.	unection	orearing	lake shakin	g that the	structure sna	in be
VB = Ah x W & Ah = Z/2 x I/R x Sa/g						
Considerations:						
External wall thickness: 300 mm						
Internal wall thickness: 230 mm						
Specific weight of RCC: 25 KN / Cum						
Specific weight of infill wall: 20 KN / Cum						
Type of soil: Medium						
Size of columns: 300 x 500 mm						
Size of Beams: 230 x 450 mm						
Response spectra: IS 1893(Part 1) : 2002						
Assumption: Live Load 3.00 KN / Sqm						
Referring to Table 8, IS 1893:2002; Cl.7.3.1. Pag	e 24: the	percentag	e of impose	ed load		
	,	F8	, <u>r</u>			
Step 1: CACULATION OF SEIS	MIC W	EIGHT O	F	1st FLOO	R	W1
Height of wall:						
= $\frac{1}{2}$ x Ht.of wall of Fl.1 + $\frac{1}{2}$ x Ht.of wall of Fl.2						
$= \frac{1}{2} x (3.66-0.45) + \frac{1}{2} x (3.66-0.45) = 3.21 M$						
Height of Column:						
$=\frac{1}{2}$ x Ht. of Col. in Fl.1 + $\frac{1}{2}$ x Ht. of Col.in Fl.2						
$= (\frac{1}{2} \times 3.66) + (\frac{1}{2} \times 3.66) = 3.66 \text{ M}$						
Description of Items	Nos.	Width M	Length M	Height M	Sp.Wt. KN/Cu m	Total Wt. KN
Weight of Slab	1.00	15.35	17.40	0.15	25.00	1001.59
Weight of columns	24.0 0	0.30	0.50	3.66	25.00	329.40
Weight of Beams:						
All beams in X-direction	6.00	0.23	0.45	15.35	25.00	
All beams in Y-direction	4.00	0.23	0.45	17.40	25.00	180.09
Weight of imposed Live Load (25%)	0.25	15.35	17.40	0.00	3.00	200.32
Weight of walls:	0.25	10.00	1,.10	0.00	2.00	200.02
All walls in X=direction:						
Internal walls:	6.00	0.23	5.60	3.21	20.00	496.14
External walls:	2.00	0.20	5.60	3.21	20.00	215.71
		0.00	2.00	0.21	_0.00	

	1.00	0.20	2.15	2.21	20.00	41.41
All walls in Y-direction:	1.00	0.30	2.15	3.21	20.00	41.41
All walls in Y-direction:	2.00	0.22	2 20	2 21	20.00	04.50
	2.00	0.23	3.20 3.00	3.21 3.21	20.00	94.50 88.60
Internal walls:					-	
	2.00	0.23	3.20	3.21 3.21	20.00	94.50
	3.00	0.23	3.40 3.20	3.21	20.00	150.61
	2.00	0.30	3.00	3.21	20.00	123.26
External walls:						115.56
	2.00	0.30	3.20	3.21 3.21	20.00	123.26
Total weight of 1st floor in KN :	2.00	0.30	3.40	W1	20.00	130.97 3385.92
Step 2: CACULATION OF SEISMIC WE	IGHT O	F 2nd	& 3rd FL	OORS	W2 & W3	3
Weight of slab: (same as 1st floor)	1.00	15.35	17.40	0.15	25.00	1001.59
Weight of columns: (same as 1st floor)	24.0 0	0.30	0.50	3.66	25.00	329.40
Weight of beams: (same as 1st floor)	6.00	0.23	0.45	15.35	25.00	238.31
	4.00	0.23	0.45	17.40	25.00	180.09
Weight of imposed Live Load: (same as 1st floor)	0.25	15.35	17.40	0.00	3.00	200.32
Weight of walls:						
All walls in X=direction:						
Internal walls:	7.00	0.23	5.60	3.21	20.00	578.83
External walls:	4.00	0.30	5.60	3.21	20.00	431.42
	1.00	0.30	2.15	3.21	20.00	41.41
All walls in Y-direction:						
Internal walls:	2.00	0.23	2.94	3.21	20.00	86.82
	2.00	0.23	3.00	3.21	20.00	88.60
	4.00	0.23	3.20	3.21	20.00	189.00
	3.00	0.23	3.40	3.21	20.00	150.61
External walls:	2.00	0.30	2.94	3.21	20.00	113.25
	2.00	0.30	3.00	3.21	20.00	115.56
	4.00	0.30	3.20	3.21	20.00	246.53
	2.00	0.30	3.40	3.21	20.00	130.97
Total weight of 2nd & 3rd floors each in KN :		W	V2 = W3	=		4122.71
Step 3: CALCULATION OF SEISMIC W	FIGHT	OF 4	th Floor	W4		
Weight of slab: (same as 1st floor)	1.00	15.35	17.40	0.15	25.00	1001.59
Weight of stab. (same as 1st floor) Weight of beams: (same as 1st floor)	6.00	0.23	0.45	15.35	25.00	238.31
	4.00	0.23	0.45	17.40	25.00	180.09
Weight of imposed Live Load: (same as 1st floor)	0.25	15.35	17.40	0.00	3.00	200.32
Weight of Columns: = $(\frac{1}{2} \times 3.66 \text{ Ht.})$ in floor 4	24.0 0	0.30	0.50	1.83	25.00	164.70
All walls in X=direction:						
Internal walls: (1/2 x 3.21 Ht.)in floor 4	7.00	0.23	5.60	1.61	20.00	290.32
External walls: ( <sup>1</sup> / <sub>2</sub> x 3.21 Ht.)in floor 4	4.00	0.30	5.60	1.61	20.00	216.38
	1.00	0.30	2.15	1.61	20.00	20.77
All walls in Y-direction:						
	2.00	0.23	2.94	1.61	20.00	43.55
Internal walls: ( <sup>1</sup> / <sub>2</sub> x 3.21 Ht.)in floor 4	2.00	0.23	3.00	1.61	20.00	44.44
	4.00	0.23	3.20	1.61	20.00	94.80
	3.00	0.23	3.40	1.61	20.00	75.54

	2.00	0.30	2.94	1.61	20.00	56.80
	2.00	0.30	3.00	1.61	20.00	57.96
External walls: $(\frac{1}{2} \times 3.21 \text{ Ht.})$ in floor 4	4.00	0.30	3.20	1.61	20.00	123.65
	2.00	0.30	3.40	1.61	20.00	65.69
Total weight of 4th floor in KN :					W4 =	2874.89
		W1	W2	W3	W4	14506.2
Total seismic weight of the Building of all 4 f	loors	3385.9	4123	4122.7	2874.89	3 KN
		•			•	
Step 4: CALCUI	LATION	OF Ah				
Design horizontal seismic coefficient: A	$\mathbf{h} = \mathbf{Z}/2$	x I/R x Sa	/g			
<b>Zone Factor:</b> $\mathbf{Z} = 0.16$ (Ref:Fig	1, Page	5 of IS 189	3:2002 (Pa	rt 1)		
(Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1)						
Importance Factor: I = 1.00 (Ref: 7	Table 6,	Cl.6.4.2 of	f IS 1893:	2002 (Part	1)	
<b>Response Reduction Factor:</b> $\mathbf{R} = 5.00$ (R	ef: Table	e 7, Cl.6.4.	2 of IS 18	393:2002(1	)	
Fundamental Time Period:						
$Tx = 0.09h/\sqrt{dx} = 0.09x14.64/\sqrt{15.35} = 0.336$ Set	ec.					
$Ty = 0.09h/\sqrt{dy} = 0.09x14.64/\sqrt{17.40} = 0.316$ Set	ec.					
(Sa/g)x = (Sa/g)y = 2.5 (Ref:Cl.6.4.5, Page 16 c	of IS 189	3:2002 (1)				
Therefore Ah			x 2.5 = 0.0	)4		
Step 5: CALCULATION OF BASE SHI	EAR	(VB)				
(VB)x = W x Ah(x) = 14506.23 x 0.04 = 580.23	25 KN					
(VB)y = 580.25  KN						

5. JAMMIDODDI, Endowments Dept.				IJAYAWA	ADA 30th	Jun.2022
Seismic weigh			alculations			
• Seismic weight of a floor (W1) (Cl. 3.26, IS						
It is the sum of dead load of the floor, appropriate permanent elements from the storeys above and b						
imposed load on the floor.	elow, lin	isnes and s	ervices, & a	appropriate	amounts of s	pecified
• Seismic weight of a Structure (W) (Cl.3.27,	IS 1893:2	2016)				
It is the sum of seismic weights of all floors.						
W1 = Dead load of floor 1 +						
Weight of Beams (1) +						
Weight of Slabs (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Columns (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Columns (2) +						
<sup>1</sup> / <sub>2</sub> Weight of Walls (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Walls (2) +						
Appropriate imposed (Live) Load.						
· Base Shear (VB) (Cl.4.7 IS 1893:2016)						
It is the horizontal lateral force in the considered of	direction	of earthqua	ake shaking	that the str	ucture shall b	be
designed for.						
VB = Ah x W & Ah = Z/2 x I/R x Sa/g						
Considerations:						
External wall thickness: 230 mm						
Internal wall thickness: 230 mm						
Specific weight of RCC: 25 KN / Cum						
Specific weight of infill wall: 20 KN / Cum						
Type of soil: Medium						
Size of columns: 250 x 650 mm						
Size of Beams: 250 x 600 mm						
Response spectra: IS 1893(Part 1) : 2002						
Assumption: Live Load 3.00 KN / Sqm						
Referring to Table 8, IS 1893:2002; Cl.7.3.1. Pag	e 24; the	percentage	e of imposed	l load		
Step 1: CACULATION OF SEIS	MIC WE	EIGHT OI	F 1	st FLOOR		W1
Height of wall:						
$= \frac{1}{2} \text{ x Ht.of wall of Fl.1} + \frac{1}{2} \text{ x Ht.of wall of Fl.2}$						
$= \frac{1}{2} \times (3.75 - 0.60) + \frac{1}{2} \times (3.75 - 0.60) = 3.15 \text{ M}$						
Height of Column:						
$=\frac{1}{2}$ x Ht. of Col. in Fl.1 + $\frac{1}{2}$ x Ht. of Col.in Fl.2						
	1 1		1		1	
$=\frac{1}{2}$ x Ht. of Col. in Fl.1 + $\frac{1}{2}$ x Ht. of Col.in Fl.2	Nos.	Width M	Length M	Height M	Sp.Wt. KN/Cum	Total Wt. KN
=½ x Ht. of Col. in Fl.1 + ½ x Ht. of Col.in Fl.2 = (½ x 3.75) + (½ x 3.75) = <b>3.75 M</b> Description of Items	<b>Nos.</b> 1.00					
$=\frac{1}{2} \text{ x Ht. of Col. in Fl.1} + \frac{1}{2} \text{ x Ht. of Col. in Fl.2}$ $= (\frac{1}{2} \text{ x } 3.75) + (\frac{1}{2} \text{ x } 3.75) = 3.75 \text{ M}$		Μ	M	M	KÑ/Cum	Wt. KN
=½ x Ht. of Col. in Fl.1 + ½ x Ht. of Col.in Fl.2 = (½ x 3.75) + (½ x 3.75) = <b>3.75 M</b> Description of Items	1.00	<b>M</b> 31.51	M 9.79	M 0.15	<b>K</b> Ñ/Cum 25.00	<b>Wt. KN</b> 1156.81
= <sup>1</sup> / <sub>2</sub> x Ht. of Col. in Fl.1 + <sup>1</sup> / <sub>2</sub> x Ht. of Col.in Fl.2 = ( <sup>1</sup> / <sub>2</sub> x 3.75) + ( <sup>1</sup> / <sub>2</sub> x 3.75) = <b>3.75 M</b> <b>Description of Items</b> Weight of Slab	1.00 1.00	M 31.51 10.46	M 9.79 19.51	M 0.15 0.15	<b>KN/Cum</b> 25.00 25.00	Wt. KN 1156.81 765.28
$=\frac{1}{2} \text{ x Ht. of Col. in Fl.1} + \frac{1}{2} \text{ x Ht. of Col. in Fl.2}$ $= (\frac{1}{2} \text{ x } 3.75) + (\frac{1}{2} \text{ x } 3.75) = 3.75 \text{ M}$ <b>Description of Items</b> Weight of Slab Weight of columns	1.00 1.00	M 31.51 10.46	M 9.79 19.51	M 0.15 0.15	<b>KN/Cum</b> 25.00 25.00	Wt. KN           1156.81           765.28           426.56
$=\frac{1}{2} \text{ x Ht. of Col. in Fl.1} + \frac{1}{2} \text{ x Ht. of Col. in Fl.2}$ $= (\frac{1}{2} \text{ x } 3.75) + (\frac{1}{2} \text{ x } 3.75) = 3.75 \text{ M}$ <b>Description of Items</b> Weight of Slab Weight of columns	1.00 1.00 28.00	M 31.51 10.46 0.25 0.25	M           9.79           19.51           0.65           10.46	M 0.15 0.15 3.75	KN/Cum           25.00           25.00           25.00	Wt. KN           1156.81           765.28           426.56           0.00           156.90
$=\frac{1}{2} \text{ x Ht. of Col. in Fl.1} + \frac{1}{2} \text{ x Ht. of Col. in Fl.2}$ $= (\frac{1}{2} \text{ x } 3.75) + (\frac{1}{2} \text{ x } 3.75) = 3.75 \text{ M}$ <b>Description of Items</b> Weight of Slab Weight of columns Weight of Beams:	1.00 1.00 28.00 4.00	M 31.51 10.46 0.25	M 9.79 19.51 0.65	M           0.15           0.15           3.75           0.60	KN/Cum           25.00           25.00           25.00           25.00           25.00	Wt. KN           1156.81           765.28           426.56           0.00           156.90           78.94
$=\frac{1}{2} \text{ x Ht. of Col. in Fl.1} + \frac{1}{2} \text{ x Ht. of Col. in Fl.2}$ $=(\frac{1}{2} \text{ x } 3.75) + (\frac{1}{2} \text{ x } 3.75) = 3.75 \text{ M}$ Description of Items Weight of Slab Weight of Columns Weight of Beams: All beams in X-direction	1.00 1.00 28.00 4.00 1.00 3.00	M 31.51 10.46 0.25 0.25 0.25 0.25 0.25	M           9.79           19.51           0.65           10.46           21.05           31.51	M           0.15           0.15           3.75           0.60           0.60	KN/Cum 25.00 25.00 25.00 25.00 25.00 25.00 25.00	Wt. KN           1156.81           765.28           426.56           0.00           156.90           78.94           354.49
$=\frac{1}{2} \text{ x Ht. of Col. in Fl.1} + \frac{1}{2} \text{ x Ht. of Col. in Fl.2}$ $= (\frac{1}{2} \text{ x } 3.75) + (\frac{1}{2} \text{ x } 3.75) = 3.75 \text{ M}$ <b>Description of Items</b> Weight of Slab Weight of Columns Weight of Beams:	1.00 1.00 28.00 4.00 1.00 3.00 5.00	M           31.51           10.46           0.25           0.25           0.25           0.25           0.25           0.25	M           9.79           19.51           0.65           10.46           21.05           31.51           0.45	M           0.15           0.15           3.75           0.60           0.60           0.60           0.60	KN/Cum 25.00 25.00 25.00 25.00 25.00 25.00 25.00	Wt. KN           1156.81           765.28           426.56           0.00           156.90           78.94           354.49           8.44
$=\frac{1}{2} \text{ x Ht. of Col. in Fl.1} + \frac{1}{2} \text{ x Ht. of Col. in Fl.2}$ $=(\frac{1}{2} \text{ x } 3.75) + (\frac{1}{2} \text{ x } 3.75) = 3.75 \text{ M}$ Description of Items Weight of Slab Weight of Columns Weight of Beams: All beams in X-direction	1.00 1.00 28.00 4.00 1.00 3.00	M 31.51 10.46 0.25 0.25 0.25 0.25 0.25	M           9.79           19.51           0.65           10.46           21.05           31.51	M           0.15           0.15           3.75           0.60           0.60	KN/Cum 25.00 25.00 25.00 25.00 25.00 25.00 25.00	Wt. KN           1156.81           765.28           426.56           0.00           156.90           78.94           354.49

					0.00
					0.00
1.00	0.23	11.76	3.15	20.00	170.40
			3.15		305.01
			3.15		456.58
					0.00
2.00	0.23	9.79	3.15	20.00	283.71
2.00	0.12	9.79	3.15	20.00	141.86
1.00	0.23	5.83	3.15	20.00	84.48
1.00	0.23	8.33	3.15	20.00	120.70
<u> </u>		1		W1	5038.43
1					V2 & W3
					1156.81
					765.28
28.00	0.25	0.65	3.75	25.00	426.56
<u> </u>					0.00
					156.90
			0.00		78.94
					354.49
					8.44
					146.85
					231.36
0.25	10.46	19.51	0.00	3.00	150.06
					0.00
					0.00
					606.26
					132.73
					43.04
					68.76
					234.45
					456.58
					289.80
1.00	0.23	10.46	3.15	20.00	151.57
1.00	0.00	17.00	2.15	20.00	0.00
					259.23
					73.90
					117.37
					603.51
					64.92
					44.77
					424.56
					282.70
	0.23				141.86 7471.67
			, <u> </u>	,	/ 7/ 1.0/
EIGHT (	OF	4	th Floor	W4	
1.00	31.51	9.79	0.15	25.00	1156.81
				•	
1.00		19.51	0.15	25.00	765.28
1.00	10.46	19.51 0.65	0.15 3.75	25.00 25.00	765.28 426.56
		19.51 0.65	0.15 3.75	25.00 25.00	765.28 426.56
	2.00 1.00 1.00 1.00 1.00 1.00 28.00 4.00 1.00 3.00 5.00 4.00 0.25 0.25 4.00 1.00	1.00       0.23         1.00       0.23         1.00       0.23         2.00       0.12         1.00       0.23         2.00       0.12         1.00       0.23         1.00       0.23         1.00       0.23         1.00       0.23         1.00       0.23         1.00       0.23         1.00       0.25         1.00       0.25         3.00       0.25         3.00       0.25         3.00       0.25         3.00       0.25         4.00       0.25         0.25       31.51         0.25       10.46         4.00       0.23         1.00       0.23         1.00       0.23         1.00       0.23         1.00       0.23         1.00       0.23         1.00       0.23         1.00       0.23         1.00       0.23         1.00       0.23         1.00       0.23         1.00       0.23         1.00       0.23         1.00 <td>1.00       0.23       21.05         1.00       0.23       31.51         2.00       0.23       9.79         2.00       0.12       9.79         1.00       0.23       5.83         1.00       0.23       8.33         IGHT OF       2nd &amp; 3rd         1.00       31.51       9.79         1.00       0.23       8.33         IGHT OF       2nd &amp; 3rd         1.00       10.46       19.51         28.00       0.25       0.65         4.00       0.25       10.46         1.00       0.25       21.05         3.00       0.25       0.45         4.00       0.25       9.79         0.25       31.51       9.79         0.25       10.46       19.51         4.00       0.23       2.97         1.00       0.23       10.46         4.00       0.23       10.46         4.00       0.23       10.46         1.00       0.23       10.46         1.00       0.23       10.46         1.00       0.23       10.46         1.00       0.2</td> <td>1.00       0.23       21.05       3.15         1.00       0.23       31.51       3.15         2.00       0.23       9.79       3.15         2.00       0.12       9.79       3.15         1.00       0.23       5.83       3.15         1.00       0.23       5.83       3.15         1.00       0.23       8.33       3.15         1.00       0.23       8.33       3.15         1.00       0.25       0.65       3.75         4.00       0.25       10.46       0.60         1.00       0.25       10.46       0.60         1.00       0.25       10.46       0.60         1.00       0.25       10.46       0.60         1.00       0.25       10.46       0.60         3.00       0.25       0.45       0.60         4.00       0.25       9.79       0.60         0.25       31.51       9.79       0.00         0.25       10.46       19.51       0.00         4.00       0.23       2.97       3.15         1.00       0.23       2.97       3.15         1.00       0.23&lt;</td> <td>1.00         0.23         21.05         3.15         20.00           1.00         0.23         31.51         3.15         20.00           2.00         0.23         9.79         3.15         20.00           2.00         0.12         9.79         3.15         20.00           1.00         0.23         5.83         3.15         20.00           1.00         0.23         8.33         3.15         20.00           1.00         0.23         8.33         3.15         20.00           1.00         0.23         8.33         3.15         20.00           1.00         10.46         19.51         0.15         25.00           28.00         0.25         10.46         0.60         25.00           1.00         0.25         10.46         0.60         25.00           3.00         0.25         10.46         0.60         25.00           3.00         0.25         0.45         0.60         25.00           3.00         0.25         9.79         0.60         25.00           4.00         0.23         10.46         3.15         20.00           1.00         0.23         10.46         &lt;</td>	1.00       0.23       21.05         1.00       0.23       31.51         2.00       0.23       9.79         2.00       0.12       9.79         1.00       0.23       5.83         1.00       0.23       8.33         IGHT OF       2nd & 3rd         1.00       31.51       9.79         1.00       0.23       8.33         IGHT OF       2nd & 3rd         1.00       10.46       19.51         28.00       0.25       0.65         4.00       0.25       10.46         1.00       0.25       21.05         3.00       0.25       0.45         4.00       0.25       9.79         0.25       31.51       9.79         0.25       10.46       19.51         4.00       0.23       2.97         1.00       0.23       10.46         4.00       0.23       10.46         4.00       0.23       10.46         1.00       0.23       10.46         1.00       0.23       10.46         1.00       0.23       10.46         1.00       0.2	1.00       0.23       21.05       3.15         1.00       0.23       31.51       3.15         2.00       0.23       9.79       3.15         2.00       0.12       9.79       3.15         1.00       0.23       5.83       3.15         1.00       0.23       5.83       3.15         1.00       0.23       8.33       3.15         1.00       0.23       8.33       3.15         1.00       0.25       0.65       3.75         4.00       0.25       10.46       0.60         1.00       0.25       10.46       0.60         1.00       0.25       10.46       0.60         1.00       0.25       10.46       0.60         1.00       0.25       10.46       0.60         3.00       0.25       0.45       0.60         4.00       0.25       9.79       0.60         0.25       31.51       9.79       0.00         0.25       10.46       19.51       0.00         4.00       0.23       2.97       3.15         1.00       0.23       2.97       3.15         1.00       0.23<	1.00         0.23         21.05         3.15         20.00           1.00         0.23         31.51         3.15         20.00           2.00         0.23         9.79         3.15         20.00           2.00         0.12         9.79         3.15         20.00           1.00         0.23         5.83         3.15         20.00           1.00         0.23         8.33         3.15         20.00           1.00         0.23         8.33         3.15         20.00           1.00         0.23         8.33         3.15         20.00           1.00         10.46         19.51         0.15         25.00           28.00         0.25         10.46         0.60         25.00           1.00         0.25         10.46         0.60         25.00           3.00         0.25         10.46         0.60         25.00           3.00         0.25         0.45         0.60         25.00           3.00         0.25         9.79         0.60         25.00           4.00         0.23         10.46         3.15         20.00           1.00         0.23         10.46         <

	1.00	0.25	21.05	0.60	25.00	78.94
	3.00	0.25	31.51	0.60	25.00	354.49
	5.00	0.25	0.45	0.60	25.00	8.44
All beams in Y-direction	4.00	0.25	9.79	0.60	25.00	146.85
Weight of imposed Live Load 25% (same as 1st	0.25	31.51	9.79	0.00	3.00	231.36
floor)	0.25	10.46	19.51	0.00	3.00	150.06
All walls in X=direction:	0.23	10.40	17.51	0.00	5.00	130.00
Internal walls: $(\frac{1}{2} \times 3.15 \text{ Ht.})$ in floor 4	7.00	0.23	5.60	1.58	20.00	284.00
	4.00	0.30	5.60	1.58	20.00	211.68
External walls: (1/2 x 3.15 Ht.)in floor 4	1.00	0.30	2.15	1.58	20.00	20.32
All walls in Y-direction:	1.00	0.00	2.110	1.00	20100	20.32
	2.00	0.23	2.94	1.58	20.00	42.60
	2.00	0.23	3.00	1.58	20.00	43.47
Internal walls: $(\frac{1}{2} \times 3.15 \text{ Ht.})$ in floor 4	4.00	0.23	3.20	1.58	20.00	92.74
	3.00	0.23	3.40	1.58	20.00	73.90
	2.00	0.30	2.94	1.58	20.00	55.57
External walls: ( <sup>1</sup> / <sub>2</sub> x 3.15 Ht.)in floor 4	2.00	0.30	3.00	1.58	20.00	56.70
	4.00	0.30	3.20	1.58	20.00	120.96
				1.58	20.00	(1.2)
	2.00	0.30	3.40	1.38	20.00	64.26
Total weight of 4th floor in KN :	2.00	0.30	3.40	1.58	20.00 W4 =	<b>4541.88</b>
Total weight of 4th floor in KN :	2.00	0.30	3.40	1.58		
		W1	3.40 W2	1.58 W3		
Total weight of 4th floor in KN : Total seismic weight of the Building of all 4 f					W4 =	4541.88
Total seismic weight of the Building of all 4 f		W1	W2	W3	W4 =	4541.88 24523.65
Total seismic weight of the Building of all 4 f	loors ATION	W1 5038.43 OF Ah	W2 7471.67	W3 7471.67	W4 = W4 4541.88	4541.88 24523.65
Total seismic weight of the Building of all 4 f Step 4: CALCUL Design horizontal seismic	loors .ATION coefficie	W1 5038.43 OF Ah ent:	W2 7471.67 Ah = Z/2	W3 7471.67 x I/R x Sa/	W4 = W4 4541.88	4541.88 24523.65
Total seismic weight of the Building of all 4 fl         Step 4:       CALCUL         Design horizontal seismic         Zone Factor:       Z = 0.16 (Ref:Fig.	loors .ATION coefficie	W1 5038.43 OF Ah ent:	W2 7471.67 Ah = Z/2	W3 7471.67 x I/R x Sa/	W4 = W4 4541.88	4541.88 24523.65
Total seismic weight of the Building of all 4 fl         Step 4:       CALCUL         Design horizontal seismic         Zone Factor:       Z = 0.16 (Ref:Fig.         (Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1)	loors ATION coefficie 1, Page 5	W1 5038.43 OF Ah ent: 5 of IS 1893	W2 7471.67 Ah = Z/2 3:2002 (Par	W3 7471.67 x I/R x Sa/ t 1)	W4 = W4 4541.88 g	4541.88 24523.65
Total seismic weight of the Building of all 4 flStep 4:CALCULDesign horizontal seismicZone Factor:Z = 0.16 (Ref:Fig. (Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Ref: Table 2)	loors ATION coefficie 1, Page 5	W1 5038.43 OF Ah ent: 5 of IS 189: Cl.6.4.2 of	W2 7471.67 Ah = Z/2 3:2002 (Par IS 1893:2	W3 7471.67 x I/R x Sa/ t 1) 002 (Part 1	W4 = W4 4541.88 g	4541.88 24523.65
Total seismic weight of the Building of all 4 flStep 4:CALCULDesign horizontal seismicZone Factor:Z = 0.16 (Ref:Fig. (Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Ref: TResponse Reduction Factor:R = 5.00 (Ref: T	loors ATION coefficie 1, Page 5	W1 5038.43 OF Ah ent: 5 of IS 189: Cl.6.4.2 of	W2 7471.67 Ah = Z/2 3:2002 (Par	W3 7471.67 x I/R x Sa/ t 1) 002 (Part 1	W4 = W4 4541.88 g	4541.88 24523.65
Total seismic weight of the Building of all 4 fl         Step 4:       CALCUL         Design horizontal seismic         Zone Factor:       Z = 0.16 (Ref:Fig.         (Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1)         Importance Factor:       I = 1.00 (Ref: T         Response Reduction Factor:       R = 5.00 (Ref: T         Fundamental Time Period:	loors ATION coefficie 1, Page 5 Fable 6, 0 ef: Table	W1 5038.43 OF Ah ent: 5 of IS 189: Cl.6.4.2 of	W2 7471.67 Ah = Z/2 3:2002 (Par IS 1893:2	W3 7471.67 x I/R x Sa/ t 1) 002 (Part 1	W4 = W4 4541.88 g	4541.88 24523.65
Total seismic weight of the Building of all 4 fStep 4:CALCULDesign horizontal seismicZone Factor:Z = 0.16 (Ref:Fig. (Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Ref: Tig. (Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Ref: Tig. (Ref: Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Ref: Tig. (Ref: Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Ref: Tig. Tig. Response Reduction Factor:R = 5.00 (RefTug. Supplemental Time Period:Tx = 0.09h/\dx = 0.09x15/\J30.16 = 0.246	loors ATION coefficie 1, Page 5 Table 6, ( ef: Table Sec.	W1 5038.43 OF Ah ent: 5 of IS 189: Cl.6.4.2 of	W2 7471.67 Ah = Z/2 3:2002 (Par IS 1893:2	W3 7471.67 x I/R x Sa/ t 1) 002 (Part 1	W4 = W4 4541.88 g	4541.88 24523.65
Total seismic weight of the Building of all 4 fStep 4:CALCULDesign horizontal seismicZone Factor:Z = 0.16 (Ref:Fig. (Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Ref: TResponse Reduction Factor:I = 1.00 (Ref: TResponse Reduction Factor:R = 5.00 (Ref: TTx = 0.09h/\dx = 0.09x15/\dot 30.16 = 0.246Ty = 0.09h/\dy = 0.09x15/\dot 28.10 = 0.255 S	loors ATION coefficie 1, Page 5 Table 6, 0 ef: Table Sec. ec.	W1 5038.43 OF Ah ent: 5 of IS 1892 C1.6.4.2 of 7, C1.6.4.2	W2 7471.67 Ah = Z/2 3:2002 (Par IS 1893:2	W3 7471.67 x I/R x Sa/ t 1) 002 (Part 1	W4 = W4 4541.88 g	4541.88 24523.65
Total seismic weight of the Building of all 4 fStep 4:CALCULDesign horizontal seismicZone Factor:Z = 0.16 (Ref:Fig. (Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Ref: Tig. (Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Ref: Tig. (Ref: Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Ref: Tig. (Ref: Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Ref: Tig. Tig. Response Reduction Factor:R = 5.00 (RefTug. Supplemental Time Period:Tx = 0.09h/\dx = 0.09x15/\J30.16 = 0.246	loors ATION coefficie 1, Page 5 Fable 6, 0 ef: Table Sec. ec. f IS 1893	W1 5038.43 OF Ah ent: 5 of IS 1892 Cl.6.4.2 of 7, Cl.6.4.2 3:2002 (1)	W2 7471.67 Ah = Z/2 3:2002 (Par IS 1893:2 of IS 189	W3 7471.67 x I/R x Sa/ t 1) 002 (Part 1 93:2002(1)	W4 = W4 4541.88 g	4541.88 24523.65
Total seismic weight of the Building of all 4 flStep 4:CALCULDesign horizontal seismicZone Factor:Z = 0.16 (Ref:Fig. (Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Ref: TResponse Reduction Factor:I = 1.00 (Ref: TResponse Reduction Factor:R = 5.00 (Ref: TTx = 0.09h/\dx = 0.09x15/\sqrt{30.16} = 0.246Ty = 0.09h/\dy = 0.09x15/\sqrt{28.10} = 0.255 S(Sa/g)y = 2.5 (Ref:Cl.6.4.5, Page 16 o)	loors ATION coefficie 1, Page 5 Fable 6, 0 ef: Table Sec. ec. f IS 1893	W1 5038.43 OF Ah ent: 5 of IS 1892 Cl.6.4.2 of 7, Cl.6.4.2 3:2002 (1)	W2 7471.67 Ah = Z/2 3:2002 (Par IS 1893:2 of IS 189	W3 7471.67 x I/R x Sa/ t 1) 002 (Part 1 93:2002(1)	W4 = W4 4541.88 g	4541.88 24523.65
Total seismic weight of the Building of all 4 fStep 4:CALCULDesign horizontal seismicZone Factor:Z = 0.16 (Ref:Fig. (Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Ref: TResponse Reduction Factor:R = 5.00 (Ref: TResponse Reduction Factor:R = 5.00 (Ref: TTx = 0.09h/\dx = 0.09x15/\dx = 0.246Ty = 0.09h/\dy = 0.09x15/\dx = 0.255 S(Sa/g)x = (Sa/g)y = 2.5 (Ref:Cl.6.4.5, Page 16 oTherefore AlStep 5:CALCULATION OF BASE SHE	loors ATION coefficie 1, Page 5 Table 6, 0 ef: Table Sec. ec. f IS 1893 h = 0.16/2 CAR (	W1 5038.43 OF Ah ent: 5 of IS 1892 Cl.6.4.2 of 7, Cl.6.4.2 3:2002 (1)	W2 7471.67 Ah = Z/2 3:2002 (Par IS 1893:2 of IS 189	W3 7471.67 x I/R x Sa/ t 1) 002 (Part 1 93:2002(1)	W4 = W4 4541.88 g	4541.88 24523.65
Total seismic weight of the Building of all 4 fStep 4:CALCULDesign horizontal seismicZone Factor:Z = 0.16 (Ref:Fig. (Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Ref: Tig. (Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Ref: Tig. (Ref: Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Ref: Tig. (Ref: Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Ref: Tig. (Ref: Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Ref: Tig. (Ref: Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1))Importance Factor:I = 1.00 (Ref: Tig. (Ref: Tig. 0, 0)Tig. 0.09h/\dx = 0.09x15/\30.16 = 0.246Ty = 0.09h/\dy = 0.09x15/\28.10 = 0.255 S(Sa/g)x = (Sa/g)y = 2.5 (Ref:Cl.6.4.5, Page 16 o Therefore All	loors ATION coefficie 1, Page 5 Table 6, 0 ef: Table Sec. ec. f IS 1893 h = 0.16/2 CAR (	W1 5038.43 OF Ah ent: 5 of IS 189: Cl.6.4.2 of 7, Cl.6.4.2 3:2002 (1) 2 x 1.0/5.0	W2 7471.67 Ah = Z/2 3:2002 (Par IS 1893:2 of IS 189	W3 7471.67 x I/R x Sa/ t 1) 002 (Part 1 93:2002(1)	W4 = W4 4541.88 g	4541.88 24523.65

#### 6. MAHANADU Rd., Sriramachandranagar, VIJAYAWADA Seismic weight & Base Shear Calculations

#### Seismic weight of a floor (W1) (Cl. 3.26, IS 1893:2016)

It is the sum of dead load of the floor, appropriate contributions of weights of columns, walls and any other permanent elements from the storeys above and below, finishes and services, & appropriate amounts of specified imposed load on the floor.

#### Seismic weight of a Structure (W) (Cl.3.27, IS 1893:2016)

It is the sum of seismic weights of all floors.

W1 = Dead load of floor 1 +

Weight of Beams (1) +

Weight of Slabs (1) +

<sup>1</sup>/<sub>2</sub> Weight of Columns (1) +

<sup>1</sup>/<sub>2</sub> Weight of Columns (2) +

<sup>1</sup>/<sub>2</sub> Weight of Walls (1) +

<sup>1</sup>/<sub>2</sub> Weight of Walls (2) + Appropriate imposed (Live) Load.

Base Shear (VB) (Cl.4.7 IS 1893:2016)

It is the horizontal lateral force in the considered direction of earthquake shaking that the structure shall be designed for.

#### VB = Ah x W & Ah = Z/2 x I/R x Sa/g

**Considerations:** 

External wall thickness: 230 mm

Internal wall thickness: 115 mm

Specific weight of RCC: 25 KN / Cum

Specific weight of infill wall: 20 KN / Cum

Type of soil: Medium

Size of columns: 230x450mm, 230x600mm, 230x750mm and 450x450mm.

Size of Beams: 230 x 450 mm

Response spectra: IS 1893(Part 1) : 2002

Assumption: Live Load 3.00 KN / Sqm

Referring to Table 8, IS 1893:2002; Cl.7.3.1. Page 24; the percentage of imposed load

#### Step 1: CACULATION OF SEISMIC WEIGHT OF 1st FLOOR

Height of wall: =  $\frac{1}{2}$  x Ht.of wall of Fl.1 +  $\frac{1}{2}$  x Ht.of wall of Fl.2

 $= \frac{1}{2} \times (2.75 - 0.45) + \frac{1}{2} \times (3.00 - 0.45) = 2.425 \text{ M}$ 

Height of Column:

= $\frac{1}{2}$  x Ht. of Col. in Fl.1 +  $\frac{1}{2}$  x Ht. of Col.in Fl.2

$= (\frac{1}{2} \times 2.75) + (\frac{1}{2} \times 3.00) = 2.875 \text{ M}$						
Description of Items	Nos.	Width M	Length M	Height M	Sp.Wt. KN/Cum	Total Wt. KN
Weight of Slab	1.00	16.61	13.86	0.15	25.00	863.30
weight of Slab	1.00	9.08	0.60	0.15	25.00	20.44
	4.00	0.23	0.45	2.88	25.00	29.76
Weight of columns	2.00	0.23	0.60	2.88	25.00	19.84
weight of columns	8.00	0.23	0.75	2.88	25.00	99.19
	1.00	0.45	0.45	2.88	25.00	14.55
Weight of Beams:						0.00

W1

Total weight of 1st floor in KN :				W	1	2004.40
External wans:	1.00	0.23	1.07	2.43	20.00	11.94
External walls:	1.00	0.23	6.48	2.43	20.00	72.28
	2.00	0.23	5.03	2.43	20.00	112.31
Internal walls:	1.00	0.23	3.00	1.83	20.00	25.25
	2.00	0.23	2.44	2.75	25.00	77.17
All walls in Y-direction:						
External walls:	1.00	0.23	5.64	2.43	20.00	62.89
Internal walls:	2.00	0.23	1.68	2.43	20.00	15.42
Internal walls:	2.00	0.23	2.13	2.75	25.00	67.36
All walls in X-direction:						0.00
Weight of walls:						0.00
Weight of imposed Live Load (25%)	0.25	16.61	13.26	0.00	3.00	165.19
	1.00	0.23	7.01	0.45	25.00	18.14
All beams in Y-direction	1.00	0.23	5.03	0.45	25.00	13.03
	4.00	0.23	13.26	0.45	25.00	137.24
	1.00	0.23	5.52	0.45	25.00	14.28
All beams in X-direction	1.00	0.23	13.87	0.45	25.00	35.89
	3.00	0.23	16.61	0.45	25.00	128.94

## Step 2:CACULATION OF SEISMIC WEIGHT OF 2nd, 3rd, 4th & 5th Floors W2,W3,W4 & W5

Total weight of each 2nd, 3rd, 4th & 5t	h floors in	KN:	W2=W	3=W4=W5	i=	3153.26
External walls:	2.00	0.23	13.26	3.00	20.00	365.98
	2.00	0.12	13.26	3.00	20.00	182.99
Internal walls:	1.00	0.12	5.75	3.00	20.00	39.68
	2.00	0.23	2.44	3.00	25.00	84.18
	1.00	0.23	10.82	3.00	20.00	149.32
All walls in Y-direction:						
External walls:	2.00	0.23	16.61	3.00	20.00	458.44
	2.00	0.23	2.44	3.00	25.00	84.18
Internal walls:	2.00	0.12	1.52	3.00	20.00	20.98
	1.00	0.12	2.44	3.00	20.00	16.84
	2.00	0.12	13.32	3.00	20.00	183.82
All walls in X-direction:						
Weight of walls:						
Weight of imposed Live Load (25%)	0.25	16.61	13.26	0.00	3.00	165.19
	1.00	0.23	7.01	0.45	25.00	18.14
All beams in Y-direction	1.00	0.23	5.03	0.45	25.00	13,03
	4.00	0.23	13.26	0.45	25.00	137.24
	1.00	0.23	5.52	0.45	25.00	14.28
All beams in X-direction	1.00	0.23	13.87	0.45	25.00	35.89
weight of beams. (same as 1st hoor)	3.00	0.23	16.61	0.45	25.00	128.94
Weight of beams: (same as 1st floor)	1.00	0.45	0.45	3.00	25.00	15.19
-	8.00	0.23	0.75	3.00	25.00	103.50
Weight of columns: (same as 1st floor)	2.00	0.23	0.60	3.00	25.00	20.70
	4.00	0.23	0.45	3.00	25.00	31.05
····g······)	1.00	9.08	0.60	0.15	25.00	20.44
Weight of slab: (same as 1st floor)	1.00	16.61	13.86	0.15	25.00	863.30

OF SEIS	MIC WE	IGHT OF	6th Floor	W6					
1	1.00	16.61	13.86	0.15	25.00	863.30			
ioor)	1.00	9.08	0.60	0.15	25.00	20.44			
	4.00	0.23	0.45	1.50	25.00	15.53			
) in floor	2.00	0.23	0.60	1.50	25.00	10.35			
, ,	8.00	0.23	0.75	1.50	25.00	51.75			
	1.00	0.45	0.45	1.50	25.00	7.59			
floor)									
	3.00	0.23	16.61	0.45	25.00	128.94			
	1.00	0.23	13.87	0.45	25.00	35.89			
	1.00	0.23	5.52	0.45	25.00	14.28			
	4.00	0.23	13.26	0.45	25.00	137.24			
	1.00	0.23	5.03	0.45	25.00	13.03			
	1.00	0.23	7.01	0.45	25.00	18.14			
(25%)	0.25	16.61	13.26	0.00	3.00	165.19			
	2.00	0.12	13.32	1.50	20.00	91.91			
n floor 4	1.00	0.12	2.44	1.50	20.00	8.42			
n 1100f 4	2.00	0.12	1.52	1.50	20.00	10.49			
	2.00	0.23	2.44	1.50	25.00	42.09			
in floor 4	2.00	0.23	16.61	1.50	20.00	229.22			
	1.00	0.23	10.82	1.50	20.00	74.66			
	2.00	0.23	2.44	1.50	25.00	42.09			
	1.00	0.12	5.75	1.50	20.00	19.84			
	2.00	0.12	13.26	1.50	20.00	91.49			
	2.00	0.23	13.26	1.50	20.00	182.99			
4th floor	in KN :			W4	=	2274.85			
1		1	1						
			W4	W5	W6	16892.29			
W1	W2	W3	**4						
W1 2004.40	W2 3153.3	W3 3153.26	3153.26	3153.26	2274.85	- KN			
					2274.85				
2004.40	3153.3		3153.26		2274.85				
2004.40	3153.3 ALCULA	3153.26	3153.26		2274.85				
<b>2004.40</b> <b>C</b> <b>efficient:</b> <b>Z</b> = 0.16 (	3153.3 ALCULA Ah = Ref:Fig.1,	3153.26 ATION OF = Z/2 x I/I	3153.26 Ah R x Sa/g	3153.26	2274.85				
2004.40 C efficient: L = 0.16 ( 93:2002 (P	3153.3 ALCULA Ah = Ref:Fig.1, art 1)	3153.26 TION OF = Z/2 x I/I Page 5 of	3153.26 Ah R x Sa/g IS 1893:200	3153.26 02 (Part 1)					
2004.40 C efficient: L = 0.16 ( 93:2002 (P I = 1.00	3153.3 ALCULA Ah = Ref:Fig.1, art 1) (Ref: Ta	3153.26 TION OF = Z/2 x I/I Page 5 of ble 6, Cl.6.	3153.26 Ah R x Sa/g IS 1893:20 4.2 of IS	3153.26 02 (Part 1) 1893:2002	(Part 1)				
2004.40 C efficient: L = 0.16 ( 93:2002 (P	3153.3 ALCULA Ah = Ref:Fig.1, art 1) (Ref: Ta	3153.26 TION OF = Z/2 x I/I Page 5 of ble 6, Cl.6.	3153.26 Ah R x Sa/g IS 1893:20 4.2 of IS	3153.26 02 (Part 1)	(Part 1)				
2004.40 C efficient: Z = 0.16 ( 93:2002 (P I = 1.00 R = 5	3153.3 ALCULA Ah = Ref:Fig.1, art 1) (Ref: Ta .00 (Ref	3153.26 TION OF = Z/2 x I/I Page 5 of ble 6, Cl.6. : Table 7, C	3153.26 Ah R x Sa/g IS 1893:20 4.2 of IS	3153.26 02 (Part 1) 1893:2002	(Part 1)				
2004.40 2004.40 C efficient: Z = 0.16 ( 93:2002 (P I = 1.00 R = 5. $\sqrt{16.61} = 0$	3153.3 ALCULA Ah = Ref:Fig.1, art 1) (Ref: Ta .00 (Ref 0.392 Sec.	3153.26 TION OF = Z/2 x I/I Page 5 of ble 6, Cl.6. : Table 7, C	3153.26 Ah R x Sa/g IS 1893:20 4.2 of IS	3153.26 02 (Part 1) 1893:2002	(Part 1)				
2004.40 C efficient: Z = 0.16 ( 93:2002 (P I = 1.00 R = 5	3153.3 ALCULA Ah = Ref:Fig.1, art 1) (Ref: Ta .00 (Ref ).392 Sec. ).439 Sec.	3153.26 TION OF = Z/2 x I/I Page 5 of ble 6, Cl.6. : Table 7, C	3153.26 Ah R x Sa/g IS 1893:200 4.2 of IS Cl.6.4.2 of	3153.26 02 (Part 1) 1893:2002	(Part 1)				
2004.40 C efficient: L = 0.16 ( 93:2002 (P I = 1.00 R = 5 $\sqrt{16.61} = (10^{-10} + 10^{-10})$ $\sqrt{13.26} = (10^{-10} + 10^{-10})$ Cl.6.4.5, Pa	3153.3 ALCULA Ah = Ref:Fig.1, art 1) (Ref: Ta .00 (Ref 0.392 Sec. ).439 Sec. age 16 of ]	3153.26 TION OF = Z/2 x I/I Page 5 of ble 6, Cl.6. : Table 7, C IS 1893:20	3153.26 Ah R x Sa/g IS 1893:200 4.2 of IS Cl.6.4.2 of 02 (1)	3153.26 02 (Part 1) 1893:2002 IS 1893:20	(Part 1)				
2004.40 C efficient: L = 0.16 ( 93:2002 (P I = 1.00 R = 5. $\sqrt{16.61} = (16, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10$	3153.3 ALCULA Ah = Ref:Fig.1, art 1) (Ref: Ta 00 (Ref 0.392 Sec. 0.439 Sec. 0.439 Sec. 0.439 Sec. 0.439 Sec.	3153.26 TION OF = Z/2 x I/I Page 5 of ble 6, Cl.6. : Table 7, C [S 1893:20] 16/2 x 1.0/	3153.26 Ah R x Sa/g IS 1893:200 4.2 of IS Cl.6.4.2 of 02 (1) 5.0 x 2.5 =	3153.26 02 (Part 1) 1893:2002 IS 1893:20	(Part 1)				
2004.40 C efficient: L = 0.16 ( 93:2002 (P I = 1.00 R = 5 $\sqrt{16.61} = (10^{-10} + 10^{-10})$ $\sqrt{13.26} = (10^{-10} + 10^{-10})$ Cl.6.4.5, Pa	3153.3 ALCULA Ah = Ref:Fig.1, art 1) (Ref: Ta .00 (Ref 0.392 Sec. 0.439 Sec. 0.439 Sec. age 16 of ] Ah = 0. SE SHEA	3153.26 TION OF = Z/2 x I/I Page 5 of ble 6, Cl.6. : Table 7, C [S 1893:20] 16/2 x 1.0/ JR (VB	3153.26 Ah R x Sa/g IS 1893:200 4.2 of IS Cl.6.4.2 of 02 (1) 5.0 x 2.5 =	3153.26 02 (Part 1) 1893:2002 IS 1893:20	(Part 1)				
	loor) .) in floor floor) (25%) (25%) n floor 4 in floor 4 in floor 4 F4th floor	$\begin{array}{c c} \text{loor} & 1.00 \\ \hline 1.00 \\ 4.00 \\ 2.00 \\ \hline 8.00 \\ \hline 1.00 \\ \hline 2.00 \\ \hline 0.25 \\ \hline \\ \hline \\ \hline \\ 2.00 \\ \hline \\ 1.00 \\ \hline 2.00 \\ \hline \\ \hline \\ 1.00 \\ \hline 2.00 \\ \hline \\ 1.00 \\ \hline 2.00 \\ \hline \\ 1.00 \\ \hline 2.00 \\ \hline \\ 1.00 \\ \hline 2.00 \\ \hline \end{array}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{ c c c c c c c c c } \hline loor) & 1.00 & 9.08 & 0.60 \\\hline 1.00 & 0.23 & 0.45 \\\hline 2.00 & 0.23 & 0.60 \\\hline 8.00 & 0.23 & 0.60 \\\hline 8.00 & 0.23 & 0.75 \\\hline 1.00 & 0.45 & 0.45 \\\hline 1.00 & 0.45 & 0.45 \\\hline 1.00 & 0.23 & 13.87 \\\hline 1.00 & 0.23 & 13.87 \\\hline 1.00 & 0.23 & 5.52 \\\hline 4.00 & 0.23 & 13.26 \\\hline 1.00 & 0.23 & 5.03 \\\hline 1.00 & 0.23 & 7.01 \\\hline (25\%) & 0.25 & 16.61 & 13.26 \\\hline & & & & & \\\hline & & & & & \\\hline & & & & & $	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$			

7. BRINDA	VAN, LAF	BBIPET,	VIJAYAV	VADA		
	eight & Bas		alculation	5		
• Seismic weight of a floor (W1) (Cl. 3.26						
It is the sum of dead load of the floor, approp						
permanent elements from the storeys above	and below, f	ïnishes and	l services, d	& appropria	te amounts o	of
specified imposed load on the floor.						
• Seismic weight of a Structure (W) (Cl.:		3:2016)				
It is the sum of seismic weights of all floors.						
W1 = Dead load of floor 1 +						
Weight of Beams (1) +						
Weight of Slabs (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Columns (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Columns (2) +						
<sup>1</sup> / <sub>2</sub> Weight of Walls (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Walls (2) +						
Appropriate imposed (Live) Load.						
· Base Shear (VB) (Cl.4.7 IS 1893:2016						
It is the horizontal lateral force in the consid	ered directio	on of earth	quake shaki	ng that the	structure sh	all be
designed for.						
$\mathbf{VB} = \mathbf{Ah} \mathbf{x} \mathbf{W}  \&  \mathbf{Ah} = \mathbf{Z}/2 \mathbf{x} \mathbf{I}/\mathbf{R} \mathbf{x} \mathbf{Sa/g}$						
Considerations:						
External wall thickness: 230 mm						
Internal wall thickness: 115 mm						
Specific weight of RCC: 25 KN / Cum						
Specific weight of infill wall: 20 KN / Cum						
Type of soil: Medium						
Size of columns: 230x300 mm, 300x450mn	n and 300x6	00mm				
Size of Beams: 230 x 375 mm						
Response spectra: IS 1893(Part 1): 2002						
Assumption: Live Load 3.00 KN / Squ	m					
Referring to Table 8, IS 1893:2002; Cl.7.3.1	. Page 24; th	ne percenta	ge of impos	sed load		
			-			
Step 1:CACULATION OFHeight of wall:	SEISMIC V	VEIGHT	OF	1st FLOC	DR	W1
$= \frac{1}{2} \times \text{Ht.of wall of Fl.1} + \frac{1}{2} \times \text{Ht.of wall of}$	'El 2					
$= \frac{1}{2} \times (2.50-0.375) + \frac{1}{2} \times (3.00-0.375) =$						
Height of Column:	2.373 IVI					
= $\frac{1}{2}$ x Ht. of Col. in Fl.1 + $\frac{1}{2}$ x Ht. of Col.in	F1 2					
$= (\frac{1}{2} \times 2.50) + (\frac{1}{2} \times 3.00) = 2.75 \text{ M}$	11.2					
$-(72 \times 2.50) + (72 \times 5.00) - 2.75$ W					Sp.Wt.	
<b>Description of Items</b>	Nos.	Width	Length	Height	KN/Cu	Total
2 comption of items	1,05	M	M	M	m	Wt. KN
Weight of Slab	1.00	12.42	17.27	0.13	25.00	670.29
	4.00	0.23	0.30	2.75	25.00	18.98
Weight of columns	8.00	0.30	0.45	2.75	25.00	74.25
	8.00	0.30	0.60	2.75	25.00	99.00
Weight of Beams:		İ				0.00
	4.00	0.23	12.42	0.43	25.00	121.41
All beams in X-direction	2.00	0.23	1.52	0.43	25.00	7.43
	4.00	0.23	17.27	0.43	25.00	168.81
All beams in Y-direction	2.00	0.23	1.52	0.43	25.00	7.43
Weight of imposed Live Load (25%)	0.25	12.42	17.27	0.00	3.00	160.87
Weight of walls:	0.20			5.00	5.00	0.00
		1	1	1	I	0.00

All walls in X=direction:						0.00
T . 1 11	2.00	0.23	3.54	2.38	20.00	77.35
Internal walls:	1.00	0.12	3.54	2.38	20.00	19.38
External walls:	1.00	0.23	3.54	2.38	20.00	161.87
All walls in Y-direction:						0.00
Internal walls:	1.00	0.23	5.43	2.38	20.00	59.45
External walls:	1.00	0.23	5.43	2.38	20.00	59.45
Total weight of 1st floor in KN :		I	8	W1	8	1705.96
Step 2: CACULATION OF SEISMIC WI			d & 3rd F		W2 & W	
Weight of slab: (same as 1st floor)	1.00	15.35	17.40	0.15	25.00	1001.59
Weight of columns: (same as 1st floor)	24.0 0	0.30	0.50	3.66	25.00	329.40
Weight of beams: (same as 1st floor)	6.00	0.23	0.45	15.35	25.00	238.31
	4.00	0.23	0.45	17.40	25.00	180.09
Weight of imposed Live Load: (same as 1st floor)	0.25	15.35	17.40	0.00	3.00	200.32
Weight of walls:						
All walls in X=direction:						
Internal walls:	7.00	0.23	5.60	3.21	20.00	578.83
External walls:	4.00	0.30	5.60	3.21	20.00	431.42
	1.00	0.30	2.15	3.21	20.00	41.41
All walls in Y-direction:						
Internal walls:	2.00	0.23	2.94	3.21	20.00	86.82
	2.00	0.23	3.00	3.21	20.00	88.60
	4.00	0.23	3.20	3.21	20.00	189.00
	3.00	0.23	3.40	3.21	20.00	150.61
External walls:	2.00	0.30	2.94	3.21	20.00	113.25
	2.00	0.30	3.00	3.21	20.00	115.56
	4.00	0.30	3.20	3.21	20.00	246.53
	2.00	0.30	3.40	3.21	20.00	130.97
Total weight of 2nd & 3rd floors each in KN	:	V	V2 = W3	=		4122.71
Step 3: CALCULATION OF SEISMIC V	VEIGH	Г OF 4	4th Floor	W4		
Weight of slab: (same as 1st floor)	1.00	15.35	17.40	0.15	25.00	1001.59
Weight of beams: (same as 1st floor)	6.00	0.23	0.45	15.35	25.00	238.31
<b>e</b>	4.00	0.23	0.45	17.40	25.00	180.09
Weight of imposed Live Load: (same as 1st floor)	0.25	15.35	17.40	0.00	3.00	200.32
Weight of Columns: = $(\frac{1}{2} \times 3.66 \text{ Ht.})$ in floor 4	24.0 0	0.30	0.50	1.83	25.00	164.70
All walls in X=direction:						
Internal walls: (1/2 x 3.21 Ht.)in floor 4	7.00	0.23	5.60	1.61	20.00	290.32
External walls: (1/ y 2 21 Ht ):= flags 4	4.00	0.30	5.60	1.61	20.00	216.38
External walls: (½ x 3.21 Ht.)in floor 4	1.00	0.30	2.15	1.61	20.00	20.77
All walls in Y-direction:						
	2.00	0.23	2.94	1.61	20.00	43.55
Internal walls: $(\frac{1}{2} \times 3.21 \text{ Ht.})$ in floor 4	2.00	0.23	3.00	1.61	20.00	44.44
mornar wans. (/2 x 3.21 III.)III 1001 4	4.00	0.23	3.20	1.61	20.00	94.80
	3.00	0.23	3.40	1.61	20.00	75.54
	2.00	0.30	2.94	1.61	20.00	56.80
	2 00	0.30	3.00	1.61	20.00	57.96
External walls: $(\frac{1}{2} \times 3.21 \text{ Ht.})$ in floor 4	2.00	0.50	5.00	1.01	20.00	57.90

	2.00	0.30	3.40	1.61	20.00	65.69
Total weight of 4th floor in KN :					W4 =	2874.89
		W1	W2	W3	W4	14506.2
Total seismic weight of the Building of all 4	floors	3385.9 2	4122.71	4122.71	2874.89	3 KN
Step 4: CALCU	JLATIO	ON OF A	h			
Design horizontal seismic coefficient:	Ah = Z/	2 x I/R x S	a/g			
<b>Zone Factor:</b> Z = 0.16 (Ref:Fi (Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1)	g.1, Pag	e 5 of IS 18	893:2002 (F	Part 1)		
<b>Importance Factor:</b> I = 1.00 (Ref	Table 6	5, Cl.6.4.2	of IS 1893	3:2002 (Par	t 1)	
<b>Response Reduction Factor:</b> $\mathbf{R} = 5.00$ (	Ref: Tab	ole 7, Cl.6.4	4.2 of IS	893:2002(	1)	
Fundamental Time Period:						
$Tx = 0.09h/\sqrt{dx} = 0.09x14.64/\sqrt{15.35} = 0.336$ S	Sec.					
$Ty = 0.09h/\sqrt{dy} = 0.09x14.64/\sqrt{17.40} = 0.316$	Sec.					
(Sa/g)x = (Sa/g)y = 2.5 (Ref:Cl.6.4.5, Page 16	of IS 18	93:2002 (1	)			
Therefore A			·	.04		
Step 5: CALCULATION OF BASE SE	IEAR	(VB)				
(VB)x = W x Ah(x) = 14770.53 x 0.04 = 590	).82 KN					
(VB)y = 590.82  KN						

8.			, VIJAYA'			
	0		hear Calcul	ations		
• Seismic weight of a floor (W1) (Cl.				0 1		
It is the sum of dead load of the floor, ap permanent elements from the storeys abo						
imposed load on the floor.	ove and b	elow, limisi	les and servic	es, & approp	mate amounts	of specified
Seismic weight of a Structure (W) (	Cl.3.27,	IS 1893:20	16)			
It is the sum of seismic weights of all flo	ors.					
W1 = Dead load of floor 1 +						
Weight of Beams (1) +						
Weight of Slabs (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Columns (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Columns (2) +						
<sup>1</sup> / <sub>2</sub> Weight of Walls (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Walls (2) +						
Appropriate imposed (Live) Load.						
· Base Shear (VB) (Cl.4.7 IS 1893:2	.016)					
It is the horizontal lateral force in the con-	nsidered	direction of	earthquake s	haking that t	he structure sh	nall be
designed for.						
VB = Ah x W & Ah = Z/2 x I/R x Sat	a/g					
Considerations:						
External wall thickness: 230 mm						
Internal wall thickness: 230 mm						
Specific weight of RCC: 25 KN / Cum						
Specific weight of infill wall: 20 KN / C	um					
Type of soil: Medium						
Size of columns: 230x450 mm and 230x	x230 mm					
Size of Beams: 230x600 mm and 230	x 450 mr	n				
Response spectra: IS 1893(Part 1): 2002						
Assumption: Live Load 3.00 KN /						
Referring to Table 8, IS 1893:2002; Cl.7	.3.1. Pag	e 24; the pe	rcentage of in	mposed load		
Step 1: CACULATION OF	SEISMI	C WEIGH	T OF	1st Floo	or	W1
Height of wall:						
$= \frac{1}{2}$ x Ht.of wall of Fl.1 + $\frac{1}{2}$ x Ht.of wall	ll of Fl.2					
$= \frac{1}{2} \times (3.75 - 0.45) + \frac{1}{2} \times (3.75 - 0.45) =$	3.30 M					
Height of Column:						
= $\frac{1}{2}$ x Ht. of Col. in Fl.1 + $\frac{1}{2}$ x Ht. of Co	l.in Fl.2					
$= (\frac{1}{2} \times 3.75) + (\frac{1}{2} \times 3.75) = 3.75 \text{ M}$						
	N	Width	Length	Height	Sp.Wt.	Total Wt.
Description of Items	Nos.	Μ	ที่	M	KN/Cum	KN
Weight of Slab	1.00	10.53	52.46	0.15	25.00	2071.51
	34.00	0.23	0.45	3.75	25.00	329.91
Weight of columns	16.00	0.23	0.23	3.75	25.00	79.35
Weight of Beams:						0.00
All beams in X-direction	3.00	0.23	52.46	0.45	25.00	407.22
	16.00	0.23	2.42	0.45	25.00	99.98
All beams in Y-direction	16.00	0.23	8.33	0.60	25.00	459.82
Weight of imposed Live Load (25%)	0.25	10.53	52.46	0.00	3.00	414.30
Weight of walls:						0.00
All walls in <b>X=direction</b> :						
Internal walls:	1.00	0.23	47.36	3.30	20.00	718.92

	1.00	0.23	52.46	3.30	20.00	796.34
External walls:	1.00	0.23	47.36	3.30	20.00	718.92
All walls in <b>Y-direction:</b>						0.00
Internal walls:	6.00	0.23	7.70	3.15	20.00	669.44
External walls:	2.00	0.23	9.77	3.15	20.00	283.13
Total weight of 1st floor in KN :			II		W1	7048.85
8					1	
Step 2: CACULATIO	N OF SE	ISMIC W	EIGHT OF		2nd Floor	W2
Weight of slab: (same as 1st floor)	1.00	10.53	52.46	0.15	25.00	2071.51
	34.00	0.23	0.45	3.75	25.00	329.91
Weight of columns: (same as 1st floor)	16.00	0.23	0.23	3.75	25.00	79.35
Weight of beams: (same as 1st floor)						
All beams in X-direction	3.00	0.23	52.46	0.45	25.00	407.22
	16.00	0.23	2.42	0.45	25.00	99.98
All beams in Y-direction	16.00	0.23	8.33	0.60	25.00	459.82
Weight of imposed Live Load: (same	0.25	10.53	52.46	0.00	3.00	414.30
as 1st floor)						414.30
Weight of walls:						
All walls in X=direction:						
Internal walls:	1.00	0.23	47.36	3.30	20.00	718.92
External walls:	2.00	0.23	52.46	3.30	20.00	1592.69
All walls in Y-direction:						
Internal walls:	6.00	0.23	7.70	3.15	20.00	669.44
External walls:	2.00	0.23	9.77	3.15	20.00	283.13
Total weight of 2nd floor in KN :					W2	7126.27
Step 3: CALCULATION OF SEIS				3rd Flo		
Weight of slab: (same as 1st floor)	1.00	10.53	52.46	0.15	25.00	2071.51
Weight of beams: (same as 1st floor)						
All beams in <b>X-direction</b>	3.00	0.23	52.46	0.45	25.00	407.22
All beams in <b>Y-direction</b>	16.00	0.23	2.42	0.45	25.00	99.98
	16.00	0.23	8.33	0.60	25.00	459.82
Weight of imposed Live Load: (same as 1st floor)	0.25	10.53	52.46	0.00	3.00	414.30
Weight of Columns: = $(\frac{1}{2} \times 3.75 \text{ Ht.})$ in	34.00	0.23	0.45	1.88	25.00	164.95
floor 3	16.00	0.23	0.23	1.88	25.00	39.78
Weight of walls:						
All walls in <b>X=direction</b> :						
Internal walls: (1/2 x 3.30 Ht.) in floor 3	1.00	0.23	47.36	3.30	20.00	718.92
External walls: (1/2 x 3.30 Ht.) in floor 3	2.00	0.23	52.46	3.30	20.00	1592.69
All walls in <b>Y-direction</b> :						
Internal walls: (1/2 x 3.15 Ht.) in floor 3	6.00	0.23	7.70	1.58	20.00	334.72
External walls: ( <sup>1</sup> / <sub>2</sub> x3.15 Ht.) in floor 3	2.00	0.23	9.77	1.58	20.00	141.57
Total weight of 3rd floor in KN :					W3 =	6445.46
Total seismic weight of the building of	all 3 flor	re	W1	W2	W3	20620.58
Total seisinc weight of the bunding of		лs	7048.85	7126.27	6445.46	KN
Step 4:	CALCIN	LATION O	)F Ah			
Step 4: Design horizontal seismic coefficient:		h = Z/2 x				
ş				2 (D		
		1, Page 5 o	of IS 1893:200	2 (Part 1)		
(Ref:Table 2, Cl.6.4.2 of IS 1893:2002 ( Importance Factor: $I = 1.0$		Table 6 Cl	612 of 101	803.2002 (1)	ort 1)	
<b>Importance Factor:</b> $I = 1.0$	u (Ref:	1 aute 0, Ul	6.4.2 of IS 1	1075:2002 (P	an 1)	

Fundamental Time Period:
$Tx = 0.09h/\sqrt{dx} = 0.09x11.25/\sqrt{52.46} = 0.140$ Sec.
$Ty = 0.09h/\sqrt{dy} = 0.09x11.25/\sqrt{10.53} = 0.312$ Sec.
(Sa/g)x = (Sa/g)y = 2.5 (Ref:Cl.6.4.5, Page 16 of IS 1893:2002 (1)
Therefore $Ah = 0.16/2 \ge 1.0/5.0 \ge 2.5 = 0.04$
Step 5: CALCULATION OF BASE SHEAR (VB)
(VB)x = W x Ah(x) = 20620.58 x 0.04 = 824.82 KN
(VB)y = 824.82  KN

9. GPV - HO	DSTEL	Block, V	IJAYAWA	DA		
Seismic weigh	t & Bas	e Shear C	alculations			
• Seismic weight of a floor (W1) (Cl. 3.26, IS	1893:20	16)				
It is the sum of dead load of the floor, appropriat						
permanent elements from the storeys above and l	below, fi	inishes and	services, &	appropriat	e amounts o	of
specified imposed load on the floor.						
• Seismic weight of a Structure (W) (Cl.3.27,	IS 1893	:2016)				
It is the sum of seismic weights of all floors.						
W1 = Dead load of floor 1 +						
Weight of Beams (1) +						
Weight of Slabs (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Columns (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Columns (2) +						
<sup>1</sup> / <sub>2</sub> Weight of Walls (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Walls (2) +						
Appropriate imposed (Live) Load.						
· Base Shear (VB) (Cl.4.7 IS 1893:2016)						
It is the horizontal lateral force in the considered designed for.	directio	n of earthq	uake shakir	g that the s	structure sha	all be
VB = Ah x W & Ah = Z/2 x I/R x Sa/g						
Considerations:						
External wall thickness: 230 mm						
Internal wall thickness: 230 mm						
Specific weight of RCC: 25 KN / Cum						
Specific weight of infill wall: 20 KN / Cum						
Type of soil: Medium						
Size of columns: 230x380, 300X550, 500X500		300mm D	ia.			
Size of Beams: 230 x 450 mm and 300 x 380 r	nm					
Response spectra: IS 1893(Part 1) : 2002						
Assumption: Live Load 3.00 KN / Sqm						
Referring to Table 8, IS 1893:2002; Cl.7.3.1. Pag	ge 24; th	e percentag	ge of impos	ed load		
					1 ( 15)	
Step 1: CACULATION OF SEIS	SMIC V	VEIGHT (	JF		1st Floor	
Height of wall:						
$= \frac{1}{2} x$ Ht.of wall of Fl.1 + $\frac{1}{2} x$ Ht.of wall of Fl.2						
= $\frac{1}{2}$ x (3.18-0.45) + $\frac{1}{2}$ x (3.18-0.45) = <b>2.73</b> M	[					
Height of Column:						
= $\frac{1}{2}$ x Ht. of Col. in Fl.1 + $\frac{1}{2}$ x Ht. of Col.in Fl.2						
$= (\frac{1}{2} \times 3.18) + (\frac{1}{2} \times 3.18) = 3.18 \text{ M}$						1
Description of Ita-	Ner	Width	Length	Height	Sp.Wt.	Total
Description of Items	Nos.	Μ	M	M	KN/Cu m	Wt. KN
	2.00	38.63	8.00	0.13	25.00	1931.50
Weight of Slab	2.00	18.29	8.00	0.13	25.00	914.50
	2.00	7.54	3.45	0.15	25.00	195.10
	50.0	0.30	0.55	3.18	25.00	655.88
	8.00	0.50	0.50	3.18	25.00	159.00
Weight of columns	8.00	0.23	0.38	3.18	25.00	55.59
-	16.0	0.30	0.00	3.18	25.00	
	-	dia.		-		89.95

Weight of Beams:						0.00
<i>c</i>	4.00	0.23	38.63	0.45	25.00	399.82
	10.0	0.23	5.94	0.45	25.00	
All beams in X-direction	0					153.70
	2.00	0.23	7.54	0.45	25.00	39.02
	2.00	0.30	22.55	0.38	25.00	128.54
	4.00	0.23	34.29	0.45	25.00	354.90
All beams in Y-direction	12.0	0.23	5.94	0.45	25.00	184.44
	4.00	0.23	3.45	0.45	25.00	35.71
W. i. 1. 4 6 i 1 I i 1 (250/)	2.00	0.30	18.29	0.38	25.00	104.25
Weight of imposed Live Load (25%) Weight of walls:	0.25				5401.88	1350.47
All walls in X=direction:						0.00
An wans in A-un ceton.	1.00	0.23	38.63	2.73	20.00	485.12
	4.00	0.23	4.73	2.73	20.00	237.60
Internal walls:	2.00	0.23	17.32	2.73	20.00	435.01
	10.0	0.23	5.49	2.73	20.00	689.43
	1.00	0.23	38.63	2.73	20.00	485.12
External walls:	1.00	0.23	33.45	2.73	20.00	420.07
	2.00	0.23	5.49	2.73	20.00	137.89
All walls in <b>Y-direction</b> :						0.00
Internal walls:	2.00	0.23	17.55	2.73	20.00	440.79
Internal walls:	16.0	0.23	5.49	2.73	20.00	1103.09
External walls:	2.00	0.23	34.29	2.73	20.00	861.23
Total weight of 1st floor in KN :				W	/1	12047.0
						8
Step 2: CACULATION OF SEISMIC WE	EIGHT OF		2nd	Floor	W2	
Step 2: CACULATION OF SEISMIC WE	<b>EIGHT OF</b> 2.00	38.63	<b>2nd</b> 8.00	Floor 0.13	<b>W2</b> 25.00	1931.50
•	2.00		8.00	0.13	25.00	
Step 2: CACULATION OF SEISMIC WE Weight of Slab	2.00 2.00	18.29	8.00 8.00	0.13 0.13	25.00 25.00	914.50
•	2.00 2.00 2.00	18.29 7.54	8.00 8.00 3.45	0.13 0.13 0.15	25.00 25.00 25.00	914.50 195.10
•	2.00 2.00 2.00 50.0	18.29 7.54 0.30	8.00 8.00 3.45 0.55	0.13 0.13 0.15 3.18	25.00 25.00 25.00 25.00	914.50 195.10 655.88
Weight of Slab	2.00 2.00 2.00	18.29 7.54	8.00 8.00 3.45	0.13 0.13 0.15	25.00 25.00 25.00	914.50 195.10 655.88
•	2.00 2.00 2.00 50.0	18.29 7.54 0.30	8.00 8.00 3.45 0.55	0.13 0.13 0.15 3.18	25.00 25.00 25.00 25.00	914.50 195.10 655.88
	2.00 2.00 2.00 50.0 8.00	18.29         7.54         0.30         0.50	8.00 8.00 3.45 0.55 0.50	0.13 0.13 0.15 3.18 3.18	25.00 25.00 25.00 25.00 25.00	914.50 195.10 655.88 159.00 55.59
Weight of Slab Weight of columns	2.00 2.00 2.00 50.0 8.00 8.00	18.29         7.54         0.30         0.50         0.23	8.00 8.00 3.45 0.55 0.50 0.38	0.13 0.13 0.15 3.18 3.18 3.18	25.00 25.00 25.00 25.00 25.00 25.00	914.50 195.10 655.88 159.00 55.59 89.95
Weight of Slab	2.00 2.00 2.00 50.0 8.00 8.00 16.0	18.29         7.54         0.30         0.50         0.23         0.30         dia.	8.00           8.00           3.45           0.55           0.50           0.38	0.13 0.13 0.15 3.18 3.18 3.18 3.18	25.00 25.00 25.00 25.00 25.00 25.00 25.00	914.50 195.10 655.88 159.00 55.59
Weight of Slab Weight of columns	2.00 2.00 2.00 50.0 8.00 8.00	18.29           7.54           0.30           0.50           0.23           0.30	8.00 8.00 3.45 0.55 0.50 0.38	0.13 0.13 0.15 3.18 3.18 3.18	25.00 25.00 25.00 25.00 25.00 25.00	914.50 195.10 655.88 159.00 55.59 89.95 0.00
Weight of Slab Weight of columns Weight of Beams:	2.00 2.00 2.00 50.0 8.00 8.00 16.0	18.29         7.54         0.30         0.50         0.23         0.30         dia.	8.00           8.00           3.45           0.55           0.50           0.38	0.13 0.13 0.15 3.18 3.18 3.18 3.18	25.00 25.00 25.00 25.00 25.00 25.00 25.00	914.50 195.10 655.88 159.00 55.59 89.95 0.00 399.82
Weight of Slab Weight of columns	2.00 2.00 2.00 50.0 8.00 16.0 4.00	18.29         7.54         0.30         0.50         0.23         0.30         dia.         0.23	8.00         8.00         3.45         0.55         0.50         0.38         0.00         38.63	0.13 0.13 0.15 3.18 3.18 3.18 3.18 0.45	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	914.50 195.10 655.88 159.00 55.59 89.95 0.00 399.82 153.70
Weight of Slab Weight of columns Weight of Beams:	2.00 2.00 2.00 50.0 8.00 16.0 4.00 10.0 2.00	18.29         7.54         0.30         0.50         0.23         0.30         dia.         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23	8.00 8.00 3.45 0.55 0.50 0.38 0.00 38.63 5.94 7.54	0.13 0.13 0.15 3.18 3.18 3.18 3.18 3.18 0.45 0.45 0.45	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	914.50 195.10 655.88 159.00 55.59 89.95 0.00 399.82 153.70 39.02
Weight of Slab Weight of columns Weight of Beams:	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	18.29         7.54         0.30         0.50         0.23         0.30         dia.         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23	8.00           8.00           3.45           0.55           0.50           0.38           0.00           38.63           5.94           7.54           22.55	0.13 0.13 0.15 3.18 3.18 3.18 3.18 3.18 0.45 0.45 0.45 0.38	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	914.50 195.10 655.88 159.00 55.59 89.95 0.00 399.82 153.70 39.02 128.54
Weight of Slab Weight of columns Weight of Beams:	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	18.29         7.54         0.30         0.50         0.23         0.30         dia.         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23	8.00         8.00         3.45         0.55         0.50         0.38         0.00         38.63         5.94         7.54         22.55         34.29	0.13 0.13 0.15 3.18 3.18 3.18 3.18 3.18 0.45 0.45 0.45 0.45 0.45 0.45	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	914.50 195.10 655.88 159.00 55.59 89.95 0.00 399.82 153.70 39.02 128.54 354.90
Weight of Slab Weight of columns Weight of Beams: All beams in X-direction	$\begin{array}{c c} 2.00\\ \hline 2.00\\ \hline 2.00\\ \hline 50.0\\ \hline 8.00\\ \hline 8.00\\ \hline 16.0\\ \hline \\ 4.00\\ \hline 10.0\\ \hline 2.00\\ \hline 2.00\\ \hline 4.00\\ \hline 12.0\\ \hline \end{array}$	18.29         7.54         0.30         0.50         0.23         0.30         dia.         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23	8.00         8.00         3.45         0.55         0.50         0.38         0.00         38.63         5.94         7.54         22.55         34.29         5.94	0.13           0.13           0.15           3.18           3.18           3.18           3.18           0.45           0.45           0.45           0.45           0.45           0.45	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	914.50 195.10 655.88 159.00 55.59 89.95 0.00 399.82 153.70 39.02 128.54 354.90
Weight of Slab Weight of columns Weight of Beams:	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	18.29         7.54         0.30         0.50         0.23         0.30         dia.         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23	8.00         8.00         3.45         0.55         0.50         0.38         0.00         38.63         5.94         7.54         22.55         34.29	0.13 0.13 0.15 3.18 3.18 3.18 3.18 3.18 0.45 0.45 0.45 0.45 0.45 0.45	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	914.50 195.10 655.88 159.00 55.59 89.95 0.00 399.82 153.70 39.02 128.54 354.90
Weight of Slab Weight of columns Weight of Beams: All beams in X-direction	$\begin{array}{c c} 2.00\\ \hline 2.00\\ \hline 2.00\\ \hline 50.0\\ \hline 8.00\\ \hline 8.00\\ \hline 16.0\\ \hline \\ 4.00\\ \hline 10.0\\ \hline 2.00\\ \hline 2.00\\ \hline 4.00\\ \hline 12.0\\ \hline \end{array}$	18.29         7.54         0.30         0.50         0.23         0.30         dia.         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23         0.23	8.00         8.00         3.45         0.55         0.50         0.38         0.00         38.63         5.94         7.54         22.55         34.29         5.94	0.13           0.13           0.15           3.18           3.18           3.18           3.18           0.45           0.45           0.45           0.45           0.45           0.45	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	914.50 195.10 655.88 159.00 55.59 89.95 0.00 399.82 153.70 39.02 128.54 354.90 184.44 35.71
Weight of Slab Weight of columns Weight of Beams: All beams in X-direction	$\begin{array}{c c} 2.00\\ \hline 2.00\\ \hline 2.00\\ \hline 2.00\\ \hline 8.00\\ \hline 8.00\\ \hline 16.0\\ \hline 4.00\\ \hline 10.0\\ \hline 2.00\\ \hline 2.00\\ \hline 4.00\\ \hline 12.0\\ \hline 4.00\\ \hline \end{array}$	18.29         7.54         0.30         0.50         0.23         0.30         dia.         0.23	8.00         8.00         3.45         0.55         0.50         0.38         0.00         38.63         5.94         7.54         22.55         34.29         5.94         3.45	0.13 0.13 0.15 3.18 3.18 3.18 3.18 3.18 0.45 0.45 0.45 0.45 0.45 0.45 0.45	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	914.50 195.10 655.88 159.00 55.59 89.95 0.00 399.82 153.70 39.02 128.54 354.90 184.44 35.71 104.25
Weight of Slab Weight of columns Weight of Beams: All beams in X-direction All beams in Y-direction Weight of imposed Live Load (25%)	$\begin{array}{c c} 2.00\\ \hline 2.00\\ \hline 2.00\\ \hline 2.00\\ \hline 8.00\\ \hline 8.00\\ \hline 16.0\\ \hline 10.0\\ \hline 2.00\\ \hline 2.00\\ \hline 4.00\\ \hline 12.0\\ \hline 4.00\\ \hline 2.00\\ \hline 2.00\\ \hline \end{array}$	18.29         7.54         0.30         0.50         0.23         0.30         dia.         0.23	8.00         8.00         3.45         0.55         0.50         0.38         0.00         38.63         5.94         7.54         22.55         34.29         5.94         3.45	0.13 0.13 0.15 3.18 3.18 3.18 3.18 3.18 0.45 0.45 0.45 0.45 0.45 0.45 0.45	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	914.50 195.10 655.88 159.00 55.59 89.95 0.00 399.82 153.70 39.02 128.54 354.90 184.44 35.71 104.25 1350.47
Weight of Slab Weight of columns Weight of Beams: All beams in X-direction All beams in Y-direction Weight of imposed Live Load (25%) Weight of walls:	$\begin{array}{c c} 2.00\\ \hline 2.00\\ \hline 2.00\\ \hline 2.00\\ \hline 8.00\\ \hline 8.00\\ \hline 16.0\\ \hline 10.0\\ \hline 2.00\\ \hline 2.00\\ \hline 4.00\\ \hline 12.0\\ \hline 4.00\\ \hline 2.00\\ \hline 2.00\\ \hline \end{array}$	18.29         7.54         0.30         0.50         0.23         0.30         dia.         0.23	8.00         8.00         3.45         0.55         0.50         0.38         0.00         38.63         5.94         7.54         22.55         34.29         5.94         3.45	0.13 0.13 0.15 3.18 3.18 3.18 3.18 3.18 0.45 0.45 0.45 0.45 0.45 0.45 0.45	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	914.50 195.10 655.88 159.00 55.59 89.95 0.00 399.82 153.70 39.02 128.54 354.90 184.44 35.71 104.25
Weight of Slab Weight of columns Weight of Beams: All beams in X-direction All beams in Y-direction Weight of imposed Live Load (25%)	$\begin{array}{c c} 2.00\\ \hline 2.00\\ \hline 2.00\\ \hline 2.00\\ \hline 8.00\\ \hline 8.00\\ \hline 16.0\\ \hline 10.0\\ \hline 2.00\\ \hline 2.00\\ \hline 4.00\\ \hline 12.0\\ \hline 4.00\\ \hline 2.00\\ \hline 2.00\\ \hline \end{array}$	18.29         7.54         0.30         0.50         0.23         0.30         dia.         0.23	8.00         8.00         3.45         0.55         0.50         0.38         0.00         38.63         5.94         7.54         22.55         34.29         5.94         3.45	0.13 0.13 0.15 3.18 3.18 3.18 3.18 3.18 0.45 0.45 0.45 0.45 0.45 0.45 0.45	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	89.95           0.00           399.82           153.70           39.02           128.54           354.90           184.44           35.71           104.25           1350.47

Total seismic weight of the Building of all 3 flo	12047.6 8	12097.7 9	8944.86	3 KN		
			W1	W2	W3	33090.3
Total weight of 3rd floor in KN :					W3 =	8944.86
External walls: (½ x2.73 Ht.)in floor 3	2.00	0.23	34.29	1.37	20.00	430.61
· · · · ·	16.0	0.23	5.49	1.37	20.00	551.55
Internal walls: $(\frac{1}{2} \times 2.73 \text{ Ht.})$ in floor 3	2.00	0.23	17.55	1.37	20.00	220.39
All walls in <b>Y-direction</b> :			1.7.7.	1.25	<b>2</b> 0.00	0.00
	2.00	0.23	5.49	1.37	20.00	68.94
External walls: ( <sup>1</sup> / <sub>2</sub> x 2.73 Ht.)in floor 3	1.00	0.23	33.45	1.37	20.00	210.03
	1.00	0.23	38.63	1.37	20.00	242.56
	10.0	0.23	5.49	1.37	20.00	344.72
Internal walls: (1/2 x 2.73 Ht.)in floor 3	4.00	0.23	4.73	1.37	20.00	118.80
	2.00	0.23	38.63	1.37	20.00	485.12
All walls in <b>X=direction:</b>						
Weight of walls:						
	10.0	0.30 dia.	0.00	1.39	25.00	44.97
Weight of Columns: = $(\frac{1}{2} \times 3.18 \text{ Ht.})$ in floor 3	8.00	0.23	0.38	1.59 1.59	25.00 25.00	27.79
Weight of Columna: $-(1/\pi^2, 10, 11/2)$ : flags 2	8.00	0.50	0.50	1.59	25.00	79.50
	50.0	0.30	0.55	1.59	25.00	327.94
floor)						1350.47
Weight of imposed Live Load: (same as 1st	0.25	0.50	10.29	0.50	5401.88	
	2.00	0.23	18.29	0.43	25.00	104.25
All beams in Y-direction	4.00	0.23	3.45	0.45	25.00	35.71
	12.0	0.23	5.94	0.45	25.00	354.90 184.44
	2.00	0.30	22.55 34.29	0.38	25.00 25.00	128.54
	2.00	0.23	7.54	0.45	25.00	39.02
All beams in X-direction	10.0	0.23	5.94	0.45	25.00	153.70
	4.00	0.23	38.63	0.45	25.00	399.82
Weight of beams: (same as 1st floor)	1.0.0					
	2.00	7.54	3.45	0.15	25.00	195.10
Weight of Slab	2.00	18.29	8.00	0.13	25.00	914.50
	2.00	38.63	8.00	0.13	25.00	1931.50
Step 3: CALCULATION OF SEISMIC V	VEIGHT	Г <b>OF</b>		3rd F	loor	W3
Total weight of 2nd floor in KN :					W2	12097.7 9
External walls:	2.00	0.23	34.29	2.73	20.00	861.23
	16.0	0.23	5.49	2.73	20.00	1103.09
Internal walls:	2.00	0.23	17.55	2.73	20.00	440.79
All walls in <b>Y-direction</b> :						0.00
	2.00	0.23	5.49	2.73	20.00	137.89
External walls:	1.00	0.23	33.45	2.73	20.00	420.07
	1.00	0.23	38.63	2.73	20.00	485.12
						689.43
	4.00	0.23	4.73 5.49	2.73	20.00	237.60

<b>Zone Factor:</b> Z = 0.16 (Ref:Fig.1, Page 5 of IS 1893:2002 (Part 1)
(Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1)
Importance Factor: I = 1.00 (Ref: Table 6, Cl.6.4.2 of IS 1893:2002 (Part 1)
<b>Response Reduction Factor:</b> $\mathbf{R} = 5.00$ (Ref: Table 7, Cl.6.4.2 of IS 1893:2002(1)
Fundamental Time Period:
$Tx = 0.09h/\sqrt{dx} = 0.09x9.54/\sqrt{38.63} = 0.138$ Sec.
$Ty = 0.09h/\sqrt{dy} = 0.09x9.54/\sqrt{34.29} = 0.147$ Sec.
(Sa/g)x = (Sa/g)y = 2.5 (Ref:Cl.6.4.5, Page 16 of IS 1893:2002 (1)
Therefore $Ah = 0.16/2 \times 1.0/5.0 \times 2.5 = 0.04$
Step 5: CALCULATION OF BASE SHEAR (VB)
$(VB)x = W \times Ah(x) = 33090.33 \times 0.04 = 1323.61 \text{ KN}$
(VB)y = 1323.61  KN

10. MARK Re	sidency, A	S Ramarao	Rd., VIJA	YAWADA		
			r Calculatio			
• Seismic weight of a floor (W1) (Cl. 3						
It is the sum of dead load of the floor, ap permanent elements from the storeys abo imposed load on the floor.	propriate co	ontributions				
• Seismic weight of a Structure (W) (	CL3.27. IS	1893:2016				
It is the sum of seismic weights of all floo		1070.2010				
W1 = Dead load of floor 1 +						
Weight of Beams (1) +						
Weight of Slabs (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Columns (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Columns (2) +						
<sup>1</sup> / <sub>2</sub> Weight of Walls (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Walls (2) +						
Appropriate imposed (Live) Load.						
· Base Shear (VB) (Cl.4.7 IS 1893:2	016)					
It is the horizontal lateral force in the condesigned for.	nsidered dir	ection of ear	rthquake sha	king that th	e structure sh	all be
VB = Ah x W & Ah = Z/2 x I/R x Sa	ı/g					
Considerations:						
External wall thickness: 230 mm						
Internal wall thickness: 115 mm						
Specific weight of RCC: 25 KN / Cum						
Specific weight of infill wall: 20 KN / Cu	ım					
Type of soil: Medium						
Size of columns: 230x450 mm						
Size of Beams: 230 x 450 mm						
Response spectra: IS 1893(Part 1): 2002						
Assumption: Live Load 3.00 KN /						
Referring to Table 8, IS 1893:2002; Cl.7	.3.1. Page 2	4; the perce	ntage of imp	osed load		
Step 1: CACULATION OF SE			1.4	FLOOR	XX/1	1
Step 1: CACULATION OF SE Height of wall:	ISMIC WI	LIGHT OF	151	FLOOK	W	L
$= \frac{1}{2} \times \text{Ht.of wall of Fl.1} + \frac{1}{2} \times \text{Ht.of wall}$	1 of F1.2					
$= \frac{1}{2} \times (2.75 - 0.450) + \frac{1}{2} \times (3.00 - 0.450)$		A				
Height of Column:						
$=\frac{1}{2}$ x Ht. of Col. in Fl.1 + $\frac{1}{2}$ x Ht. of Col	l.in Fl.2					
= $(\frac{1}{2} \times 2.75) + (\frac{1}{2} \times 3.00) = 2.875 \text{ M}$						
Description of Items	Nos.	Width M	Length M	Height M	Sp.Wt. KN/Cum	Total Wt. KN
Weight of Slab	1.00	11.28	25.61	0.13	25.00	902.75
Weight of columns	26.00	0.23	0.45	2.75	25.00	185.01
Weight of Beams:						0.00
All beams in X-direction	7.00	0.23	11.28	0.45	25.00	204.31
	3.00	0.23	3.37	0.45	25.00	26.16
	3.00	0.23	25.61	0.45	25.00	198.80
All beams in Y-direction	2.00	0.23	11.74	0.45	25.00	60.75
	1.00	0.23	4.16	0.45	25.00	10.76
Weight of imposed Live Load (25%)	0.25	11.28	25.61	0.00	3.00	216.66

Weight of walls:						0.00
All walls in X=direction:		0.00				10
Internal walls:	3.00	0.23	3.84	2.43	20.00	128.51
	2.00	0.23	2.07	2.43	20.00	46.18
External walls:	0.00	0.00	0.00	0.00	0.00	0.00
All walls in Y-direction:	• • •					0.00
Internal walls:	2.00	0.23	2.07	2.43	20.00	46.18
	2.00	0.23	2.64	2.43	20.00	58.90
External walls:	1.00	0.23	2.64	2.43	20.00	29.45
Total weight of 1st floor in KN :					W1	2114.42
Step 2: CACULATION OF SEISM	C WEIG	HT OF 2nd	1 3rd 4th &	5th Floors	W2 W3	, W4 & W5
Weight of slab: (same as 1st floor)	1.00	11.28	25.61	0.13	25.00	902.75
Weight of columns: (same as 1st floor)	26.00	0.23	0.45	3.00	25.00	201.83
Weight of beams: (same as 1st floor)						201.05
	7.00	0.23	11.28	0.45	25.00	204.31
All beams in X-direction	3.00	0.23	3.37	0.45	25.00	26.16
	3.00	0.23	25.61	0.45	25.00	198.80
All beams in Y-direction	2.00	0.23	11.74	0.45	25.00	60.75
	1.00	0.23	4.16	0.45	25.00	10.76
Weight of imposed Live Load: (same	0.25	11.28	25.61	0.00	3.00	
as 1st floor)		_				216.66
Weight of walls:						
All walls in X=direction:						
	1.00	0.12	11.28	2.58	20.00	66.81
	2.00	0.23	11.28	2.58	20.00	267.22
	3.00	0.12	3.37	2.58	20.00	59.88
Internal walls:	2.00	0.12	2.69	2.58	20.00	31.86
	1.00	0.23	3.75	2.58	20.00	44.36
	3.00	0.12	4,13	2.58	20.00	76.72
	2.00	0.12	2.23	2.58	20.00	26.36
External walls:	2.00	0.23	11.28	2.58	20.00	267.22
All walls in Y-direction:						
	2.00	0.12	4.13	2.58	20.00	48.92
	1.00	0.12	3.27	2.58	20.00	19.37
	1.00	0.12	2.26	2.58	20.00	13.38
Testa multi sualla.	1.00	0.12	2.76	2.58	20.00	16.35
Internal walls:	1.00	0.12	11.74	2.58	20.00	69.53
	1.00	0.12	10.10	2.58	20.00	59.82
	1.00	0.12	3.02	2.58	20.00	17.86
	2.00	0.23	2.10	2.58	20.00	49.75
External walls:	2.00	0.23	25.61	2.58	20.00	606.70
Total weight of 2nd, 3rd, 4th & 5th floo	ors each in	KN:		W2=W3=	W4=W5=	3564.12
Step 3: CALCULATION OF SEIS	MIC WEI	GHT OF		6th Floo	r W6	
Weight of slab: (same as 1st floor)	1.00	11.28	25.61	0.13	25.00	902.75
Weight of beams: (same as 1st floor)						
All booms in V direction	7.00	0.23	11.28	0.45	25.00	204.31
All beams in X-direction	3.00	0.23	3.37	0.45	25.00	26.16
	3.00	0.23	25.61	0.45	25.00	198.80
All beams in Y-direction	2.00	0.23	11.74	0.45	25.00	60.75
	1.00	0.23	4.16	0.45	25.00	10.76
Weight of imposed Live Load: (same	0.25	11.28	25.61	0.00	3.00	216.66

Weight of Columns: = $(\frac{1}{2} \times 3.0)$	00 Ht.)in	26.00	0.23	0.45	1.50	25.00	100.91
floor 6 Weight of walls:							
All walls in <b>X=direction</b> :							
An wans in A uncerton.		1.00	0.12	11.28	1.29	20.00	33.40
		2.00	0.23	11.28	1.29	20.00	133.61
		3.00	0.12	3.37	1.29	20.00	29.94
Internal walls: (1/2 x 2.55 Ht.)in	floor 6	2.00	0.12	2.69	1.29	20.00	15.93
	1 11001 0	1.00	0.23	3.75	1.29	20.00	22.18
		3.00	0.12	4,13	1.29	20.00	76.72
		2.00	0.12	2.23	1.29	20.00	13.18
External walls: (1/2 x 2.55 Ht.)	in floor 6	2.00	0.23	25.61	1.29	20.00	303.35
All walls in <b>Y-direction</b> :	-						
		2.00	0.12	4.13	1.29	20.00	24.46
	1.00	0.12	3.27	1.29	20.00	9.68	
		1.00	0.12	2.26	1.29	20.00	6.69
		1.00	0.12	2.76	1.29	20.00	8.17
Internal walls: $(\frac{1}{2} \times 2.55 \text{ Ht.})$	in floor 6	1.00	0.12	11.74	1.29	20.00	34.77
		1.00	0.12	10.10	1.29	20.00	29.91
		1.00	0.12	3.02	1.29	20.00	8.93
		2.00	0.23	2.10	1.29	20.00	24.87
		2.00	0.23	25.61	1.29	20.00	303.35
External walls: (1/2 x2.55 Ht.)	in floor 6	2.00	0.23				
External walls: (½ x2.55 Ht.) Total weight of 6th floo		2.00	0.25			W6 =	2800.26
Total weight of 6th floo	or in KN :	W2	W3	W4	W5	W6 =	
· · · · · · · · · · · · · · · · · · ·							2800.26 19171.16 KN
Total weight of 6th floo Total seismic weight of the Building of all 6 floors	or in KN : W1 2114.42	W2 3564.12	W3 3564.12	W4 3564.12	W5	W6	19171.16
Total weight of 6th floo Total seismic weight of the Building of all 6 floors Step 4:	r in KN : W1 2114.42 C	W2 3564.12 CALCULA	W3 3564.12 TION OF	W4 3564.12 Ah	W5	W6	19171.16
Total weight of 6th floo Total seismic weight of the Building of all 6 floors Step 4: Design horizontal seismic coe	r in KN : W1 2114.42 Cefficient:	W2 3564.12 CALCULA Ah =	W3 3564.12 TION OF Z/2 x I/R	W4 3564.12 Ah x Sa/g	W5 3564.12	W6	19171.16
Total weight of 6th floo Total seismic weight of the Building of all 6 floors Step 4: Design horizontal seismic coe Zone Factor: Z	r in KN : W1 2114.42 Cefficient: Z = 0.16 (	W2 3564.12 CALCULA Ah = (Ref:Fig.1,	W3 3564.12 TION OF Z/2 x I/R	W4 3564.12 Ah	W5 3564.12	W6	19171.16
Total weight of 6th floo Total seismic weight of the Building of all 6 floors Step 4: Design horizontal seismic coo Zone Factor: Z (Ref:Table 2, Cl.6.4.2 of IS 18	r in KN : W1 2114.42 Cefficient: L = 0.16 ( 93:2002 (F	W2 3564.12 CALCULA Ah = (Ref:Fig.1, Part 1)	W3 3564.12 TION OF Z/2 x I/R Page 5 of IS	W4 3564.12 Ah x Sa/g 1893:2002 (	W5 3564.12 (Part 1)	W6 2800.26	19171.16
Total weight of 6th floo Total seismic weight of the Building of all 6 floors Step 4: Design horizontal seismic coo Zone Factor: Z (Ref:Table 2, Cl.6.4.2 of IS 18 Importance Factor:	W1           2114.42           C           efficient:           Z = 0.16 (           93:2002 (F           I = 1.00	W2 3564.12 CALCULA Ah = (Ref:Fig.1, <sup>0</sup> art 1) (Ref: Tab	W3 3564.12 TION OF Z/2 x I/R Page 5 of IS ble 6, Cl.6.4.	W4 3564.12 Ah x Sa/g 1893:2002 ( 2 of IS 185	W5 3564.12 (Part 1) 93:2002 (Par	W6 2800.26	19171.16
Total weight of 6th floo Total seismic weight of the Building of all 6 floors Step 4: Design horizontal seismic coo Zone Factor: Z (Ref:Table 2, Cl.6.4.2 of IS 18 Importance Factor: Response Reduction Factor:	W1           2114.42           C           efficient:           Z = 0.16 (           93:2002 (F           I = 1.00	W2 3564.12 CALCULA Ah = (Ref:Fig.1, <sup>0</sup> art 1) (Ref: Tab	W3 3564.12 TION OF Z/2 x I/R Page 5 of IS ble 6, Cl.6.4.	W4 3564.12 Ah x Sa/g 1893:2002 (	W5 3564.12 (Part 1) 93:2002 (Par	W6 2800.26	19171.16
Total weight of 6th floo Total seismic weight of the Building of all 6 floors Step 4: Design horizontal seismic coo Zone Factor: Z (Ref:Table 2, Cl.6.4.2 of IS 18 Importance Factor: Response Reduction Factor: Fundamental Time Period:	r in KN : W1 2114.42 Cefficient: Z = 0.16 ( 93:2002 (F I = 1.00 R = 5	W2 3564.12 CALCULA Ah = (Ref:Fig.1, Part 1) (Ref: Tab 5.00 (Ref:	W3 3564.12 TION OF Z/2 x I/R Page 5 of IS ble 6, Cl.6.4.	W4 3564.12 Ah x Sa/g 1893:2002 ( 2 of IS 185	W5 3564.12 (Part 1) 93:2002 (Par	W6 2800.26	19171.16
Total weight of 6th floo Total seismic weight of the Building of all 6 floors Step 4: Design horizontal seismic coo Zone Factor: Z (Ref:Table 2, Cl.6.4.2 of IS 18 Importance Factor: Response Reduction Factor:	W1         2114.42         C         efficient: $L = 0.16$ (         93:2002 (F         I = 1.00         R = 5 $\sqrt{8.86} = 0.$	W2 3564.12 CALCULA' Ah = (Ref:Fig.1, art 1) (Ref: Tak .00 (Ref: 537 Sec.	W3 3564.12 TION OF Z/2 x I/R Page 5 of IS ble 6, Cl.6.4.	W4 3564.12 Ah x Sa/g 1893:2002 ( 2 of IS 185	W5 3564.12 (Part 1) 93:2002 (Par	W6 2800.26	19171.16
Total weight of 6th flooTotal seismic weight of the Building of all 6 floorsStep 4:Design horizontal seismic coeZone Factor:Zone Factor:Table 2, Cl.6.4.2 of IS 18Importance Factor:Response Reduction Factor:Tx = 0.09h/\dx = 0.09x17.75/Ty = 0.09h/\dy = 0.09x17.75/	W1         2114.42         C         efficient: $Z = 0.16$ (         93:2002 (F         I = 1.00         R = 5 $\sqrt{8.86} = 0.$ $\sqrt{25.61} = 0$	W2           3564.12           CALCULA'           Ah =           (Ref:Fig.1,           (Ref:Tab           0 (Ref: Tab           5.00 (Ref:           537 Sec.           0.316 Sec.	W3 3564.12 TION OF Z/2 x I/R Page 5 of IS Dele 6, Cl.6.4. Table 7, Cl.	W4 3564.12 Ah x Sa/g 1893:2002 ( 2 of IS 189 6.4.2 of IS	W5 3564.12 (Part 1) 93:2002 (Par	W6 2800.26	19171.16
Total weight of 6th flooTotal seismic weight of the Building of all 6 floorsStep 4:Design horizontal seismic coeZone Factor:Zone Factor:Table 2, Cl.6.4.2 of IS 18Importance Factor:Response Reduction Factor:Tx = 0.09h/\dx = 0.09x17.75/Ty = 0.09h/\dy = 0.09x17.75/	W1         2114.42         C         efficient: $Z = 0.16$ (         93:2002 (F         I = 1.00         R = 5 $\sqrt{8.86} = 0.$ $\sqrt{25.61} = 0$	W2           3564.12           CALCULA'           Ah =           (Ref:Fig.1,           art 1)           (Ref:Tab           0 (Ref: Tab           537 Sec.           0.316 Sec.           age 16 of 15	W3 3564.12 TION OF Z/2 x I/R : Page 5 of IS Dile 6, Cl.6.4. Table 7, Cl.	W4 3564.12 Ah x Sa/g 1893:2002 ( 2 of IS 189 6.4.2 of IS	W5 3564.12 (Part 1) 93:2002 (Part 1893:2002(	W6 2800.26	19171.16
Total weight of 6th flooTotal seismic weight of the Building of all 6 floorsStep 4:Design horizontal seismic coorZone Factor:Zone Factor:Table 2, Cl.6.4.2 of IS 18Importance Factor:Response Reduction Factor:Tx = 0.09h/\dx = 0.09x17.75/Ty = 0.09h/\dy = 0.09x17.75/	W1         2114.42         C         efficient: $L = 0.16$ (c)         93:2002 (F)         I = 1.00         R = 5 $\sqrt{8.86} = 0$ . $\sqrt{25.61} = 0$ Cl.6.4.5, P	W2           3564.12           CALCULA'           Ah =           (Ref:Fig.1,           art 1)           (Ref:Tab           0 (Ref: Tab           537 Sec.           0.316 Sec.           age 16 of 15	W3 3564.12 TION OF Z/2 x I/R : Page 5 of IS Dile 6, Cl.6.4. Table 7, Cl.	W4 3564.12 Ah x Sa/g 1893:2002 ( 2 of IS 189 6.4.2 of IS	W5 3564.12 (Part 1) 93:2002 (Part 1893:2002(	W6 2800.26	19171.16
Total weight of 6th flooTotal seismic weight of the Building of all 6 floorsStep 4:Design horizontal seismic coorZone Factor:Zone Factor:Table 2, Cl.6.4.2 of IS 18Importance Factor:Response Reduction Factor:Tx = 0.09h/\dx = 0.09x17.75/Ty = 0.09h/\dy = 0.09x17.75/	W1         2114.42         C         efficient: $L = 0.16$ (gramma structure)         93:2002 (F         I = 1.000         R = 5 $\sqrt{8.86} = 0.$ $\sqrt{25.61} = 0$ Cl.6.4.5, P         Therefore	W2           3564.12           CALCULA           Ah =           (Ref:Fig.1,           art 1)           (Ref:Tab           .00 (Ref:           537 Sec.           .316 Sec.           age 16 of It           ore         Ah =	W3         3564.12         TION OF         ₹ Z/2 x I/R :         Page 5 of IS         ble 6, Cl.6.4.         Table 7, Cl.         S 1893:2002         0.16/2 x 1.0	W4 3564.12 Ah x Sa/g 1893:2002 ( 2 of IS 189 6.4.2 of IS	W5 3564.12 (Part 1) 93:2002 (Part 1893:2002(	W6 2800.26	19171.16
Total weight of 6th flooTotal seismic weight of the Building of all 6 floorsStep 4:Design horizontal seismic coeZone Factor:Zone Factor:Zone Factor:Zone Factor:Zone Factor:Response Reduction Factor:Fundamental Time Period:Tx = $0.09h/\sqrt{dx} = 0.09x17.75/$ Ty = $0.09h/\sqrt{dy} = 0.09x17.75/$ (Sa/g)x = (Sa/g)y = 2.5(Ref:	W1         2114.42         C         efficient: $L = 0.16$ (gramma stress)         93:2002 (F         I = 1.00         R = 5 $\sqrt{8.86} = 0$ . $\sqrt{25.61} = 0$ Cl.6.4.5, P         Therefore         DN OF BA	W2           3564.12           CALCULA           Ah =           (Ref:Fig.1,           Part 1)           (Ref: Tab           .00 (Ref:           537 Sec.           .316 Sec.           age 16 of It           ore         Ah =           SE SHEA	W3         3564.12         TION OF         ₹ Z/2 x I/R :         Page 5 of IS         ble 6, Cl.6.4.         Table 7, Cl.         S 1893:2002         0.16/2 x 1.0         R (VB)	W4 3564.12 Ah x Sa/g 1893:2002 ( 2 of IS 189 6.4.2 of IS	W5 3564.12 (Part 1) 93:2002 (Part 1893:2002(	W6 2800.26	19171.16

11. AB Plaza, Krishna La	ıka. VIJA	YAWAI	DA			
Seismic weight &						
• Seismic weight of a floor (W1) (Cl. 3.26, IS 1893						
It is the sum of dead load of the floor, appropriate cor permanent elements from the storeys above and below imposed load on the floor.	ntributions					
• Seismic weight of a Structure (W) (Cl.3.27, IS 1	893:2016	)				
It is the sum of seismic weights of all floors.	0,012010	/				
W1 = Dead load of floor 1 +						
Weight of Beams (1) +						
Weight of Slabs (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Columns (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Columns (2) +						
<sup>1</sup> / <sub>2</sub> Weight of Walls (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Walls (2) +						
Appropriate imposed (Live) Load.						
· Base Shear (VB) (Cl.4.7 IS 1893:2016)						
It is the horizontal lateral force in the considered direct designed for.	ction of ea	rthquake	shaking t	hat the st	ructure sha	ll be
VB = Ah x W & Ah = Z/2 x I/R x Sa/g						
Considerations:						
External wall thickness: 200 mm						
Internal wall thickness: 200 mm						
Specific weight of RCC: 25 KN / Cum						
Specific weight of infill wall: 20 KN / Cum						
Type of soil: Medium						
Size of columns: 650x350; 500x350; 500x450; 250x	250; 350x	450; 750;	x900 mm			
Size of Beams: 250x450; 250x300; 650x600 mm						
Response spectra: IS 1893(Part 1): 2002						
Assumption: Live Load 3.00 KN / Sqm						
Referring to Table 8, IS 1893:2002; Cl.7.3.1. Page 24	; the perce	entage of	imposed l	oad		
Step 1: CACULATION OF SEISMIC W1	C WEIGH	IT OF		]	lst FLOO	R
Height of wall:						
= $\frac{1}{2}$ x Ht.of wall of Fl.1 + $\frac{1}{2}$ x Ht.of wall of Fl.2						
= $\frac{1}{2} x (2.50-0.30) + \frac{1}{2} x (3.05-0.45) = 2.40 \text{ M}$						
Height of Column:						
$=\frac{1}{2}$ x Ht. of Col. in Fl.1 + $\frac{1}{2}$ x Ht. of Col. in Fl.2						
$= (\frac{1}{2} \times 2.50) + (\frac{1}{2} \times 3.05) = 2.775 \text{ M}$			1		0.11	
Description of Items	Nos.	Widt h M	Lengt h M	Heigh t M	Sp.Wt. KN/Cu m	Total Wt. KN
Weight of Slab	1.00	19.23	24.03	0.13	25.00	1443.83
	5.00	0.65	0.35	2.78	25.00	78.91
	23.00	0.50	0.35	2.78	25.00	279.23
	1.00	0.50	0.45	2.78	25.00	15.61
Weight of columns	3.00	0.25	0.25	2.78	25.00	13.01
	2.00	0.35	0.45	2.78	25.00	21.85
	1.00	0.75	0.90	2.78	25.00	46.83
Weight of Beams:						0.00

	-					
	4.00	0.25	19.23	0.45	25.00	216.34
	6.00	0.25	8.64	0.45	25.00	145.80
All beams in X-direction	1.00	0.25	2.92	0.45	25.00	8.21
	2.00	0.25	4.02	0.45	25.00	22.61
	1.00	0.25	1.96	0.30	25.00	3.68
	2.00	0.25	24.03	0.30	25.00	90.11
	2.00	0.25	19.81	0.30	25.00	74.29
	1.00	0.25	13.37	0.30	25.00	25.07
All beams in Y-direction	1.00	0.25	5.48	0.30	25.00	10.28
	1.00	0.25	2.75	0.30	25.00	5.16
	1.00	0.25	4.27	0.38	25.00	10.01
	4.00	0.25	4.27	0.45	25.00	48.04
	3.00	0.65	7.77	0.60	25.00	227.27
Weight of imposed Live Load (25%)	0.25	19.23	24.03	0.13	25.00	2887.66
Weight of walls:						
All walls in X=direction:						
Internal walls:	1.00	0.20	3.71	2.40	20.00	35.62
	2.00	0.23	2.13	2.40	20.00	47.03
External walls:	1.00	0.23	4.44	2.40	20.00	49.02
All walls in Y-direction:						
	2.00	0.23	5.00	2.40	20.00	110.40
Internal walls:	2.00	0.23	3.00	2.40	20.00	66.24
	2.00	0.23	2.13	2.40	20.00	47.03
External walls:	1.00	0.23	3.00	2.40	20.00	33.12
Total weight of 1st floor in KN :					W1 =	6062.24
			FLOOT			4 0 3315
Step 2: CACULATION OF SEISMIC WEIGH					2, W3, W	
Step 2:       CACULATION OF SEISMIC WEIGH         Weight of slab:       (same as 1st floor)	4.00	11.73	8.64	0.13	25.00	1266.84
*	4.00	11.73 22.02	8.64 1.96	0.13 0.13	25.00 25.00	1266.84 140.27
*	4.00 1.00 3.00	11.73 22.02 0.65	8.64 1.96 0.35	0.13 0.13 3.05	25.00 25.00 25.00	1266.84 140.27 52.04
Weight of slab: (same as 1st floor)	4.00 1.00 3.00 24.00	11.73 22.02 0.65 0.50	8.64 1.96 0.35 0.35	0.13 0.13 3.05 3.05	25.00 25.00 25.00 25.00	1266.84 140.27 52.04 320.25
*	4.00 1.00 3.00 24.00 1.00	11.73 22.02 0.65 0.50 0.50	8.64 1.96 0.35 0.35 0.45	0.13 0.13 3.05 3.05 3.05	25.00 25.00 25.00 25.00 25.00	1266.84 140.27 52.04 320.25 17.16
Weight of slab: (same as 1st floor)	4.00 1.00 3.00 24.00 1.00 3.00	11.73 22.02 0.65 0.50 0.50 0.25	8.64 1.96 0.35 0.35 0.45 0.25	0.13 0.13 3.05 3.05 3.05 3.05	25.00 25.00 25.00 25.00 25.00 25.00	1266.84 140.27 52.04 320.25 17.16 14.30
Weight of slab: (same as 1st floor) Weight of columns	4.00 1.00 3.00 24.00 1.00	11.73 22.02 0.65 0.50 0.50	8.64 1.96 0.35 0.35 0.45	0.13 0.13 3.05 3.05 3.05	25.00 25.00 25.00 25.00 25.00	1266.84 140.27 52.04 320.25 17.16
Weight of slab: (same as 1st floor)	4.00 1.00 3.00 24.00 1.00 3.00 2.00	11.73 22.02 0.65 0.50 0.50 0.25 0.35	8.64 1.96 0.35 0.35 0.45 0.45 0.45	0.13 0.13 3.05 3.05 3.05 3.05 3.05 3.05	25.00 25.00 25.00 25.00 25.00 25.00 25.00	1266.84 140.27 52.04 320.25 17.16 14.30 24.02
Weight of slab: (same as 1st floor) Weight of columns	4.00 1.00 3.00 24.00 1.00 3.00 2.00 4.00	11.73 22.02 0.65 0.50 0.25 0.35 0.25	8.64 1.96 0.35 0.35 0.45 0.25 0.45 19.23	0.13 0.13 3.05 3.05 3.05 3.05 3.05 3.05 0.45	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	1266.84 140.27 52.04 320.25 17.16 14.30 24.02 216.34
Weight of slab: (same as 1st floor) Weight of columns Weight of beams: (same as 1st floor)	4.00           1.00           3.00           24.00           1.00           3.00           24.00           1.00           3.00           2.00           4.00           6.00	11.73 22.02 0.65 0.50 0.25 0.25 0.25 0.25	8.64 1.96 0.35 0.45 0.45 0.45 0.45 19.23 8.64	0.13 0.13 3.05 3.05 3.05 3.05 3.05 0.45 0.45	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	1266.84 140.27 52.04 320.25 17.16 14.30 24.02 216.34 145.80
Weight of slab: (same as 1st floor) Weight of columns	4.00           1.00           3.00           24.00           1.00           3.00           24.00           1.00           3.00           2.00           4.00           6.00           1.00	11.73 22.02 0.65 0.50 0.25 0.25 0.25 0.25	8.64 1.96 0.35 0.45 0.45 0.45 0.45 19.23 8.64 2.92	0.13 0.13 3.05 3.05 3.05 3.05 3.05 0.45 0.45	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	1266.84 140.27 52.04 320.25 17.16 14.30 24.02 216.34 145.80 8.21
Weight of slab: (same as 1st floor) Weight of columns Weight of beams: (same as 1st floor)	$\begin{array}{c} 4.00\\ \hline 1.00\\ \hline 3.00\\ \hline 24.00\\ \hline 1.00\\ \hline 3.00\\ \hline 2.00\\ \hline \\ 4.00\\ \hline 6.00\\ \hline 1.00\\ \hline 2.00\\ \hline \end{array}$	11.73 22.02 0.65 0.50 0.25 0.25 0.25 0.25 0.25	8.64         1.96         0.35         0.35         0.45         0.25         0.45         19.23         8.64         2.92         4.02	0.13 0.13 3.05 3.05 3.05 3.05 3.05 0.45 0.45 0.45 0.45	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	1266.84 140.27 52.04 320.25 17.16 14.30 24.02 216.34 145.80 8.21 22.61
Weight of slab: (same as 1st floor) Weight of columns Weight of beams: (same as 1st floor)	$\begin{array}{c} 4.00\\ 1.00\\ 3.00\\ 24.00\\ 1.00\\ 3.00\\ 2.00\\ \hline \\ 4.00\\ 6.00\\ 1.00\\ 2.00\\ 1.00\\ \hline \end{array}$	11.73 22.02 0.65 0.50 0.25 0.25 0.25 0.25 0.25 0.25	8.64           1.96           0.35           0.35           0.45           0.25           0.45           19.23           8.64           2.92           4.02           1.96	$\begin{array}{c} 0.13\\ 0.13\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ \hline 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.30\\ \end{array}$	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	1266.84 140.27 52.04 320.25 17.16 14.30 24.02 216.34 145.80 8.21 22.61 3.68
Weight of slab: (same as 1st floor) Weight of columns Weight of beams: (same as 1st floor)	$\begin{array}{c} 4.00\\ 1.00\\ 3.00\\ 24.00\\ 1.00\\ 3.00\\ 2.00\\ \hline \\ 4.00\\ 6.00\\ 1.00\\ 2.00\\ 1.00\\ 2.00\\ \hline \end{array}$	11.73 22.02 0.65 0.50 0.25 0.25 0.25 0.25 0.25 0.25 0.2	8.64           1.96           0.35           0.35           0.45           0.25           0.45           19.23           8.64           2.92           4.02           1.96           24.03	$\begin{array}{c} 0.13\\ 0.13\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ \hline \\ 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.30\\ \hline \\ 0.30\\ \hline \end{array}$	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	1266.84 140.27 52.04 320.25 17.16 14.30 24.02 216.34 145.80 8.21 22.61 3.68 90.11
Weight of slab: (same as 1st floor) Weight of columns Weight of beams: (same as 1st floor)	$\begin{array}{c} 4.00\\ \hline 1.00\\ \hline 3.00\\ \hline 24.00\\ \hline 1.00\\ \hline 3.00\\ \hline 2.00\\ \hline \\ 4.00\\ \hline 6.00\\ \hline 1.00\\ \hline 2.00\\ \hline 1.00\\ \hline 2.00\\ \hline 2.00\\ \hline \end{array}$	11.73 22.02 0.65 0.50 0.25 0.25 0.25 0.25 0.25 0.25 0.2	8.64           1.96           0.35           0.45           0.25           0.45           19.23           8.64           2.92           4.02           1.96           24.03           19.81	$\begin{array}{c} 0.13\\ 0.13\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.30\\ 0.30\\ 0.30\\ \end{array}$	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	1266.84 140.27 52.04 320.25 17.16 14.30 24.02 216.34 145.80 8.21 22.61 3.68 90.11 74.29
Weight of slab: (same as 1st floor) Weight of columns Weight of beams: (same as 1st floor)	$\begin{array}{c} 4.00\\ \hline 1.00\\ \hline 3.00\\ \hline 24.00\\ \hline 1.00\\ \hline 3.00\\ \hline 2.00\\ \hline 4.00\\ \hline 6.00\\ \hline 1.00\\ \hline 2.00\\ \hline 1.00\\ \hline 2.00\\ \hline 1.00\\ \hline 2.00\\ \hline 1.00\\ \hline \end{array}$	11.73 22.02 0.65 0.50 0.25 0.25 0.25 0.25 0.25 0.25 0.2	8.64           1.96           0.35           0.45           0.25           0.45           19.23           8.64           2.92           4.02           1.96           24.03           19.81           13.37	$\begin{array}{c} 0.13\\ 0.13\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ \end{array}$	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	1266.84 140.27 52.04 320.25 17.16 14.30 24.02 216.34 145.80 8.21 22.61 3.68 90.11 74.29 25.07
Weight of slab: (same as 1st floor) Weight of columns Weight of beams: (same as 1st floor)	$\begin{array}{c} 4.00\\ 1.00\\ 3.00\\ 24.00\\ 1.00\\ 3.00\\ 2.00\\ \hline \\ 4.00\\ 6.00\\ 1.00\\ 2.00\\ 1.00\\ 2.00\\ 1.00\\ 1.00\\ 1.00\\ \hline \end{array}$	$\begin{array}{c} 11.73\\ 22.02\\ 0.65\\ 0.50\\ 0.50\\ 0.25\\ 0.2$	8.64           1.96           0.35           0.35           0.45           0.25           0.45           19.23           8.64           2.92           4.02           1.96           24.03           19.81           13.37           5.48	$\begin{array}{c} 0.13\\ 0.13\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ \end{array}$	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	1266.84 140.27 52.04 320.25 17.16 14.30 24.02 216.34 145.80 8.21 22.61 3.68 90.11 74.29 25.07 10.28
Weight of slab: (same as 1st floor) Weight of columns Weight of beams: (same as 1st floor) All beams in X-direction	$\begin{array}{c} 4.00\\ 1.00\\ 3.00\\ 24.00\\ 1.00\\ 3.00\\ 2.00\\ \hline \\ 4.00\\ 6.00\\ 1.00\\ 2.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ \hline \end{array}$	11.73 22.02 0.65 0.50 0.25 0.25 0.25 0.25 0.25 0.25 0.2	8.64           1.96           0.35           0.35           0.45           0.25           0.45           19.23           8.64           2.92           4.02           1.96           24.03           19.81           13.37           5.48           2.75	$\begin{array}{c} 0.13\\ 0.13\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.30\\$	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	$\begin{array}{r} 1266.84\\ 140.27\\ 52.04\\ 320.25\\ 17.16\\ 14.30\\ 24.02\\ \hline \\ 216.34\\ 145.80\\ 8.21\\ 22.61\\ 3.68\\ 90.11\\ 74.29\\ 25.07\\ 10.28\\ 5.16\\ \end{array}$
Weight of slab: (same as 1st floor) Weight of columns Weight of beams: (same as 1st floor) All beams in X-direction	$\begin{array}{c} 4.00\\ 1.00\\ 3.00\\ 24.00\\ 1.00\\ 3.00\\ 2.00\\ \hline \\ 4.00\\ 6.00\\ 1.00\\ 2.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ \hline \end{array}$	11.73 22.02 0.65 0.50 0.25 0.25 0.25 0.25 0.25 0.25 0.2	8.64           1.96           0.35           0.45           0.25           0.45           19.23           8.64           2.92           4.02           1.96           24.03           19.81           13.37           5.48           2.75           4.27	$\begin{array}{c} 0.13\\ 0.13\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.38\\ \end{array}$	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	$\begin{array}{r} 1266.84\\ 140.27\\ 52.04\\ 320.25\\ 17.16\\ 14.30\\ 24.02\\ \hline \\ 216.34\\ 145.80\\ 8.21\\ 22.61\\ 3.68\\ 90.11\\ 74.29\\ 25.07\\ 10.28\\ 5.16\\ 10.01\\ \hline \end{array}$
Weight of slab: (same as 1st floor) Weight of columns Weight of beams: (same as 1st floor) All beams in X-direction	$\begin{array}{c} 4.00\\ 1.00\\ 3.00\\ 24.00\\ 1.00\\ 3.00\\ 2.00\\ \hline \\ 4.00\\ 6.00\\ 1.00\\ 2.00\\ 1.00\\ 2.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ \hline \end{array}$	11.73 22.02 0.65 0.50 0.25 0.25 0.25 0.25 0.25 0.25 0.2	8.64           1.96           0.35           0.45           0.25           0.45           19.23           8.64           2.92           4.02           1.96           24.03           19.81           13.37           5.48           2.75           4.27	$\begin{array}{c} 0.13\\ 0.13\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.38\\ 0.45\\ \end{array}$	25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00 25.00	$\begin{array}{c} 1266.84\\ 140.27\\ 52.04\\ 320.25\\ 17.16\\ 14.30\\ 24.02\\ \hline \\ 216.34\\ 145.80\\ 8.21\\ 22.61\\ 3.68\\ 90.11\\ 74.29\\ 25.07\\ 10.28\\ 5.16\\ 10.01\\ 48.04\\ \end{array}$
Weight of slab: (same as 1st floor) Weight of columns Weight of beams: (same as 1st floor) All beams in X-direction	$\begin{array}{c} 4.00\\ 1.00\\ 3.00\\ 24.00\\ 1.00\\ 3.00\\ 2.00\\ \hline \\ 4.00\\ 6.00\\ 1.00\\ 2.00\\ 1.00\\ 2.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 3.00\\ \hline \end{array}$	$\begin{array}{c} 11.73\\ 22.02\\ 0.65\\ 0.50\\ 0.50\\ 0.25\\ 0.2$	8.64           1.96           0.35           0.45           0.25           0.45           19.23           8.64           2.92           4.02           1.96           24.03           19.81           13.37           5.48           2.75           4.27           4.27	$\begin{array}{c} 0.13\\ 0.13\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.30\\$	25.00 25.00	$\begin{array}{r} 1266.84\\ 140.27\\ 52.04\\ 320.25\\ 17.16\\ 14.30\\ 24.02\\ \hline \\ 216.34\\ 145.80\\ 8.21\\ 22.61\\ 3.68\\ 90.11\\ 74.29\\ 25.07\\ 10.28\\ 5.16\\ 10.01\\ \hline \end{array}$
Weight of slab: (same as 1st floor)         Weight of columns         Weight of beams: (same as 1st floor)         All beams in X-direction         All beams in Y-direction         Weight of imposed Live Load: 25% (same as 1st	$\begin{array}{c} 4.00\\ 1.00\\ 3.00\\ 24.00\\ 1.00\\ 3.00\\ 2.00\\ \hline \\ 4.00\\ 6.00\\ 1.00\\ 2.00\\ 1.00\\ 2.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ \hline \end{array}$	11.73 22.02 0.65 0.50 0.25 0.25 0.25 0.25 0.25 0.25 0.2	8.64           1.96           0.35           0.45           0.25           0.45           19.23           8.64           2.92           4.02           1.96           24.03           19.81           13.37           5.48           2.75           4.27	$\begin{array}{c} 0.13\\ 0.13\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.30\\ 0.38\\ 0.45\\ \end{array}$	25.00 25.00	1266.84 140.27 52.04 320.25 17.16 14.30 24.02 216.34 145.80 8.21 22.61 3.68 90.11 74.29 25.07 10.28 5.16 10.01 48.04 227.27
Weight of slab: (same as 1st floor)         Weight of columns         Weight of beams: (same as 1st floor)         All beams in X-direction         All beams in Y-direction         Weight of imposed Live Load: 25% (same as 1st floor)	$\begin{array}{c} 4.00\\ 1.00\\ 3.00\\ 24.00\\ 1.00\\ 3.00\\ 2.00\\ \hline \\ 4.00\\ 6.00\\ 1.00\\ 2.00\\ 1.00\\ 2.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 3.00\\ \hline \end{array}$	$\begin{array}{c} 11.73\\ 22.02\\ 0.65\\ 0.50\\ 0.50\\ 0.25\\ 0.2$	8.64           1.96           0.35           0.45           0.25           0.45           19.23           8.64           2.92           4.02           1.96           24.03           19.81           13.37           5.48           2.75           4.27           4.27	$\begin{array}{c} 0.13\\ 0.13\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.30\\$	25.00 25.00	$\begin{array}{r} 1266.84\\ 140.27\\ 52.04\\ 320.25\\ 17.16\\ 14.30\\ 24.02\\ \hline \\ 216.34\\ 145.80\\ 8.21\\ 22.61\\ 3.68\\ 90.11\\ 74.29\\ 25.07\\ 10.28\\ 5.16\\ 10.01\\ 48.04\\ 227.27\\ 351.78\\ \hline \end{array}$
Weight of slab: (same as 1st floor)         Weight of columns         Weight of beams: (same as 1st floor)         All beams in X-direction         All beams in Y-direction         Weight of imposed Live Load: 25% (same as 1st	$\begin{array}{c} 4.00\\ 1.00\\ 3.00\\ 24.00\\ 1.00\\ 3.00\\ 2.00\\ \hline \\ 4.00\\ 6.00\\ 1.00\\ 2.00\\ 1.00\\ 2.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 1.00\\ 3.00\\ \hline \end{array}$	$\begin{array}{c} 11.73\\ 22.02\\ 0.65\\ 0.50\\ 0.50\\ 0.25\\ 0.2$	8.64           1.96           0.35           0.45           0.25           0.45           19.23           8.64           2.92           4.02           1.96           24.03           19.81           13.37           5.48           2.75           4.27           4.27	$\begin{array}{c} 0.13\\ 0.13\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 3.05\\ 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.45\\ 0.30\\$	25.00 25.00	1266.84 140.27 52.04 320.25 17.16 14.30 24.02 216.34 145.80 8.21 22.61 3.68 90.11 74.29 25.07 10.28 5.16 10.01 48.04 227.27

	0.00	0.15	0.64	2 (0	20.00	50044
	8.00	0.15	8.64	2.60	20.00	539.14
Internal walls:	6.00	0.15	5.00	2.60	20.00	352.78
	2.00	0.15	1.33	2.60	20.00	20.75
External walls:	4.00	0.20	8.64	2.60	20.00	359.42
All walls in <b>Y-direction:</b>	2.00	0.20	19.23	2.60	20.00	399.98
All walls in <b>1-un ection</b> .	8.00	0.15	4.27	2.60	20.00	353.78 266.45
	4.00	0.13	3.66	2.60	20.00	152.26
Internal walls:	8.00	0.20	3.96	2.60	20.00	247.10
	2.00	0.15	24.03	2.60	20.00	354.78
External walls:	2.00	0.20	24.03	2.60	20.00	499.82
Total weight of 2nd, 3rd, 4th & 5th floors each in		0.20			4 = W5 =	<b>6619.77</b>
	1111					001)111
Step 3: CALCULATION OF SEISMIC WEIG	GHT OF	6	th Floor	We	ó	
*	4.00	11.73	8.64	0.13	25.00	1266.84
Weight of slab: (same as 1st floor)	1.00	22.02	1.96	0.13	25.00	140.27
	3.00	0.65	0.35	1.53	25.00	26.02
	24.00	0.50	0.35	1.53	25.00	160.13
Weight of columns	1.00	0.50	0.45	1.53	25.00	8.58
	3.00	0.25	0.25	1.53	25.00	7.15
	2.00	0.35	0.45	1.53	25.00	12.01
Weight of beams: (same as 1st floor)						
	4.00	0.25	19.23	0.45	25.00	216.34
	6.00	0.25	8.64	0.45	25.00	145.80
All beams in X-direction	1.00	0.25	2.92	0.45	25.00	8.21
	2.00	0.25	4.02	0.45	25.00	22.61
	1.00	0.25	1.96	0.30	25.00	3.68
	2.00	0.25	24.03	0.30	25.00	90.11
	2.00	0.25	19.81	0.30	25.00	74.29
	1.00	0.25	13.37	0.30	25.00	25.07
All beams in Y-direction	1.00	0.25	5.48	0.30	25.00	10.28
	1.00	0.25	2.75	0.30	25.00	5.16
	1.00	0.25	4.27	0.38	25.00	10.01
	4.00	0.25	4.27	0.45	25.00	48.04
W/ 1/ C' 11' I 1 250/ / 1/	3.00	0.65	7.77	0.60	25.00	227.27
Weight of imposed Live Load: 25% (same as 1st floor)	0.25	0.00	0.00	0.00	1407.1	351.78
All walls in <b>X=direction:</b>					1	
All wans in <b>A-un ection</b> .	8.00	0.15	8.64	1.30	20.00	260.57
						269.57
Internal walls:	6.00	0.15	5.00	1.30	20.00	352.78
	2.00	0.15	1.33	1.30	20.00	10.37
	4.00	0.20	8.64	1.30	20.00	179.71
External walls:	2.00	0.20	19.23	1.30	20.00	199.99
All walls in <b>Y-direction</b> :						353.78
	8.00	0.15	4.27	1.30	20.00	
						133.22
Internal walls:	4.00	0.20	3.66	1.30	20.00	76.13
	8.00	0.15	3.96	1.30	20.00	123.55
	2.00	0.20	24.03	1.30	20.00	354.78
External walls:	2.00	0.20	24.03	1.30	20.00	249.91

Total saismis weight of the Duilding of	W1 W2 W	W3	W4	W5	W6	37704.75	
Total seismic weight of the Building of all 6 floors	6062.	6619.	6619.	6619.	6619.	5163.4	57704.75 KN
	24	77	77	77	77	3	<b>N</b> IN
Step 4: CA	LCULAT	ION OF	Ah				
Design horizontal seismic coefficient:	Ah =	Z/2 x I/R	x Sa/g				
<b>Zone Factor:</b> $\mathbf{Z} = 0.16$ (R	ef:Fig.1, P	age 5 of I	S 1893:20	002 (Part	1) (Ref:1	Table 2, Cl.	6.4.2 of IS
1893:2002 (Part 1)		-					
<b>Importance Factor:</b> I = 1.00	(Ref: Tabl	e 6, Cl.6.4	.2 of IS	5 1893:20	02 (Part 1	)	
<b>Response Reduction Factor:</b> $\mathbf{R} = 5.0$	0 (Ref: 1	able 7, C	l.6.4.2 of	` IS 1893	:2002(1)		
Fundamental Time Period:							
$Tx = 0.09h/\sqrt{dx} = 0.09x17.75/\sqrt{14.20} = 0.4$	24 Sec.						
$Ty = 0.09h/\sqrt{dy} = 0.09x17.75/\sqrt{16.10} = 0.3$	98 Sec.						
(Sa/g)x = (Sa/g)y = 2.5 (Ref:Cl.6.4.5, Pag	e 16 of IS	1893:200	2(1)				
	$\mathbf{A}\mathbf{h}=0$			5 = 0.04			
Step 5: CALCULATION OF BAS	E SHEAR	(VB	)				
(VB)x = W x Ah(x) = 37704.75 x 0.04 =	= 1508.19	KN					
(VB)y = 1508.19  KN							

12. RANGANATH Residency,	VIJAYA	WADA	(Moga	alrajapur	ram)		
Seismic weight & B	ase Shea	r Calcul	ations	• *	,		
· Seismic weight of a floor (W1) (Cl. 3.26, IS 189	3:2016)						
It is the sum of dead load of the floor, appropriate co							
permanent elements from the storeys above and below	w, finishe	s and ser	vices, & a	ppropria	te amounts	of	
specified imposed load on the floor.							
• Seismic weight of a Structure (W) (Cl.3.27, IS 1	893:2010	5)					
It is the sum of seismic weights of all floors.							
W1 = Dead load of floor 1 +							
Weight of Beams (1) +							
Weight of Slabs (1) +							
<sup>1</sup> / <sub>2</sub> Weight of Columns (1) +							
<sup>1</sup> / <sub>2</sub> Weight of Columns (2) +							
<sup>1</sup> / <sub>2</sub> Weight of Walls (1) +							
<sup>1</sup> / <sub>2</sub> Weight of Walls (2) +							
Appropriate imposed (Live) Load.							
• Base Shear (VB) (Cl.4.7 IS 1893:2016)							
It is the horizontal lateral force in the considered dire	ction of e	arthquak	e shaking	that the	structure s	hall be	
designed for.							
VB = Ah x W & Ah = Z/2 x I/R x Sa/g							
Considerations: External wall thickness: 230 mm							
Internal wall thickness: 115 mm							
Specific weight of RCC: 25 KN / Cum							
Specific weight of infill wall: 20 KN / Cum							
Type of soil: Medium	500						
Size of columns: 350x700; 300x700; 300x650; 300:	x500 mm						
Size of Beams: 230x425; 230x600 mm							
Response spectra: IS 1893(Part 1) : 2002							
Assumption: Live Load 3.00 KN / Sqm	1. 41		c ·	111			
Referring to Table 8, IS 1893:2002; Cl.7.3.1. Page 24	; the per	centage o	1 imposed	lioad			
Step 1:     CACULATION OF SEISMIC WEIGHT OF     1st FLOOR     W1							
Height of wall:					** 1		
$= \frac{1}{2} \times \text{Ht.of wall of Fl.1} + \frac{1}{2} \times \text{Ht.of wall of Fl.2}$							
$= \frac{1}{2} \times (2.75 - 0.425) + \frac{1}{2} \times (3.00 - 0.425) = 2.45 \text{ M}$							
Height of Column:							
$=\frac{1}{2}$ x Ht. of Col. in Fl.1 + $\frac{1}{2}$ x Ht. of Col. in Fl.2							
$= (\frac{1}{2} \times 2.75 - 0.125) + (\frac{1}{2} \times 3.00 - 0.125) = 2.75 \text{ M}$							
		XX7* 14	<b>T</b> .		Total		
Description of Items	Nos.	Widt b M	Lengt	Heigh	Sp.Wt. KN/Cu	Wt.	
		h M	h M	t M	m	KN	
Weight of Slab	2.00	17.85	10.77	0.13	25.00	1249.59	
	1.00	11.22	2.13	0.13	25.00	77.67	
Weight of columns	1.00	0.70	0.35	2.75	25.00	16.84	
	11.00	0.70	0.30	2.75	25.00	158.81	
	7.00	0.65	0.30	2.75	25.00	93.84	
	3.00	0.50	0.30	2.75	25.00	30.94	
Weight of Beams:						0.00	
All beams in X-direction	7.00	0.23	17.85	0.30	25.00	215.54	
	3.00	0.23	3.72	0.30	25.00	19.25	

	2.00	0.23	3.90	0.30	25.00	12.46
	4.00	0.23	10.77	0.30	25.00	13.46 74.31
All beams in Y-direction	7.00	0.23	10.77	0.30	25.00	195.07
	5.00	0.23	2.13	0.45	25.00	195.07
Weight of imposed Live Load (25% of 1327.26	0.25	1.00	1327.	1.00	1.00	10.37
slab wt.)	0.25	1.00	26	1.00	1.00	331.82
Weight of walls:						0.00
All walls in X=direction:						0.00
	2.00	0.23	5.11	2.45	20.00	115.18
<b>T</b> . <b>1</b>	1.00	0.23	3.08	2.45	20.00	34.71
Internal walls:	1.00	0.23	1.43	2.45	20.00	16.12
	1.00	0.12	4.88	2.45	20.00	27.50
External walls:	1.00	0.12	4.88	2.45	20.00	27.50
All walls in Y-direction:						0.00
Internal walls:	1.00	0.23	2.13	2.45	20.00	24.01
	2.00	0.12	4.77	2.45	20.00	53.76
	1.00	0.12	4.77	2.45	20.00	26.88
External walls:	1.00	0.23	2.13	2.45	20.00	24.01
Total weight of 1st floor in KN :					W1 =	2845.1
Step 2: CACULATION OF SEISMIC WEIG	GHT OF 2	nd to 5	th FLOC	DRS V	W2, W3, W	/4, & W5
*	2.00	17.85	10.77	0.13	25.00	1249.59
Weight of slab: (same as 1st floor)	1.00	11.22	2.13	0.13	25.00	77.67
	1.00	0.70	0.35	2.88	25.00	17.61
	11.00	0.70	0.30	2.88	25.00	166.03
Weight of columns	7.00	0.65	0.30	2.88	25.00	98.11
	3.00	0.50	0.30	2.88	25.00	32.34
Weight of beams: (same as 1st floor)						0.00
	7.00	0.23	17.85	0.30	25.00	215.54
All beams in X-direction	3.00	0.23	3.72	0.30	25.00	19.25
	2.00	0.23	3.90	0.30	25.00	13.46
	4.00	0.23	10.77	0.30	25.00	74.31
All beams in Y-direction	7.00	0.23	10.77	0.45	25.00	195.07
	5.00	0.23	2.13	0.30	25.00	18.37
Weight of imposed Live Load: 25% (same as 1st floor)	0.25	1.00	1327. 26	1.00	1.00	331.82
Weight of walls:						0.00
All walls in <b>X=direction:</b>						0.00
	1.00	0.23	17.85	2.88	20.00	236.48
	1.00	0.23	12.20	2.88	20.00	161.63
	1.00	0.12	17.85	2.88	20.00	118.24
Internal walls:	1.00	0.12	5.69	2.88	20.00	37.69
	2.00	0.12	4.54	2.88	20.00	60.15
	2.00	0.12	6.00	2.88	20.00	79.49
	1.00	0.12	6.16	2.88	20.00	40.80
	2.00	0.12	2.10	2.88	20.00	27.82
External walls:	2.00	0.23	17.85	2.88	20.00	472.95
All walls in <b>Y-direction</b> :						0.00
Internal walls:	1.00	0.23	5.92	2.88	20.00	78.43
	1.00	0.23	2.13	2.88	20.00	28.22
	4.00	0.12	10.77	2.88	20.00	285.36
	2.00	0.12	6.72	2.88	20.00	89.03

	3.00	0.12	2.00	2.88	20.00	39.74	
	2.00	0.12	4.42	2.88	20.00	58.56	
External walls:	2.00	0.23	10.80	2.88	20.00	286.16	
	1.00	0.23	5.55 3.56	2.88 2.88	20.00	73.53	
	1.00	0.23	7.00	2.88	20.00	47.16 46.37	
	1.00	0.12	5.00	2.88	20.00	33.12	
Total weight of 2nd, 3rd, 4th & 5th floors each i		0.112	W2 = W3 = W4 = W5 = 44				
Step 3: CALCULATION OF SEISMIC WE			8				
Step 3: CALCULATION OF SEISMIC WE	2.00	17.85	6th Floor 10.77	0.13	25.00	1249.59	
Weight of slab: (same as 1st floor)	1.00	11.22	2.13	0.13	25.00	77.67	
	1.00	0.70	0.35	1.44	25.00	8.82	
	11.00	0.70	0.30	1.44	25.00	83.16	
Weight of columns	7.00	0.65	0.30	1.44	25.00	49.14	
	3.00	0.50	0.30	1.44	25.00	16.20	
Weight of beams: (same as 1st floor)						0.00	
All beams in X-direction	7.00	0.23	17.85	0.30	25.00	215.54	
	3.00	0.23	3.72	0.30	25.00	19.25	
	2.00	0.23	3.90	0.30	25.00	13.46	
	4.00	0.23	10.77	0.30	25.00	74.31	
All beams in Y-direction	7.00	0.23	10.77	0.45	25.00	195.07	
Weight of imposed Live Load: 25% (same as 1st floor)	5.00 0.25	0.23	2.13 1327. 26	0.30	25.00 1.00	18.37 331.82	
All walls in <b>X=direction</b> :			20			0.00	
	1.00	0.23	17.85	2.88	20.00	236.48	
	1.00	0.23	12.20	2.88	20.00	161.63	
	1.00	0.12	17.85	2.88	20.00	118.24	
	1.00	0.12	5.69	2.88	20.00		
Internal walls:						37.69	
	2.00	0.12	4.54	2.88	20.00	60.15	
	2.00	0.12	6.00	2.88	20.00	79.49	
	1.00	0.12	6.16	2.88	20.00	40.80	
	2.00	0.12	2.10	2.88	20.00	27.82	
External walls:	2.00	0.23	17.85	2.88	20.00	472.95	
All walls in <b>Y-direction:</b>						0.00	
Internal walls:	1.00	0.23	5.92	2.88	20.00	78.43	
	1.00	0.23	2.13	2.88	20.00	28.22	
	4.00	0.12	10.77	2.88	20.00	285.36	
	2.00	0.12	6.72	2.88	20.00		
						89.03	
	3.00	0.12	2.00	2.88	20.00	39.74	
	2.00	0.12	4.42	2.88	20.00	58.56	
External walls:	2.00	0.23	10.80	2.88	20.00	286.16	
	1.00	0.23	5.55	2.88	20.00	73.53	
	1.00	0.23	3.56	2.88	20.00	47.16	
	1.00	0.12	7.00	2.88	20.00	46.37	
	1				1	1 10.07	

Total weight of 6th floor in KN :						W6 =	4653.3
Total seismic weight of the Building of all	W1	W2	W3	W4	W5	W6	26738.8
6 floors	284 5.1 7	4810. 08	4810. 08	4810. 08	4810. 08	4653.3 1	0 KN
Step 4: CALC	CULAT	TION OF	7 Ah				
Design horizontal seismic coefficient:	Ah =	Z/2 x I/	R x Sa/g				
Zone Factor: Z = 0.16 (Ref:Fig.1, 1893:2002 (Part 1)	Page 5	of IS 18	93:2002 (	(Part 1)	(Ref:Tabl	e 2, Cl.6.4	.2 of IS
<b>Importance Factor:</b> $I = 1.00$ (R	ef: Tab	le 6, Cl.6	.4.2 of	IS 1893:2	2002 (Part	:1)	
<b>Response Reduction Factor:</b> $\mathbf{R} = 5.00$	(Ref: '	Fable 7, <b>(</b>	Cl.6.4.2 d	of IS 189	93:2002(1	.)	
Fundamental Time Period:							
$Tx = 0.09h/\sqrt{dx} = 0.09x17.75/\sqrt{13.54} = 0.434$	Sec.						
$Ty = 0.09h/\sqrt{dy} = 0.09x17.75/\sqrt{18.31} = 0.373$	Sec.						
(Sa/g)x = (Sa/g)y = 2.5 (Ref:Cl.6.4.5, Page )	16 of IS	1893:20	02 (1)				
Therefore A	h = 0.1	6/2 x 1.0	/5.0 x 2.5	5 = 0.04			
Step 5: CALCULATION OF BASE S	SHEAF	R (VE	8)				
(VB)x = W x Ah(x) = 26738.80 x 0.04 = 1	069.55	KN					
(VB)y = 1069.55  KN							

--000---

13. CHAKRA	DHAR, No.5	Route, I	FI Rd., V	/IJAYAV	WADA		
	ic weight &		ar Calcula	ations			
• Seismic weight of a floor (W1) (Cl.							
It is the sum of dead load of the floor, ap							
permanent elements from the storeys abo	ove and below	w, finishes	and servi	ces, & ap	propriate	amounts of	
specified imposed load on the floor.							
• Seismic weight of a Structure (W)		893:2016	)				
It is the sum of seismic weights of all flo	ors.						
W1 = Dead load of floor 1 +							
Weight of Beams (1) +							
Weight of Slabs (1) +							
<sup>1</sup> / <sub>2</sub> Weight of Columns (1) +							
<sup>1</sup> / <sub>2</sub> Weight of Columns (2) +							
<sup>1</sup> / <sub>2</sub> Weight of Walls (1) +							
<sup>1</sup> / <sub>2</sub> Weight of Walls (2) +							
Appropriate imposed (Live) Load.							
· Base Shear (VB) (Cl.4.7 IS 1893:2	.016)						
It is the horizontal lateral force in the con-	nsidered dire	ction of ea	rthquake	shaking t	hat the str	ucture shal	l be
designed for.			1	U			
VB = Ah x W & Ah = Z/2 x I/R x Sa	a/g						
Considerations:							
External wall thickness: 230 mm							
Internal wall thickness: 230 mm and 11	5 mm						
Specific weight of RCC: 25 KN / Cum							
Specific weight of infill wall: 20 KN / C	um						
Type of soil: Medium							
Size of columns: 230 x 500 mm							
Size of Beams: 230 x 600; 350x375; 2	230x350.350	0x525 mm	1				
Response spectra: IS 1893(Part 1) : 2002		5X525 IIII					
Assumption: Live Load 3.00 KN							
Referring to Table 8, IS 1893:2002; Cl.7		the nerv	ontago of	imposed 1	and		
Referring to Table 8, 13 1875.2002, Cl.7	.5.1. 1 age 24	, inc pere	chage of	imposed i	Uau		
Step 1: CACULATION	OF SEISMI	C WEIGI	IT OF			1st FI	OOR
W1	or sension	e which				150 1 1	JOON
Height of wall:							
$= \frac{1}{2} \times \text{Ht.of wall of Fl.} 1 + \frac{1}{2} \times \text{Ht.of wall}$	ll of F1.2						
$= \frac{1}{2} x (2.75 - 0.0.60) + \frac{1}{2} x (3.00 - 0.60)$	= 2.275 M						
Height of Column:							
$=\frac{1}{2}$ x Ht. of Col. in Fl.1 + $\frac{1}{2}$ x Ht. of Co	l.in Fl.2						
$=(\frac{1}{2} \times 2.75) + (\frac{1}{2} \times 3.00) = 2.875 \text{ M}$							
			****	<b>T</b> .		Sp.Wt.	Total
<b>Description of Items</b>		Nos.	Width	Lengt	Heigh	KN/Cu	Wt.
•			M	h M	t M	m	KN
Weight of Slab		1.00	12.80	19.28	0.13	25.00	771.20
		12.00	0.23	0.50	2.88	25.00	99.19
Weight of columns			1				0.00
Weight of columns Weight of Beams:							0.00
		2.00	0.23	0.60	11.58	25.00	79.90
Weight of Beams:		2.00 1.00	0.23 0.23	0.60	11.58 4.04	25.00 25.00	
Weight of Beams:							79.90
Weight of Beams:		1.00	0.23	0.60	4.04	25.00	79.90 13.93
Weight of Beams:		1.00 5.00	0.23 0.35	0.60 0.53	4.04 6.86	25.00 25.00	79.90 13.93 157.57 13.25
Weight of Beams:		1.00 5.00 1.00	0.23 0.35 0.35	0.60 0.53 0.38	4.04 6.86 4.04	25.00 25.00 25.00	79.90 13.93 157.57

			1	1	
1.00	0.35	0.53	5.71	25.00	26.23
1.00					28.02
1.00	0.23	0.60	18.06	25.00	62.30
0.25	12.80	19.28	0.00	3.00	185.09
3.00	0.23	4.04	2.28	20.00	126.77
1.00	0.23	4.04	2.28	20.00	42.28
1.00	0.23	10.06	2.28	20.00	105.5
1.00	0.30	11.74	2.28	20.00	160.60
i				W1	1943.2 8
	2 1 44	0 <b>5</b> 41 E			
HTOF 2nd					/3,W4 &
1.00	12.80	19.28		25.00	771.20
12.00	0.23	0.50	3.00	25.00	103.50
2.00	0.23	0.60	11.58	25.00	79.90
1.00	0.23	0.60	4.04	25.00	13.93
5.00	0.35	0.53	6.86	25.00	157.5
1.00	0.35	0.38	4.04	25.00	13.25
1.00	0.23	0.35	4.04	25.00	8.13
1.00	0.23	0.43	18.06	25.00	44.13
1.00	0.23	0.60	5.56	25.00	19.18
1.00	0.35	0.53	5.71	25.00	26.23
1.00	0.35	0.53	6.10	25.00	28.02
1.00	0.23	0.60	18.06	25.00	62.30
0.25	12.80	19.28	0.00	3.00	185.09
2.00	0.23	4.04	2.40	20.00	89.16
					50.39
					282.32
2.00	0.25	11.00	2.05	20.00	202.32
1.00	0.23	5 56	2 40	20.00	61.38
					44.45
					440.30
2.00	0.23	10.00	2.05	20.00	2480.4
		W	2=W3=W	/4=W5=	3
ГІСИТ ОБ	64h Fl-	or		W6	
1.00		1			EAEC
1 1.00	12.80	13.64	0.13	25.00	545.60
	0.25	0.20	4.0.4	25.00	10.01
1.00	0.35	0.38	4.04	25.00	
1.00 1.00	0.23	0.35	4.04	25.00	8.13
1.00 1.00 1.00	0.23 0.23	0.35 0.60	4.04 4.04	25.00 25.00	8.13 13.94
1.00 1.00 1.00 1.00	0.23 0.23 0.23	0.35 0.60 0.60	4.04 4.04 11.58	25.00 25.00 25.00	13.94 39.95
1.00 1.00 1.00	0.23 0.23	0.35 0.60	4.04 4.04	25.00 25.00	8.13 13.94
	1.00         1.00         0.25         3.00         1.00         2.00         2.00         2.00         2.00         2.00         2.00         2.00         1.00         1.00         1.00         1.00         1.00         1.00         1.00         1.00         1.00         1.00 </td <td>1.00       0.35         1.00       0.23         0.25       12.80         3.00       0.23         1.00       0.23         0.25       12.80         2.00       0.23         2.00       0.23         1.00       0.23         1.00       0.23         1.00       0.23         1.00       0.23         2.00       0.23         2.00       0.23         1.00<td>1.00       0.35       0.53         1.00       0.23       0.60         0.25       12.80       19.28         3.00       0.23       4.04         1.00       0.23       4.04         1.00       0.23       4.04         1.00       0.23       10.06         1.00       0.23       10.06         1.00       0.23       10.06         1.00       0.23       10.06         1.00       0.23       0.50         2.00       0.23       0.50         2.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         0.25       12.80       19.28         2.00       0.23       4.04         2.00       0.23</td><td>1.00       0.35       0.53       6.10         1.00       0.23       0.60       18.06         0.25       12.80       19.28       0.00         3.00       0.23       4.04       2.28         1.00       0.23       4.04       2.28         1.00       0.23       4.04       2.28         1.00       0.23       10.06       2.28         1.00       0.23       10.06       2.28         1.00       0.23       0.50       3.00         2.00       0.23       0.50       3.00         2.00       0.23       0.60       11.58         1.00       0.23       0.60       11.58         1.00       0.23       0.60       11.58         1.00       0.23       0.60       11.58         1.00       0.23       0.60       5.66         1.00       0.23       0.60       5.56         1.00       0.23       0.60       5.56         1.00       0.23       0.60       18.06         1.00       0.23       0.60       18.06         0.25       12.80       19.28       0.00         1.00       0.</td><td>1.00       0.35       0.53       6.10       25.00         1.00       0.23       0.60       18.06       25.00         0.25       12.80       19.28       0.00       3.00         1.00       0.23       4.04       2.28       20.00         1.00       0.23       4.04       2.28       20.00         1.00       0.23       10.06       2.28       20.00         1.00       0.30       11.74       2.28       20.00         W1</td></td>	1.00       0.35         1.00       0.23         0.25       12.80         3.00       0.23         1.00       0.23         0.25       12.80         2.00       0.23         2.00       0.23         1.00       0.23         1.00       0.23         1.00       0.23         1.00       0.23         2.00       0.23         2.00       0.23         1.00 <td>1.00       0.35       0.53         1.00       0.23       0.60         0.25       12.80       19.28         3.00       0.23       4.04         1.00       0.23       4.04         1.00       0.23       4.04         1.00       0.23       10.06         1.00       0.23       10.06         1.00       0.23       10.06         1.00       0.23       10.06         1.00       0.23       0.50         2.00       0.23       0.50         2.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         0.25       12.80       19.28         2.00       0.23       4.04         2.00       0.23</td> <td>1.00       0.35       0.53       6.10         1.00       0.23       0.60       18.06         0.25       12.80       19.28       0.00         3.00       0.23       4.04       2.28         1.00       0.23       4.04       2.28         1.00       0.23       4.04       2.28         1.00       0.23       10.06       2.28         1.00       0.23       10.06       2.28         1.00       0.23       0.50       3.00         2.00       0.23       0.50       3.00         2.00       0.23       0.60       11.58         1.00       0.23       0.60       11.58         1.00       0.23       0.60       11.58         1.00       0.23       0.60       11.58         1.00       0.23       0.60       5.66         1.00       0.23       0.60       5.56         1.00       0.23       0.60       5.56         1.00       0.23       0.60       18.06         1.00       0.23       0.60       18.06         0.25       12.80       19.28       0.00         1.00       0.</td> <td>1.00       0.35       0.53       6.10       25.00         1.00       0.23       0.60       18.06       25.00         0.25       12.80       19.28       0.00       3.00         1.00       0.23       4.04       2.28       20.00         1.00       0.23       4.04       2.28       20.00         1.00       0.23       10.06       2.28       20.00         1.00       0.30       11.74       2.28       20.00         W1</td>	1.00       0.35       0.53         1.00       0.23       0.60         0.25       12.80       19.28         3.00       0.23       4.04         1.00       0.23       4.04         1.00       0.23       4.04         1.00       0.23       10.06         1.00       0.23       10.06         1.00       0.23       10.06         1.00       0.23       10.06         1.00       0.23       0.50         2.00       0.23       0.50         2.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         1.00       0.23       0.60         0.25       12.80       19.28         2.00       0.23       4.04         2.00       0.23	1.00       0.35       0.53       6.10         1.00       0.23       0.60       18.06         0.25       12.80       19.28       0.00         3.00       0.23       4.04       2.28         1.00       0.23       4.04       2.28         1.00       0.23       4.04       2.28         1.00       0.23       10.06       2.28         1.00       0.23       10.06       2.28         1.00       0.23       0.50       3.00         2.00       0.23       0.50       3.00         2.00       0.23       0.60       11.58         1.00       0.23       0.60       11.58         1.00       0.23       0.60       11.58         1.00       0.23       0.60       11.58         1.00       0.23       0.60       5.66         1.00       0.23       0.60       5.56         1.00       0.23       0.60       5.56         1.00       0.23       0.60       18.06         1.00       0.23       0.60       18.06         0.25       12.80       19.28       0.00         1.00       0.	1.00       0.35       0.53       6.10       25.00         1.00       0.23       0.60       18.06       25.00         0.25       12.80       19.28       0.00       3.00         1.00       0.23       4.04       2.28       20.00         1.00       0.23       4.04       2.28       20.00         1.00       0.23       10.06       2.28       20.00         1.00       0.30       11.74       2.28       20.00         W1

1.00

0.23

0.60

5.56

19.18

25.00

		1.00	0.35	0.53	5.71	25.00	26.23
Weight of imposed Live Load: (same as 1st	t floor)	0.25	12.80	13.64	0.00	3.00	130.94
Weight of Columns: = $(\frac{1}{2} \times 3.00 \text{ Ht.})$ in floor	or 6	9.00	0.23	0.50	1.50	25.00	38.81
Weight of walls:							
All walls in X=direction:							
Internal walls: (1/2 x 3.00 Ht.) in floor 6		1.00	0.23	11.58	1.50	20.00	79.90
. ,		1.00	0.12	6.82	1.50 1.50	20.00	150.90
External walls: (½ x 3.00 Ht.) in floor 6 All walls in Y-direction:		2.00	0.23	11.58	1.30	20.00	159.80
All walls in Y-direction:		1.00	0.22	556	1.50	20.00	20.26
Internal walls: $(\frac{1}{2} \times 3.00 \text{ Ht.})$ in floor 6		1.00	0.23	5.56 5.64	1.50 1.50	20.00	38.36
		3.00	0.12	13.64	1.50	20.00	58.37 94.12
External walls: (1/2 x 3.00 Ht.) in floor 4		1.00	0.23	5.56	1.50	20.00	38.36
		1.00	0.12	5.64	0.00	20.00	13.56
Total weight of 6th floor in KN :		I	1		I	W6 =	1528.2 1
Total seismic weight of the Building of	W1	W2	W3	W4	W5	W6	13393.
all 6 floors	1943.2 8	2480.4 3	2480.4 3	2480.4 3	2480.4 3	1528.21	21 KN
	1943.2 8	2480.4 3	2480.4 3	2480.4 3	2480.4 3	1528.21	
all 6 floors		3				1528.21	
all 6 floors	8 LCULAT	3	3 Ah			1528.21	
all 6 floors Step 4: CA Design horizontal seismic coefficient: Zone Factor: Z = 0.16 (Ref:I 1893:2002 (Part 1)	8 LCULAT Ah = Fig.1, Pag	3 ION OF Z/2 x I/R e 5 of IS	3 Ah x Sa/g 893:2002	3 2 (Part 1)	3 (Ref:Tab	le 2, Cl.6.4	KN
all 6 floors          Step 4:       CAI         Design horizontal seismic coefficient:       Zone Factor:         Zone Factor:       Z = 0.16 (Ref: Ilegal 1893:2002 (Part 1))         Importance Factor:       I = 1.00 (Importance factor)	8 LCULAT Ah = Fig.1, Pag (Ref: Tabl	3 ION OF Z/2 x I/R e 5 of IS 1 e 6, Cl.6.4	3 Ah x Sa/g 1893:2002	<b>3</b> 2 (Part 1) 5 1893:200	3 (Ref:Tab D2 (Part 1)	le 2, Cl.6.4	KN
Step 4:       CAI         Design horizontal seismic coefficient:       Zone Factor:         Zone Factor:       Z = 0.16 (Ref:Horizontal seismic coefficient)         1893:2002 (Part 1)       Importance Factor:         Importance Factor:       I = 1.00 (Response Reduction Factor:	8 LCULAT Ah = Fig.1, Pag (Ref: Tabl	3 ION OF Z/2 x I/R e 5 of IS 1 e 6, Cl.6.4	3 Ah x Sa/g 1893:2002	<b>3</b> 2 (Part 1) 5 1893:200	3 (Ref:Tab D2 (Part 1)	le 2, Cl.6.4	KN
all 6 floors          Step 4:       CAI         Design horizontal seismic coefficient:       Zone Factor:         Zone Factor:       Z = 0.16 (Ref:I         1893:2002 (Part 1)       Importance Factor:         Importance Factor:       I = 1.00 (Response Reduction Factor:         Fundamental Time Period:       Verify and the sector is a sec	8 LCULAT Ah = Fig.1, Pag (Ref: Tabl 0 (Ref: 1	3 ION OF Z/2 x I/R e 5 of IS 1 e 6, Cl.6.4	3 Ah x Sa/g 1893:2002	<b>3</b> 2 (Part 1) 5 1893:200	3 (Ref:Tab D2 (Part 1)	le 2, Cl.6.4	KN
all 6 floors Step 4: CA Design horizontal seismic coefficient: Zone Factor: Z = 0.16 (Ref:I 1893:2002 (Part 1) Importance Factor: I = 1.00 ( Response Reduction Factor: R = 5.00 Fundamental Time Period: $Tx = 0.09h/\sqrt{dx} = 0.09x17.75/\sqrt{11.58} = 0.4$	8 LCULAT Ah = Fig.1, Pag (Ref: Tabl 0 (Ref: Tabl 0 (Ref: 1	3 ION OF Z/2 x I/R e 5 of IS 1 e 6, Cl.6.4	3 Ah x Sa/g 1893:2002	<b>3</b> 2 (Part 1) 5 1893:200	3 (Ref:Tab D2 (Part 1)	le 2, Cl.6.4	KN
Step 4:       CA         Design horizontal seismic coefficient:       Z         Zone Factor:       Z       = 0.16 (Ref:I         1893:2002 (Part 1)       Importance Factor:       I         Importance Factor:       I       = 1.00 (         Response Reduction Factor:       R       = 5.00         Fundamental Time Period:       Tx = 0.09h/ $\sqrt{dx}$ = 0.09x17.75/ $\sqrt{11.58}$ = 0.4         Ty = 0.09h/ $\sqrt{dy}$ = 0.09x17.75/ $\sqrt{18.06}$ = 0.3	8 LCULAT Ah = Fig.1, Pag (Ref: Tabl 0 (Ref: Tabl 0 (Ref: Tabl 0 (Ref: Tabl 376 Sec.	3 ION OF Z/2 x I/R e 5 of IS 1 e 6, Cl.6.4 Gable 7, C	3 Ah x Sa/g 893:2002 4.2 of IS 1.6.4.2 of	<b>3</b> 2 (Part 1) 5 1893:200	3 (Ref:Tab D2 (Part 1)	le 2, Cl.6.4	KN
Step 4:       CAI         Design horizontal seismic coefficient:       Z         Zone Factor:       Z       = 0.16 (Ref:I         1893:2002 (Part 1)       Importance Factor:       I       = 1.00 (Response Reduction Factor:         Response Reduction Factor:       I       = 5.00         Fundamental Time Period:       Tx = 0.09h/ $\sqrt{dx} = 0.09x17.75/\sqrt{11.58} = 0.4$ Ty = 0.09h/ $\sqrt{dy} = 0.09x17.75/\sqrt{18.06} = 0.3$ (Sa/g)x = (Sa/g)y = 2.5 (Ref:Cl.6.4.5, Page)	8 LCULAT Ah = Fig. 1, Pag (Ref: Tabl 0 (Ref: T 10 (Ref: 1 10 (Ref: 3 10 (Ref: 3 10 (Ref: 3 10 (Ref: 3 10)(Ref: 3 (Ref: 3 10)(Ref: 3 (Ref: 3 (Ref: 3 (Ref: 3 )(Ref: 3 (Ref: 3 )(Ref: 3 )	3 ION OF Z/2 x I/R e 5 of IS 1 e 6, Cl.6.4 Cable 7, C 1893:200	3 Ah x Sa/g 893:2002 4.2 of IS 1.6.4.2 of 2 (1)	3 2 (Part 1) 3 1893:200 1 IS 1893	3 (Ref:Tab D2 (Part 1)	le 2, Cl.6.4	KN
Step 4:       CA         Design horizontal seismic coefficient:       Z         Zone Factor:       Z       = 0.16 (Ref:Ilegative coefficient:         1893:2002 (Part 1)       Importance Factor:       I       = 1.00 (Response Reduction Factor:         Response Reduction Factor:       R       = 5.00         Fundamental Time Period:       Tx = 0.09h/ $\sqrt{dx}$ = 0.09x17.75/ $\sqrt{11.58}$ = 0.4         Ty = 0.09h/ $\sqrt{dy}$ = 0.09x17.75/ $\sqrt{18.06}$ = 0.3	8 LCULAT Ah = Fig. 1, Pag (Ref: Tabl 0 (Ref: T 10 (Ref: 1 10 (Ref: 3 10 (Ref: 3 10 (Ref: 3 10 (Ref: 3 10)(Ref: 3 (Ref: 3 10)(Ref: 3 (Ref: 3 (Ref: 3 (Ref: 3 )(Ref: 3 (Ref: 3 )(Ref: 3 )	3 ION OF Z/2 x I/R e 5 of IS 1 e 6, Cl.6.4 Gable 7, C	3 Ah x Sa/g 893:2002 4.2 of IS 1.6.4.2 of 2 (1)	3 2 (Part 1) 3 1893:200 1 IS 1893	3 (Ref:Tab D2 (Part 1)	le 2, Cl.6.4	KN
Step 4:       CAI         Design horizontal seismic coefficient:       Z         Zone Factor:       Z = 0.16 (Ref:I         1893:2002 (Part 1)       Importance Factor:       I = 1.00 (         Response Reduction Factor:       R = 5.00         Fundamental Time Period:       Tx = 0.09h/ $\sqrt{dx} = 0.09x17.75/\sqrt{11.58} = 0.4$ Ty = 0.09h/ $\sqrt{dy} = 0.09x17.75/\sqrt{18.06} = 0.3$ (Sa/g)x = (Sa/g)y = 2.5 (Ref:Cl.6.4.5, Page         Therefore	8 LCULAT Ah = Fig.1, Pag (Ref: Tabl 0 (Ref:	3 ION OF Z/2 x I/R e 5 of IS 1 e 6, Cl.6.4 Cable 7, C 1893:200 16/2 x 1.0	3 Ah x Sa/g 893:2002 4.2 of IS 1.6.4.2 of 2 (1) 2/5.0 x 2.5	3 2 (Part 1) 3 1893:200 1 IS 1893	3 (Ref:Tab D2 (Part 1)	le 2, Cl.6.4	KN
Step 4:       CAI         Design horizontal seismic coefficient:       Z         Zone Factor:       Z = 0.16 (Ref:I         1893:2002 (Part 1)       Importance Factor:       I = 1.00 (         Response Reduction Factor:       R = 5.00         Fundamental Time Period:       Tx = 0.09h/ $\sqrt{dx} = 0.09x17.75/\sqrt{11.58} = 0.4$ Ty = 0.09h/ $\sqrt{dy} = 0.09x17.75/\sqrt{18.06} = 0.3$ (Sa/g)x = (Sa/g)y = 2.5 (Ref:Cl.6.4.5, Page         Therefore         Step 5: CALCULATION OF BASE	8 LCULAT Ah = Fig.1, Pag (Ref: Tabl 0 (Ref: Tabl 0 (Ref: Tabl)) (Ref: Tabl 0 (Ref: Tabl 0 (Ref: Tabl)) (Ref: Tabl 0 (Ref:	3 ION OF Z/2 x I/R e 5 of IS 1 e 6, Cl.6.4 Table 7, C 1893:200 16/2 x 1.0	3 Ah x Sa/g 893:2002 4.2 of IS 1.6.4.2 of 2 (1) 2/5.0 x 2.5	3 2 (Part 1) 3 1893:200 1 IS 1893	3 (Ref:Tab D2 (Part 1)	le 2, Cl.6.4	KN
all 6 floors Step 4: CA Design horizontal seismic coefficient: Zone Factor: Z = 0.16 (Ref:I 1893:2002 (Part 1) Importance Factor: I = 1.00 ( Response Reduction Factor: R = 5.00 Fundamental Time Period: $Tx = 0.09h/\sqrt{dx} = 0.09x17.75/\sqrt{11.58} = 0.4$ $Ty = 0.09h/\sqrt{dy} = 0.09x17.75/\sqrt{11.58} = 0.4$ $Ty = 0.09h/\sqrt{dy} = 0.09x17.75/\sqrt{18.06} = 0.3$ (Sa/g)x = (Sa/g)y = 2.5 (Ref:Cl.6.4.5, Page Therefore	8 LCULAT Ah = Fig.1, Pag (Ref: Tabl 0 (Ref: Tabl 0 (Ref: Tabl)) (Ref: Tabl 0 (Ref: Tabl 0 (Ref: Tabl)) (Ref: Tabl 0 (Ref:	3 ION OF Z/2 x I/R e 5 of IS 1 e 6, Cl.6.4 Table 7, C 1893:200 16/2 x 1.0	3 Ah x Sa/g 893:2002 4.2 of IS 1.6.4.2 of 2 (1) 2/5.0 x 2.5	3 2 (Part 1) 3 1893:200 1 IS 1893	3 (Ref:Tab D2 (Part 1)	le 2, Cl.6.4	KN

--000---

14. HIGH SC				YAWADA		
	eight & Base	Shear Calo	culations			
• Seismic weight of a floor (W1) (Cl. 3.26, IS	/					
It is the sum of dead load of the floor, appropria						
elements from the storeys above and below, find	ishes and servi	ces, & app	ropriate am	ounts of sp	ecified impo	sed load
on the floor.	1 10 1002 201					
Seismic weight of a Structure (W) (Cl.3.27	, IS 1893:201	6)				
It is the sum of seismic weights of all floors.						
W1 = Dead load of floor 1 +						
Weight of Beams (1) +						
Weight of Slabs (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Columns (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Columns (2) +						
<sup>1</sup> / <sub>2</sub> Weight of Walls (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Walls (2) +						
Appropriate imposed (Live) Load.						
· Base Shear (VB) (Cl.4.7 IS 1893:2016)						
It is the horizontal lateral force in the considered	d direction of e	earthquake	shaking that	at the struct	ure shall be o	lesigned
for.						
VB = Ah x W & Ah = Z/2 x I/R x Sa/g						
Considerations:						
External wall thickness: 230 mm						
Internal wall thickness: 230 and 115 mm						
Specific weight of RCC: 25 KN / Cum						
Specific weight of infill wall: 20 KN / Cum						
Type of soil: Medium						
Size of columns: 560x270; 560x350; 480x270;	and 230x230	mm				
Size of Beams: 230 x 450 mm						
Response spectra: IS 1893(Part 1) : 2002						
Assumption: Live Load 3.00 KN / Sqm						
Referring to Table 8, IS 1893:2002; Cl.7.3.1. Pa	age 24. the per	centage of	imposed lo	ad		
Tereforming to Tuble 0, 15 1075.2002, 01.7.5.1. Te	go 21, the per	centage of	imposed io	uu		
Step 1: CACULATION OF SEISMIC	WEIGHT OF	1		1st FLO	OR	W1
Height of wall:				1001120		
$= \frac{1}{2} \text{ x Ht.of wall of Fl.1} + \frac{1}{2} \text{ x Ht.of wall of Fl.}$	2					
$= \frac{1}{2} \times (2.75 - 0.30) + \frac{1}{2} \times (3.00 - 0.30) = 2.575$						
Height of Column:	111					
= $\frac{1}{2}$ x Ht. of Col. in Fl.1 + $\frac{1}{2}$ x Ht. of Col. in Fl.2	)					
$= (\frac{1}{2} \times 2.75) + (\frac{1}{2} \times 3.00) = 2.875 \text{ M}$	2					
$-(72 \times 2.75) + (72 \times 5.00) - 2.075$ M		Width	Langth	Haigh4	6- W4	Tata W/4
<b>Description of Items</b>	Nos.	M	Length M	Height M	Sp.Wt. KN/Cum	TotalWt. KN
Weight of Slab	1.00	8.11	14.89	0.15	25.00	452.84
Weight of columns	2.00	0.27	0.56	2.88	25.00	
weight of columns	4.00	0.27	0.36		25.00	21.74
				2.88		56.35
	2.00	0.27	0.48	2.88	25.00	18.63
W/-!	3.00	0.23	0.23	2.88	25.00	11.41
Weight of Beams:	2.00	0.00	0.15	0.11	05.00	0.00
	3.00	0.23	0.45	8.11	25.00	62.95
All beams in X-direction	1.00	0.23	0.45	3.33	25.00	8.62
	2.00	0.35	0.30	8.11	25.00	42.58
All booms in V dimention	3.00	0.23	0.45	14.89	25.00	115.58
All beams in Y-direction						
All beams in Y-direction Weight of imposed Live Load (25%) Weight of walls:	0.25	8.11	14.89	0.00	3.00	90.57

All walls in X=direction:						
Internal walls:	3.00	0.23	3.33	2.58	20.00	118.33
External walls:	1.00	0.23	3.33	2.58	20.00	39.44
External walls:	1.00	0.12	3.33	2.58	20.00	19.72
All walls in Y-direction:						
Internal walls:	1.00	0.23	2.00	2.58	20.00	23.69
Internal wans:	1.00	0.23	3.77	2.58	20.00	44.66
East	1.00	0.23	3.77	2.58	20.00	44.66
External walls:	1.00	0.23	2.00	2.58	20.00	23.69
Total weight of 1st floor in KN :	·				W1	1195.45
~						1

Step 2: CACULATION OF SEISMIC W	VEIGHT OF	2	2nd FLOC	DR		W2
Weight of slab: (same as 1st floor)	1.00	8.11	14.89	0.15	25.00	452.84
Weight of columns: (same as 1st floor)	2.00	0.27	0.56	2.88	25.00	21.74
	4.00	0.35	0.56	2.88	25.00	56.35
	2.00	0.27	0.48	2.88	25.00	18.63
	3.00	0.23	0.23	2.88	25.00	11.41
Weight of Beams:						0.00
	3.00	0.23	0.45	8.11	25.00	62.95
All beams in X-direction	1.00	0.23	0.45	3.33	25.00	8.62
	2.00	0.35	0.30	8.11	25.00	42.58
All beams in Y-direction	3.00	0.23	0.45	14.89	25.00	115.58
Weight of imposed Live Load (25%)	0.25	8.11	14.89	0.00	3.00	90.57
Weight of walls:						
All walls in X=direction:						
T. 6	1.00	0.23	8.11	2.70	20.00	100.73
Internal walls:	1.00	0.12	3.33	2.70	20.00	20.68
External walls:	1.00	0.12	3.33	2.70	20.00	20.68
External walls:	1.00	0.23	8.11	2.70	20.00	100.73
All walls in Y-direction:						
Internal walls:	2.00	0.12	2.00	2.70	20.00	24.84
External walls:	2.00	0.23	12.66	2.70	20.00	314.47
Total weight of 2nd floor in KN :				V	V2	1463.39
Step 3: CALCULATION OF SEISMIC	WEIGHT OF	3rd & 4t	h Floors	W3 &V	W4	
$\mathbf{W}_{\mathbf{r}} = \mathbf{f}_{\mathbf{r}} = $	1.00		14.00	0.15	25.00	452.94

Step 3: CALCULATION OF SEISMIC WE	IGHT OF	3rd & 4th	1 Floors	W3 & V	W4	
Weight of slab: (same as 1st floor)	1.00	8.11	14.89	0.15	25.00	452.84
Weight of columns: (same as 1st floor)	2.00	0.27	0.56	2.88	25.00	21.74
	4.00	0.35	0.56	2.88	25.00	56.35
	2.00	0.27	0.48	2.88	25.00	18.63
	3.00	0.23	0.23	2.88	25.00	11.41
Weight of Beams:						0.00
	3.00	0.23	0.45	8.11	25.00	62.95
All beams in X-direction	1.00	0.23	0.45	3.33	25.00	8.62
	2.00	0.35	0.30	8.11	25.00	42.58
All beams in Y-direction	3.00	0.23	0.45	14.89	25.00	115.58
Weight of imposed Live Load (25%)	0.25	8.11	14.89	0.00	3.00	90.57
Weight of walls:						
All walls in X=direction:						
	1.00	0.23	8.11	2.70	20.00	100.73
Internal walls:	1.00	0.12	2.30	2.70	20.00	14.28
	2.00	0.12	8.11	2.70	20.00	100.73
External walls:	1.00	0.12	3.33	2.70	20.00	20.68

	1.00	0.23	8.11	2.70	20.00	100.73
All walls in Y-direction:	1.00	0.23	0.11	2.70	20.00	100.75
Internal walls:	2.00	0.12	3.54	2.70	20.00	43.97
internal wans.	1.00	0.12	3.77	2.70	20.00	23.41
External walls:	1.00	0.12	5.73	2.70	20.00	35.58
Total weight of 3rd & 4th floors each in KN		0.112	0170		& W4 =	1321.37
Step 4: CACULATION OF SEISMIC WEI		5th	FLOOR			W5
Weight of slab: (same as 1st floor)	1.00	8.11	14.89	0.15	25.00	452.84
Weight of columns: (same as 1st floor)	2.00	0.27	0.56	2.88	25.00	21.74
0	4.00	0.35	0.56	2.88	25.00	56.35
	2.00	0.27	0.48	2.88	25.00	18.63
	3.00	0.23	0.23	2.88	25.00	11.41
Weight of Beams:						0.00
	3.00	0.23	0.45	8.11	25.00	62.95
All beams in X-direction	1.00	0.23	0.45	3.33	25.00	8.62
	2.00	0.35	0.30	8.11	25.00	42.58
All beams in Y-direction	3.00	0.23	0.45	14.89	25.00	115.58
Weight of imposed Live Load (25%)	0.25	8.11	14.89	0.00	3.00	90.57
Weight of walls:						
All walls in X=direction:						
	1.00	0.23	3.33	2.70	20.00	41.36
Internal walls:	2.00	0.12	3.33	2.70	20.00	41.36
	1.00	0.12	8.11	2.70	20.00	50.36
	1.00	0.12	3.33	2.70	20.00	20.68
External walls:	1.00	0.23	8.11	2.70	20.00	100.73
	1.00	0.23	4.32	2.70	20.00	53.65
All walls in Y-direction:						
Internal walls:	2.00	0.12	3.77	2.70	20.00	46.82
internal wans.	1.00	0.12	1.86	2.70	20.00	11.55
	2.00	0.23	8.66	2.70	20.00	215.11
External walls:	1.00	0.12	1.87	1.00	20.00	4.30
	1.00	0.12	1.86	2.70	20.00	11.55
	1.00	0.12	3.54	2.70	20.00	21.98
Total weight of 5th floor in KN :					W5 =	1500.73
	***	11/0	11/2	***	***	
Total seismic weight of the Building of all 5	W1 1195.45	W2 1463.39	W3 1321.37	W4 1321.37	W5 1500.73	6802.31
floors			1521.57	1521.57	1300.73	KN
*	ATION OF					
	$n = Z/2 \times I/2$		$\mathbf{D}$			
Zone Factor: $Z = 0.16$ (Ref:Fig. (Ref:Table 2, Cl.6.4.2 of IS 1893:2002 (Part 1)	I, Page 5 of	18 1893:20	102 (Part 1)			
Importance Factor:         I = $1.00$ (Ref: 7)	Table 6 CL6	42  of  18	1893-2001	2 (Part 1)		
<b>Response Reduction Factor:</b> $\mathbf{R} = 5.00$ (Ref.						
Fundamental Time Period:	• 7			× /		
$Tx = 0.09h/\sqrt{dx} = 0.09x14.75/\sqrt{8.11}=0.466$ Sec.						
$Ty = 0.09h/\sqrt{dy} = 0.09x14.75/\sqrt{12.66} = 0.373$ Sec.						
(Sa/g)x = (Sa/g)y = 2.5 (Ref:Cl.6.4.5, Page 16 or	f IS 1893:20	002 (1)				
	h = 0.16/2		2.5 = 0.04	ļ		
Step 6: CALCULATION OF BASE SHE			-			
(VB)x = W x Ah(x) = 6802.31 x 0.04 = 272.09		,				
(VB)y = 272.09  KN						

15. MACHAVARAM, N	arla Vari	Streeet,	Vijayawa	ıda.		
Seismic weight & B		r Calcula	tions			
• Seismic weight of a floor (W1) (Cl. 3.26, IS 1893:	2016)					
It is the sum of dead load of the floor, appropriate cont						
permanent elements from the storeys above and below	, finishes	and servio	ces, & app	propriate a	amounts of	
specified imposed load on the floor.						
• Seismic weight of a Structure (W) (Cl.3.27, IS 18	93:2016)					
It is the sum of seismic weights of all floors.						
W1 = Dead load of floor 1 +						
Weight of Beams (1) +						
Weight of Slabs (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Columns (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Columns (2) +						
<sup>1</sup> / <sub>2</sub> Weight of Walls (1) +						
<sup>1</sup> / <sub>2</sub> Weight of Walls (2) +						
Appropriate imposed (Live) Load.						
• Base Shear (VB) (Cl.4.7 IS 1893:2016)						
It is the horizontal lateral force in the considered direct	tion of ear	thouake s	haking tl	hat the str	ucture shal	l be
designed for.						
VB = Ah x W & Ah = Z/2 x I/R x Sa/g						
Considerations:						
External wall thickness: 230 mm						
Internal wall thickness: 115 mm						
Specific weight of RCC: 25 KN / Cum						
Specific weight of infill wall: 20 KN / Cum						
Type of soil: Medium						
Size of columns: 380x680 mm						
Size of Beams: 300x450; 300x300 230x300 mm						
·						
Response spectra: IS 1893(Part 1) : 2002						
Assumption: Live Load 3.00 KN / Sqm	41			1		
Referring to Table 8, IS 1893:2002; Cl.7.3.1. Page 24;	the perce	ntage of f	mposed id	Jad		
Step 1: CACULATION OF SEISMIC	WEICH	ТОЕ			EI (	DOR -
Step 1: CACULATION OF SEISMIC	WEIGH	ГОГ			ГLA	JUK -
Height of wall:						
$= \frac{1}{2}$ x Ht.of wall of Fl.1 + $\frac{1}{2}$ x Ht.of wall of Fl.2						
$= \frac{1}{2} \times (2.75 - 0.60) + \frac{1}{2} \times (3.00 - 0.60) = 2.275 \text{ M}$						
Height of Column:						
$=\frac{1}{2}$ x Ht. of Col. in Fl.1 + $\frac{1}{2}$ x Ht. of Col.in Fl.2						
$= (\frac{1}{2} \times 2.75 \cdot 0.15) + (\frac{1}{2} \times 3.00 \cdot 0.15) = 2.725 \text{ M}$						
(72X2.75 0.15) (72X5.00 0.15) <b>2.725</b> (1					Sp.Wt.	Total
<b>Description of Items</b>	Nos.	Widt	Lengt	Heigh	KN/Cu	Wt.
		h M	h M	t M	m	KN
Weight of Slab	1.00	22.80	9.60	0.15	25.00	820.80
Weight of columns	13.00	0.38	0.68	2.73	25.00	228.85
Weight of Beams:						0.00
	1.00	0.30	9.60	0.45	25.00	32.40
	2.00	0.30	9.60	0.30	25.00	43.20
All beams in X-direction	1.00	0.30	4.10	0.30	25.00	9.23
	4.00	0.23	9.60	0.30	25.00	66.24
	1.00	0.23	4.10	0.30	25.00	7.07
	3.00	0.30	20.80	0.45	25.00	210.60
All beams in Y-direction	4.00	0.23	2.00	0.30	25.00	13.80
		-				

	1.00	0.23	5.00	0.30	25.00	8.63
Weight of imposed Live Load (25% of 820.80 slab	0.25	1.00	820.8	1.00	1.00	
wt.)			0			205.20
Weight of walls:						0.00
All walls in X=direction:						0.00
Internal walls:	2.00	0.23	3.11	2.28	20.00	65.09
Internal wans.	2.00	0.23	1.24	2.28	20.00	25.95
External walls:	0.00	0.00	0.00	0.00	0.00	
All walls in Y-direction:						0.00
Internal walls:	1.00	0.23	1.77	2.28	20.00	18.52
External walls:	1.00	0.23	1.77	2.28	20.00	18.52
Total weight of 1st floor in KN : =					W1	1774.1 0
Step 2: CACULATION OF SEISMIC WEIGH	TOF 2n	d to 5th	FLOOR	S	W2, W3,	1
W5	1.00	22.80	0.60	0.15	25.00	00000
Weight of slab: (same as 1st floor)	1.00	22.80 0.38	9.60	0.15	25.00	820.80
Weight of columns	13.00	0.38	0.68	2.85	25.00	239.34
Weight of Beams:	1.00	0.20	0.60	0.45	25.00	0.00
	1.00	0.30	9.60 9.60	0.45	25.00 25.00	32.40
All Learning V. Line they	1.00	0.30	4.10	0.30	25.00	43.20
All beams in X-direction	4.00	0.30	9.60	0.30	25.00	9.23
	1.00	0.23	4.10	0.30	25.00	66.24
	3.00	0.23	20.80	0.30	25.00	7.07
	4.00	0.30	20.80	0.43	25.00	210.60
All beams in Y-direction	1.00	0.23	5.00	0.30	25.00	13.80
Weight of imposed Live Load (25% of 820.80 slab wt.)	0.25	1.00	820.8 0	1.00	1.00	8.63 205.20
Weights of walls:					0.00	
All walls in X=direction:					0.00	
	5.00	0.12	9.60	2.85	20.00	293.76
Internal walls:	2.00	0.23	9.60	2.85	20.00	251.71
External walls:	2.00	0.23	9.60	2.85	20.00	251.71
All walls in Y-direction:						0.00
	1.00	0.12	9.60	2.85	20.00	62.93
Internal walls:	1.00	0.12	14.50	2.85	20.00	95.05
	1.00	0.23	2.00	2.85	20.00	26.22
External walls:	2.00	0.23	22.80	2.85	20.00	597.82
Total weight of 2nd, 3rd, 4th & 5th floors each in	KN:				= W4 =	3235.7
W5 =						0
Step 3: CALCULATION OF SEISMIC WEIG			1	Floor	W6	
Weight of slab: (same as 1st floor)	1.00	22.80	9.60	0.15	25.00	820.80
Weight of columns	13.00	0.38	0.68	1.43	25.00	119.67
Weight of Beams:						0.00
	1.00	0.30	9.60	0.45	25.00	32.40
	2.00	0.30	9.60	0.30	25.00	43.20
All beams in X-direction	1.00	0.30	4.10	0.30	25.00	9.23
	4.00	0.23	9.60	0.30	25.00	66.24
	1.00	0.23	4.10	0.30	25.00	7.07
All beams in Y-direction	3.00	0.30	20.80	0.45	25.00	210.60
	4.00	0.23	2.00	0.30	25.00	13.80

		1.00	0.23	5.00	0.30	25.00	8.63
Weight of imposed Live Load (25% of 820.8 wt.)	0 slab	0.25	1.00	820.8 0	1.00	1.00	205.20
Weights of walls:						0.00	
All walls in <b>X=direction:</b>						0.00	
T 1 11		5.00	0.12	9.60	1.43	20.00	293.76
Internal walls:		2.00	0.23	9.60	1.43	20.00	251.71
External walls:		2.00	0.23	9.60	1.43	20.00	251.71
All walls in <b>Y-direction:</b>							0.00
		1.00	0.12	9.60	1.43	20.00	31.46
Internal walls:		1.00	0.12	14.50	1.43	20.00	47.52
		1.00	0.23	2.00	1.43	20.00	13.11
External walls:		2.00	0.23	22.80	1.43	20.00	298.91
Total weight of 6th floor in KN :	=					W6	2725.0 2
	W1	11/2	11/2	3374	W5	W6	
	W/1	11/2	11/2	3374	W5	W6	
		W2	W3	W4			
Total seismic weight of the Building of all 6 floors	1774. 10	W2 3235. 70	W3 3235. 70	w4 3235. 70	3235. 70	2725.02	17441. 92 KN
all 6 floors	1774. 10	3235. 70	3235. 70	3235.	3235.		
all 6 floors Step 4: CAL	1774. 10 CULATI	3235. 70 ON OF	3235. 70	3235.	3235.		
all 6 floors	1774. 10 CULATI Ah = 2	3235. 70 ON OF Z/2 x I/R	3235. 70 Ah x Sa/g	3235. 70	3235. 70	2725.02	92 KN
all 6 floors <u>Step 4:</u> CAL <u>Design horizontal seismic coefficient:</u> <u>Zone Factor:Z = 0.16 (Ref:Fig.1, Page 5 o (Part 1)</u> <u>Importance Factor: I = 1.00 (F</u>	1774. $10$ $CULATI$ $Ah = 7$ of IS 1893 $Ref: Table$	3235. 70 ON OF Z/2 x I/R :2002 (Pa	3235. 70 Ah x Sa/g rt 1) (Re	3235. 70 :f:Table 2 1893:200	3235. 70 , Cl.6.4.2 2 (Part 1)	2725.02 of IS 1893	92 KN
all 6 floors Step 4: CAL Design horizontal seismic coefficient: Zone Factor:Z = 0.16 (Ref:Fig.1, Page 5 o (Part 1)	1774. $10$ $CULATI$ $Ah = 7$ of IS 1893 $Ref: Table$	3235. 70 ON OF Z/2 x I/R :2002 (Pa	3235. 70 Ah x Sa/g rt 1) (Re	3235. 70 :f:Table 2 1893:200	3235. 70 , Cl.6.4.2 2 (Part 1)	2725.02 of IS 1893	92 KN
all 6 floors <u>Step 4:</u> CAL <u>Design horizontal seismic coefficient:</u> <u>Zone Factor:Z = 0.16 (Ref:Fig.1, Page 5 o (Part 1)</u> <u>Importance Factor: I = 1.00 (F</u>	1774. $10$ $CULATI$ $Ah = 7$ of IS 1893 $Ref: Table$	3235. 70 ON OF Z/2 x I/R :2002 (Pa	3235. 70 Ah x Sa/g rt 1) (Re	3235. 70 :f:Table 2 1893:200	3235. 70 , Cl.6.4.2 2 (Part 1)	2725.02 of IS 1893	92 KN
Step 4:       CAL         Design horizontal seismic coefficient:       Zone Factor:Z = 0.16 (Ref:Fig.1, Page 5 or (Part 1))         Importance Factor:       I = 1.00 (Free Factor:)         Response Reduction Factor:       R = 5.00	1774. 10 CULATI Ah = 2 of IS 1893 Ref: Table (Ref: Table	3235. 70 ON OF Z/2 x I/R :2002 (Pa	3235. 70 Ah x Sa/g rt 1) (Re	3235. 70 :f:Table 2 1893:200	3235. 70 , Cl.6.4.2 2 (Part 1)	2725.02 of IS 1893	92 KN
all 6 floors          Step 4:       CAL         Design horizontal seismic coefficient:       Zone Factor:Z         Zone Factor:Z       = 0.16 (Ref:Fig.1, Page 5 or (Part 1))         Importance Factor:       I         Response Reduction Factor:       R = 5.00         Fundamental Time Period:	1774. 10 CULATI Ah = 2 of IS 1893 Ref: Table (Ref: Table Sec.	3235. 70 ON OF Z/2 x I/R :2002 (Pa	3235. 70 Ah x Sa/g rt 1) (Re	3235. 70 :f:Table 2 1893:200	3235. 70 , Cl.6.4.2 2 (Part 1)	2725.02 of IS 1893	92 KN
all 6 floors Step 4: CAL Design horizontal seismic coefficient: Zone Factor:Z = 0.16 (Ref:Fig.1, Page 5 o (Part 1) Importance Factor: I = 1.00 (F Response Reduction Factor: R = 5.00 Fundamental Time Period: Tx = 0.09h/ $\sqrt{dx}$ = 0.09x17.75/ $\sqrt{9.60}$ = 0.516 Ty = 0.09h/ $\sqrt{dy}$ = 0.09x17.75/ $\sqrt{18.31}$ = 0.335 (Sa/g)x = (Sa/g)y = 2.5 (Ref:Cl.6.4.5, Page	1774. $10$ $CULATI$ $Ah = 2$ of IS 1893 $Ref: Table$ $(Ref: Table)$ $Sec.$ $5 Sec.$ $16 of IS$	3235. 70 ON OF Z/2 x I/R :2002 (Pa :6, Cl.6.4 able 7, Cl	3235. 70 Ah x Sa/g rt 1) (Re .2 of IS .6.4.2 of 2 (1)	3235. 70 ef:Table 2 1893:200 IS 1893:	3235. 70 , Cl.6.4.2 2 (Part 1)	2725.02 of IS 1893	92 KN
all 6 floors Step 4: CAL Design horizontal seismic coefficient: Zone Factor: Z = 0.16 (Ref:Fig.1, Page 5 o (Part 1) Importance Factor: I = 1.00 (F Response Reduction Factor: R = 5.00 Fundamental Time Period: Tx = 0.09h/ $\sqrt{dx}$ = 0.09x17.75/ $\sqrt{9.60}$ = 0.516 Ty = 0.09h/ $\sqrt{dy}$ = 0.09x17.75/ $\sqrt{18.31}$ = 0.335	1774. $10$ $CULATI$ $Ah = 2$ of IS 1893 $Ref: Table$ $(Ref: Table)$ $Sec.$ $5 Sec.$ $16 of IS$	3235. 70 ON OF Z/2 x I/R :2002 (Pa :6, Cl.6.4 able 7, Cl	3235. 70 Ah x Sa/g rt 1) (Re .2 of IS .6.4.2 of 2 (1)	3235. 70 ef:Table 2 1893:200 IS 1893:	3235. 70 , Cl.6.4.2 2 (Part 1)	2725.02 of IS 1893	92 KN
all 6 floors Step 4: CAL Design horizontal seismic coefficient: Zone Factor:Z = 0.16 (Ref:Fig.1, Page 5 or (Part 1) Importance Factor: I = 1.00 (F Response Reduction Factor: R = 5.00 Fundamental Time Period: Tx = 0.09h/ $\sqrt{dx}$ = 0.09x17.75/ $\sqrt{9.60}$ = 0.516 Ty = 0.09h/ $\sqrt{dy}$ = 0.09x17.75/ $\sqrt{18.31}$ = 0.335 (Sa/g)x = (Sa/g)y = 2.5 (Ref:Cl.6.4.5, Page	1774. $10$ $CULATI$ $Ah = 2$ of IS 1893 $Ref: Table$ $(Ref: Table)$ $Sec.$ $5 Sec.$ $16 of IS$	3235. 70 ON OF Z/2 x I/R :2002 (Pa :6, Cl.6.4 able 7, Cl	3235. 70 Ah x Sa/g rt 1) (Re .2 of IS .6.4.2 of 2 (1)	3235. 70 ef:Table 2 1893:200 IS 1893:	3235. 70 , Cl.6.4.2 2 (Part 1)	2725.02 of IS 1893	92 KN
all 6 floors Step 4: CAL Design horizontal seismic coefficient: Zone Factor:Z = 0.16 (Ref:Fig.1, Page 5 o (Part 1) Importance Factor: I = 1.00 (F Response Reduction Factor: R = 5.00 Fundamental Time Period: Tx = 0.09h/ $\sqrt{dx}$ = 0.09x17.75/ $\sqrt{9.60}$ = 0.516 Ty = 0.09h/ $\sqrt{dy}$ = 0.09x17.75/ $\sqrt{18.31}$ = 0.335 (Sa/g)x = (Sa/g)y = 2.5 (Ref:Cl.6.4.5, Page	1774. 10 CULATI Ah = 2 of IS 1893 Ref: Table (Ref:	3235. 70 ON OF Z/2 x I/R :2002 (Pa :6, Cl.6.4 able 7, Cl	3235. 70 Ah x Sa/g rt 1) (Re .2 of IS .6.4.2 of 2 (1) 2 (1) 2 (5.0 x 2.5	3235. 70 ef:Table 2 1893:200 IS 1893:	3235. 70 , Cl.6.4.2 2 (Part 1)	2725.02 of IS 1893	92 KN
all 6 floors Step 4: CAL Design horizontal seismic coefficient: Zone Factor: Z = 0.16 (Ref:Fig.1, Page 5 o (Part 1) Importance Factor: I = 1.00 (F Response Reduction Factor: R = 5.00 Fundamental Time Period: $Tx = 0.09h/\sqrt{dx} = 0.09x17.75/\sqrt{9.60} = 0.516$ $Ty = 0.09h/\sqrt{dy} = 0.09x17.75/\sqrt{18.31} = 0.335$ (Sa/g)x = (Sa/g)y = 2.5 (Ref:Cl.6.4.5, Page Therefore	1774. 10 CULATI Ah = 7 of IS 1893 Ref: Table (Ref: Table (Ref: Table (Ref: Table Sec. 5 Sec. 16 of IS Ah = 0.1 SHEAR	3235. 70 ON OF Z/2 x I/R :2002 (Pa :6, Cl.6.4 able 7, Cl 1893:2002 6/2 x 1.0/ (VB)	3235. 70 Ah x Sa/g rt 1) (Re .2 of IS .6.4.2 of 2 (1) 2 (1) 2 (5.0 x 2.5	3235. 70 ef:Table 2 1893:200 IS 1893:	3235. 70 , Cl.6.4.2 2 (Part 1)	2725.02 of IS 1893	92 KN

--000---

## **Bibliography**

- ASCE/SEI 7-16, Minimum Design Loads and Associated Criteria for Buildings and Other Structures, American Society of Civil Engineers, Reston, VA, 2016.
- ACI 318-19, Building Code Requirements for Structural Concrete and Commentary, American Concrete Institute, Farmington Hills, MI, 2019.
- 3. Chopra, A. K. (2012). Dynamics of Structures: Theory and Applications to Earthquake Engineering (4th ed.). Prentice Hall.
- Priestley, M. J. N., Calvi, G. M., & Kowalsky, M. J. (2007). Displacement-Based Seismic Design of Structures. IUSS Press.
- BMTPC. Methodology for Documenting Seismic Safety of Housing Typologies in India. New Delhi: 2012.
- Yakut A. Preliminary seismic performance assessment procedure for existing RC buildings. Engineering Structures 2004; 26: 1447–61. https://doi.org/10.1016/j.engstruct.2004.05.011.
- 7. FEMA P-154, Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook, Federal Emergency Management Agency, Washington, D.C., 2002.
- ATC-78, Applied Technology Council, "Guidelines for Rapid Visual Screening of Buildings to Evaluate Terrorism Risks," Redwood City, CA, 2003.
- 9. PEER Report 2007/01, PEER Center, "Rapid Visual Screening of Buildings for Potential Seismic Hazards: Supporting Documentation," University of California, Berkeley, CA, 2007.
- 10. Chopra, A. K. (2012). Dynamics of Structures: Theory and Applications to Earthquake Engineering (4th ed.). Prentice Hall.
- Priestley, M. J. N., Calvi, G. M., & Kowalsky, M. J. (2007). Displacement-Based Seismic Design of Structures. IUSS Press.
- BMTPC. Methodology for Documenting Seismic Safety of Housing Typologies in India. New Delhi: 2012.
- Yakut A. Preliminary seismic performance assessment procedure for existing RC buildings. Engineering Structures 2004; 26:1447–61. https://doi.org/10.1016/j.engstruct.2004.05.011.
- 14. FEMA P-154, Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook, Federal Emergency Management Agency, Washington, D.C., 2002.
- 15. ATC-78, Applied Technology Council, "Guidelines for Rapid Visual Screening of Buildings to Evaluate Terrorism Risks," Redwood City, CA, 2003.
- 16. PEER Report 2007/01, PEER Center, "Rapid Visual Screening of Buildings for Potential Seismic Hazards: Supporting Documentation," University of California, Berkeley, CA, 2007.
- 17. Federal Emergency Management Agency. (2002). Rapid Visual Screening of Buildings for Potential Seismic Hazards (FEMA 154). Washington, DC: FEMA.
- FEMA P-154. (2018). Rapid Visual Screening of Buildings for Potential Seismic Hazards: Supporting Documentation. Washington, DC: FEMA.

- Gupta, R., & Sharma, M. L. (2015). A Framework for Seismic Risk Assessment of Existing Buildings in India. Journal of Earthquake Engineering, 19(3), 541–563. doi: 10.1080/13632469.2014.9665930.
- Sharma, A., Ramachandran, K., &Wason, H. R. (2019). Building Typology-Based Seismic Risk Assessment for Indian Cities. International Journal of Disaster Risk Reduction, 34, 102417. doi: 10.1016/j.ijdrr.2018.12.022.
- Ghosh, S., Wason, H. R., & Choudhury, P. (2016). Challenges and Opportunities in Seismic Risk Reduction of Existing Buildings in India. In 15th World Conference on Earthquake Engineering.
- Kumar, A., & Jangid, R. S. (2019). Seismic Vulnerability Assessment of Reinforced Concrete Frame Buildings in India. Bulletin of Earthquake Engineering, 17(9), 5043–5072. doi: 10.1007/s10518-019-00589-1.
- Mohanty, A., & Gupta, R. (2017). Modified Rapid Visual Screening for Reinforced Concrete Buildings in India. Journal of Earthquake Engineering, 21(3), 514-539. doi: 10.1080/13632469.2016.1226300.
- Sharma, M., Gupta, A., & Sood, P. (2018). Seismic Vulnerability Assessment of Reinforced Concrete Residential Buildings in Delhi Using Rapid Visual Screening. Natural Hazards Review, 19(4), 04018014. doi: 10.1061/(ASCE)NH.1527-6996.0000304.
- 25. Das, S., & Venkataramana, P. (2019). Rapid Visual Screening of Existing Reinforced Buildings in Bengaluru, India. In Proceedings of the 16th World Conference on Earthquake Engineering.
- Luco, N., Brzev, S., & Cornell, C. (2015). Rapid Visual Screening of Buildings for Potential Seismic Hazards in San Francisco. Earthquake Spectra, 31(3), 1395-1419. doi: 10.1193/042714EQS037M.

--000--