

**FEASIBILITY STUDY FOR  
CONSTRUCTION OF ADDITIONAL  
FLOOR OVER THE EXISTING  
"ACADEMIC BLOCK" BUILDING OF  
NATIONAL LAW SCHOOL OF INDIA  
UNIVERSITY, NAGARABHAVI,  
BENGALURU**

CIVIL-AID

Job no: BNS/5/5/2011

*Report on*

**FEASIBILITY STUDY FOR CONSTRUCTION OF ADDITIONAL  
FLOOR OVER THE EXISTING "ACADEMIC BLOCK" BUILDING  
OF NATIONAL LAW SCHOOL OF INDIA UNIVERSITY,  
NAGARABHAVI, BENGALURU**

**JULY 2011**

*Report for*

**The Registrar  
National Law School of India University  
Nagarabhavi, Bengaluru**



**CIVIL-AID TECHNOCLINIC PRIVATE LIMITED**

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**Report on** : Feasibility study for construction of additional floor over the existing "Academic Block" Building of National Law School of India University, Nagarabhavi, Bengaluru

**Report for** : The Registrar  
 National Law School of India University  
 Nagarabhavi, Bengaluru

**Reference** : Letter No. NLSIU-66066/4/2011-ESTS, dtd. 25<sup>th</sup> April 2011

**Period of feasibility study** : 30<sup>th</sup> May to 5<sup>th</sup> June 2011

**Feasibility study carried out under the guidance of** : Prof. H. V. Venkata Krishna  
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**Date of submission of report**

**:** 9<sup>th</sup> July 2011

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**CIVIL-AID TECHNOCLINIC Pvt. Ltd.**

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## **A. INTRODUCTION**

The existing Academic Block building of National Law School of India University located at Nagarabhavi, Bengaluru is an RC framed structure with infilled masonry walls. The building comprises of part basement, ground and first floor only. It is reported that the building was constructed during the year 1991 and since then it has been in service.

The concerned authorities propose to construct one additional floor over the existing building as a part of their expansion programme. In view of this, a reference was made to Civil-Aid Technoclinic Pvt. Ltd. to carry out the structural soundness and feasibility study for construction of the proposed additional floor over the existing building.

In response to this a detailed investigation was carried out by us on 30<sup>th</sup> May to 5<sup>th</sup> June 2011. This report, in brief, summarizes the outcome of the feasibility study and conclusions thereon.

## **B. PHYSICAL OBSERVATIONS**

Following are the physical observations made consequent to the detailed inspection of the building:

- No signs of settlement of foundation system were observed in any part of the building.
- Growth of vegetation / plantation was observed close to the building at various locations.
- Debonding of cladded tiles were observed in external masonry walls at various locations.
- Separation cracks were observed in between RC members and masonry walls at various locations / floors.
- Growth of fungus was observed in masonry walls at various locations.
- Peeling of paint was observed in masonry walls of at various locations.
- Damage of rain water outlet pipes were observed at various locations of the building.

- Dampness and damp patches were observed in RC members and masonry walls at various locations of the building.
- Haphazard cracks and Accumulation of dead leaves were observed in WPC over roof slab at various locations.
- Chocking of rain water outlets over terrace was observed at various locations.

### C. INVESTIGATIVE STUDIES

In order to ascertain the structural soundness of the building for the proposed additional floor construction, following investigative studies were carried out:

1. Dimensional measurements of structural members.
2. Examination of foundation and tests on soil at founding level.
3. Semi-destructive test to assess the quality / strength of in-situ concrete in RC footings.
4. Non-Destructive tests to assess the quality / strength of in-situ concrete in RC members:
  - a) Ultrasonic Pulse Velocity test on RC columns and beams.
  - b) Rebound Hammer test on RC slabs.
5. Cover meter studies to map the disposition and probable dia of peripheral rebars in RC members.
6. Theoretical analysis and design verification for the proposed additional floor.

#### 1. Dimensional measurements of structural members.

The dimensions of typical footings (after exposing typical column footing), masonry walls, columns, beams and slabs were physically measured and recorded for theoretical verification and preparation of layout sketch.

***(Refer sketch Civil-Aid/NDT/RES- 01)***

**2. Examination of foundation and tests on soil at founding level.**

To examine the foundation system and to verify the soil characteristics below the foundation one number of trial pit was excavated up to the founding level selected at random. The soil strata encountered at the founding level consisted of soft rocky strata. Ground water table was not encountered at the founding level.

Due to encounter of rocky strata at founding level, the **safe bearing capacity** of soil is assumed as **25 t/sq.m.**

**3. Semi-destructive tests to assess the quality / strength of in-situ concrete in RC footings.**

In order to assess the quality / strength of in-situ concrete in RC footing, semi- destructive test such as core test was resorted to. Two numbers of core samples were extracted from the RC footing for laboratory tests. The extracted core samples were subjected to compressive strength test after necessary trimming and capping as per the guidelines in IS: 516-1959- (Reaffirmed in 1998).

The extracted concrete cores were free from voids, honeycombs indicating good quality of concrete in RC footings. The results of concrete core tests are tabulated in **Table-1**.

The results of the tests indicate that the strength of concrete in tested cores is varying in the range of **21.9 N/sq.mm** to **22.9 N/sq.mm** in footings.

**4. Non-Destructive Tests to assess the quality / strength of in-situ concrete in RC members.**



**a) Ultrasonic Pulse Velocity test on RC Columns & Beams:**

Ultrasonic Pulse Velocity test was conducted on RC columns and beams at random at all accessible regions of the building. The tests were conducted using **"PUNDIT" (Portable Ultrasonic Non-destructive Digital Indicating Tester) equipment from M/s. CNS Farnell, UK** as per the guidelines in Indian Standards IS:13311-(Part-I)-1992-(Reaffirmed in 2004). The results of the tests are tabulated in **Table-2**.

The Ultrasonic Pulse Velocity test results indicate that the quality of concrete in the tested RC columns and beams falls under the category of **"Medium to Good Concrete"** as per Table-2 of IS: 13311-(Part-I)-1992-(Reaffirmed in 2004). Further, the estimated strength of concrete falls in the range of **18 N/sq.mm to 21 N/sq.mm**.

**b) Rebound Hammer test on RC Slabs:**

Rebound Hammer test was carried out on the RC slabs at random to assess the surface hardness / quality and strength of in-situ concrete. The tests were conducted using **Schmidt Rebound Hammer from M/s. Proceq, Switzerland** as per the guidelines in Indian Standards IS: 13311-(Part-II)-1992-(Reaffirmed in 2004). The results of the tests are tabulated in **Table-3**.

Rebound Hammer test results indicate that the estimated strength of in-situ concrete nearer to surface in tested region falls in the range of **20 N/sq.mm to 22 N/sq.mm**.

**5. Covermeter studies to map the disposition and probable dia of peripheral rebars in RC members.**

Cover meter studies were carried out on various RC members in order to assess the thickness of cover concrete, disposition and probable dia of peripheral embedded rebars in the RC members. The tests were conducted using

**Profometer-5** from **M/s. Proceq, Switzerland** as per the guidelines furnished by the manufacturer's manual. The results of the tests were recorded for theoretical verification. The results of the tests are tabulated in **Table-4**.

From the results of the test, it is observed that cover concrete provided to the rebars is adequate in most of the tested RC members and disposition of reinforcement is recorded for theoretical verifications.

#### **6. Theoretical analysis and design verification for the proposed additional floor.**

In addition to the above investigative tests, a detailed theoretical structural analysis was carried out for the existing structure and also for the proposed additional floor over the existing structure. The entire building is modeled in **STAAD Pro 2006** software for detailed structural analysis.

Based on the physical observation, non-destructive test results, the grade of steel and concrete considered are as follows:

- |                      |   |        |
|----------------------|---|--------|
| 1. Grade of concrete | - | M20    |
| 2. Grade of steel    | - | Fe-415 |

#### **Loadings**

Following are the loadings considered in the structural analysis:

##### **1. Dead load as per IS: 875 (Part I)-1987**

- |                                       |   |                        |
|---------------------------------------|---|------------------------|
| i) Self weight of slab (150 mm thick) | - | 3.75 kN/m <sup>2</sup> |
| ii) Loading due to Floor Finishes     | - | 1.50 kN/m <sup>2</sup> |
| iii) Load due to unknown partition    | - | 1.00 kN/m <sup>2</sup> |

##### **2. From Wall**

- |                                |   |           |
|--------------------------------|---|-----------|
| 300mm thick Brick masonry wall | - | 19.5 kN/m |
|--------------------------------|---|-----------|

### 3. Live load as per IS: 875 (Part-II)-1987

i) Live load on floor	-	3.00 kN/m <sup>2</sup>
ii) Live load on roof	-	1.5 kN/m <sup>2</sup>

Load cases considered are –

Load case	1:	Earthquake Load (EQX)
	2:	Earthquake Load (EQZ)
	3:	Dead Load
	4:	Live Load

Load combinations:

5:	1.5 (DL + LL)
6:	1.2 (DL + LL + EQX)
7:	1.2 (DL + LL + EQZ)
8:	1.2 (DL + LL - EQX)
9:	1.2 (DL + LL - EQZ)
10:	1.5 (DL + EQX)
11:	1.5 (DL + EQZ)
12:	1.5 (DL - EQX)
13:	1.5 (DL - EQZ)
14:	(0.9 DL + 1.5 EQX)
15:	(0.9 DL + 1.5 EQZ)
16:	(0.9 DL - 1.5 EQX)
17:	(0.9 DL - 1.5 EQZ)

Forces from the critical combination of load cases are considered for the design check. The design check has been carried out as per the guidelines in IS: 456-2000. The safe bearing capacity of soil is considered as 250 KN/m<sup>2</sup>.

The design check was carried out based on the structural framing plans and relevant results of non-destructive testing.

### **Discussions on Structural Analysis and Design Check:**

#### **Foundation:**

Foundation system provided consists of isolated and combined footings. The footing size, concrete thickness and area of reinforcement provided for the exposed footing and furnished drawing considering SBC of soil as 250 kN/sq.m, are found to be adequate for additional load due to the proposed additional floor.

#### **Columns:**

The design check on all columns at all levels was carried out considering the critical forces obtained from the analysis. The section required as per the analysis is compared with the section provided at the site. From the design check it is observed that, the section and area of steel provided in columns of all floors is adequate for the proposed additional floor loadings as per relevant Indian standards.

#### **Beams:**

The design check on all beams was carried out considering the critical forces from the analysis. From the design check it is observed that the size and area of reinforcement provided in existing beams are found to be in order for the present loading.

#### **Slabs:**

Analysis and design check revealed that, the sizes and reinforcement provided for the slabs are found to be in order for the proposed loading.

### **D. INFERENCES**

Following are the inferences drawn from the results of the above investigative studies:

- ❖ Dampness and Damp patches were observed masonry walls are essentially due to the leakage of water from damaged / deteriorated rain water outlet pipes at various levels.

- ❖ Development of cracks at the interface of beam-wall / column-wall is mainly due to separation, shrinkage and differential thermal movement.
- ❖ From the results of Semi-Destructive test on RC footing and Non-Destructive tests on RC columns, beams and slab, it is inferred that the quality of concrete is found to be satisfactory.
- ❖ The Covermeter studies indicated that the cover concrete provided for reinforcement of RC members confirms to required standard.
- ❖ From the theoretical analysis and design verifications, it is found that the construction of one additional floor (i.e., Third floor) over the existing building is feasible.

#### **E. REMEDIAL MEASURES**

Following are the remedial measures for deficient / distressed members:

##### **1. Treatment for cracks between masonry walls and RC members:**

The existing separation cracks between masonry walls and RC members shall be sealed with elastomeric crack sealant after making necessary surface preparation as per manufacturer's specification.

##### **2. Treatment for Dampness in masonry walls:**

- a. The affected plaster due to dampness on masonry walls shall be totally removed by gentle chipping.
- b. The mortar joints in walls shall be deep raked and repointed with cement mortar 1:4 as per standard practice followed by replastering in cement mortar 1:6.
- c. All damaged / deteriorated rainwater outlet pipes shall be removed completely and replace the same with new ones as per standard practice.

**F. CONCLUDING REMARKS**

Based on the results of the feasibility study, it is inferred that the construction of one additional floor (i.e., second floor) over the existing "**Academic Block**" building of National Law School of India University is feasible over the existing building subject to the following conditions:

- a. The loading on proposed floor shall not exceed the loading assumed for analysis and design check.
- b. The existing WPC on the terrace shall be completely removed before construction of additional floor.
- c. Floor height for the proposed additional floor shall be same as the height of the existing floors.
- d. The proposed window / door position shall match with the existing window / door positions in lower floor along with their sizes.
- e. No structural alterations and change in loading shall be made in future in the existing building after construction of proposed additional floor.
- f. After constructing the additional floor, the exposed top surface of roof shall be provided with suitable WPC treatments for ensuring leak proof RC roof slab.
- g. The construction of additional floor shall be carried out as per appropriate design details and standard / sound engineering construction practice by an experienced agency under the supervision of a competent engineer.
- h. After carrying out the recommended remedial measures, it is mandatory to carry out periodic maintenance of the building as per standard practice.



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Principal Engineer



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Managing Director (Tech.)

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# APPENDIX

# TABLES



TABLE - 1

## CONCRETE CORE TEST RESULTS

Project	:	Academic block - National Law School of India University, Nagarabhavi, Bangalore
Core extracted from	:	RC Footing
Date of core extraction	:	31st May 2011
Date of test	:	10th June 2011
Grade of concrete	:	Not furnished
Age of concrete	:	More than 28 days
Capping material used	:	EPCO KP 350 (PART A) and EPCO HP 350 (PART B) from M/s. Krishna Conchem
Technical references	:	IS:456-2000 and IS:516-1959 (Reaffirmed in 1999)

Sl. No.	Grid Identification *	Core Length** (l) (mm)	Core Dia (d) (mm)	Core Wt.** (Kg.)	Failure load (kN)	Core Comp. Strength# (N/sq.mm)	l/d Ratio	Correction factor for (l/d) ratio+-	Corrected Cyl. Comp Strength (N/sq.mm)	Equivalent Cube Comp. Strength ++ (N/sq.mm)	Type of Failure
	RC Footing										Typical compressive failure
1	F2 - Core 1	125	85	1.680	102.00	19.41	1.471	0.943	18.29	22.9	
2	F2 - Core 2	122	85	1.560	98.00	18.64	1.435	0.939	17.50	21.9	

\* Refer sketch Civil-Aid/NDT/RES - 01 for Grid Identification.

\*\* Core length and core weight after trimming and capping.

# After applying correction factor for diameter of core which is less than 100 mm (i.e., strength of core x 1.08) as per SP-24-1983, clause:16.3.2

+ For l/d ratio, correction factors are as per Figure-1 of IS:516-1959 (Reaffirmed in 1999).

++ Equivalent cube compressive strength = 1.25 x corrected cylinder compressive strength as per IS:516-1959, Cl.5.6.1 (Reaffirmed in 1999).

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TABLE -2

## RESULTS OF ULTRASONIC PULSE VELOCITY TEST

<b>Project</b>	:	Academic block-National Law School of India University Nagarabhavi, Bangalore
<b>Members tested</b>	:	R C Columns & Beams
<b>Period of test</b>	:	30 <sup>th</sup> and 31 <sup>st</sup> May 2011
<b>Grade of concrete</b>	:	Not furnished
<b>Age of concrete</b>	:	More than 28 days
<b>Test instrument</b>	:	PUNDIT (Portable Ultrasonic Non-Destructive Digital Indicating Tester)
<b>Make</b>	:	M/s. CNS Farnell, U.K
<b>Test method</b>	:	Direct and Semi direct
<b>Technical reference</b>	:	1. Indian Standard IS: 13311-(Part-I)-1992- (Reaffirmed 2004) Non Destructive Testing of Concrete, Methods of Test, Part-1 Ultrasonic Pulse Velocity 2. Instrument manual furnished by M/s. CNS Farnell, U.K

Sl. No.	Floor/Member Identification*	Grid Identification*	Average Pulse Velocity (Km/Sec)	Remarks
1	2	3	4	5
	<b>Basement Floor</b>			<b>Refer Table -2A for estimated compressive strength range and quality grading of in-situ concrete</b>
1	<b>R C Columns</b>	A6	3.7	
2		C6	3.5	
3		D6	3.6	
4	<b>R C Beams</b>	B6-C6	3.6	
5		C6-C7	3.6	
6		D5-D6	3.5	
7		D6-E6	3.6	
8		D6-D7	3.6	
	<b>Ground Floor</b>			
9	<b>R C Columns</b>	A1'	3.5	
10		B1	3.5	
11		C1	3.5	
12		C3	3.8	

\* Refer sketch Civil-Aid/NDT/RES- 01 for Floor / Member Identification

1	2	3	4	5
	<b>Ground Floor</b>			<b>Refer Table –2A for estimated compressive strength range and quality grading of in-situ concrete</b>
13	<b>R C Columns</b>	C5		
14		D1	3.6	
15	<b>R C Beams</b>	B1-B2	3.5	
16		A4-B4	3.5	
17		A4-C4	3.5	
18		C1-C2	3.5	
19		C4-E4	3.5	
	<b>First Floor</b>			
20	<b>R C Columns</b>	A2	3.6	
21		A4	3.7	
22		B1	3.5	
23		B7	3.6	
24		C1	3.8	
25		C2	3.6	
26		C4	3.5	
27		C5	3.6	
28		C6	3.5	
29		D1	3.8	
30		D7	3.7	
31	<b>R C Beams</b>	A2-C2	3.6	
32		A4-C4	3.6	
33		C4-C5	3.6	
34		C2-E2	3.6	
35		C4-E4	3.5	
36		C6-E6	3.6	

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**TABLE – 3A**

**REFERENCE QUALITY GRADING & STRENGTH CHART FOR  
ULTRASONIC PULSE VELOCITY TEST**

Instrument : PUNDIT [Portable Ultrasonic Non-Destructive Digital Indicating Tester]

Make : C.N.S. Electronics, London, U.K.

Pulse Velocity (Km/sec)	Concrete Quality Grading
Below 3.0	Doubtful
3.1 to 3.5	Medium
3.6 to 4.5	Good
Above 4.5	Excellent

**Note:** Concrete quality grading for different velocity criterion as reproduced  
From Table-2 of IS: 13311(Part I) 1992

In case of “Doubtful quality”, it may be necessary to carry out further testing.

Pulse Velocity (Km/sec)	Estimated Compressive Strength (N/Sq.mm)
3.1 to 3.3	14 – 16
3.3 to 3.5	16 – 18
3.5 to 3.7	18 – 20
3.7 to 4.0	20 – 22
4.0 to 4.3	22 – 25

**Note:** The estimated compressive strength worked out based on the calibration  
Chart developed for the above test instrument in our laboratory

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TABLE – 3

## RESULTS OF REBOUND HAMMER TEST

<b>Project</b>	:	Academic block-National Law School of India University Nagarabhavi, Bangalore
<b>Members tested</b>	:	R C Slabs
<b>Period of test</b>	:	30 <sup>th</sup> and 31 <sup>st</sup> May 2011
<b>Grade of concrete</b>	:	Not furnished
<b>Age of concrete</b>	:	More than 28 days
<b>Test instrument</b>	:	Schmidt Hammer
<b>Make</b>	:	M/s. Proceq, Switzerland
<b>Position of hammer</b>	:	Vertically upwards
<b>Technical references</b>	:	1. Indian Standard IS: 13311-(Part-II)-1992- (Reaffirmed 2004) 2. Instrument manual furnished by M/s. Proceq, Switzerland

Sl. No.	Floor / Member Identification*	Grid Identification*	Average Rebound Number+	Remarks
1	2	3	4	5
	<b>Basement Floor</b>			<b>Refer Table – 3A for estimated compressive strength range of in-situ concrete</b>
1	<b>R C Slabs</b>	B5-B6 C5-C6	34	
2		C5-C6 D5-D6	34	
3		C6-C7 D6-D7	34	
	<b>Ground Floor</b>			
5	<b>R C Slabs</b>	B1-B2 C1-C2	32	
6		A2-A4 C2-C4	34	
7		C1-C2 D1-D2	32	
8		C4-C5 E4-E5	32	
	<b>First Floor</b>			
9	<b>R C Slabs</b>	A2-A3 C2-C3	32	
10		A5-A6 C5-C6	34	

\* Refer sketch Civil-Aid/NDT/RES-01 for Floor / Grid Identification

+ After applying necessary correction factor for position of Hammer.

1	2	3	4	5
	<b>First Floor</b>			<b>Refer Table – 3A for estimated compressive strength range of in-situ concrete</b>
11	<b>R C Slabs</b>	C4-C5 E4-E5	32	
12		C1-C2 D1-D2	34	
13		C6-C7 E6-E7	32	

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**TABLE – 3A**

**REFERENCE STRENGTH CHART FOR  
REBOUND HAMMER TEST**

**Equipment** : Schmidt Hammer

**Make** : M/s. Proceq, Switzerland

**Type** : N-34

**Technical reference** : 1. IS: 13311-(Part -2) – 1992 and  
2. Instrument manual furnished by  
M/s. Proceq, Switzerland

REBOUND NUMBER	ESTIMATED COMPRESSIVE STRENGTH RANGE (N/Sq.mm)
22 to 26	10 to 14
26 to 30	14 to 18
30 to 34	18 to 22
34 to 38	22 to 26
38 to 42	26 to 30
42 to 46	30 to 34

**Note :** Estimated compressive strength is worked out based on the Calibration Chart developed for the above test instrument in our laboratory

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TABLE-4

## RESULTS OF COVERMETER STUDIES

<b>Project</b>	:	Academic block-National Law School of India University Nagarabhavi, Bangalore
<b>Members tested</b>	:	R C Columns, Beams & Slabs
<b>Period of test</b>	:	30 <sup>th</sup> and 31 <sup>st</sup> May 2011
<b>Test instrument</b>	:	Profometer-5
<b>Make</b>	:	M/s. Proceq, Switzerland
<b>Technical Reference</b>	:	BS: 1881-(Part 204) & Test Instrument Manual "Metal & Reinforcement Detector" from M/s. Proceq, Switzerland

Sl. No.	Floor / Member Identification*	Grid Identification*	Range of cover concrete (mm)**	Reinforcement Disposition & Probable Diameter (Peripheral Only)
1	2	3	4	5
	<b>Basement Floor</b>			
1	<b>R C Columns</b>	B6	40 to 60	<u>Main Bars</u> 04Nos.of 20mm dia <u>Ties</u> 8 mm dia @ 220 mmc/c
2		C6	45 to 55	<u>Main Bars</u> 08Nos.of 25mm dia <u>Ties</u> 8 mm dia @ 210 mmc/c
3		D6	50 to 60	<u>Main Bars</u> 04Nos.of 20mm dia <u>Ties</u> 8 mm dia @ 200 mmc/c
4	<b>R C Beams</b>	B6-C6	40 to 50	<u>Bottom Bars</u> 05Nos.of 20mm dia <u>Stirrups</u> 8 mm dia @ 155 mmc/c
5		C6-C7	50 to 55	<u>Bottom Bars</u> 05Nos.of 20mm dia <u>Stirrups</u> 8 mm dia @ 145 mmc/c
6		D5-D6	40 to 55	<u>Bottom Bars</u> 05Nos.of 20mm dia <u>Stirrups</u> 8 mm dia @ 150 mmc/c

\* Refer sketches *Civil-Aid/NDT/Res- 01* for Member / Grid Identification

\*\* Inclusive of plaster.

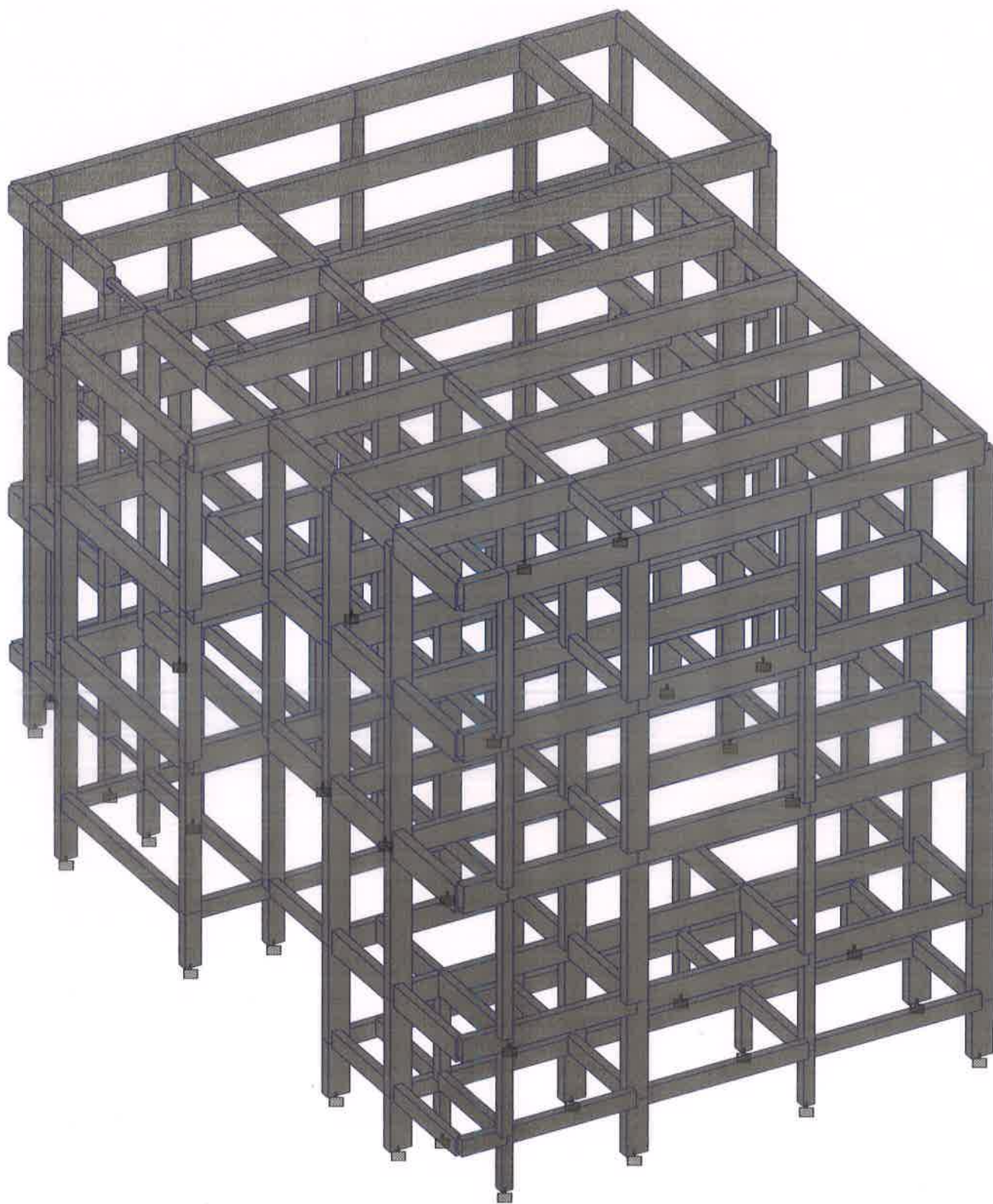


1	2	3	4	5
	<b>Basement Floor</b>			
7	<b>R C Ceiling Slabs</b>	B5-B6 C5-C6	30 to 35	<b>Main Bars</b> 10 mm dia @100 mm c/c <b>Distribution Bars</b> 8mm dia @ 120 mm c/c
8		C5-C6 D5-D6	25 to 35	<b>Main Bars</b> 10 mm dia @110 mm c/c <b>Distribution Bars</b> 8mm dia @ 130 mm c/c
9		C6-C7 D6-D7	20 to 30	<b>Main Bars</b> 10 mm dia @125 mm c/c <b>Distribution Bars</b> 8mm dia @ 130 mm c/c
	<b>Ground Floor</b>			
10	<b>R C Columns</b>	A1'	40 to 55	<b>Main Bars</b> 04Nos.of 25mm dia & 04Nos.of 20mm dia <b>Ties</b> 8 mm dia @ 220 mmc/c
11		C1, C3	40 to 50	<b>Main Bars</b> 08Nos.of 25mm dia <b>Ties</b> 8 mm dia @ 210 mmc/c
12		C5	50 to 60	<b>Main Bars</b> 08Nos.of 25mm dia <b>Ties</b> 8 mm dia @ 200 mmc/c
13		D1	60 to 70	<b>Main Bars</b> 08Nos.of 25mm dia <b>Ties</b> 8 mm dia @ 200 mmc/c
14	<b>R C Beams</b>	A4-C4	40 to 50	<b>Bottom Bars</b> 05Nos.of 20mm dia <b>Stirrups</b> 8 mm dia @ 160 mmc/c
15		C1-C2	50 to 70	<b>Bottom Bars</b> 05Nos.of 25mm dia <b>Stirrups</b> 8 mm dia @ 165 mmc/c
16		C4-E4	40 to 65	<b>Bottom Bars</b> 05Nos.of 25mm dia <b>Stirrups</b> 8 mm dia @ 160 mmc/c
17	<b>R C Ceiling Slabs</b>	B1-B2 C1-C2	35 to 45	<b>Main Bars</b> 10 mm dia @120 mm c/c <b>Distribution Bars</b> 8mm dia @ 130mm c/c

1	2	3	4	5
	<b>Ground Floor</b>			
18	<b>R C Ceiling Slabs</b>	A2-A4 C2-C4	20 to 40	<b>Main Bars</b> 10 mm dia @120 mm c/c <b>Distribution Bars</b> 8mm dia @ 130 mm c/c
19		C1-C2 D1-D2	30 to 35	<b>Main Bars</b> 10 mm dia @125 mm c/c <b>Distribution Bars</b> 8mm dia @ 135 mm c/c
	<b>First Floor</b>			
20	<b>R C Columns</b>	A2, A4	45 to 50	<b>Main Bars</b> 04Nos.of 25mm dia & 04Nos.of 20mm dia <b>Ties</b> 8 mm dia @ 210 mmc/c
21		B7	50 to 70	<b>Main Bars</b> 04 Nos.of 20mm dia <b>Ties</b> 8 mm dia @ 200mmc/c
22		C1, C4	60 to 70	<b>Main Bars</b> 08 Nos.of 25mm dia <b>Ties</b> 8 mm dia @ 200mmc/c
23		D1	65 to 70	<b>Main Bars</b> 08 Nos.of 25mm dia <b>Ties</b> 8 mm dia @ 200mmc/c
24	<b>R C Beams</b>	A2-C2, A4-C4	45 to 60	<b>Bottom Bars</b> 05Nos.of 25mm dia <b>Stirrups</b> 8 mm dia @ 165 mmc/c
25		C4-C5	50 to 65	<b>Bottom Bars</b> 03Nos.of 16mm dia <b>Stirrups</b> 8 mm dia @ 150 mmc/c
26		C2-E2, C4-E4	55 to 65	<b>Bottom Bars</b> 05Nos.of 25mm dia <b>Stirrups</b> 8 mm dia @ 160 mmc/c
27	<b>R C Ceiling Slabs</b>	C4-C5 E4-E5	40 to 45	<b>Main Bars</b> 10 mm dia @100mm c/c <b>Distribution Bars</b> 8mm dia @ 130 mm c/c
28		C1-C2 D1-D2	40 to 50	<b>Main Bars</b> 10 mm dia @120 mm c/c <b>Distribution Bars</b> 8mm dia @ 140 mm c/c

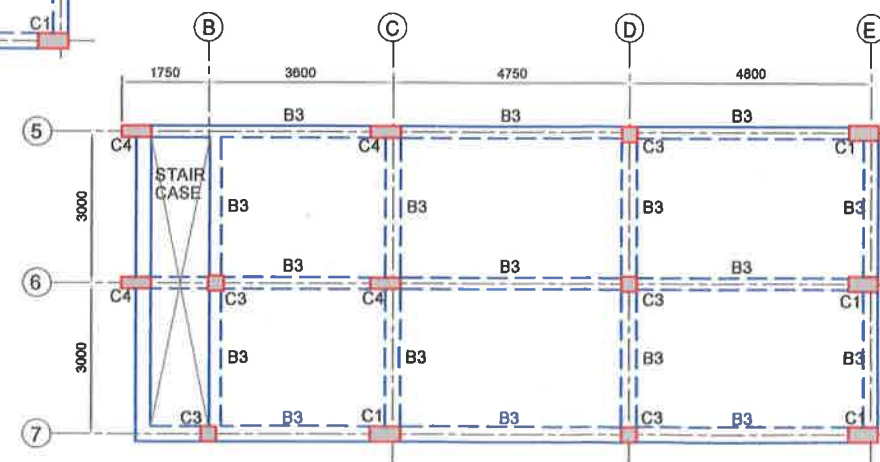
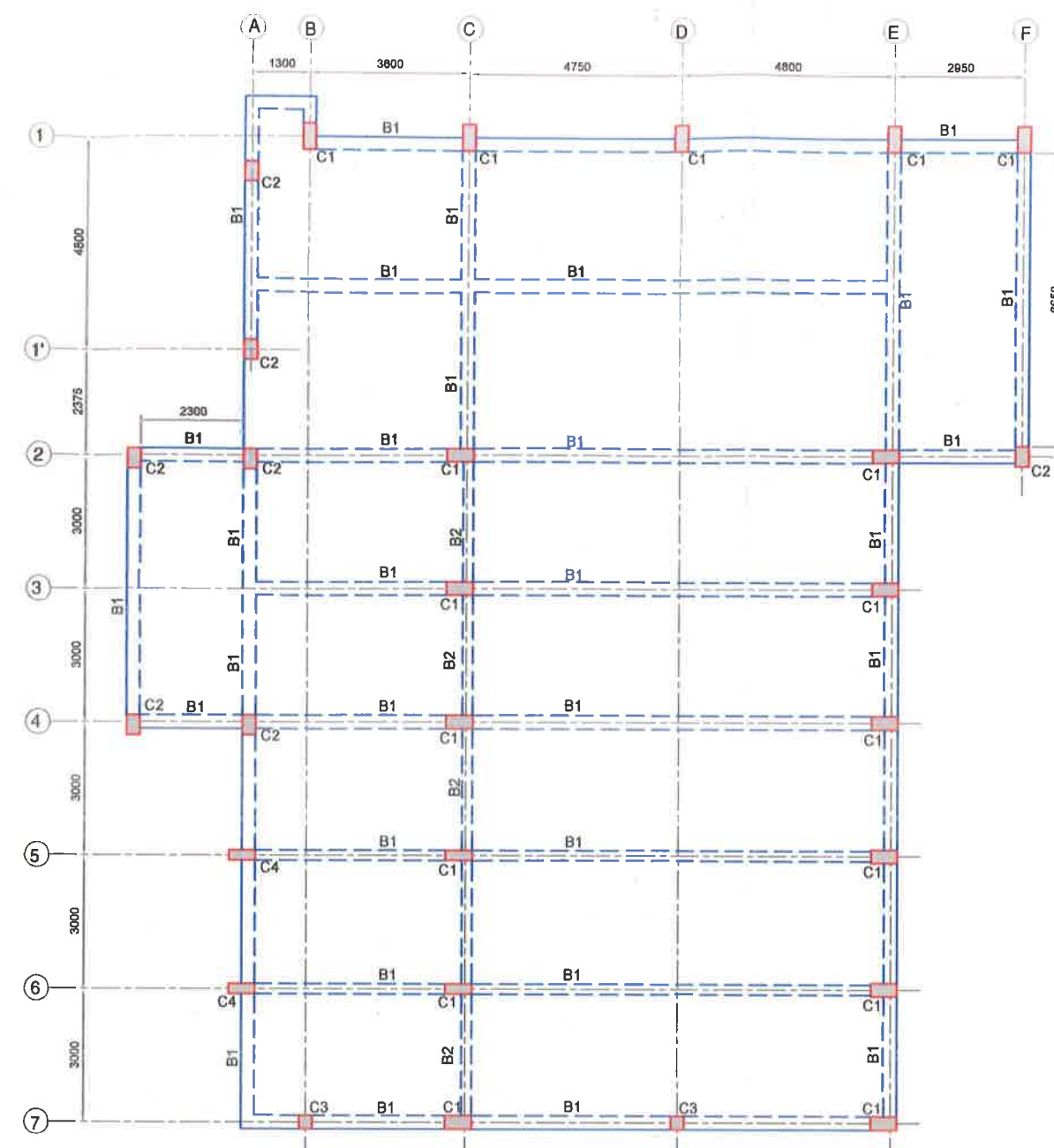
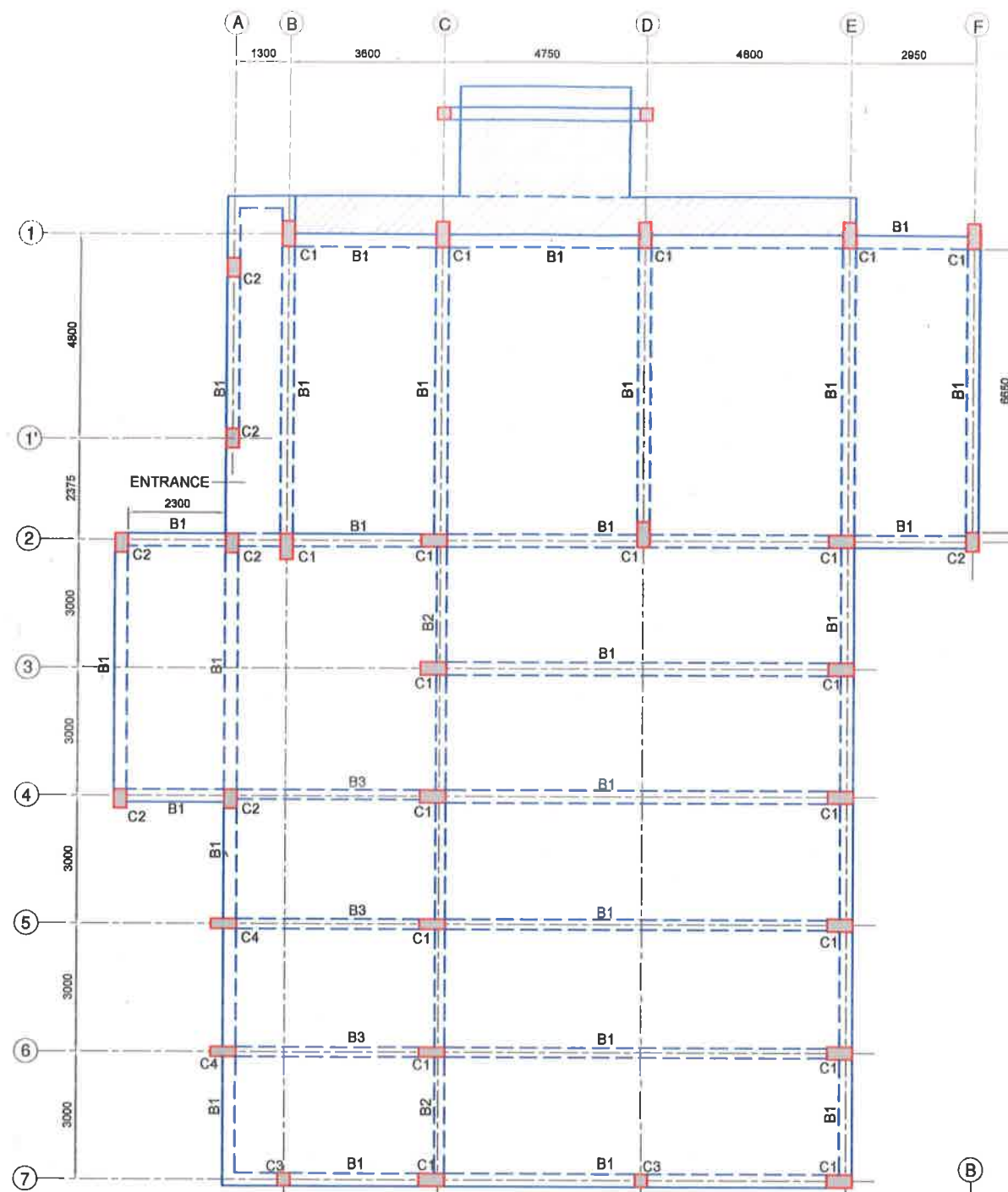
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# STAAD MODELS



**SKETCH**





#### NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. FOLLOW FIGURED DIMENSIONS ONLY.
3. COLUMNS (i) C1 - (300X800) (ii) C2 - (300X450)  
(iii) C3 - (300X300) (iv) C4 - (230X800)
4. BEAMS (i) B1 - (300X750) (ii) B2 - (230X450)  
(iii) B3 - (230X625)

CLIENT: NATIONAL LAW SCHOOL OF INDIA UNIVERSITY-  
NAGARABHAVI BANGALORE.

PROJECT: FEASIBILITY STUDY FOR CONSTRUCTION OF ADDITIONAL FLOOR  
OVER THE EXISTING ACADEMIC BLOCK OF NATIONAL LAW  
SCHOOL OF INDIA UNIVERSITY- NAGARABHAVI BANGALORE

TITLE:

### EXISTING LAYOUT OF COLUMNS & BEAMS

DRAWN : PA

CHECKED : RG/THS

SCALE  
NTS

DATE  
20-6-2011

REV.No  
R0

APPROVED : SVS

JOB No.  
2011/099

ORDER NO.  
BNS/5/5/2011

CONSULTANTS



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DRG. NO.

CIVIL-AID/NDT/RES-01

# PHOTOGRAPHS



*(Front view)*

**General views of the building**



*(Rear view)*





**View of basement**



**(RC Slab)**

**Internal view of first floor**



**Growth of vegetation close to the building  
(Typical views)**





**Chocking of rain water outlet  
(Typical views)**







**Debonding of cladded tiles**



**Accumulation of waste materials over chejja**



**Separation crack between masonry wall  
and RC members**



**Damp patches in masonry wall  
(Typical views)**





**Damp patches in RC column and ceiling slab**







**View of terrace**



**Crack in WPC over roof slab**





**Extraction of undisturbed soil sample  
from founding level in progress**



**Extraction of concrete core sample  
from footing in progress**



**Rebound Hammer test  
on RC slab in progress**



**(RC Column)**



**(RC Beam)**

**Ultrasonic Pulse Velocity  
test on RC members  
in progress**



(RC Beam)

Covermeter studies on RC members in progress



(RC Slab)