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ISSE

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APR - MAY - JUNE 2022

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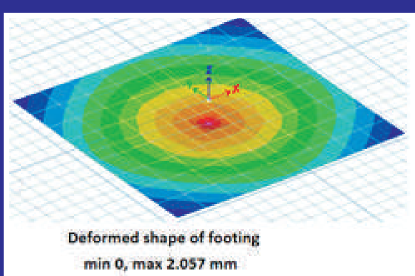

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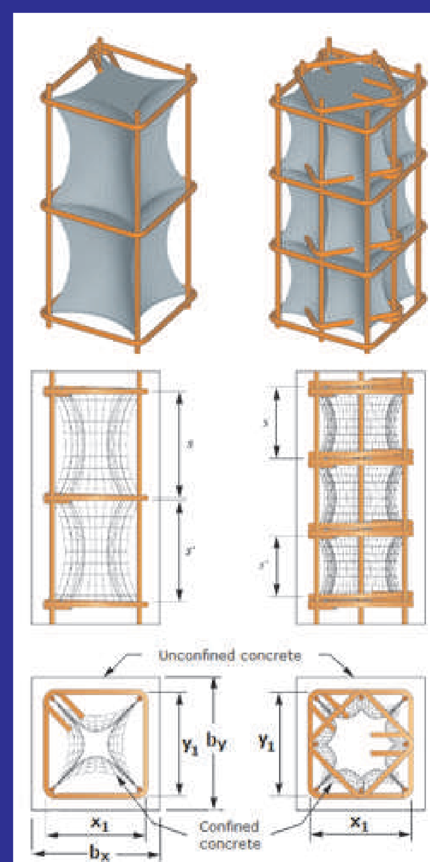

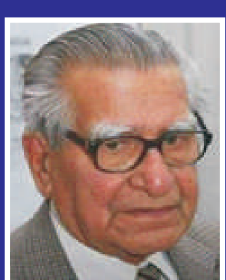

MAHENDRA RAJ

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LET US BUILD A STRONG STRUCTURE OF INDIAN SOCIETY

STRUCTURAL ENGINEERS

INDIAN SOCIETY OF STRUCTURAL ENGINEERS

ISSE

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1. To restore the desired status to the Structural Engineer in construction industry and to create awareness about the profession.
2. To define Boundaries of Responsibilities of Structural Engineer, commensurate with remuneration.
3. To get easy registration with Governments, Corporations and similar organizations all over India, for our members.
4. To reformulate Certification policies adopted by various authorities, to remove anomalies.
5. To convince all Govt. & Semi Govt. bodies for directly engaging Structural Engineer for his services.
6. To disseminate information in various fields of Structural Engineering, to all members.

FIELD OF INTEREST

- Structural; Designing & Detailing
- Computer Software
- Materials Technology, Ferrocement
- Teaching, Research % Development
- Rehabilitation of Structures
- Construction Technology & Management
- Geo-Tech & Foundation Engineering
- Environmental Engineering
- Non Destructive Testing
- Bridge Engineering

& Other related branches

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2143 Mukesh Ramsaroop Pritamdasani
2144 Krishna Kanth Gummidi
2145 Mohd. Ahteshammudin Ansari
2146 Chetan Triloknath Prajapati
2147 Ramamohana Reddy Bellum
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2149 Nikhil Vijaykumar Taori
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2159 Saurabh Vikas Tadas
2160 Satyanarayan Sahoo
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2179 M V S S Sastri
2180 Hussain Syed Mubarak Jan Jahir
2181 Suruthu Teja Venkata Narayan
Om 34 Epitome Consultacy Services
Om 35 Gahan Assoiates

Patrons : 38
Organisation Members : 35
Sponsor : 8
Members : 2181
Junior Members : 66
IM : 04
Student Members : 225

TOTAL STRENGTH : 2,557

GEM 32- PROF. P. KUMAR MEHTA – DEVELOPER OF GREEN CONCRETE AND A HUMANITARIAN

Dr. N. Subramanian, Ph.D., FNAE

Prof. P.K. Mehta (1930 - 2019)

Professor Povindar Kumar (PK) Mehta was a pioneer in the science and technology of concrete. He developed techniques of energy-saving and waste material utilization in the manufacture of cement and was a world expert in the development of "green concrete."

EARLY LIFE AND EDUCATION

Povindar Kumar was born in Nurpur, India, on August 27, 1930. His father Gurparkash Mehta was a Railway Station Master. Because of his profession, the family moved to a new city each year, and Povindar Kumar had to change schools with each relocation in Nurpur and the surrounding cities of Himachal Pradesh. Despite the transitions, Povindar Kumar excelled in academics and placed first in his class throughout grades 1 – 10. Povindar's mother, Rajeshwari Devi, passed away when he was 3 months old, and Kumar was raised by his paternal grandmother up until he entered college. His father remarried, and he was joined by 8 stepbrothers and sisters. Being in a large family, they lived simply, taking care of the necessities, with no excess or non-essentials.

After completing the 10th standard, Povindar attended the Government College in Lahore for 2 years. Although Povindar was gifted in writing and Language Arts, his teacher persuaded him to study Engineering, because he believed it would be easier to make a living in this field.

With the help of money that was saved by his maternal grandfather, along with one of the few scholarships available during that time, Povindar Kumar transferred to the University of Delhi, where he pursued and received his bachelor's degree in Chemical Engineering

Young Povindar Kumar Mehta

Other influences on Prof. Mehta's life include his near-death experiences. From the time he was born, he had experienced five close encounters with death, which had a deep effect on him. This led him to believe that God had spared his life so that he could be an instrument for serving others. Prof. Mehta felt his return from these near-death experiences was such that he could continue work to liberate the poor and uplift marginalized populations in India, and that this effort was unfinished.

TEACHING AND RESEARCH IN THE USA

Kumar Mehta moved to the United States for graduate studies. He received an M.S. degree in ceramic engineering from North Carolina State University and a Ph.D. in materials science and engineering from the University of California at Berkeley, USA.

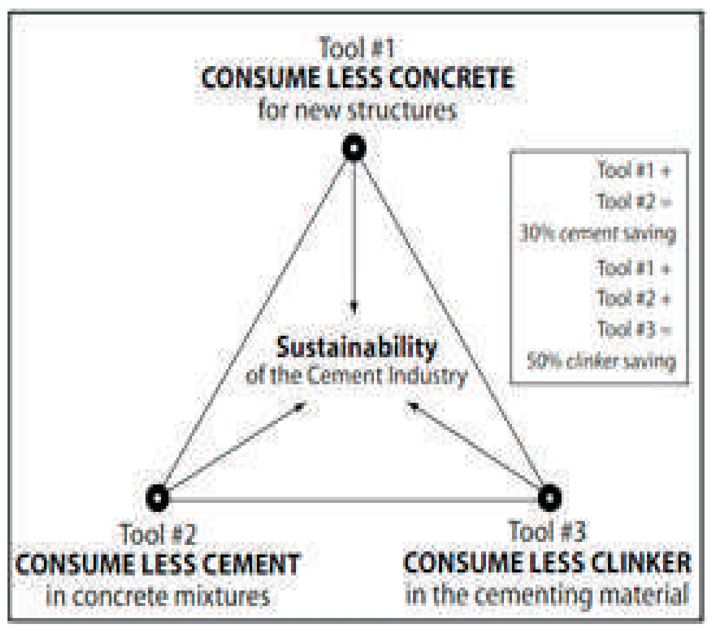
In the early '60s, Berkeley was the most exciting place in the world to study new types of cement capable of reducing cracking in concrete. Professor Alexander Klein, a civil engineer and the inventor of expansive cement (Type K, after Klein), realized that continuing progress would require deep expertise in chemistry, so he hired Dr. Mehta as a research assistant. This was an inspired decision because, for the next 40 years, Dr. Mehta was a pioneer and leader in the field of green cement and concrete.

Professor Mehta joined the Civil and Environmental Engineering at the University of California at Berkeley as a faculty in 1963 and taught in the department until his retirement in 1993, then continued as a Professor Emeritus. Prof. Mehta taught courses in civil engineering materials, advanced concrete technology, and concrete construction. While at UC Berkeley, Professor Mehta also held two administrative positions – serving as Ombudsman, and the Director of Southeast Asian Studies Abroad.

Prof. Mehta in his classroom and during his lectures

Professor Mehta was always ready to tackle challenging problems related to materials and their impact on the environment. For example, he realized that California had a massive amount of rice husks, produced during the de-husking operation of paddy rice. As they are bulky, the husks presented an enormous disposal problem for centralized rice mills. Professor Mehta discovered an industrial process to produce, by controlled combustion, very reactive ash capable of partially replacing Portland cement. This approach took care of the rice byproduct and at the same time was capable of reducing the carbon footprint of concrete. For this breakthrough, he became a hero in Asia, Latin America, and other places where there is large rice production.

The reduction of the carbon footprint of concrete became his great passion. Professor Mehta was the driving force for the development of green concrete where 50% of Portland cement is replaced by fly ash, a byproduct from the coal industry. His pioneering work modified the construction industry, and nowadays a high amount of cement replacement has become standard practice. Professor Mehta also propounded three simple tools to improve the sustainability of concrete which will reduce the cement industry's CO_2 emission to the 1990 level in 20 years.



The three simple tools propounded by Prof. Mehta to improve the sustainability of concrete

In addition to his teaching and research, he served the campus as an active member of the Academic Senate, with a total of ten years' service on five different committees.

AWARDS AND RECOGNITION

His original research was recognized with prestigious awards. On his retirement in 1993, after 30 years of teaching and research in concrete technology, Professor Mehta received the Berkeley Citation; one of the University's highest honors, the Citation recognizes those whose contributions to UC Berkeley go beyond the call of duty and whose achievements exceed the standards of excellence in their fields.

Mrs. Mehta with Prof. Mehta holding his Berkeley Citation Award

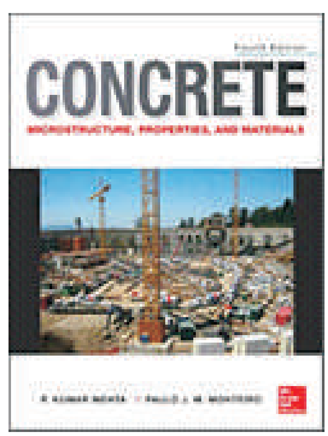
Prof. Mehta was named a Fellow of the American Ceramics Society in 1981, and in 1984, he was named a Fellow in the American Concrete Institute (ACI).

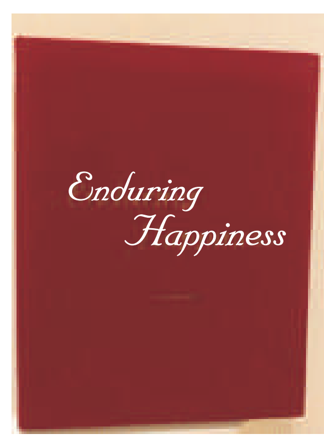
In 2006, he received a Lifetime Achievement Award from the Coal Combustion Products Partnership in recognition of his outstanding research for decades on the use of fly ash in structural concrete. In 2006, Mehta received an honorary membership to the American Concrete Institute, its highest distinction. The Institute recognized his dedicated teaching and research in concrete materials technology and his impact in inspiring the concrete industry to be sustainable. He also served as a member of the ACI Board Advisory Committee on Sustainable Development.

Prof. Mehta was the Past Chair of the ACI Commemorative Lectures Series Committee and was a member of the ACI Board Advisory Committee on Sustainable Development and ACI Committee 232, Fly Ash and Natural Pozzolans in Concrete. Mehta had received several ACI awards: In 1988, the ACI awarded Professor Mehta the prestigious Wason Medal for Materials Research, ACI Construction Practice Award in 1999, ACI/CANMET award for outstanding contributions to knowledge and understanding of physical-chemical factors influencing the performance of concrete in the marine environment, and the Malhotra Award for outstanding contributions to research on supplementary cementing materials. He has been a keynote speaker at numerous international conferences. At the Fall 2001 ACI Convention, he was invited to deliver the Tuthill Commemorative lecture on Greening of the Concrete Industry.

PATENTS AND BOOKS

Mehta holds nine patents in the area of cement and concrete technology and is the author or co-author of nearly 250 seminal archival papers on cement and concrete and many books, including the popular university textbook Concrete: Microstructure, Properties, and Materials, published by Prentice-Hall, in 1986. The book has been translated into Chinese, Japanese, Portuguese, Spanish, and Farsi. A thoroughly revised third edition of this book (coauthor P.J.M. Monteiro), containing topics of current interest in modern concrete technology, was published in 2006 and the current fourth edition in 2014. He also contributed chapters to other seminal books on the properties of concrete.



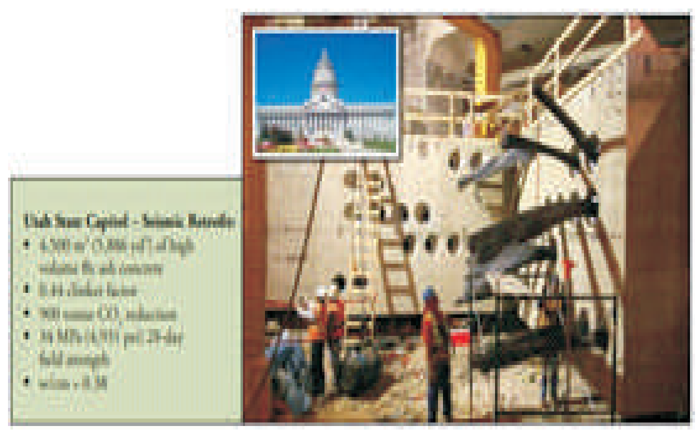


Other books authored by him are (last 2 are translations of his book on Concrete):

1. Concrete in The Marine Environment, Elsevier Applied Science, London; New York,1991.
2. Pozzolanic and Cementitious Materials with V.M. Malhotra, Gordon, and Breach, Amsterdam, The Netherlands, 1996.
3. Cement Standards, Evolution And Trends: A Symposium, St. Louis, Mo., 7th Dec. 1977, American Society for Testing and Materials, 1978.
4. High-Performance, High-Volume Fly Ash Concrete for Building Sustainable and Durable Structures, Supplementary Cementing Materials for Sustainable Development, Inc., Ottawa, Canada,2008.
5. High-Performance, High-Volume Fly Ash Concrete: Materials, Mixture Proportioning, Properties, Construction Practice, and Case Histories, with V.M. Malhotra, Supplementary Cementing Materials for Sustainable Development, Inc., Ottawa, Canada, 2002.
6. SP-144, Concrete Technology: Past, Present, and Future, Proceedings of V. Mohan Malhotra Symposium, with V.M. Malhotra, American Concrete Institute, 1994.
7. Enduring Happiness (Spiritual book he wrote and self-published to give away as gifts)
8. Hun ningtu : Wei guan jiegou, xingneng he cailiao (Chinese), Zhongguojianzhu gong ye chu ban she, Beijing, With Paulo J M Monteiro; and Dong Ouyang, 2008.
9. Concreto:estructura, propiedades y materiales (Spanish), IMCYC,México , 1998.

DESIGN OF FOUNDATIONS TO LAST 1000 YEARS

Starting in 2000 until 2011, Dr. Mehta volunteered his expertise in designing the foundation for several new Hindu temples in the US and Canada, using high-volume fly ash. He traveled to Kauaii, Houston, Atlanta, Chicago, Toronto, and Newark to lend his expertise on building foundations that are built to last 1000 years. For example, the 36 m long, 17 m wide, and 0.61 m thick foundation for the Sanmarga Iraivan Hindu Temple in the Kauai island of Hawaii, USA was designed by Dr. Kumar Mehta and is made of a crack-free, 48 MPa fly ash concrete-it was the first project to demonstrate his theories on the use of fly ash in concrete (Mehta and Langley, 2000). This technology has also been used at U.C. Berkeley's football stadium, and Barker and Seton Halls, and also in Utah State Capitol Building (Kumar and Meryman, 2009).



(a)The Chola-style San MargaIraivan Hindu Temple dedicated to Lord Shiva on the Kauai island, Hawaii, USA, (b)Utah state Capitol Building, seismic Retrofit 2006 using high volume fly ash concrete for foundations, beams, and shear walls (Source: Kumar and Meryman, 2009)

HUMANITARIAN CONTRIBUTIONS

Professor Mehta was born with a generous heart, and a kind, compassionate disposition. This inborn character was further shaped by his life events and experiences. The seed to help others began at a young age when as a teenager, he would prepare homeopathic remedies at home, to help heal others. Throughout his life, he has devoted himself to serve others, whether in teaching university students for over 30 years, setting up college scholarships for underprivileged youth, helping develop

infrastructure in villages, building temples with concrete to last 1000 years, teaching non-violent ways to promote social causes, or empowering the marginalized.

Professor Mehta was also very pious. He drew his inspiration to do humanitarian work from the great sages and masters of India - Vivekananda, Rama Krishna, and Holy Mother, who instilled in him that God is present in every human being. He truly treated everyone as though they were divine. He was guided by the ***Bhagavad Gita***, and was influenced to write a book on spirituality called "Enduring Happiness." The book is a blueprint for daily living as prescribed by the Bhagavad Gita scriptures, which Professor Mehta beautifully translated.

Professor Mehta also made numerous humanitarian contributions. Fifty years ago, he established the Front for ***Rapid Economic Advancement*** (FREA), raising funds for humanitarian causes in India. FERA identified, inspired, and recruited talented youth - mainly graduated students in the U.S. to return to India, to address sustainable development, environmental issues, job training, advancement of women, and building infrastructure in poor villages. When Professor Mehta realized that one could not initiate economic advancement in India, while living in the USA, he moved to India in 1966-68 to facilitate the work.

Over time, FREA evolved into ICA (Indians for Collective Action), which raised Eight million dollars and distributed it to over 300 charitable foundations. Each year, the ICA honored individuals who have made outstanding contributions in India. In 2015, the Amtes shared the award with Professor Thomas Kailath, the Hitachi America Professor Emeritus of Engineering at the Stanford University.

Indians for Collective Action Co-Founder Dr. P K Mehta, left, presents the award to Social Workers Dr. Mandakini and Dr. Prakash Amte

He was very generous and charitable in donating his earnings to charitable causes-and was ready to give to others whenever they needed it. When the Director of Ruchika Social Service, approached him that they would be forced to close their train platform project of educating and feeding poor children living at the railway station, he on the spot wrote her a check to keep the program running. Anytime he was approached to donate to a cause, he was ready to write a generous check. He also provided the funding to start many charities, including the Himalaya Foundation, scholarships for students in Himachal Pradesh, and the PK Mehta Fellowship at UC Berkeley.

Professor Mehta was committed to expanding the role of spiritual awareness in everyday life. With this goal in mind, in 1993, ***The Centennial of the First Parliament of Religions*** (which had been held in conjunction with the World's Columbian Exposition in Chicago Illinois), Kumar, (along with Henry Baer and Nik Warren) co-founded AHIMSA, a non-profit organization. AHIMSA was dedicated to sponsoring interdisciplinary conferences which explored global issues from a platform drawing on the spirit and practice of ahimsa. Kumar dedicated the profits from the sales of his famous textbook book on "Concrete" to support this organization.

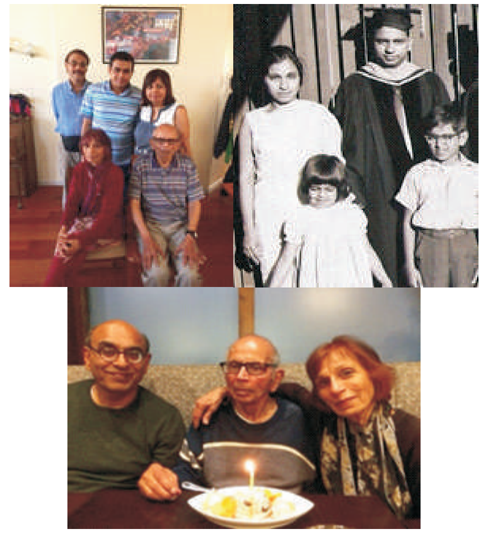
His home had the vibe of an ashram-simple, functional, and serving as a base for inner practice. Prof. Mehta also started an organization at UC-Berkeley called Ahimsa-Berkeley, dedicated to bringing together some of the senior faculty at the University (in the Humanities, Life Sciences, Physics, Ethics, Theology departments) to talk with each other. It was a remarkable idea at that time. The AHIMSA series seminars and workshops had significant influence in the Bay Area with many distinguished speakers, such as Geoffrey Chew, Marian Diamond, Michael Nagler, Swami Prabuddhananda, Ruth Richards, and Huston Smith. The desire to commit to social action continued with other charities Professor Mehta started. Fired by Swami Vivekananda's call to youth for social action, Professor Mehta established another charity with the help of Dunu Roy and Ravi Chopra - the Himalaya Foundation in the early 1990s. The organization supports the training of young men and women in rural development work - from farming to water resource management. To date, close to 50 youth have been trained to participate in rural development projects.

One of Professor Mehta's earliest projects, the Vivekananda Literacy Project, was to collect and distribute textbooks from the US, to promote literacy in India. In recent years, he set up a scholarship fund for low-income men and women in Himachal Pradesh, where he grew up. Through this project, scholarships were given to about 25 students each year, for few years.

To help educate young engineering students on the importance of sustainable materials, he generously donated to UC Berkeley to create the P.K. Mehta Fellowship. Many of the recipients of this fellowship are now in leadership positions in the industry or academemia.

HOBBIES AND FAMILY

Dr. Mehta's hobbies included hiking, painting, reading, and writing.



(a) Prof. Mehta with his wife Shanti, daughter Nita, son-in-law law Anil and Nita's son Neil,
(b) At the time of his graduation with his wife and young children
(c) (b) Prof. Mehta with his son Samir and wife Shanthi.

Professor Mehta passed away on August 7, 2019, at the ripe age of 88. He has survived by his wife Shanti, daughter Nita, son Samir, son-in-law law Anil, and grandchildren Daniel, Hannah, Neil, and Sarah.

ENCOMIUMS FROM FRIENDS AND STUDENTS

Professor Mehta inspired his students to be superb and ethical researchers. Professor Kim Kurtis at GeorgiaTech University states that "Prof. Mehta will be remembered as among the very first to 'ring the bell' about the important and vital role that concrete plays in making sustainable infrastructure. His vision has incited change in the industry and the way concrete is made around the world".

Professor Kevin J. Folliard from the University of Texas recalls that "I learned more from Prof. Mehta about life than I did about concrete. I learned about being compassionate. I learned about being selfless. I learned about being generous. Not to detract from everything I learned from him about cement and concrete, which I am eternally grateful for, having been his last Ph.D. student, I will always remember Prof. Mehta first as a great person. The impact he had on his family, his friends, and people from all walks of life are tremendous. ”

Mr. Rahul Brown said that “For a man who held 9 patents and collected royalties on his groundbreaking inventions, he never ramped up his consumption. In a culture where success is defined by a ‘winner takes all’ attitude, his example reminded us of the way of saints and Mahatmas—where ‘winners give all’.

Mr. Nik Warren said that “Prof. Kumar, in his life and actions, was deeply committed to recognizing the Gandhian principles of nonviolence (ahimsa) and the force of truth (satyagraha — literally ‘holding firmly to truth’). And he saw these principles as mutually reflecting a deeper truth; namely that we are all interconnected and interdependent, and that in being so, are unified at the deepest levels. His sense of the Common Good covered the material, social, and philosophical. At the material level, in focusing on the Common Good, he reinvented the chemistry and technology of making concrete to increase its sustainability and to reduce its environmental impact. Prof.Kumar responded to the social dimension of Common Good by offering his patents to India, and by direct social action such as restoring water tanks in Indian villages. He drew on the spiritual and philosophical grounds of ahimsa to explore how society may cultivate the Common Good”.

Mr. Tom Mahonnarrates a fascinating experience of a night when Prof. Mehta offered to be his bodyguard at an event at the Crosses of Lafayette, a hillside monument in the Bay Area to the fallen in Iraq war. As Tom began to speak, Prof. Kumar took a place in front of him as half-dozen of the angry Tea Party demonstrators came close and shouted obscenities at Tom. Then, one person put his hand on Prof. Kumar's shoulder as if to push him aside. As Tom was behind Prof. Kumar he could barely hear what Prof. Kumar said to the bully. But with that, the guy removed his arm, and walked away from the area, took his bike, and left the event. Prof. Kumar whispered a sentence or two, and the thug got on his Harley and left. It gave Mr. Tom confidence that non-violent resistance works.

Acknowledgments: The author would like to thank Prof. Paulo J.M. Monteiro and Ms. Nita Mehta for providing information and photos of Prof. P.K. Mehta.

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4. https://ce.berkeley.edu/news/2224
5. https://www.servicespace.org/blog/view.php?id=28319

About The Author

Dr. N. Subramanian,
Ph.D., FNAE, FASCE, FIE

Dr. N. Subramanian is an award-winning author, consultant, researcher, and mentor, currently based in Maryland, USA, with over 45 years of experience in Industry (including consultancy, research, and teaching). He was awarded a ‘Life Time Achievement Award’ by the Indian Concrete Institute and many other awards for his contributions towards Structural Engineering. He is the author of 26 books, including the famous books on Design of Steel Structures, Design of RC Structures, Principles of Space Structures, and Building Materials, Testing, and Sustainability.

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COMPLEXITIES IN THE DESIGN OF ISOLATED FOOTING

By Prof (Retd) M. G. Gadgil

1. Introduction

Design of foundation to transfer load from column to soil foundation below presents a very special problem to design engineer. It is an experience of almost all structural designers that though safety of structure is dependent on proper design of foundation, very little time is allotted to this task by the stake holders. Many times geotechnical data is not made available to the designer and thereby he is expected to rely on his experience to make a guesstimate of the SBC of soil and the settlement characteristics of the same. Further, using software like SAFE or ETABS make the matter more complicated as these softwares need precise numbers representing settlement characteristics of soil foundation and any approximation in this regard will lead to either an uneconomical design or an unsafe design. Attempt is made in this article to explain the interdependence of various parameters involved in the design of an isolated footing, though same concepts apply to more complex foundations like combined foundations (foundations supporting more than one column) and raft foundation.

2. Traditional design of footing from static consideration

Foundation design involves design of two parameters of RCC element, viz. plan dimension of footing (which limit pressure on soil to a desired level, say SBC of soil) and thickness of footing to resist Punching Shear and Bending Moment in footing. Traditional concepts (used before the advent of more sophisticated tool like analysis and design software) involved pressure calculation below footing using simple formula

$$\text{Pressure } p = P/A \pm M/Z$$

Where p = pressure below foundation

P = concentric load on foundation

A = Area of footing

M = moment on foundation

Z = Section modulus of foundation

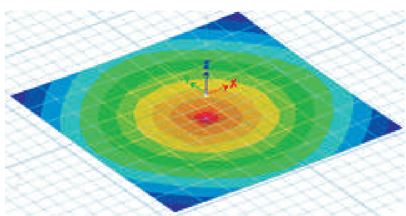
The aim was to take provide such dimension of footing so that the summation results into a number less than the SBC of soil and the subtraction does not result into a number less than 0 (no uplift). It is presumed in this formula that under concentric load, soil pressure is uniform throughout, and under Bending moment, the pressure varies linearly from one end to the other end.

If for any reason, the pressure becomes – ve, then the only option is to resize the footing so that the minimum pressure is greater than zero. Other option of carrying out analysis so that the contact area of footing is more than 70 to 80 % of the total area of footing (or any such arbitrarily selected value), this procedure is quite involved and involves some kind of approximation which may not be acceptable to all.

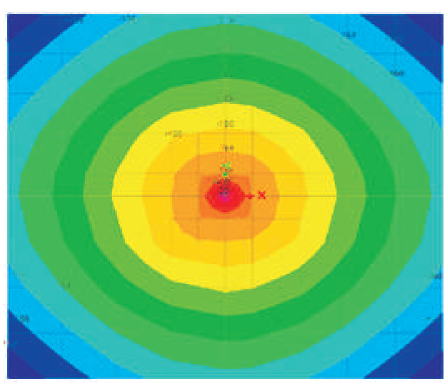
3. Development of pressure below foundation

As more and more input came from field and laboratory, it became necessary to understand the interaction between RCC footing and the soil below it representing deformable medium with complex settlement characteristics. Since long, soil has been treated as an elastic medium with Winkler type load deformation characteristics, for the design of rail which transfers load to soil through stone aggregates below the sleepers. This idealization of soil characteristics treats soil as an elastic deformable semi-infinite medium causing compatible deformation all around the loaded area.

With more sophistication in the tools of analysis, it is now realized that the elasticity of foundation also plays an important role in the development of pressure below it. Thus now, the pressure calculation involves three parameters viz. point of application and distribution of load, deformation characteristics of RCC foundation which itself is a variable, and deformation characteristics of the soil (which needs detailed geo-technical investigation) Figures below show pressure distribution below RCC footing subjected to concentric load



Deformed shape of footing
min 0, max 2.057 mm



148 < pressure < 188

The tensile behavior of concrete is modelled in a tri-linear manner. Tensile stress-strain curve starts as a linear elastic upto tensile rupture (ft). Upon reaching tensile strength, stress is reduced to 40% of ft and then followed by linear descending curve up to 0.01 MPa. The tensile strength ft is taken as per equation below:

Thickness of footing – 800 mm, size 4m x 4m, load 2730 kN (including self wt) Figure 1

4. Parameters affecting pressure below foundation

Pressure developed below foundation is affected by two important parameters

i. Thickness of structural footings
ii. Modulus of subgrade reaction of soil kN/sq m/m

It is observed, from the studies conducted here, that larger the thickness of footing more is the evening out of the pressure, thus the ratio of maximum pressure to minimum pressure reduces and in the limit should tend to 1, a uniform pressure.

On the other hand for thin footing, the pressure near point of application of load is maximum and it reduces sharply as we go away towards the edge of footing.

Table below show variation pressure below footing for various thicknesses of the footing.

Table 1

Sr No	Footing size			Pressure variation	
	B mm	D mm	t mm	p max	p min
1	4000	4000	300	319	38
2	4000	4000	400	248	42
3	4000	4000	500	214	90
4	4000	4000	600	198	118
5	4000	4000	700	191	136
6	4000	4000	800	188	148
7	4000	4000	900	187	157
8	4000	4000	1000	187	164
9	4000	4000	1250	192	177
10	4000	4000	1500	199	189
11	4000	4000	2000	213	208

It is further observed in the numerical study conducted here that pressure below Structural foundation is dependent on the characteristics of the soil foundation available below. The characteristics of soil affecting this behaviour is the Modulus of Subgrade Reaction expressed as KN/Sq M/M or kN/cu m. It is seen from the studies conducted here that larger the value of mod of subgrade reaction, more localized is the effect of load giving larger ratio of maximum to minimum pressure.

Table 2

Sr No	Footing size			Mod of sub grade reaction	Pressure variation	
	B	D	t	kN/m^3	p max	p min
1	4000	4000	500	10000	164	150
2	4000	4000	500	20000	170	142
3	4000	4000	500	30000	176	135
4	4000	4000	500	50000	188	121
5	4000	4000	500	100000	214	90
6	4000	4000	500	200000	260	42
7	4000	4000	500	500000	361	38
8	4000	4000	500	1000000	473	86
9	4000	4000	500	2000000	619	0.1
10	4000	4000	500	5000000	881	0.1

Two table given above indicate that arbitrarily selected values of thickness of footing ignorantly selected value of modulus of subgrade reaction can significantly affect design of footing and there could be wide variation in the cost of the footing.

5. Effect of modulus of subgrade reaction on pressure below foundation

A single footing of a G + 4 building with large span for beams is designed, considering initially a modulus of subgrade reaction as 50000 kN/sq m/m. Later on a parametric study was done to ascertain effect of the value of modulus of subgrade reaction on the Design of footing. This result also confirm that for very hard soil, the ratio of maximum to minimum pressure is large and the effect of load is felt locally. A stiff soil therefore gives very small moment at face of column resulting into very light design. On the contrary, for same thickness of RC footing, the pressure is felt over larger distance resulting into smaller value of pressure but larges value of moment at face of column. This will result into heavy design This study on analysis of footing is given in the table below

Table 3

Sr No	Footing size mm			Mod of sub grade reaction	Pressure variation kN/sq m		Max BM
	B	D	Thk	kN/cu m	Max	Min	kN-m
1	3000	5500	1000	10000	356	340	3713
2	3000	5500	1000	20000	364	333	3700
3	3000	5500	1000	50000	385	311	3654
4	3000	5500	1000	75000	404	295	3614
5	3000	5500	1000	100000	421	280	3572
6	3000	5500	1000	200000	488	228	3412
7	3000	5500	1000	500000	662	115	3025
8	3000	5500	1000	1000000	903	5	2610
9	3000	5500	1000	2000000	1300	0.1	2165
10	3000	5500	1000	5000000	2256	0.1	1654

6. Effect of thickness of footing on pressure below foundation

For the same footing, original design was carried out with 1000 mm thk, but later on parametric study was carried out for various thickness of footing and effect of the same is reported on the Max moment developed and the % reinforcement required to resist Maximum moment.

Table 4

			mod of subgrade reaction		100000	kN/m^3	
Sr No	Footing size			Pressure variation		Max BM	% reinf tensile
	B	D	t	p max	p min	kN-m	
1	3000	5500	300	810	0.1	1836	1.514
2	3000	5500	400	614	48	1935	0.983
3	3000	5500	500	512	151	1972	0.697
4	3000	5500	600	456	216	1987	0.502
5	3000	5500	700	424	256	1995	0.364
6	3000	5500	800	404	282	1999	0.276
7	3000	5500	900	393	299	2002	0.217
8	3000	5500	1000	386	312	2004	0.174
9	3000	5500	1100	381	321	2005	0.143
10	3000	5500	1200	379	328	2006	0.120
11	3000	5500	1300	378	334	2006.2	0.102
12	3000	5500	1400	377	339	2006.8	0.088
13	3000	5500	1500	377.3	343.4	2007.2	0.076
14	3000	5500	1600	377.9	347.3	2007.5	0.067
15	3000	5500	1700	378.8	350.9	2007.7	0.059

7. Concluding remarks

The study reported here highlights the effect of footing thickness and soil modulus of subgrade reaction on the design of footing. It is hoped that designer will be able to produce more efficient / economical design of footing and also appreciate importance of getting correct geo technical data – the modulus of sub grade reaction.

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COLUMNS ARE IMPORTANT FOR THE SAFETY OF BUILDINGS - HANDLE THEM WITH CARE

By Dr. N. Subramanian, Ph.D., FNAE

(continued from previous issue)

In multi-storey buildings, the columns at top floors will have less axial force and large bending moments whereas for the columns at bottom floors the reverse will be true. For novice designers it poses problems as the design for the forces and moments will show more reinforcement at the top storey and less reinforcement at bottom storey columns. Although codes do not prohibit providing more reinforcement at the top storey, it is better to provide the same column cross-section for 4 or 5 floors and provide the same reinforcement throughout the column. Also, restricting the column sizes to 4 or 5 cross-sections in a project will also reduce the formwork cost. The designers should always remember that optimum quantities of materials will not always produce economical RC designs.

Detailing of Columns

Although Clause 26.5.3.1 of IS 456:2000 allows 0.8 % to 6% of the gross cross-sectional area of column for reinforcement, the practical limit is 4% only. Also note that in locations, where lapping takes place, it could only be 3%. It is always better to have a minimum of 3 bars at each side of the column, although only 2 bars at each side are required as per the code.

Proper importance is not given to the shear (transverse) reinforcement in columns. Closer spacing of hoops should be provided near the column ends, where plastic hinges may form during earthquake loading. Invariably uniform spacing is provided and no control is there at the site on the spacing of these bars. Who is checking this spacing at the site? Proper spacing of ties in columns will result in the confinement of concrete within the column core and will result in better performance of the column (as shown in Fig.3).

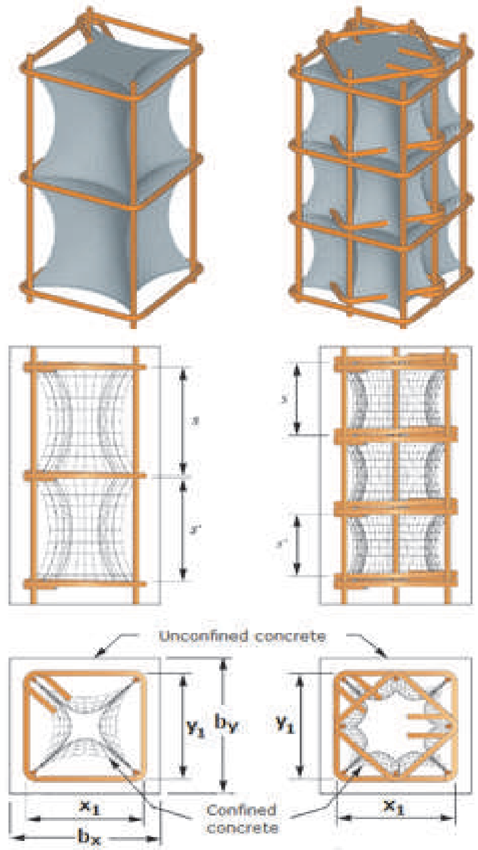

Fig. 3 Confinement of concrete in rectangular and square columns (source: Paultre and Legeron, 2008)

The transverse reinforcement requirements for columns of special moment frames as per the ACI 318:2019 code and the IS 13920:2016 code are compared in Table 1. It is seen that when the axial force level in the column exceeds 0.24 $A_g f_{ck}$ and the concrete strength exceeds 87.5 MPa, ACI code suggests considering an additional equation for determining the area of transverse reinforcement. Typical reinforcement details for the two axial force levels mentioned in the ACI 318:2019 (as per Table1) are shown in Fig. 4 (Moehle and Hopper, 2016). Figure 5 shows examples of poor, improved and well confined core of RC column, due to the arrangement of transverse reinforcement. It is seen that for better confinement, all the longitudinal rods have to be supported by closely spaced transverse reinforcement, and also the spacing of longitudinal rods should also be reduced.

In Earthquake zones, the stirrups should have 135 degree bends. Many do not do this due to the difficulty of bending and providing only 90-degree bends, which will straighten during earthquakes and cause the failure of RC columns, due o buckling of main longitudinal bars. In addition, in earthquake zones, welding of column rebars are not preferable. Welding of stirrups, ties, or inserts to longitudinal reinforcement is not permitted because cross-welding can lead to local embrittlement of the welded materials.

Table 1 Transverse reinforcement requirements for columns of special moment frames

Transverse reinforcement	Condition	Expression as per ACI 318:2019		Expression as per IS 13920:2016
$\frac{A_{sh}}{sb_c}$ for rectilinear hoop	$P_u \le 0.24\, A_g f_{ck}$ and $f_{ck} \le 87.5\, MPa$	Greater of (a) and (b)	$0.24\left(\frac{A_g}{A_c}-1\right)\left(\frac{f_{ck}}{f_{yt}}\right)$ (a)	$0.24\left(\frac{A_g}{A_c}-1\right)\left(\frac{f_{ck}}{f_{yt}}\right)$ (a)
			$0.072\left(\frac{f_{ck}}{f_{yt}}\right)$ (b)	$0.05\left(\frac{f_{ck}}{f_{yt}}\right)$ (b)
	$P_u > 0.24\, A_g f_{ck}$ and $f_{ck} > 87.5\, MPa$	Greatest of (a), (b) and (c)	$0.2k_f k_n\left(\frac{P_u}{f_{yt}A_c}\right)$ (c)	-
$\rho_s = \frac{4A_{sh}}{sD_c}$ for spiral or circular hoop	$P_u \le 0.24\, A_g f_{ck}$ and $f_{ck} \le 87.5\, MPa$	Greater of (d) and (e)	$0.36\left(\frac{A_g}{A_c}-1\right)\left(\frac{f_{ck}}{f_{yt}}\right)$ (d)	$0.36\left(\frac{A_g}{A_c}-1\right)\left(\frac{f_{ck}}{f_{yt}}\right)$ (d)
			$0.096\left(\frac{f_{ck}}{f_{yt}}\right)$ (e)	$0.096\left(\frac{f_{ck}}{f_{yt}}\right)$ (e)
	$P_u > 0.24\, A_g f_{ck}$ and $f_{ck} > 87.5\, MPa$	Greatest of (d), (e) and (f)	$0.35k_f\left(\frac{P_u}{f_{yt}A_c}\right)$ (f)	-

A_c = area of confined concrete core, measured to its outer dimensions = $\frac{\pi D_c^2}{4}$ for circular columns, A_g = gross area of column cross-section, b_c = longer dimension of rectangular hoop measured to its outer face, which should not exceed 300 mm, D_c = diameter of core of circular column measured to outside of spiral/hoop, f_{ck} = characteristic compressive strength of concrete cube, f_{yt} = 0.2% proof strength of transverse steel reinforcement, $k_f = f_{ck}/215 + 0.6 \ge 1$, $k_n = \frac{n_l}{n_l - 2}$, n_l = number of longitudinal bars around the perimeter of a column core that are laterally supported by the seismic hooks, and s =pitch of spiral or spacing of hoops.

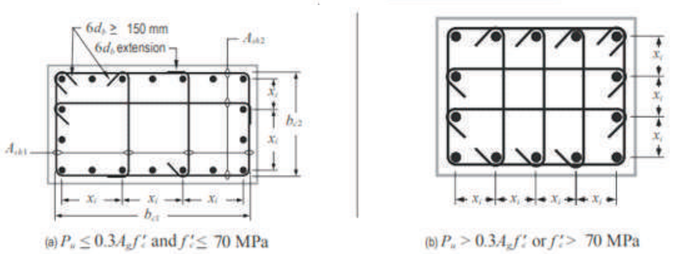

Fig. 4 Column transverse reinforcement detail as per ACI 318 Clause 18.7.5.2(Source: Moehle and Hopper, 2016)

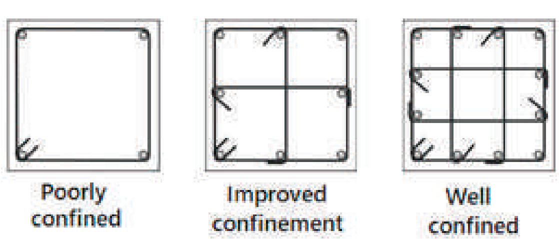

Fig. 5 Poor, improved and well confined core of RC column

The lap length of the longitudinal bars of columns is also treated at site similar to that of transverse reinforcement and normally unchecked. In addition, IS 13920:2016 recommends that lap splices shall be provided only in the central half of columns in seismic zones and should be provided as a tension splice. The spacing of transverse reinforcement is also limited to 150 mm over the splice length. Lapping is prohibited for bars larger than 32 mm and hence mechanical splices should be used (clause 26.2.5.1 of IS 456). SP 34-1987 suggests that the horizontal thrust for which the stirrups are to be designed is 1.5 times the horizontal component of the nominal force in the inclined portion of the bar (see Fig. 6 and also Fig. 7.9 C and 7.9 D of SP 34). Not more than 50% of the longitudinal bars should be lapped at a given section. It is better to use mechanical couplers (IS 16172:2014), as they will be economical and reduce congestion of rebars. In how many places "only 50% of the vertical rebars are to be curtailed at a section" rule is followed? Even when using couplers, adjacent couplers should be spaced at least 300 mm away.

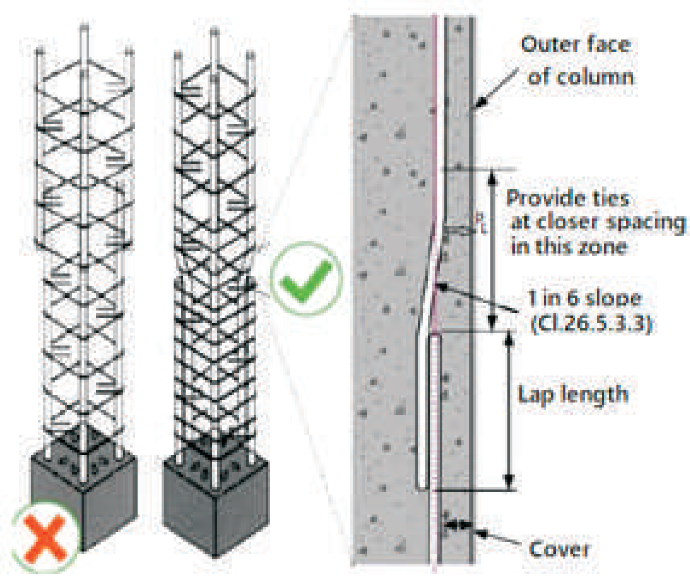

Fig. 6 Splicing/lapping of column bars Beam-column or Slab-column Joints

These are important locations and have to be detailed and concreted properly. Normally, these joints are not provided with properly designed and detailed transverse reinforcement and most often do not have any ties at all (Subramanian, 2015). Typical well designed and detailed interior and exterior joints are shown in Fig. 7 and 8. These joints are also not concreted properly due to the congestion of rebars; use of self consolidating concrete will solve this problem. Steel Fibre Reinforced Concrete (SFRC) can also be used to increase hoop spacing and to provide higher shear resistance (Gefken and Ramey, 1989). It is important that each vertical bar is having a tie or loop. Use of hooks often results is congestion of reinforcement in the joint. ACI 318 allows the use of headed bars, as shown in Fig.9, which will ease the congestion (Subramanian, 2013).

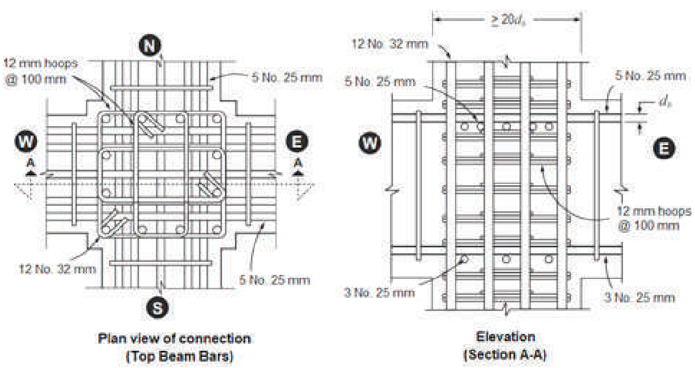

Fig. 7 Example of typical interior joint detailing (Adapted from Moehle and Hopper, 2016)

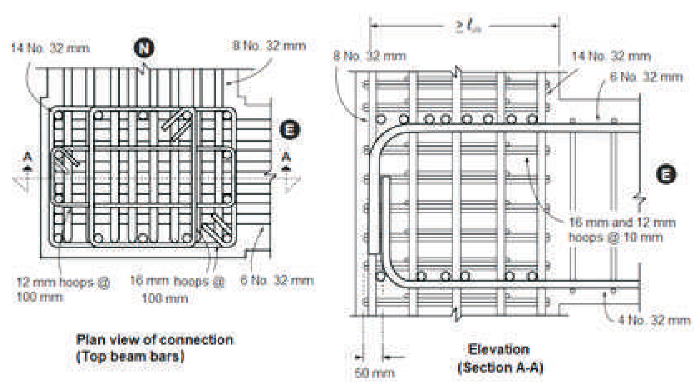

Fig.8 Example of typical exterior joint detailing (Adapted from Moehle and Hopper, 2016)

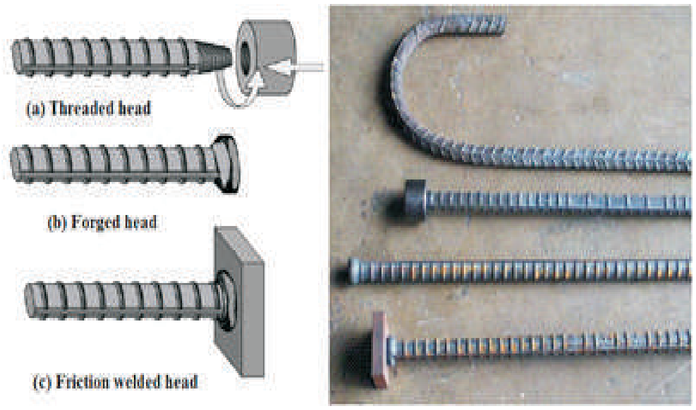

Fig. 9 Types of headed bars

Normal Strength Concrete Slabs and High Strength Concrete Columns

When using High Strength Concrete in columns (to reduce the column sizes and to increase the carpet area) and Normal Strength Concrete in slabs [it may not be economical to use concrete of strength more than M30 in slabs and normal length beams (say up to 4 m)], one has to be careful while concreting. Only ACI 318-19 provides guidelines for this situation. Subramanian, 2020, discussed these three provisions given in the American code and also provides an expression for calculating the equivalent strength of such slab-column joints.

SUMMARY AND CONCLUSIONS

Columns are important elements in any building or structure as they transmit the applied loads to the foundation. Even the failure of one column may lead to progressive collapse, and the collapse of the whole building/structure. Hence, reinforced concrete columns have to be properly located, analyzed, designed, detailed, executed, and cured properly at site. But it has been found that RC columns are not given proper importance and care during the different phases, mentioned as above. Hence, an attempt is made to identify these abuses and solutions are proposed, which when practiced in the design offices and at site, will result in columns, which will perform well even during excessive loadings, such as those occurring during earthquakes.

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PERMISSIBLE SETTLEMENT OF SHALLOW FOUNDATION

By Shekhar Vaishampayan

In overall design process of any structure, analysis of structure is an important step. In this step, structural designer visualises the likely behaviour of proposed structure and makes assumptions compatible with the same. Results of analysis allows designer to select appropriate materials, suitable factor of safety and design structural elements. Structural design of foundation elements additionally requires geotechnical inputs, namely net safe bearing capacity and permissible settlement.

Geotechnical design of foundation is controlled by two necessary criteria. Foundation must have enough factor of safety against shear strength failure (Safe Bearing Capacity), which relates to strength of founding stratum (soil/rock) and secondly gross and differential settlements must remain in permissible limits (Allowable Bearing Pressure), which relates to serviceability of structural foundation. Smaller of these two in magnitude is used in design and is called Safe Bearing Pressure.

In addition, foundation system must perform satisfactorily for the design life of structure. This aspect relates to durability of foundation, in which both structural foundation and founding stratum must sustain the detrimental changes in environment, if any.

In the following note, we will go through process of defining permissible magnitude of settlement.

Whenever a structure is constructed, we change the naturally existing equilibrium of sub surface stratification. If the effective stress increases, founding stratum below structural foundation will undergo deformation. This vertical downward deformation of ground (founding stratum-Soil or rock) is defined as settlement. It is also implied that on reduction of stresses (say excavation for foundation), founding stratum may move upwards which is called heaving.

Settlements are results of following causes. These are listed below.

1. Settlement of foundation on application of static and dynamic loads
2. Deterioration of foundation due to corrosive environment
3. Shrinkage & swelling of soil and resulting upheaval for foundations
4. Squeezing of soil below foundation due to repetitive loading
5. Subsidence due to void/cavity formation below foundation due to either by natural forces or by human intervention.
6. Sudden loss of support caused by Liquefaction of soil in earthquake of significant magnitude
7. Creep of founding stratum

Settlements caused by reasons from second to seventh are of larger magnitude and they mostly result in disastrous consequences. For the purpose of this review, only the first cause is considered, i.e., settlements resulting on application static loads on founding stratum.

Available/established relations used for estimation of settlement are mostly defined for saturated soils. For partially saturated or unsaturated soils, soil behaviour is not well defined. In case of coarse-grained soil with high permeability, behaviour remains to be mostly elastic as pore water dissipation is instantaneous. Load transfer in these soils is from particle to particle.

For fine grained soils with low to very low permeability, pore pressure dissipation is slow to very slow. Unless water is squeezed out of soilr is system by application of sustained loading, settlement will not occur. Therefore, the settlement becomes time dependent.

In case of soils having organic content, creep settlement happens which is also time dependent. This can become important if organic soil laye present well below accessible depth of excavation. In such cases, replacement of organic content from soil becomes necessary.

Settlement can be uniform as well as differential. Uniform settlement can happen if large area or locality undergoes subsidence due to lowering of ground water table such as in case of Mexico City. It could also be large area treated by stone columns on which very large fuel tanks are placed. In such cases, structure do not get distressed but facilities like plumbing, sewerage as well as electrical and air conditioning facilities will require repeated maintenance or replacements

.

Factors Governing Settlement

1. Type of structure (having different spans and loading intensities): Residential, Commercial, Industrial, Hospitality, Educational, Public Utility, etcetera.

2. Material of Construction (having different stress strain characteristics): RCC, Steel, Timber, Composite

3. Functional requirement: Glass façade, Printing Press, extremely sensitive equipment like MRI or Cat scan machines etcetera

4. Type of loads: Static, Repetitive, Vibration, Impact

5. Life of structure: Temporary, Permanent (30 yrs., 100 yrs., duration of lease,)

6. Founding stratum: Clay, Sand, Rock

7. Foundation Type: Footing, combined footings, Raft, pile & caissons

To make a reasonable estimate of likely settlement that proposed structure will undergo under different loading conditions, following parameters are extracted from geotechnical investigation data.

Width of Foundation which defines depth of influence zone

Thickness of Compressible Stratum in the sub surface stratification thickness of stratum which will contribute to settlements up to maximum depth of two times foundation width.

Shear Strength: indicated by SPT **N** Value or Cone penetration resistance recorded in SCPT in terms of **C** Cohesion, ϕ Angle of Internal Resistance, γ Bulk Density. Compressibility Parameters : **Cc** compressibility Coefficient, $\mathbf{m_v}$ volume compressibility coefficient from consolidation test, **C** in De Beers Equation,

Elastic Parameters: **E** Youngs Modulus, μ Poisson's ratio,

Methods of Estimating Settlements

Estimation of settlements is done by two sets of methods. For partially saturated /saturated but quick draining soils, immediate settlements are calculated for immediate/elastic settlement. For slow draining soils, time dependent consolidation settlement is calculated.

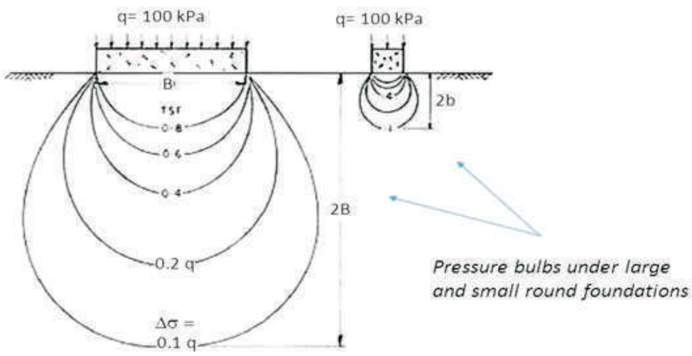

Fig 1.0: Pressure Bulb

Basic equation for immediate settlement is equation used in Hooks Law δ = QL/AE or plate Load Test δ = Q B (1-μ^2) I / E. This equation has been modified from time to time to accommodate influence factors derived from theory of elasticity or findings of different researchers. These equations are listed below.

Immediate Settlement (Based on Plate Load Test)

As per IS Code 8009 (Part I)-1976

$$\Delta H = \frac{qH(1-\mu^2)l_f}{E}$$

Timoshenko and Goodier Method

$$\Delta H = q_0 B' \left(\frac{1-\mu^2}{E_s}\right)\left(l_1 + \frac{1-2\mu}{1-\mu} l_2\right) m l_f$$

Modified Schmertmann Method

$$S_i = C_1 C_2 \Delta p \sum_{i=1}^{n} \left(H_i \left(\frac{I_z}{XE_i}\right)\right)$$

Peck and Bazaraa method

$$S = C_w C_D \frac{2p}{(N_1)_{60}} \left(\frac{B}{B+0.3}\right)^2$$

Burland and Burbidge Method

$$S = f_s f_l f_t \left[\left(q' - \frac{2}{3}\sigma_0'\right) B^{0.7} I_C\right]$$

Other set of equations used are to determine the time dependent settlement for slow draining soils, which are similar to consolidation equation derived by Karl Terzaghi.

$$\frac{\partial u}{\partial t} = c_v \frac{\partial^2 u}{\partial z^2} = \frac{k}{\gamma_w m_v} \frac{\partial^2 u}{\partial z^2}$$

Changes in basic equations are to accommodate mixed soil (C-Phi) and meant for large rafts.

Consolidation Settlement (As per Terzhaghi)

DeBeer's method

$$\Delta H = 2.303 \text{ x } H/C \text{ x } \log[(Po+\Delta P)/Pc$$

Hough Method

$$\Delta H = H_i \left(\frac{1}{c}\right) \log_{10}\left(\frac{\sigma_0' + \Delta\sigma_v'}{\sigma_0'}\right)$$

Acceptable Settlement Defined

Considerable amount of work has been done for developing methods to predict or estimate magnitude of settlement, but limited work has been done in determining acceptable value or magnitude of settlement.

Structures vary from each other in concept and detailing as well as functions they serve. Therefore, it becomes difficult to lay rules for permissible settlements, lateral movements, angular rotations, or relative rotations. Moreover, serviceability is subjective and depends on both functions it serves and risk perceptions of users.

Performance of structure may not be as assumed at conceptual stage in design. Different construction materials behave differently in real time and analysis of complete structure with composite materials including founding stratum is exceedingly complex. Deformations and deflections of structural frame will occur as response to applied loads.

However other factors such as temperature, shrinkage, creep will also contribute. Relative magnitudes of these can not be separated and monitored in real time performance of structures. Major structural distress at working static loads is due to differential settlements even at relatively smaller magnitudes of settlements.

Therefore, there is tendency to assume that settlement/heave of foundations are the major contributing factors and if we can keep foundation settlements in permissible limits, structure will perform satisfactorily.

Conventionally all footings are designed and placed at same level. If structure is founded at a given reduced level, then shear strength of founding stratum at each point over full plinth area will not be the same.

Selected design SBP value is the characteristic strength of soil mass of project site under consideration. Design SBP value ensures that gross settlement is within permissible limits

Structure when loaded to nearly same loading intensity will still settle differently under different footing in such case. These different values of settlements must remain within tolerance of relative rotation of structure.

If structure settles uniformly, there may not be significant structural distress. But connections and services will be affected. On other hand, whenever structure settles non-uniformly and relative rotation become significant, structural distress will become apparent, visible, be seen.

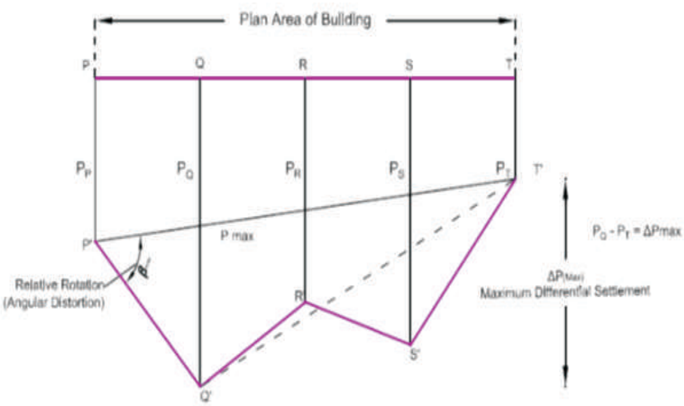

Fig 2.0: Relative Rotation of Footing

It is observed by early masters of geotechnical engineering that structure founded on sand rarely settled more than 40 mm. About 75 percent of total settlement (25 mm) was taken as permissible differential settlement for satisfactory performance.

These values defined the relative rotation values. In clays these values were higher. These were used as basis of developing acceptable values of settlements.

IS codes are not very explicit about serviceability criterion. One of the best sources is Eurocode 7: BS EN 1997-1:2004 wherein settlement magnitude is defined by serviceability criterion of structure & foundation movement.

a. The relative rotation of foundation that is likely to cause an ultimate limit state of foundation serviceability is about 1/150 (0.0067L)

b. Range of the maximum acceptable relative rotations from about 1/2000 (0.0005L) to about 1/300 (0.0033L).

c. A maximum relative rotation of 1/500 (0.002L) is acceptable for most of the structures

For normal structures with isolated foundations, total settlements up to 50 mm are often acceptable. Larger settlements may be acceptable provided rigorous settlement analysis is carried out and it is shown that the relative rotations remain within acceptable limits and provided the total settlements do not cause tilting etc. Such allowable bearing pressure values must not be greater than safe bearing capacity.

Standard values should not be applied to buildings or structures, which are out of the ordinary or for which the loading intensity is markedly non-uniform. To estimate likely magnitude of settlements with higher degree of confidence, more geotechnical data is required, which is obtained from location specific, focused objective defined geotechnical investigation.

Permissible Settlement (IS 1904-2021)

Table 1: Permissible Settlement for Shallow Foundation (Isolated Footing) in Soil

Sr No	Type of Structure	Isolated Footing					
		Sand and hard Clay			Plastic Clay		
		Maximum Settlement (mm)	Differential Settlement (mm)	Angular Distortion (mm)	Maximum Settlement (mm)	Differential Settlement (mm)	Angular Distortion (mm)
i	For steel structure	50	0.0033L	1/300	50	0.0033L	1/300
ii	For reinforced concrete structure	50	0.0015L	1/666	75	0.0015L	1/666
iii	For multi storeyed building a) RC or steel framed building with panel walls	60	0.002L	1/500	75	0.002L	1/500
	b) For load bearing wall 1) L/H = 2	60	0.0002L	1/5000	60	0.0002L	1/5000
	2) L/H = 7	60	0.0004L	1/2500	60	0.0004L	1/2500
iv	For water tower and silos	50	0.0015L	1/666	75	0.0015L	1/666

Table 2: Permissible Settlement for Shallow Foundation (Raft Footing) in Soil

Sr No	Type of Structure	Raft Footing					
		Sand and hard Clay			Plastic Clay		
		Maximum Settlement (mm)	Differential Settlement (mm)	Angular Distortion (mm)	Maximum Settlement (mm)	Differential Settlement (mm)	Angular Distortion (mm)
i	For steel structure	75	0.0033L	1/300	100	0.0033L	1/300
ii	For reinforced concrete structure	75	0.0021L	1/500	125	0.002L	1/500
iii	For multi storeyed building a) RC or steel framed building with panel walls	75	0.0025L	1/400	125	0.0033L	1/300
	b) For load bearing wall 1) L/H = 2	–	–	–	–	–	–
	2) L/H = 7	–	–	–	–	–	–
iv	For water tower and silos	100	0.0025L	1/400	125	0.0025L	1/400

For intermediate ratio of L/H the value can be interpolated.
L – denotes the length of deflected part of wall/raft or center to center distance between columns.
H – denotes the height of wall from foundation footing

Permissible Settlement (IS 13036-1991)

Table 3: Maximum and Differential Settlements of Building on Rock Mass

Sr no	Type of structure	Maximum Settlement (mm)	Differential Isolated Footing (mm)	Settlement raft foundation (mm)	Angular Isolated Footing	Distortion Raft Foundation
i	For steel structure	12	0.0033L	0.0033L	1/300	1/300
ii	For reinforced concrete structure	12	0.0015L	0.002L	1/666	1/500
iii	For plain brick block walls in multistoried buildings	12				
	a) For L/H<3	12	0.00025L	–	1/400	–
	b) For L/H>3	12	0.00033L	–	1/300	–
iv	For water tower and silos	12	–	0.0025L	–	1/400

Note: The values given in the table may be taken only as a guide nd permissible settlement and differential settlement in each case should be decided as per requirement of designer depending upon importance of structure.

L – denotes the length of deflected part of wall/raft or center to center distance between columns.
H – denotes the height of wall from foundation footing

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ISSE Event

ISSE will be organizing an event on 5th Aug 2022 at 6 PM at Sasmira Auditorium, Worli, Mumbai for ISSE book publication on "Performance Based Design" and publication of booklet on Wind code IS875 (Part3) by Dr. SureshKumar along with technical lectures. All are requested to attend in person or via online mode.

NEWS AND EVENTS DURING APRIL TO JUNE 2022

by Hemant Vadalkar

22 Apr 2022 : ISSE Navi Mumbai centre along with Ultratech Cement arranged technical lecture at Belapur. Chairman Navi Mumbai centre Er. Mohan Dagaonkar welcomed all. Hemant Vadalkar gave brief information about the functions of ISSE. Er. Shekhar Vaishampayan, a geotechnical consultant delivered a lecture on "Deep Excavations in Metro cities" with case studies. Type of shoring systems for different applications like retaining walls, sheet piles, touching piles with or without anchors, diaphragm wall, secant piles were discussed. The lecture was well appreciated by engineers in the region. Ultratech representative elaborated various products available for repair and architectural concrete for various paving applications. Function was attended by more than 100 engineers.

26-27 April 2022 : Steel day was celebrated in Mumbai by MX media. All the stalwarts in the steel industry attended the event and made presentations on various type of structures like buildings and Industrial structures. All steel manufacturers, contractors, architects and consulting engineers attended the event in large number.

30 April 2022 : Epicons friends of concrete arranged a webinar on " Pile foundation – pile termination criteria and testing". Geotechnical consultant Shekhar Vaishampayan delivered a lecture touching all aspects of pile , termination criteria and testing methods.

April 2022 :

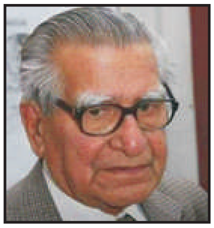
Our regular contributor,

Dr. N. Subramanian, Ph.D., FNAE,

elected as Honorary Fellow of AStructE Considering the outstanding achievements in the field of structural engineering and further recognizing his contribution to the Association's activities, the Governing Council of Indian Association of Structural Engineers (IAStructE) at its 97th meeting held on 25th February 2022, unanimously elected Dr. N. Subramanian as a 'Honorary Fellow' of IAStructE. Honorary Fellow is the highest recognition given by an Association to a person of eminence, who has performed extraordinary meritorious service to the Association. He was also recently awarded the Gourav Award for his significant contributions to the Civil Engineering Profession by the Association of Consulting Civil Engineers (India).

5-6-7 May 2022 : iDAC Exhibition and conference was held in Mumbai at Jio Convention Centre in BKC. Various architectural, interior products were showcased. Lectures in parallel sessions were arranged on various topics like interior, building services, tall building, façade, HVAC , structural and repairs.

8 May 2022 :



Structural Engineering Legend Mahendra Raj passed away this morning. His contribution to the World of Structures in Post Independence India has been phenomenal. Mahendra Raj served the profession for more than seven decades. A Book named Structures of Mahendra Raj penned by his son tells about his excellence in design and outstanding structures created by him. He designed the first skyscraper in India, with shear walls and designed several amazing structures. He was also responsible for starting several associations, especially for consulting engineers. Many civil engineers will be inspired by his work. ISSE Salutes the Legend.

20 May 2022 :

Er. S D Limaye , an outstanding structural engineer and bridge expert passed away. He worked with Konkan Railway as Chief Engineer and was a very dynamic person in making the quick decisions and finding solutions to practical problems. He was a Director with Balaji Railroad Systems Private Limited for last decade and advisor to Pune Metro. We lost a great personality. ISSE group salutes the great engineer.

20 May 2022 : Online Lecture on Steel bridges was arranged by IIBE on the topic "Design of open web girders including prestressing". The lecture was delivered by Er. R. K. Goel, Chief Engineer Western

Railways. He touched upon the basic concept of steel bridge design , Indian Railway bridge design code, load calculations, how Camber is provided during fabrication and prestressing can be done by shortening bottom chord of truss, site fabrication and erection issues and quality control measures. The lecture was very interesting for the concept of prestressing in steel truss bridge which reduces forces and deflection on the application of live load like train load.

21 May 2022 : Epicons friends of concrete arranged webinar on "Design and detailing of coupled shear walls" by Prof. Dr. Yogendra Singh of IIT Roorkee. He elaborated modelling, analysis , design and detailing of coupled shear wall. Behaviour of coupling beam was explained based on various codes like Indian and American codes of practice and actual site photographs.

May 2022 : Epicons Consultants Pvt. Ltd., under leadership of Mr. Jayant Kulkarni was conferred with 'Certificate of Merit' from Jamnalal Bajaj Council of Fair Business Practices, Mumbai. This award was given in the hands of Ms. Zarin Daruwala – CEO, Standard Chartered Bank. Whereas the selection committee was headed by Shri. Krishna – retired chief justices.

This is a very prestigious recognition by the Council formed by Late. Shri. Jamnalal Bajaj disciple of Mahatma Gandhi in 1988. (The applications are invited in three categories from Companies all over India.

1) Manufacturing Enterprises
2) Trade & Service Enterprises
3) Charitable Associations)

This award is based on following criteria:

1) Customer Satisfaction
2) Customer Communication
3) Employee Motivation
4) Supply Chain System
5) Environment Protection
6) Corporate Social Responsibility
7) Compliance with law
8) Adherence to the CFBP Code of Conduct

Special features / contribution of Epicons Consultants as compare to other organizations was:

a) Continuous efforts for training through Epicons Friends of Concrete
b) Fulfillment of Social Responsibility through We Need You – Charitable Trust

'Certificate of Merit' was received by Management team of Epicons.

29 May 2022 : ISSE Baramati Local centre was inaugurated by Dy. Chief Minister Shri Ajitdada Pawar. Chairman Pune District centre Er. Dhairyashil Khaire Patil was present on the occasion along with ISSE committee members from Pune. ISSE Baramati office bearers were felicitated during the function which includes Er. Shamrao Raut - Chairman , Er. Suraj Chandgude-Secretary and Er. Mayur Tade - Treasurer. ISSE team members appreciated help from Hon. Minister in the modification of certificate formats in UDCPR of Maharashtra as per ISSE suggestions and put forward their views regarding problems faced by Structural Engineers. It was informed that civil and structural engineers were harassed by various authorities in case of any accident at construction site or building collapse. Hon. Minister assured help by calling a meeting of all concerned departments. The function was attended by engineers in the region.

June 2022 : Dr. Mangesh Joshi received CE&CR award for Bridge Retrofitting work.

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