



Value beyond the ordinary



Our Guiding Principles



Commitment

At Capstone we are committed to provide a world-class customer experience. Our team is made up of highly professional people who approach work with integrity and always seek to add value to the clients. We seek to build strong, long-term relationships with our clients by understanding their needs.

Our commitment does not end with the project; we assure to help our clients with the solutions we have provided any time in the future should the need arise.



Excellence

It is our policy at Capstone to maintain the high standards that we started with. We do not compromise on quality in any area of our business. Whether it is hiring new people or working on a client's project, we thrive on excellence. With our well-structured internal quality control procedures, we make sure all client deliverables meet or exceed expectations. We also welcome feedback from clients to help us evaluate our own people; identify any shortcomings and implement necessary improvements.



Innovation

The spirit of innovation is ingrained in the Capstone culture. We are always looking to provide value added services to our clients which are based on latest cutting edge technologies. Some examples include using drones for inspections or using advanced scanners for preparation of as-built drawings. Innovative design & testing solutions are devised based on client requirements.



Company Profile

Capstone is an engineering consultancy firm founded in 2005 in Mumbai. From a small beginning, the firm has grown to a team of more than sixty members now consisting of civil & structural engineers, architects, CAD technicians, project managers & inspection / testing engineers & technicians.

We provide the complete range of services for construction projects, starting from planning, architectural & structural design, tendering, quality control, project management & handover.

We also have an in-house **NABL accredited** construction material testing laboratory with advanced testing equipment. Our expertise in **non-destructive testing** is used by clients such as **Tata Projects, Tata Steel, Larsen & Toubro and Reliance Industries** regularly in their projects across India.

Services Offered

- Design for Greenfield / Brownfield Projects
 - Industrial Plants/ Warehouses
 - o Residential Buildings & Housing Projects
 - Commercial / Institutional Buildings
 - Power Sector Electric Substations, Solar & Wind Energy
 - Infrastructure Highways / Bridges / Airports / Municipal Structures / Telecom
- Structural Health Assessment & Retrofitting Design for all types of Existing Buildings
 - $_{\odot}~$ For additional loads
 - $_{\circ}$ Change in usage
 - For Pre-Purchase / Lease decision making
 - $\circ~$ For seismic preparedness
 - Periodic Structure Health Monitoring

• Non-Destructive Testing

- Reinforced Concrete Buildings
- Steel Structures
- Wood / Stone Masonry Heritage Structures
- Pile Testing (Static test / Dynamic test / Pile Integrity)
- Consulting services for Repair & Upgradation Works

Project Snapshots





Cyclone Replacement IOCL, Vadodara



Wind Turbine Towers Design



Royal Terrace Apartments, Geurnsey, Channel Islands



Founder Profile

Rahul Agarwal

B.Tech. (IIT Bombay), M.Tech. (IIT Bombay)

Capstone is headed by Mr. Rahul Agarwal who has completed his graduation and post-graduation in civil & structural engineering from IIT Bombay and has more than 19 years of consulting experience.

Apart from carrying our design for a large number of Indian projects, he has also provided his expertise in many projects located outside India, in USA, UK, Bhutan, Nicaragua, Brunei, Australia, Italy, Afghanistan, UAE, St. Kitts & Brazil. Hence his global knowledge of civil & structural engineering codes & practices is regularly used for our projects in India.

Rahul's other interests include design of temporary scaffolding structures. He has conducted training sessions for engineers of Reliance Industries to help them design and use scaffolding. He has also designed scaffolding for Mumbai Metro project. Rahul has also served as a jury member for the CREDAI Bengal Realty Awards.

<u>Advisor</u>

Dr. Alok Goyal Professor IIT Bombay

Dr. Alok Goyal is one of the leading authorities on structural engineering in India. Apart from having numerous research publications, he is a consultant to a large number of government organizations such as ONGC, DRDO, Indian Railways and MMRDA. He is consulted by the most reputed Indian companies, real estate developers and engineering consultants for his innovative and practical approach to various structural engineering problems. Dr. Goyal is also a member of the review committee for Indian Standards.

Project Snapshots



Fabrication Plant Bkkoks, Bhilai



Iron Ore Pellet Plant Godawri Power & Ispat Ltd.



Guyed Wind Masts



Project Planning & Design Services (Greenfield / Brownfield)

- Industrial Plants
 - □ Industrial Sheds & Warehouses
 - □ Manufacturing Plants / Factories
 - Chemical Plants
 - Technological Structures
 - □ Pipe racks & sleepers
 - □ Conveyor Structures & Junction Houses
 - Equipment & Tank Foundations
 - □ Electric Substations (GIS / AIS)
 - □ Canteens/Offices/Water Tanks/Reservoirs
 - □ Site Infra: Roads/Drains/Culverts/Trenches
- High and Mid Rise Buildings
 - □ RCC, Steel & Composite construction
- Infrastructure
 - □ Airport Buildings
 - Municipal Infrastructure
 - □ Water & Wastewater treatment plants
 - □ Telecommunication Towers, Wind Masts
 - □ Solar Power & Wind Power Plants

Services Offered:

- Civil, Structural & Architectural Design
- MEP Services Design
- 3D BIM Modeling
- Tender Documentation
- Review of Contractor's submissions: Tekla Model / Shop Drawings / Equipment Details
- Coordination & Design Review of EPC contracts (PEB structures / Cooling Towers)
- Site Visits During Execution
- Peer Review & Value Engineering

Design Capabilities:

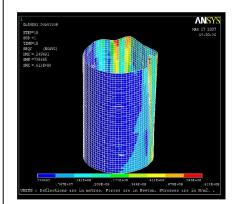
- Advanced Software (Staad-Pro, RAM Connection, Staad Foundation, RCDC, Revit etc)
- Design & Drawing standards equivalent to the best in the industry
- International project experience; worked on projects in Middle East, North & Central America, Europe, Africa, Asia



Jai Neptune, Mumbai



Structural Audit at Rio Tinto Chhatarpur (M.P.)



Analysis of Concrete Silos Iceland



Structural Health Assessment Services

Routine Structural Audit

- Visual Inspection
- Drone Inspection for Chimneys / Silos / Industrial Roofs
- Non-Destructive Testing (RCC & Steel Members)
- Alignment Checking of Columns, Gantry Girders, Chimney by Total Station
- Decide repair/retrofitting methodologies
- Prepare Bill of Quantities & Budgetary Cost Estimates
- Prepare Drawings for Strengthening Measures
- Prepare Comprehensive Report Covering all the above

Detailed Structural Audit including Design Check

Below activities are carried out in addition to "Routine Structural Audit"

- As-Built Data Obtain (LIDAR scanning / Manual Measurement)
- Reinforcement Mapping for RCC members
- Preparation of As-Built Structural Drawings
- Obtain Existing & Proposed Additional Loads
- Structural FEM Analysis
- Bill of Quantities for Strengthening based on analysis
- GFC Drawings for the Required Strengthening Measures



Structural Assessment at Hospet Steel Ltd



Seismic Assessment of Residential Block for Cipla in Sikkim

Non Destructive Testing (NABL Accredited Lab)

Type of Members	Name of Te	ests Conducted
RCC	 Ultrasonic Pulse Velocity Test Rebound Hammer Test Half Cell Potential Test Carbonation Test Concrete Core Test 	 Concrete Chemical Test Rebar Mapping with Graphical Output Electrical Resistivity Test Tomography Test Corrosion Rate Measurement
Steel	 Weld Tests (Magnetic Particle / Dye Penetrant) Ultrasonic Thickness Test 	Portable Hardness TestBolt Tightness TestVibration Measurement
Pile Tests	 Pile Integrity Test Pile Dynamic Test Pile Load Tests: Compression / Lateral / Uplift 	
Other Tests	 Slab Load Test Long Duration Structural Health Monitoring (SHM): Vibration, Strain, Acceleration Alignment Check by Total Station Plate Load Test LIDAR scanning GPR Scanning 	



DESIGN PROJECTS

Residential/Commercial/Institutional

- Cargo Complex at Santacruz Domestic Airport, Mumbai
- Design of Campus Buildings for Assam Skill University
- Design of Clubhouse for St. Patrick Society, Pune
- 38 storied residential towers at Kanjurmarg (Lodha Grande)
- 20 storied residential cum office complex Mumbai for Lotus Group
- 15 storied residential building at Kalina, Mumbai for Lotus Group
- 20 storied residential building, Silvex Developers, Mumbai
- 30 storied residential building (Lodha Simtools), Thane
- 22 storey residential building, Diamond Group, Kolkata
- Nanotechnology Department, Mumbai University
- MTNL Telephone Exchange building, Vashi
- Design of Form Work for residential building, Talib & Shamsi
- 25 storied residential building, Kanjurmarg (Lodha Aurum), Mumbai
- Guest House buildings for HAL, Kanpur
- Royal Terrace Apartments, BubbleDeck UK, Guernsey
- Broxbourne & Ware College Buildings, BubbleDeck UK
- Carol Johnson residence, California
- Woods Residence, Smart Engineering, Arizona
- Social Security Building, St. Kitts, West Indies
- Gemini Apartment Building, BubbleDeck, Middle East
- Pre-engineered buildings (G+5, G+10), Canada
- Medical Center, British Virgin Islands
- Hotel Frett Marina Building, British Virgin Islands
- Design of Home for the Aged project at Andheri East Mumbai
- Elpro Housing, Residential Building, Pune (G+13)
- Elpro Global International School, Chinchawad, Pune (B+G+5)
- CDKD Hospital Building, Mumbai (G+17)
- Silver Skyline (G+18), Andheri (w)
- Lotus Jai Neptune (G+18), Malad (w)

Industrial

- Industrial Plant structures for Epsilon Carbon at Bellary
- Design of Plant buildings for TANFAC Industries, Cuddalore
- Design of PCC building for Epsilon Carbon at Vijaynagar
- Design of Electric Substations for Reliance Industries at Jamnagar
- Design for Industrial/Warehouse Buildings for Reliance New Energy Ltd
- Design of Motor Bay for Tata Tin Plate, Jamshedpur (capacity enhancement project)







- Design of Canteen Building for Shreeyam Power and Steel, Kandla
- Industrial Warehouses for Wheel Detergent Factory at Patna
- Manufacturing facility for Japanese firms, Tsujikawa & Hanwei at Bangalore
- Design of Lifeline structure for Epsilon Carbon, Vijaynagar
- Site Assembly Shop for Nuclear Power project at Kalpakkam
- Design of Hot Metal Bay for Tata Metalliks, Kharagpur (capacity enhancement project)
- Design of Energy Building at IFFCO Paradeep (Capacity augmentation)
- Design of Gantry Girders for Tata Steel Ltd., Khopoli
- 500/230/110 kV GIS Substations for KEC International at Chennai
- Municipal Water Storage & Pumping facilities for MCGM Mumbai at Phoenix Mall Kurla & Home Guard Ground
- Control Room Buildings for Electric Substations at Afghanistan
- Pre-bid Engineering for Electric Substations at Zambia
- Design of Power Equipment Manufacturing Plant, NBPPL, Chitoor
- Temporary Structures for cyclone replacement at IOCL, Vadodara
- Fabrication plant for BHEL, Varanasi
- Expansion of Existing Machine Shops for BHEL, Varanasi
- Steel fabrication facility for BK Koks, Bhilai
- Design of Gantry Shed for BK Koks, Bhilai
- Design of Boiler House, Larsen & Toubro, Hazira
- Design of Printing Press building, Times of India, Lucknow
- Expansion Design at Godrej Industries Ltd., Satara
- Design of factory shed for Silvol plant at Silvassa
- Detailed Engineering for 1.2MTPA Pellet plant for Godawri Power & Ispat Ltd., Raipur
- Showroom & Workshops for Tata Motors Dealership at Muzaffarpur
- Design of Telecom towers (4G deployment) for Reliance Industries
- Design of Guyed Wind Masts and Latticed Towers, Shah Energy Inc
- Design of Form work system for Mumbai Metro, Ghatkopar Station
- Design of Solar Mounts & Control station for Chemtrols Solar
- Design of Road Sign Structures for 3M India Ltd.
- Design of Wind Turbine Towers for ABS Group, Mumbai
- Design Review of Glenmark Pharamaceuticals, Sikkim
- Design of Solar Power Plant Structures for Solaire Direct India Ltd.
- Electrical Substation Building, Palm Jebel Ali, Dubai
- Fair & Show Electrical Substation, Dubai
- Design of Electric Substations at Ghana, Africa
- Analysis of Concrete Silos, Alcan Iceland Ltd., Iceland
- Design of AAC Panel Walls for Windmill Workshop, Texas
- Design of multiple Skid structures for John Crane, Singapore























STRUCTURAL ASSESSMENT & RETROFITTING DESIGN PROJECTS

- Structural Assessment of more than 1,200 Civil Structures for Tata Steel at their Plant in Jamshedpur
- Structural Assessment of more than 100 Civil Structures for Tata Steel at their Plant in Kalinganagar, Odisha
- Structural Assessment for more than 600 structures at Tata Steel Angul (ongoing)
- Structural Assessment for all plant buildings at Tata Steel Khopoli
- Structural Assessment for all plant buildings at Tata Steel Sahibababd
- Structural Assessment & Retrofitting Design for Ramco Cement Plant at RR Nagar, Jayanthipuram & Alathiyur
- Structural Assessment for Nuvoco Cement Plants at Arasmeta & Sonadih (Chattisgarh)
- Structural Assessment of complete plant of Mazgaon Dock Ltd, Mumbai
- Structural Assessment of Induration Building at KIOCL, Mangalore
- Structural Assessment of Residential, School & Plant Buildings for Godrej & Boyce, Mumbai
- Structural Assessment & Retrofitting Design for more than 70 structures at Hindalco Ltd, Hirakud
- Structural Assessment & Retrofitting Design of Huntsman India Office cum Lab building in Mumbai
- Structural Assessment of Hindustan Unilever Abhiyaan R&D Building at Mumbai
- Structural Assessment & Retrofitting Design of Industrial Shed for Trident Plant at Barnala, Punjab
- Structural Assessment & Retrofitting Design of Tata Tin Plate Machine Shop at Jamshedpur
- Structural Assessment & Retrofitting Design of IndusInd Media office in Andheri, Mumbai
- Structural Assessment & Retrofitting Design of Rock Phosphate Raw Material Shed for IFFCO at Paradeep
- Seismic Assessment & Retrofitting Design of Residential Buildings for Cipla Ltd. at Sikkim
- Structural Assessment & & Retrofitting Design for John Deere Tractor Assembly & Paint Shops at Pune
- Structural Assessment & Retrofitting Design of Mini Blast Furnace and LRF Buildings at Hospet Steel Ltd, Hospet
- Design of Retrofitting for LPG plant, ONGC, Uran
- Seismic Assessment & Retrofitting Design of office building, AFL Logistics, Mumbai
- Structural Assessment of R&D lab building for Godrej Sara Lee Ltd.
- Structural Assessment of Rolls Royce facility at Turbhe for blast vibrations
- Structural Assessment of DMS Plant for Rio Tinto at Chhatarpur (M.P.)
- Seismic Assessment of Office Building, Goldman Sachs, Mumbai
- Structural Assessment & Retrofitting Design of Halliburton facility at Barmer (Raj.)
- Structural Assessment of Cooling Towers at Haldia Energy Ltd., Haldia



- Structural Assessment for fire affected SHCIL House at Mahape, Mumbai
- Structural Assessment of Community Structure for Jagadguru Narendracharya Maharaj Sansthan, Ratnagiri
- Non-Destructive Testing for Bombay Scottish School, Mahim
- Structural Assessment of Tata Trust School at Navsari
- Structural Assessment & Retrofitting Design of Elpro Business Bay in Pune
- Structural Assessment & Retrofitting Design of Elpro Corporate Building in Pune
- Structural Assessment & Retrofitting Design of Municipal Corporation of Mumbai's R-South Office Building at Kandivali, Mumbai
- Structural Assessment & Retrofitting Design of Mata Amritanandmayi Building in Nerul, Navi Mumbai
- Structural Assessment & Retrofitting Design of Kinara residential building at Bandra
- Structural Assessment & Retrofitting Design of Bliss Pharma Building, Hubli
- Structural Assessment & Retrofitting Design of Indian Coastal Guard Office Building at Worli
- Earthquake Time History Simulation of 3-D Structure, Core Projects
- Structural Assessment of IKEA stores at Hyderabad & Mumbai
- Structural Assessment & Design Review of Unilever Ice Cream Plant, Nashik
- Structural Assessment & Design Review of Unilever Surf Detergent Plant, Punjab













मेकॉन लिमिटेड भारत सरकार का संस्थान MECON LIMITED A GOVT. OF INDIA ENTERPRISE





बृहन्मुंबई महानगरपालिका Municipal Corporation of Greater Mumbai



EFKON

asianpaints

Reliance

Industries Limited

Johnson & Johnson









YOKOHAMA















asian

PROTECTIVE, PERFORMANCE AND POWDER COATINGS









Case Study: Tractor Manufacturing Plant, Pune

Project Requirement

- Prepare structural drawings for existing plant buildings (13 yrs old) as original drawings were misplaced
- Carry out detailed structural assessment of the buildings
- Determine if surplus capacity exists for an additional production line

Assessment Procedure

Stage I: Data Collection/Drawing Preparation

- On-site measurements were carried out for all structural elements of the building (beams, columns, roof trusses, selective foundations)
- Measurements were also carried out for production line conveyors, paint booths and other equipment supporting structures
- Loading data was obtained for assembly lines, equipment supporting structures
- As-built structural drawings were prepared based on the obtained data

Stage II: Testing & Condition Assessment

In addition to Visual Assessment, following tests were carried out to ascertain the condition of the structure

Test	Purpose
Concrete Core Tests	To determine the compressive strength of concrete
Ultrasonic Pulse Velocity	To establish the quality of concrete
Half-Cell Potential & Carbonation	To assess the probability of corrosion in reinforcement
Reinforcement Mapping Tests	To obtain size and numbers of reinforcing bars in the concrete members
Weld Tests (Magnetic Particle + Liquid Penetrant)	To check the condition of welds in structural steel members
Ultrasonic Thickness Measurement	To estimate loss in thickness of steel members due to corrosion

Stage III: Interpretation of Results & Structural Analysis

- Based on the test results, inferences were made for use in structural analysis. These included the concrete grade, reinforcement quantity in members, corrosion in reinforcement and effective sections for steel members.
- Software analysis was carried out based on the prepared drawings & test results.
- Conclusions & recommendations were provided in reference to:
 - o Stability of the structures with current loads
 - Possibility of adding a production line
 - Suggestions to improve the structural performance including retrofitting where required



Assembly Shop



Footing Measurement



Member Testing

Geometric Data Collection



Case Study: Structural Assessment for Blast Vibrations

Project Requirement

- Vibrations occurring in office & workshop buildings due to regular blasts occurring in stone quarries nearby
- Structural Stability in terms of strength & serviceability including occupant's comfort level was to be determined

Assessment Procedure

Stage I: Data Collection

- Acceleration measurement equipment was set up on each structure
- Accelerometers were fixed at different locations on the building to measure the acceleration whenever any vibration due to blast occurs
- Data was collected over two days and the peak acceleration was obtained after processing the obtained data

Stage II: Structural Analysis

- Computer analysis was carried out for the structures using the vibration forces in combination with gravity, wind and seismic forces.
- Design of the structures was checked and conclusion regarding the safety and comfort levels for the buildings was drawn.



Accelerometer fixed to terrace slab



Data collection system



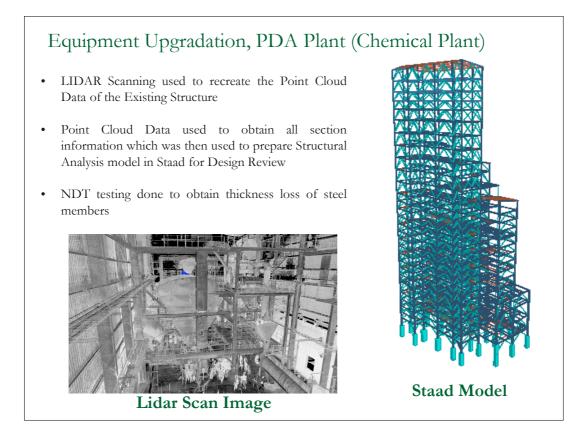
Equipment Upgradation, PDA Plant (Chemical Plant)

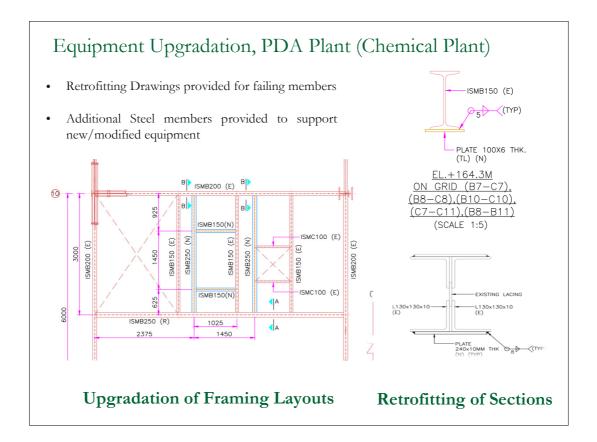
- Existing Equipment Supporting Structure of Size 15m x 21m x 70m height
- Equipment Layout & Loading was to be modified due to process requirement
- Existing Structural Drawings were not available
- Existing Structural Steel members were corroded.

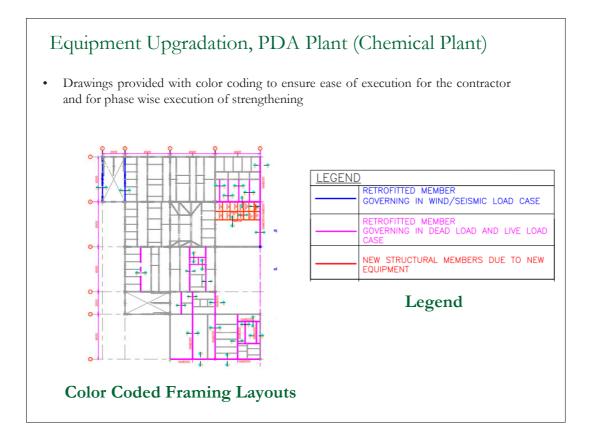












hallenges: Equip	ment Upgradation, PDA Plant
Challenges	Resolution
No existing drawings available	Drawings prepared by using Lidar Scanning
Members were Corroded	NDT test carried out to estimate thickness loss and the results used for design review for new loading
Existing Equipment Loading Data not available completely	Equipment sizes measured and empty/operating weights considered according to volume.
Execution Challenges	Drawings provided with color coding to ensure ease of execution for the contractor



Expansion of Business Bay, Pune



- A single storey RCC building more than 50 years old.
- No drawings available.
- Client wanted to add two more floors to the existing ground floor structure for usage as a primary school
- This was to be done with office running in half area of the existing ground floor.

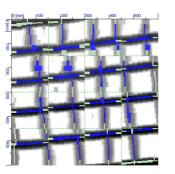


• Original building photos shown here

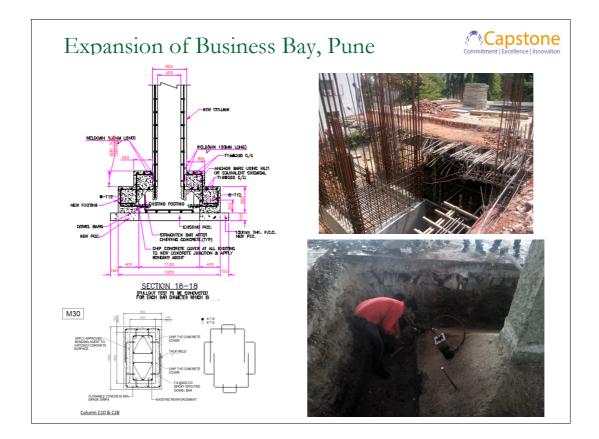


Expansion of Business Bay, Pune

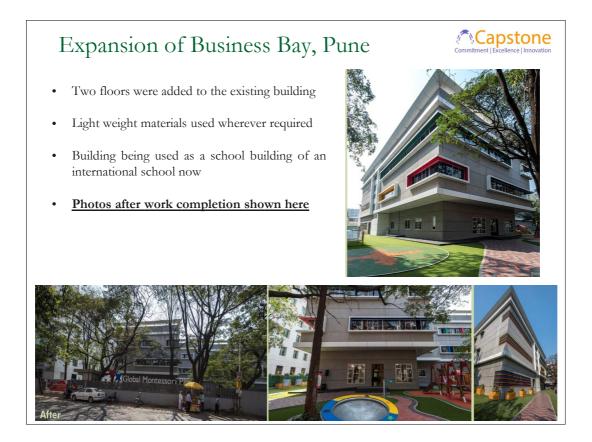
- As-Built drawings were prepared
- Non-Destructive Tests were carried out
- Rebar Mapping done
- Existing Footing measurements done
- Existing RCC Columns & Footings were retrofitted
- Beams were retrofitted using steel plates
- Lift added within the existing building footprint
- Partial Demolition & replacement of slabs done strategically without disturbing building stability
- Two floors added without disturbing the existing ground floor office







Capstone



Challenges	Resolution
No existing drawings available	As-Built Drawings prepared along with Rebar Mapping using Hilti Equipment
Low Strength for Concrete obtained from NDT tests + insufficient load capacities of members	 Different types of retrofitting techniques used based on suitability and ease of implementation RCC jacketing Steel Jacketing Additional Columns
Partial Ground Floor Occupied by Tenant on Long Lease	Structural Design carried out using light weight materials (AAC slabs with steel beams & AAC walls) so that retrofitting is avoided in that area Roof done with structural steel trusses for partia area



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