STRUCTURAL ENGINEERING

QUARTERLY JOURNAL OF
INDIAN SOCIETY
OF
STRUCTURAL ENGINEERS

ISSE

VOLUME 12-3

Jul-Aug-Sep-2010

PALAIS ROYALE – A TREND SETTER

(See page 3 inside)

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VOLUME 12-3, JUL-AUG-SEP 2010

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ORGANISATION MEMBER

OM-15 Soft Tech Engineers (P) Ltd.
OM-16 Outokumpu India Pvt. Ltd.

REVISED STRENGTH AS ON 30-9-2010

Patrons : 29 Organisation Members : 16 Sponsors : 8
Members : 1048 Junior Members : 9

TOTAL STRENGTH : 1110

AIMS & OBJECTIVES

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 organisations 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.

FIELDS CONSIDERED AS ASPECTS OF STRUCTURAL ENGINEERING

- ❄ 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

PALAIS ROYALE – A TREND SETTER

Girish Dravid & Dr. Deepali Hadker

INTRODUCTION :-

Palais Royale (pronounced as pa-lai ro – yaal) In French means a Royal Palace. This is a high- end residential complex being built in Mumbai. Situated at Worli Naka, this building with a height of 295 m above the ground level has a total structural height of 325 m from the button of the foundation to the top of the elevation cap. The base dimensions of the octagonal prismatic building are 84 m x 86 m. The construction area of the building is over three million sq. ft. with 88 slabs.

STRUCTURAL SYSTEMS:-

The residential levels have been provided with a conventional column / beam and solid slab configuration. Presence of an atrium following the principles of Vastu Shastra has provided the structural advantage of a stable form.

TRANSFER LEVEL:-

In order to transfer the loads of the 244 residential columns to the foundation through the 88 lower columns, transfer girders are provided at + 76 m level. The depth of these RCC girders is 9 m and the widths are varying from 1200 mm to 1500 mm as per the design and bearing requirement.

THE PARKING AND AMENITY LEVELS:-

The structural system below transfer girder level comprises predominantly of post Tensioned Flat Slabs except in the central rectangular area called the Brahmasthan. This 25 m x 22 m area is framed by strong post – tensioned beams. The amenity areas carry huge loads, the average intensity of the superimposed loads (SDL + LL) being as high as 35 kN/sq.m at the swimming pool level. The parking levels are designed for the possibility of double stacked parking. Seismic design is corresponding to Earthquake Zone III aimed at operational level performance – maximum allowed drift ratio being 1000 and acceleration in wind limited to 5 milli-g .

WIND TUNNEL TESTS:-

Wind tunnel tests by RWDI showed that for a 10 year return period the Total Peak Acceleration in simulated wind conditions was 7.2 milli – g- against the criteria of ISO 10137: 2007 of 14 milli – g (extrapolated from the criteria for 1 to 5 year return period to 10 year return period).

A Graphical View of Palais Royal

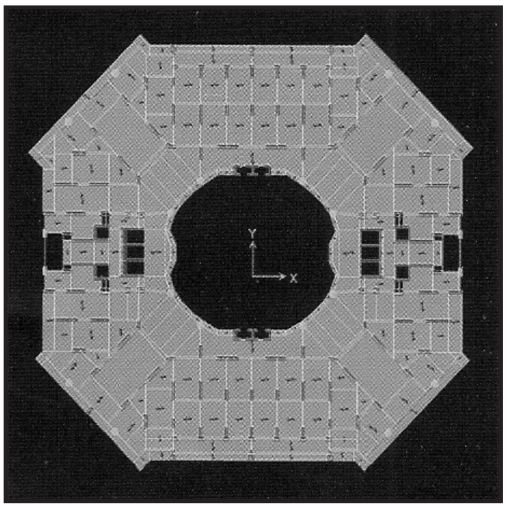
SOIL PROFILE:-

Soil consultants estimated a safe bearing pressure of 150 T / sq . m with settlement less than 25 mm. Modulus of sub – grade reaction of 6500 T/m3 was recommended for the design of raft foundations . Cross – hole velocity tests yielded average values of Poisson's Ration , Young's Modulus and shear Modulus as 0.32 , 5200 Mpa and 200 Mpa respectively showing excellent characteristics of the rock profile . Due to presence of weak soil for the upper 8 to 9 m, soil retention system was installed in the form of contiguous concrete in – filled tubular steel piles, held to the bedrock. During the excavation for the deep foundation shoring piles were installed with inclined pre – stressed rock anchors.

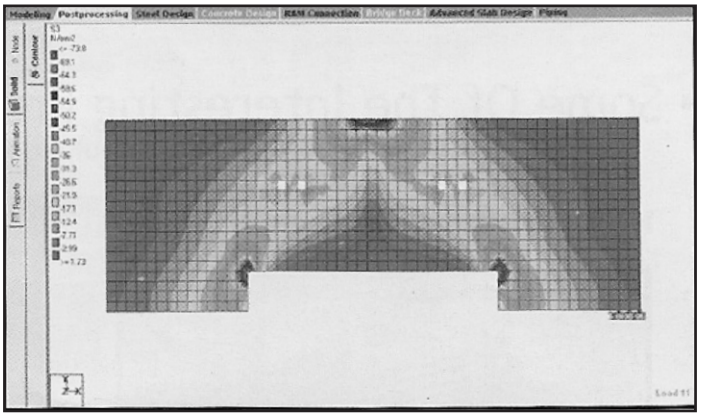
COMPUTER MODEL:-

A combination of shell diaphragm and membrane diaphragm was chosen to simulate framing conditions of the structure, in order to optimize the run time and the computer memory. The flat slabs at the parking and amenity levels have been treated as shell elements contributing to the lateral stiffness.

At the residential levels, the lateral resistance is derived from the beams / column frame action. Hence, the diaphragm is modeled as a membrane Cracked section properties were assigned in accordance with the code recommendations. The foundation raft was analyzed in SAFE, using the reactions obtained from the Etabs Analysis.



Plan View of Palais Royale



Principle stress 53 pattern for dead and load in a grider

RESULTS OF THE ANALYSIS:-

Considering the overall maximum lateral deflection of the building being only 300 mm occurring at the top level, the general performance of the building is well controlled. The massive proportions and the enormous stiffness of the building are evident from the modal frequencies found to be 0.1206 Hz for Model 1 in Y direction, 0.1349 Hz for Model 2 primarily in X direction and Model 3 showing 0.155 Hz primarily in Z direction as torsion. Fortunately, differential elastic shortening of columns and shear walls due to vertical loads was not found to be significant.

ANALYSIS OF TRANSFER GIRDERS:-

The transfer girders were analyzed by Solid Finite Element Method. Both individual girder models and integrated layout model involving all girders and the three floor levels within the girder depth were assembled in STAAD – pro. The stress patterns clearly indicated that the girders acted in conformity with strut-tie model corresponding to deep beam action. In-depth research was carried out to design the girders, which are probably the largest transfer girders being constructed in the world.

CONCRETE INFORMATION:-

M: 80 and M: 60 grades of concrete have been used for columns/ shear walls and beams / slabs respectively. With the help of an elite team of concrete expert, concrete manufacturers, admixture vendors, contractor's engineers and batching plant operators, innumerable trial mixes were tested for various performance criteria. Eventually, M: 80 SCC was finalized with free water cement ratio of 0.225 and free water binder ration of 0.23. With 450 kg cement content and 168 kg/cu.m fly ash, the target strength was 90 N/sq.mm. Micro silica content was tried starting from 0% and was varied up to 10% to examine the performance. The design was finalized with 5% i.e.23 kg/cu.m content. Minor adjustments are carried out for aggregate quality variation and moisture content on a routine basis.

CONSTRUCTION METHODOLOGY:-

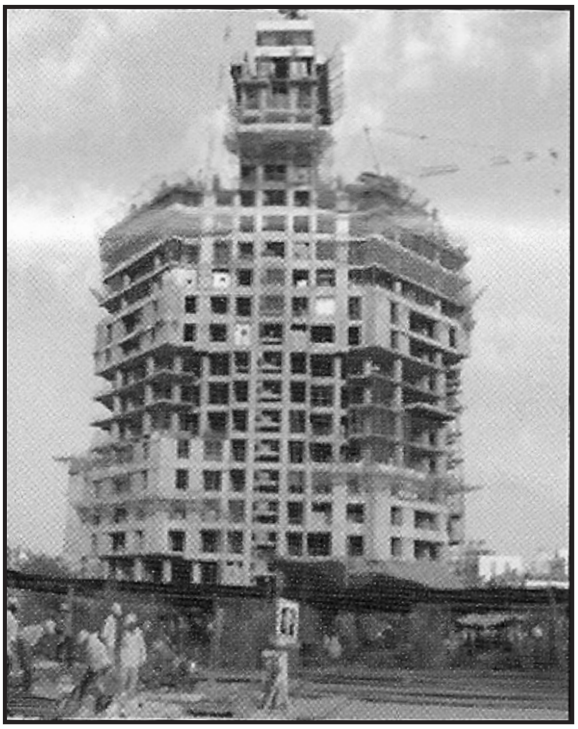
Our engineers were actively involved in the finalization of the construction methodology and participated in selecting high performance equipment from vendors all around the world apart from providing structural designs. M:80 concrete, use of self compacting concrete, using surface retarders, introduction of retarded concrete to avoid cold joints, column cages, compulsory use of couplers for rebar splicing, Automatic Climbing System for walls and cores etc. are some salient aspects of the construction method.

MOCK UPS:-

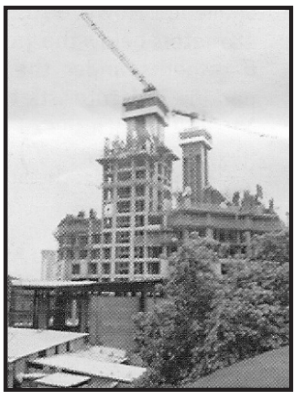
Starting with this project, Sterling has set up a practice of insisting on setting up true scale mock-ups to study the veracity of the systems. For example, two mock foundation blocks were cast with 3.5 m depth with reinforcing bars as per the actual design requirement, and were cast, cured and monitored for formwork system, feasibility of using SCC, temperature variation thermocouple working, segregation characteristics, E-value and characteristic strength curve. These mock-ups were tested two months in advance before commencing the actual foundation concreting. Similarly, bottom chord of 2 m depth of the overall 9 m deep transfer girder with all the rebars and other embedment was successfully cast recently.

PRESENT STATUS:-

The construction has now reached 125m, after completion of the parking and amenity levels, to the level of transfer girders.



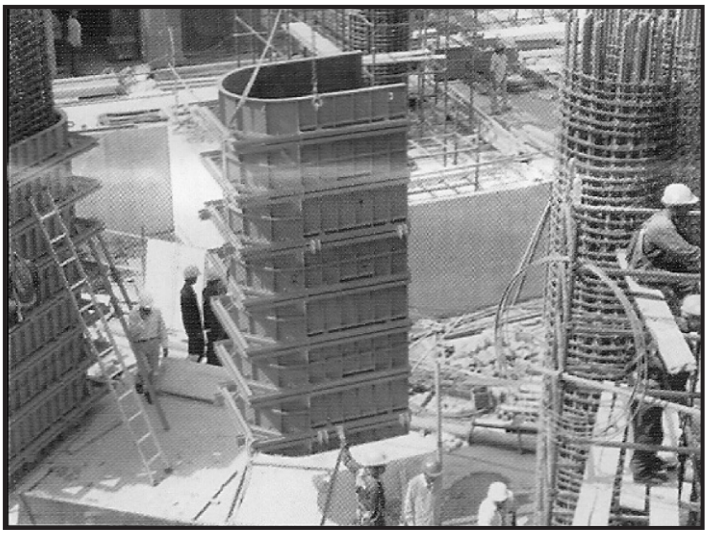
Current Construction Stage



Automatic climbing formwork for cores

Executing agencies

Principal Contractors	Shree Ram Urban Infrastructure
Concrete Production	Constromat Consultancy Services
Reinforcement Fabrication	Ready Made Steel
Formwork	MEVA, Germany / Pranav Constructions Limited, India
Couplers	Dextra India
Reinforcement	Tata, SAIL
Concrete Embedments	Halfen-Deha
Waterproofing	Nina Concrete Systems Pvt. Ltd.
Cladding Material	Du-Pont
Electrical Contractor	SEW Electricals Pvt.Ltd.



Pre-engineered formwork.

List of consultants

Architects	Talati and Panthaky Associates, INDIA
Structural Engineers	Sterling Engineering Consultancy Services Pvt.Ltd., INDIA
Structural Peer Reviewers	CBM Engineers, USA
Damper Consultants	Coffman Engineers, USA
Geotechnical Consultant	Mr. Jaydeep Wagh
MEP Services Consultants	Pankaj Dharkar Associates, INDIA
MEP Peer Reviewers	LEHR Consultants International, USA
Concrete Technologists	Dr. S.A.Reddi, S.G.Bapat
Project Management	Dongre Associates
Wind Tunnel Testing	RWDI, Canada
Post Tensioning agency	BBR India, Bangalore, India
Design Management	Anand Palaye Architects Colasce
Acoustics	Smita Chogle
Landscaping	Kishore Pradhan
Firefighting	SSN Corporation
Solar Energy	Entegra Infrastructure Ltd.
Lift Consultants	LBA Consultants Pvt.Ltd.
Façade Consultants	Fusion Cladding

Author :
Girish Dravid is a Director with Sterling Engineering Consultancy Services Pvt. Ltd. having 27 years of experience in design.
Email - girishdravid@sify.com

Affordable Housing by Eco Friendly Reinforced Masonry Method.

Ganesh N. Kamat Dr. Anuja Kamat

I would like to introduce one such building construction system which may change the total scenario of construction business in near future.
This building system can put a great role in making Green Buildings, Eco-friendly & Affordable homes, hotels, Slum Re-development, Transit Camp.

The article presents the bearing and shear wall concept of multi-storeyed reinforced block masonry buildings. Starting from the history of masonry wall, the block technology, introduction in India, its advantages, Eco Friendly Affordable method, IS code, rate analysis has been illustrated.

INTRODUCTION

Air is freely available, and Hollow Concrete Blocks consist of 50% of hollow i.e. air and hence when a structure is built by Reinforced Concrete Block Masonry method (R.C.B) described below, the cost of construction is slashed down and Eco-friendly as it SAVES 100% bricks, 50% steel + shuttering, 40%concrete,25%utility bill.

HISTORY OF CONCRETE BLOCK WALL SYSTEMS.

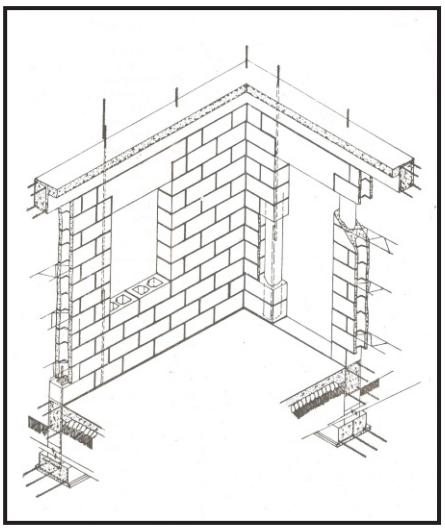
Masonry bearing wall is one of the oldest structural systems known. Man has laid one stone upon another and built wall to support floor or roof. In 1961 at Chicago, a 16 storied Monadnock building was built with the six feet unreinforced masonry bearing wall. The walls had within themselves sufficiently stability through gravity to withstand all lateral and vertical loads. Thereafter for economy the masonry bearing wall construction was replaced by structural frame.

Later on for the last 55 years there has been a very significant swing back to Concrete Masonry Bearing Wall system in Europe, Canada, United States. This trend has developed not only for three and four storied construction but more recently for structures up to sixteen storied in height or more. In India 300 Buildings have been constructed by this method.

METHOD OF CONSTRUCTION

*8"X8"X16" concrete blocks
with two holes are laid one upon another by staggered joint.
*Vertical reinforcement is placed through these holes & those holes are grouted.
*No column, No beam just shear wall & slab staircase is by R.C.C.
*Foundation is simple R.C.C. wall footing.
*See fig. R.C.B. Construction detail, no beam- no column.

R.C.B. Construction detail, no beam- no column.



Advantages of shear wall R.C.B. method of construction

A))Earthquake: Load bearing concrete block walls can be designed to be wind, earthquake resistant too.

B)Fire Proof : Due to concrete block & 3" cover to steel, rusting is minimized & such buildings are fire & bomb last proof.

C)Durable : Concrete blocks are attractive, durable and have excellent thermal, acoustic properties. No repair like R.C.C. is needed in every

ten years.

D)Speed: No heavy equipment needed on site, less form-work, less steel so construction is simple, speedier & hence economical.

E)Architecture: Ancient type of architectural elevation is also possible by R.C.B type of construction.

F)Economy : As steel, cement, shuttering, concrete & Labour required is almost half & due to simplicity of construction & speed minimum saving is Rs. 200/- per sq. ft. So R.C.B.is Eco Friendly and Affordable Method.

Affordable & Eco Friendly method of Construction.

1) R.C.C.(Reinforced Cement Concrete) type of construction was taught by British & we are following Beam & Column type of construction for the last hundred years or so in India.

2) R. C. C. building needs repairs within 15 years of construction.

   Not that anything is wrong with R. C. C. but there is more scope to use inferior material & workmanship in R.C.C.& hence need for early repair.

3) Our Forts, Old buildings V. T. Station. Municipal Bldg., Palaces, Towers are generally constructed by Stone Masonry load bearing method & have stood for hundreds of years without any major repair work.

4) The same load bearing technology has been further developed in

   U.S.A.& is called R.C.B.(Reinforced Concrete Block) which is Speedy, Sturdy, Simple, Durable,

   Eco-Friendly also saves 20%in construction cost. Called

   R.C.B. / Reinforced Masonry.

5) R. C.B. is a proven method of construction with millions of buildings being built by this way in the world.

6) 300 buildings are built by R.C.B. design in India & U.S.A. by us.

7) Eco-friendly as it SAVES100 % bricks, 50 % steel + shuttering, 40%concrete,25%utility bill.

So R.C.B./C.M.U./Reinforced Masonry is Eco-friendly, Affordable, Durable, Speedy, Simple.

Shear wall construction.

IS CODE

Classification of Hollow Blocks (IS 2185-1979 Part-I)

Type	Grade	Density of blocks (kg/cu.m)	Min. Average compressive strength of units (N/sq.mm)	Min. Strength of individual units (N/sq.mm)
Hollow (Open and closed cavity) load-bearing units	A(3.5)	Not less than 1500	3.5	2.8
	A(4.5)		4.5	3.6
	A(5.5)		5.5	4.4
	A(7.0)		7.0	5.6
	B(2.0)	less than 1500 but not less than 1000	2.0	1.6
	B(3.0)		3.0	2.4
	B(5.0)		5.0	4.0
Hollow (Open and closed cavity) non load bearing units	c(1.5)	less than 1500 but more less than 100	1.5	1.2
Solid load bearing units	D(5.0)	not less than 1800	5.0	4.0
	D(4.0)		4.0	3.2

(Other Specifications (IS 2185-1979-Part I)

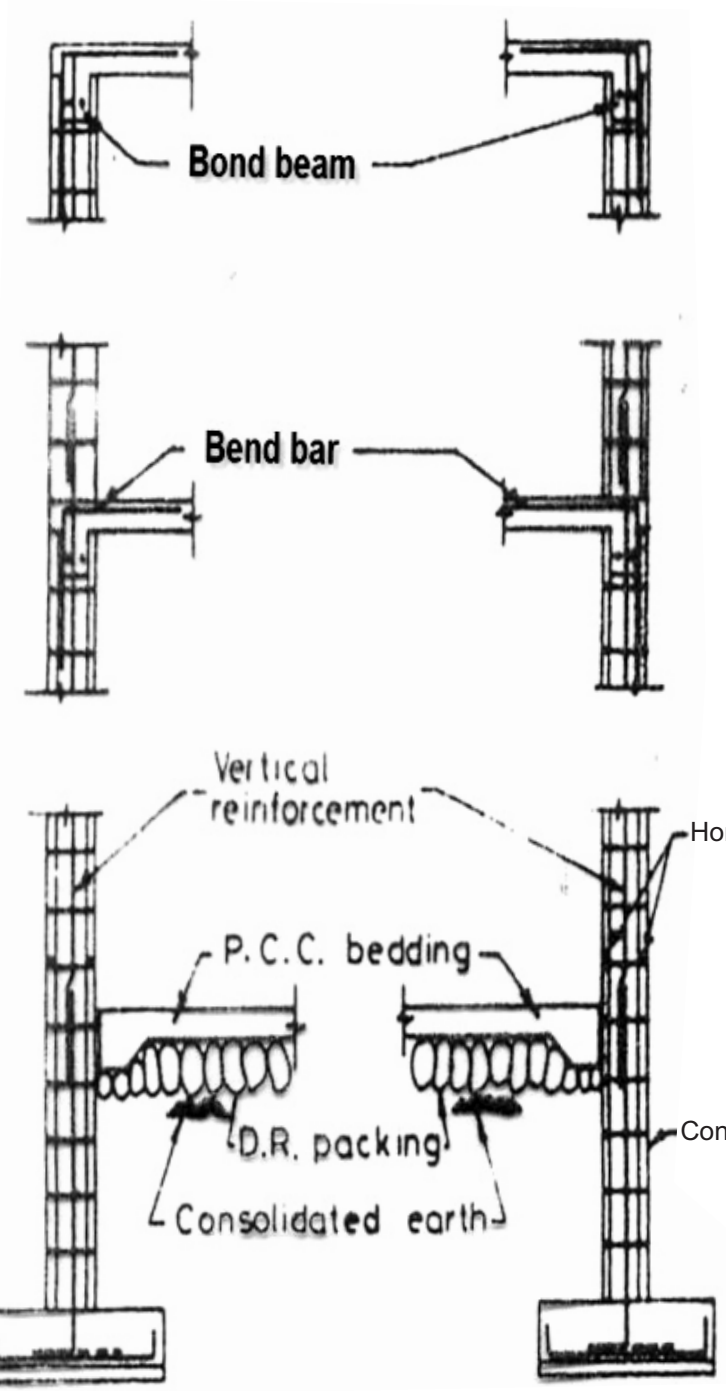
Property	Minimum requirement
Water absorption	Not more than 10% by mass
Drying Shrinkage	shall not exceed 0.1%
Moisture movement	shall not exceed 0.09%

INTRODUCTION IN INDIA since past 33 years.

Hotel Projects.

1. Hotel Maharaja Inn, at Lonavala, Maharashtra, India 1977.
2. Ganaka Motel -NH3-Near Manas Resort ,Igatpuri, India1999
3. Kamat Hotel at Nashik, India
4. United-21, 4-Star Resort at Durgapur, India

BEND BAR IS SHEAR CONNECTOR



RATE ANALYSIS

ECONOMY (Eco Friendly Buildings are also Affordable)

	RCC	RCB	Saving
Reinforcement	3.5 Kg / SF X Rs 40 / Kg	1.5 Kg / SF X Rs 40 / Kg	Rs 80
	Rs 140	Rs 60	
Cement	0.6 bags/SF X Rs 266 / Bag	0.3 Bags/SF X Rs 266/Bag	Rs 80
	Rs 160	Rs 80	
Sand, Mettle, Labor, masonry & Shuttering.	Rs 300	Rs 260	Rs 40
Total	Rs 600	Rs 400	Rs 200

(Save up to Rs. 200/- per sq.ft of slab area)

Housing Projects and Slum Projects

1. Building for Excon at Goregaon, Mumbai, India
2. Model house for Vipassana, Igatpuri, Maharashtra, India
3. 16 buildings at Vinoba Bhave Nagar at Kurla, Mumbai
4. 6 Buildings for SRPF Policemen Quarters, Goregaon,India
5. 5 Buildings for Pancharatna Soc. Complex at Neral, India
6. Transit Bldg. for Unity Const. at Mahim, Mumbai, India
7. 150-Eathquake proof Houses for Gujrat Goverment at Morvi, Gujrat,
8. Transit Bldg for Bhojwani Builders at Khar, Mumbai, India
9. Housing Complex for Lodha at Shirdi, India
10. Affordable Housing for Poddar Developers at Bhivpuri, Karjat, India

Commercial and School Project

1. Shopping Centre For Rajkumar Silk Mills and Vareli, Surat, India
2. Meditation Hall for Vipassana At Igatpuri Maharashtra, India
3. School and Dispensary for BMC at Goregaon (East) Mumbai, India.

CONCLUSION

1. R.C.B. is the technology backed by uniform building code, A.C.I., manuals, text books etc. Million of structures are built by R.C.B. in different part of the world. So R.C.B. is very well established technology.
2. While designing the building it is more appropriate to work out which is the most suitable structural system i.e. R.C.C., STEEL, PRECAST, BRICK OR R.C.B.
3. R.C.B. is the particularly suited to Hotel, Schools, Hospital, Bungalows, Industrials, Residential Building, Transit camp, Slum Redevelopment Project.
4. Eco Friendly & Affordable saves 20% in construction cost.

   Note : the concrete blocks used here are load bearing blocks of strength 40,000 kg per blocks & NOT local blocks.

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BURJ DUBAI DESIGN BRIEF

Compiled by Hemant Gor

The present article provides ready reference structural information about the world's tallest structure Burj Khalifa. The main objective of article is to provide bench mark quantities for structural information for tall building.

1.	Project Type	:	Mixed Use Project (Five Star Hotel, Office, Retail and Residential)
2.	Total Floor area	:	439,935m^2
3.	Site Area	:	104,210m^2
4.	Height	:	828m (Concrete 606m Plus Steel 222m)
5.	Gross Floor area above Grade	:	312,400m^2
6.	Floor Plate Size at Grade Level	:	3,065m^2
7.	Floor Plate Size at Upper top	:	380 m^2
8.	Floor Plate Size at Basement	:	35,300m^2
9.	Structural Consultant	:	SOM
10.	Wind Engineering Consultant	:	RWDI Wind Tunnel Analysis Rigid Model Force Balance Tests Full Multi Degree of Freedom Aero-elastic Model
11.	Floor Geometry in Plan	:	Y Shaped (to reduce the wind forces on the tower, as well as to keep the structure Simple and foster constructability)
12.	Structural System	:	“Buttressed” Six Sided Central Core, Each wing, with its own high performance concrete core and perimeter columns, buttresses the others via a six-sided central core, or hexagonal hub
13.	Foundation	:	Pile Supported Raft
	Number of piles under tower	:	194
	Pile Diameter	:	1.5m
	Length of pile	:	43.0m
	Concrete Cube Strength for Pile	:	60MPa SCC (Self Compacting Concrete) (Triple Blend 25% Fly Ash + 7% Micro silica + Portland Cement, Water Cement ratio 0.32)
	Pile Load Test	:	6000 t
	Working Design Capacity	:	3000 t
	Raft Thickness	:	3.7m
	Reinforcement Spacing	:	300 mm $^{c}/_{c}$
	Concrete Cube Strength for Raft	:	C50 Self Consolidating Concrete

14. Super Structure		
Number of Outrigger Levels	:	5
Concrete cube strength for Vertical Element (Reinforced Concrete Wall/Column)	:	C80 (at Base) – C60 (at Upper Level)
Composition of Concrete for Vertical Elements	:	Portland Cement + Fly Ash
Analysis Software and Model Size	:	ETABS (Version 8.4) , 73,500 Shells and 75,000 Nodes
Reinforced Concrete Design Code	:	ACI 318-02
Free Vibration Analysis Result		
1st Mode, Lateral Side sway	:	11.3 sec
2nd Mode, Lateral Side sway	:	10.2 sec
5th Mode, Torsion Mode	:	4.3 sec
Top Steel Portion (Spire)	:	Diagonally braced lateral system
Steel Design Code	:	AISC LRFD 1999
Seismic Zone	:	Zone 2A (Z = 0.15) as per UBC97
Modulus of Elasticity of Concrete (E_c)for Core and Outrigger at Lower Portion at 90 Day	:	43,800MPa
Walls and Columns optimized	:	Virtual Work Method
Effect of Column Shortening	:	Perimeter columns were sized such that the self-weight gravity stress on the perimeter columns matched the stress on the interior corridor walls.
Weight of Empty Building	:	500,000MT
15. Quantity		
Concrete	:	330,000 m^3
Reinforcement Steel	:	39,000MT
Glass used for Façade	:	103,000 m^2
Stainless Steel used for Cladding	:	15,500 m^2
Structural Steel for Top Spire	:	Approximately 4000MT

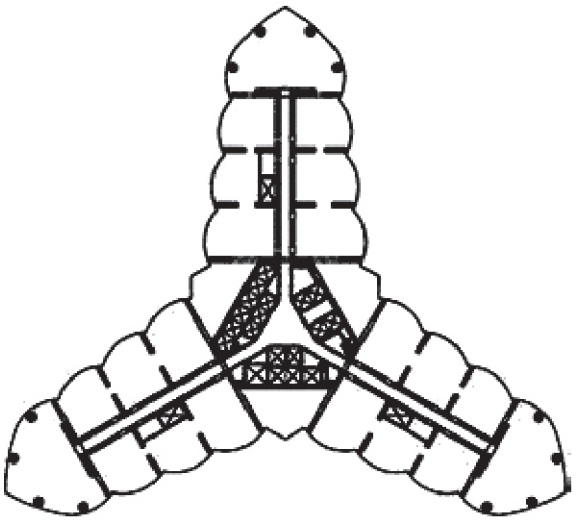

Figure 1 Typical Floor Plan

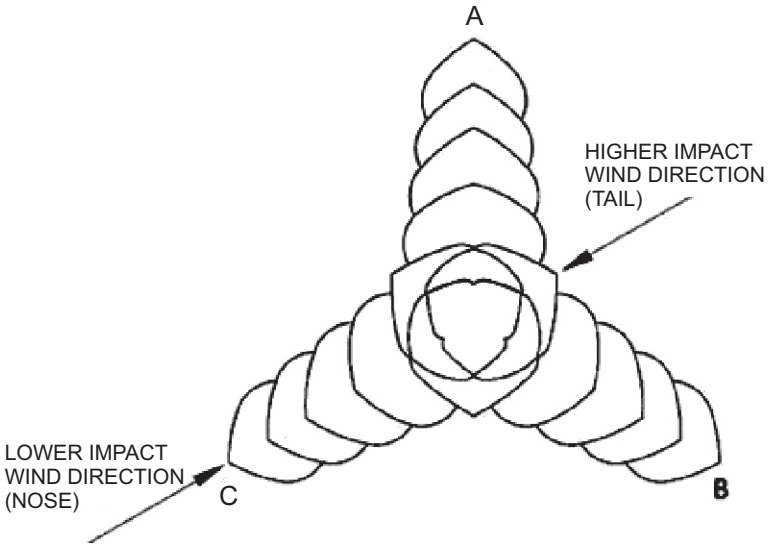

Figure 2 Plan View of Tower
(Orientation of Tower for Minimum Wind Base Shear)

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SELECTION OF PILE TYPES

D. J. Ketkar, Mumbai.

1. Objective of Pile Foundations is to provide -

(a) Strong,

(b) Appropriately oriented and

(c) Durable support to foundations of superstructures.

2. Parameters affecting the selection of the Type of Pile Foundation:

(a) Subsoil layeration and strength

(b) Material of the piles

(c) Load and deformation requirements of the superstructure.

(d) Ground – water/subsoil effects on pile-material

(e) Construction Environment

(f) Equipment Limitations

3. For our discussions, we will assume that --

(a) The pile material is reinforced cement concrete,

(b) Restrict deformation of the superstructure to 12/25 mm as provided in I.S. 2911.

(c) We will also assume that the situation needs only pile foundations.

4. Ideal Type of Pile :

To meet the 'objective' stated above the 'ideal' type of pile would consist of -

(a) a single high strength, precast (precoated if necessary for durability) concrete member under each column, and

(b) of a cross-section and reinforcement appropriately oriented to carry the desired loads (vertical/horizontal and moments),

(c) by (i) reaching to an unyielding strong rock as end-bearing support, or

(ii) penetrating competent sand/clay layer to derive adequate frictional support, or

(iii) a combination of these two.

5. Approach

One approach, for selecting the Pile Type, could be to consider“ disadvantages/limitations” of each of the presently available pile systems in India and select a type which can meet most of the requirements of a particular structure. This approach, however, restricts the selection to the 'presently' available systems only and does not encourage 'innovative/new methods'.

Another approach, for selecting the Pile Type is to list various 'parameters' influencing the pile- Type and pick-up a suitable Pile-Type for a 'set of parameters' applicable to a particular situation. It may happen, that one cannot pick-up a 'unique' Pile-Type to satisfy a given 'set of parameters'. But, with some “modifications/compromise”, it will be possible to pick-up a useful Pile-Type.

Hence, for this present discussion, the later approach has been selected.

6. Types of Piles

Table – 1

A1	Cast-in-situ Bored using temp. casing
A2	Cast-in-situ Bored- mud (DMC/RMC)
A3	Cast-in-situ Driven
B1	Cast-in-situ with permanent liner-bored using temp. casing
B2	Cast-in-situ with permanent liner- bored using mud (DMC/RMC)
B3	Cast-in-situ with permanent liner – Driven
B4	Cast-in-situ with permanent liner – mechanical Rotary (crane or trailer mounted)
C1	Precast Bored using temp. casing
C2	Precast Bored using mud
C3	Precast Driven
D1	Combination of Precast + Cast-in-situ –Bored using temp. casings
D2	Combination of Precast + Cast-in-situ –Bored using mud.
D3	Combination of precast + Cast-in-situ - Driven
E	Under-reamed Piles
F	Mini/Micro Piles.

For the present discussion A, B, and C types only will be considered.

7. Relationship of various parameters and the Pile Type :

(a) Subsoil

(b) Ground water

(c) Structural loads

(d) Construction environment

(e) Equipment Constraints

Table No. 02

PARAMETERS		SUITABLE TYPE OF PILES									
Subsoil		A1	A2	A3	B1	B2	B3	B4	C1	C2	C3
I	Uniform sand –improving in strength with depth		*	*		*	*	*		*	*
II	Uniform clay – improving in strength with depth	*	*	*	*	*	*	*	*	*	*
III	Obstructions – cemented layers	*	*		*	*		*	*		
	- boulders	*	*		*	*			*		
	- tree truck etc.	*	*		*	*			*		
IV	Loose Filled up ground	*	*		*	*			*		
V	Soft soil above hard rock	*	*		*	*		*	*	*	
VI	Soft soil above medium/soft rock	*	*	*	*	*	*		*	*	*
VII	Stiff clay above dense sand	*	*		*	*		*	*	*	
VIII	Dense sand above stiff clay	*	*	*	*	*	*	*	*	*	*
ix	Lateritic formation	*	*		*	*	*			*	
x	Thick murrum above hard rock	*	*	*	*	*	*		*	*	*
xi	Silt above hard clay/rock		*		*	*	*	*	*	*	*
xii	Need for very deep piles	*	*	*	*	*	*				
xiii	Very erratic depth variations	*	*		*	*		*	*	*	

Table No. 03

PARAMETERS		SUITABLE TYPE OF PILES									
b) Ground water /chemical effects		**A1**	**A2**	**A3**	**B1**	**B2**	**B3**	**B4**	**C1**	**C2**	**C3**
I	Absent	*	*	*	*	*	*	*	*	*	*
II	Having tidal variation				*	*	*	*	*	*	*
III	Having lateral flow				*	*	*	*	*	*	*
IV	Under artesian pressure		*		*	*	*	*	*	*	*
V	Harmful chemicals in ground water								*	*	*
VI	Harmful chemicals in subsoil								*	*	*

Table No. 04

PARAMETERS		SUITABLE TYPE OF PILES									
c) Loading from structures		**A1**	**A2**	**A3**	**B1**	**B2**	**B3**	**B4**	**C1**	**C2**	**C3**
I	Very high loads-vertical	*	*		*	*		*	*	*	
	- moments	*	*		*	*		*	*	*	
II	Raker Piles			*	*	*	*		*	*	*
III	Penetration in rock is a must	*	*		*	*		*	*	*	

Table No. 05

PARAMETERS		SUITABLE TYPE OF PILES									
d) Construction Environment		**A1**	**A2**	**A3**	**B1**	**B2**	**B3**	**B4**	**C1**	**C2**	**C3**
I	Old foundations in subsoil	*			*				*		
II	Adjacent weak structures		*			*		*		*	
III	Adjacent structures on open foundations		*			*		*		*	

Table 5 Continue

PARAMETERS		SUITABLE TYPE OF PILES									
d) Construction Environment		**A1**	**A2**	**A3**	**B1**	**B2**	**B3**	**B4**	**C1**	**C2**	**C3**
IV	Adjacent Excavations		*			*		*		*	
V	Future excavations,eg basement/ducts				*	*	*	*	*	*	*
VI	Restricted entry to work areas	*	*		*	*			*	*	
VII	Limited headroom	*			*				*		
VIII	Overhead electricity lines etc.	*	*		*	*			*		
IX	Adjacent working equipment e.g. electricity generators, compressors		*			*				*	
X	Noise restrictions		*			*		*		*	
XI	Vibration /shock restrictions		*			*		*		*	
XII	Work in standing water	*			*		*		*		*
XIII	Restriction of equipment load movement on working ground surface.	*	*		*	*			*	*	
XIV	Mud disposal restrictions	*		*	*		*	*	*		*
XV	Muck disposal restrictions		*	*		*	*	*		*	*
XVI	No space for precasting yard		*	*		*	*	*		*	*
XVII	Very small number of piles.	*	*		*	*					
XVIII	Piles very close to the plot boundry /adjacent structures.		*			*		*		*	
XIX	Need for top-down basement construction				*	*	*	*	*	*	*

Table No. 06

PARAMETERS		SUITABLE TYPE OF PILES									
Equipment Constraints		A1	A2	A3	B1	B2	B3	B4	C1	C2	C3
I	Cranes – not available	*	*		*	*			*	*	
II	Mechanized rotary piling equipment- not available	*		*	*		*		*		*
III	Temporary casings of various diamters in sufficient quantities in short supply		*			*				*	
IV	Chiselling /rock cutting tools –not very heavy	*		*	*		*		*		*
V	Heavy mechanized pile driving hammers not available.	*	*		*	*			*	*	
VI	Mobile pile driving equipment- not available	*	*		*	*			*	*	
VII	Need for very short mobilization time when contract is of short duration.	*	*		*	*			*	*	
VIII	Heavy cranes for handling long precast piles –not available	*	*	*	*	*	*		*	*	
IX	Equipment has to be light in weight	*	*		*	*			*	*	
X	Equipment has to be of small dimensions.	*	*		*	*			*	*	
XI	Cost of equipment to be small	*	*		*	*			*	*	
XII	Highly trained manpower for mechanized operating equipment is not available.	*	*		*	*			*	*	

0 - Trailer mounted rotary equipment.

8). Selection of Pile Types :

The above relationships mainly indicate suitability or otherwise of individual Pile Types for a particular 'parameter'. However these relationships are not 'explicit', but there is some inter-dependence.

For a specific project, a set of significant parameters has to be defined first. This can be followed by selecting a Pile Type which is suitable for all these parameters. At times, a compromise may be necessary and the aspects to be compromised (in the preferred order) can be listed as :

I) Mobilization time
ii) Total construction time
iii) Muck disposal time.
iv) Mud disposal problems.
v) Excavation of old foundations & backfilling
vi) Using only 2 to 3 pile sizes (by diameter)
vii) Sound levels
viii) Vibration levels
ix) Pile liners.
x) Reinforcement in precast driven piles.
xi) Cost.

However, there shall be no compromise on the safety of the pile foundation and damage to the adjacent structures / equipment.

* In some projects, one or two parameters will exert a controlling influence, e.g.
(I) Mud is not allowed, or (ii) crane has no access, or (iii) space for precasting yard is not available.

With this approach it will be possible to select a feasible and useful pile type within the available means, resources and the construction environment.

9) Example

Table No. 07

PARAMTERS				
I	Subsoil – Silt above hard clay/rock	A2	B	C
II	Ground water – having artesian pressure - with harmful chemicals	A2	B	C
III	Loads -Moderate	A	B	C
IV	Construction Environment – Old foundations - in subsoil	A1	B1	C1
	- Restricted entry to work area	A1A2	B1B2	C1C2
	- mud disposal restrictions	A1A3	B1B3B4	C1C3
	- No space for precasting yard	A	B	
V	Equipment Constrains – mechanized rotary piling equipment not available. - equipment to be of small dimensions	A1A3 A1A2	B1B3 B1B2	C1C3 C1C2
b)	Pile Type From tables above, suitable types are	7A1 6A2	9B1 6B2	8C1
i.e. B1,C1,A1,A2, & B2 in decreasing order of preference.				

* Now, C1 is difficult since no space For 'precasting yeard' and 'equipment to be of small dimensions'

* Then, A2 and B2 will pose a problem of 'mud disposal', and

* A1 is not suitable for 'silty subsoil' and 'artesian ground water'.

* Thus, the selected type is B1.

* i.e. Cast- in- situ Bored piling using temporary casing and permanent liner.

10) Selection of appropriate (i.e. safe and practical) type of pile is dependent on various parameters. The list of Pile Types and the Parameters is not 'complete' and will need revision, in the light of experience gained in using this approach to selection of the Pile Type.

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IN THE PROFESSION OF STRUCTURAL ENGINEERING ……

N K Bhattacharyya

Responsibility of a Structural Engineers encompasses provisioning of strength, stiffness, stability to the structure he designs and specifies. Of late, codes of practices include a new parameter that is durability to be ensured to his creation. Serviceability is generally not questioned unless the structure is put to use and shows signs of malfunctioning.

The beginning of a career of a structural designer goes in understanding of analysis of structures to evaluate stress and strength resulting out of combination of loading and proportioning of the sizes of structural elements to keep those within the capacities of the materials to be used to build up those elements. With incoming of computers, elaborate, intricate and timing consuming mathematical analysis based on structural mechanics has gone out of fashion. Software companies make a good business in selling programmes to relieve a structural designer out of drudgery of analysis and provide fast tool to arrive at the result and also make comparative studies for efficiency of the structures and its economics. His limitation of competency is confined to this scope, algorithms used and analytical approach of the software programmer. The designer remains ignorant of the safety unless the reliability of the software is tested and verified.

To ensure durability of the structure he designs, a designer rarely specifies mechanical properties of the materials to be used in the structure and tests that need to be carried out for the desire quality. If the material is a manufactured one, the designer needs to specify the assembly process and stages of fabrication. There are cases where locked in stresses resulted malfunction or failures under service loading. In case of reinforced or pre-stressed concrete, quality of each ingredient, process of manufactures, post manufacture treatment and stage wise testing for quality assurance and recording thereof are essential part of the designer to fulfill his commitment to the client and for his own safety.

Parameters to control deflection, noise, vibration, impact bearing etc., to comply different serviceability requirements are not well defined in our codes nor our users are much concerned nor our planners care much about with these. Requirements of minimum thickness, robustness, sway etc., are not given much of an importance. As a result, sleek structures because of its vulnerability to sway and movements are getting separated from infill walls resulting dampness after monsoon rains and even spalling of concrete within life span of the structures are taking place.

In our codes of practices, durability remains as a desire in the specification without laying down specific parameters and their limitations to achieve certain expected results. Concrete is no longer considered to be an alternative to igneous rocks and maintenance free besides the extensive care it needs to decide its grading, precautions for its manufactures and placement. Greed and business promises of increased floor space construction do not motivate to create longer service life of built structures. Clients are more attracted by glamour and glitter of finishes rather than the soundness of the structures with its material of construction not to weather out of vagaries of nature. The interesting part of it is that a structural designer is held responsible by authorities for malfunctioning of failure at any time without any regulation to prevent misuse, abuse and damages done to it by other agencies even without a limitation or specifying a period of responsibility, a design is questioned ever at any time. Who does not like to see his creation attractive and appearing? If a designer is to be held responsible or questionable, where are his controls with whatever follows or is done with his structures?

Construction process is progressively getting mechanised and the structure under construction particularly in concrete has to carry stage wise construction load. Construction engineer is not responsible for load carrying capacity of a structure; but is definitely required to inform the stages at which what construction load will be put on the structures so that constructability vis-à-vis need of partial pre-stressing or additional false work can be examined by a structural designer in consultation with a construction engineer. The practice has not taken its root in the Country. Once structural drawings are received, he is forgotten.

Most of the commercial and recreational buildings require large open spaces for which in filled walls are generally not provided. Light partitions are incapable of transferring lateral shears besides that their positions are subject to change with change in the in housel functional requirements. This situation necessitates the vertical frame of the structure bear complete lateral shear. To this when glass, acrylic or aluminium exterior transfers load due to heavy wind or any localised load to the main frame, the frame needs to be checked for such lateral point loads. Cyclone does not come with every monsoon and excessive

distress may not occur every year. But let us not be a fatalist believing on the myth who has seen tomorrow. When tomorrow comes, it comes on a structural engineer.

Any secondary built element which directly, indirectly or partially contributes to the strength and stiffness of the structure needs check on its specification and load sharing capacity so that deficiency does not create a major damage or failure particularly in case of lateral load analysis. Even facades, space dividers and fitments which directly transfers load to the main structures need examination so that connections or load transfer mechanism do not weak-end the structure permanently or affects its durability. Any embedment or insertions in the structure affect a structure depending upon depth of such insertions and locations within stressed zones of the structure elements. The properties and qualities ofmaterial or metal inserted become a source of early corrosion damage of a structure. It is always preferable to preplan such attachments so that life span and load bearing capacity of the structure are not compromised. Once a failure or collapse occurs, it becomes difficult and at times impossible to locate where the collapse mechanism got initiated. But it can be easily concluded that failure of a structural member initiated the total collapse dragging the structure engineer directly to own the responsibility of failure. Unfortunately, its sphere of responsibility of a structural engineer goes beyond the clauses of codes of practices and local regulations. But his jurisdiction of authority in a project remains restricted and limited.

In a major project, a structure engineer needs a large team not only for his analysis and detailing of the structure for construction purpose but also to make a wide scrutiny of every detail of construction or its process which affect strength, stiffness and stability of the structure. But for the meager fees paid for, he can ill afford such a luxury leaving it's ultimately to his fate like a typical Indian. The responsibility bestowed on a structure engineer cannot and is not shared by any other member of the projective. He has to carry his own cross. He must keep his shoulder strong enough to bear the stress. May almighty God bless a structural engineer?

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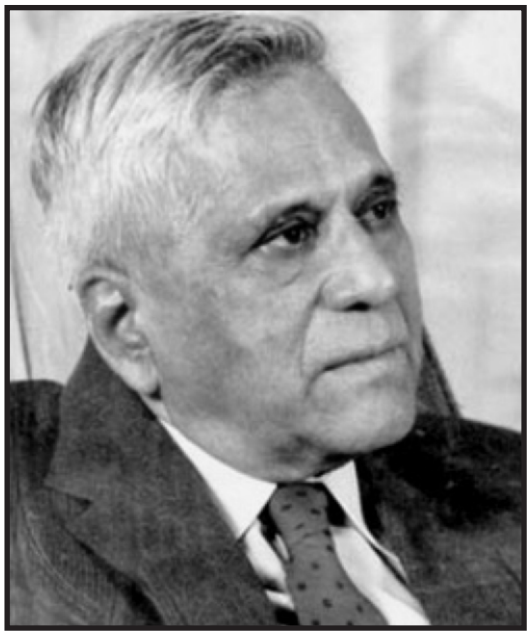
ISSE LOSES A MAJOR PATRON



Born : August 1, 1918
At: Pasarni
Dist: Satara, Maharashtra

Demise: 14th August 2010
At: Pune, Maharashtra

Padmashree Baburao Govindrao Shirke, a graduate civil engineer of June 1943 from Pune Engineering College was an exceptional civil engineer who had entrepreneurial vision to solve country's acute and appalling housing problem through industrialization. He carried out a crusading mission to eradicate ills of vested interest, evils and malpractices in the construction industry and change the discriminatory tender practices set by alien rulers 200 years ago for insignificant works and for utterly different and dissimilar purpose.

He started his first construction company, Supreme Construction Company on 14th September 1944 Vijaya Dashami day and made a proven track record of efficiency in the works of military engineering service. His record contributions in constructions are Kirloskar factories in Pune, CIDCO's NRI Seawood project at Nerul with demonstrative speed and quality. He brought the Siporex technology in June 1966 from Sodertalje, Stockholm to produce as a Joint Sector Public Limited Company light weight high strength to weight ratio material, highly insulating and fire resisting. The most important products were un-reinforced blocks for load-bearing walls and partition walls, and reinforced slabs and lintels, all steam-cured under high pressure and temperature.

His splendid autobiography “The Crusade” is worth reading for all civil engineering technocrats to fight against total degradation of National character, erosion of all ethical and moral values enveloping our country. His panacea for this social cancer was total industrialization of civil engineering. Builders' Association of India (BAI) honoured him with the title of 'A Legend of the Indian construction Industry'.

His passing can only be described in the worlds of Theodore Roosevelt “… … his place shall never be with those cold and timid souls who know neither victory nor defeat”

ISSE-SOLAPUR LOCAL CENTRE
FIRST FOUNDATION DAY CELEBRATION

Celebration of ISSE - SLC 1 Foundation Day :
(L to R) **Er. Dr. J. B. Dafedar, Er. C. B. Nadgouda, Er. Pramod Joshi** (Past-Chairman)
Er. S. S. Patil (Chairman) **Er. H. N. Somani** (Chairman-ISSE), **Er. O. G. Darak** (Hon. Secretary),
Er. Mahesh Verma & **Er. N. R. Verma** (Chief Guests)

'Indian Society of Structural Engineers' (ISSE) was founded on 29th Jan 1997 by ten advisory trustees as its initial members under the leadership of great visionary & eminent engineer Late R.L.Nene and its membership is now spreading all over India with more than thousand. ISSE was founded in response to unique problems plaguing structural engineers for years. Since there was no professional institution solely dedicated and devoted to the cause of structural engineers in India, it fulfills the great need which has been felt for many years. The goal of ISSE is to enhance the dignity of structural engineers and to evolve suitable norms for their responsibilities and remunerations, to bring about brotherhood and unity among the fraternity.

(1) ISSE SOLAPUR LOCAL CENTRE :

Inaugurated on 30th August 2009 in presence of ISSE Mumbai Headquarter Dignitaries President Er. S.G.Dharmadhikari, Secretary K.L.Savla, IEI MSC Chairman Er. Shantilal Jain and Er.Dr.Sonaje. Guest lectures were given by Rtd Chief Engr. Gammon India, (Bangalore). Er.Dr.S.A.Reddy and Rtd. Chief Engr. Bridges, (M.P.), Er.C.V.Kand. on 'Civilization & sthapatis of India'. The response of structural and Civil Engineering society was so encouraging that the membership has reached to a number close to Fifty. Following activities were conducted under the leadership of office bearers President Er.Pramod Joshi. Secretary Er.Gokul Chitari and Treasurer Er.Om dark.

A) One Workshop was arranged on 27.1109 at WIT,Solapur on 'Structural Audit and Retrofitting of Buildings'. President of ISSE Mumbai Er.S.G. Dharamadhikari Inaugurated the workshop. Eminent Structural experts and academicians such as Principal. Dr.S.A.Halkude, Prof. S.S.Patil, Er. Mangesh Jagushte, and Er.Pataskar shared their experiences regarding damage assessment and retrofitting of structures. Public Address on Structural Audit was also

arranged at Hutatma Smruti Mandir.

Presentation on "Behavior & Performance of Structures in Earthquake" by Er. Dr.J.B.Dafedar was arranged on 11.08.10. It gave important tips for special care to be taken by Structural Designers and Civil Engineers while Principal in Earthquake prone zones.

Principal Dr. J.B.Dafedar has generously offered the campus of Orchid college of Engineering for conducting the ISSE activities for the year 2010-11.

(2) ENGINERS'DAY CELEBRATION

On September 15th the Engineer's Day: the birthday anniversary of Bharat-Ratna Sir Mokshagundam Vishweshwaraiyyah: was celebrated by Indian Society of Structural Engineers- Solapur Local centre in Association with The Institution of Engineer India – Solapur Local Centre. As the event marks its 150th years, on the eve of at this event The ISSE-SLC and IEI-SLC decided to felicitate the Principals of all engineering institutions in the Solapur district province. To grace the function, three eminent engineer dignitaries form three disciplines such as Eminent Technical administrator, Eminent Government Administrator and Eminent Professional Administrator were invited as the Guest of honores.

Dr.S.D.Madnaik, (Former Principal, WIT – Solapur), Er. Mukund Surkutwar, (Superintending Engineer of PWD Solapur) and Er. W.Suryaprakasham, (Management Consultant) graced the function by accepting invitation as Guest of Honor. As the Solapur District province in present era is developing its Engineering Education Hub with around Ten Engineering Institutions: to honor with appreciation the contribution of these Engineering Institutions in development of Engineering Arena: Principal of Engineering Institutions including The registrar of Solapur University felicitate.

The Function started with enlightening of lamp and garlanding the photo of sir Mokshagundam Vishveshwariyya by all dignitaries on Dais. The IEI-SLC Honorary Secretary Er. G.K.Deshmukh delivered the preamble of the function. He highlighted the role of IEI to all Engineer members with special reference to IEI Engineering Staff training Centre Hyderabad, and appealed to participate in seminars being organized by The IEI State and Local Center in the country, mentioning the importance of 100th center as The IEI-SLC. The IEI-SLC chairman Er.H.N.Somani in his presidential address express with due regards the initiatives and supports for membership drive by all Engineers, besides, The inspiration given by Dr. Madnaik in the opening of The IEI-SLC about one and half decades earlier, and highlighted ' The importance of IEI- Membership' right form individual level to international level.

The chairman ISSE – SLC Er. S.S.Patil in his speech defined the role of ISSE by underline the need of all Academic and Professional Engineers as well as Engineers from Govt. Department to unite together and share their experiences on the platform of ISSE in relevance to the Civil Engineers and Structural Engineers for the benefit of construction industry of the Nation.

On this ritual function Emeritus invitee guest of honor Eminent Technical Administrator r. Dr.S.D.Madnaik was being felicities by the hands of the Chairman The IEI-SLC followed by Eminent Government Administration Er. M.M.Surkutwar was being felicitated by the hands of Honorary Secretary ISSE-SLC and Eminent Professional Administrator Er. W. Suryaprakasham was being felicitated by the hands of Honorary Secretary The IEI-SLC.

Missing You !

We appeal to all ISSE members to provide their Name, membership number, correct address , contact number and email to ISSE. We noticed that around 125 journals were returned by courier due to incorrect address. Please intimate ISSE about your change of address on **issemumbai@gmail.com**

ISSE Journal sent to following members were returned. Please provide your correct address-

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M-2- Raghubir Kumar Sharma
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M-73- Jitendra.A. Bhandwalkar
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ISSE

ISSE is in a process of revamping its web site. We would like to have suggestions from members regarding the contents and other features to be uploaded on the site. We are planning to have listing under various categories with nominal charges for its members. Members can add one page information about their company by paying nominal annual fees.

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- Industrial Building Consultant
- Structural Audit
- Repair Consultant
- Geotechnical Consultant
- Project management consultant
- Plumbing Consultant
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