



Precast Technology

**PEPSCON
Conference
Hyderabad**

March 2013

**Stephen Carr MD
Spirall Precast Services Ltd
Derby
England**

**Pravin Sharode
Marketing Manager
Apollo Infratec Ltd
Ahmedabad**





Specialists Supplier of Precast and Prestressing Technology, Equipment



Apollo Infratech Private Limited
Raipur 382 740, Gujarat, INDIA
TEL: +91 2764 232 217, FAX: +91 2764 233 117,
E-MAIL: sales@apolloinfratech.com
www.apolloinfratech.com

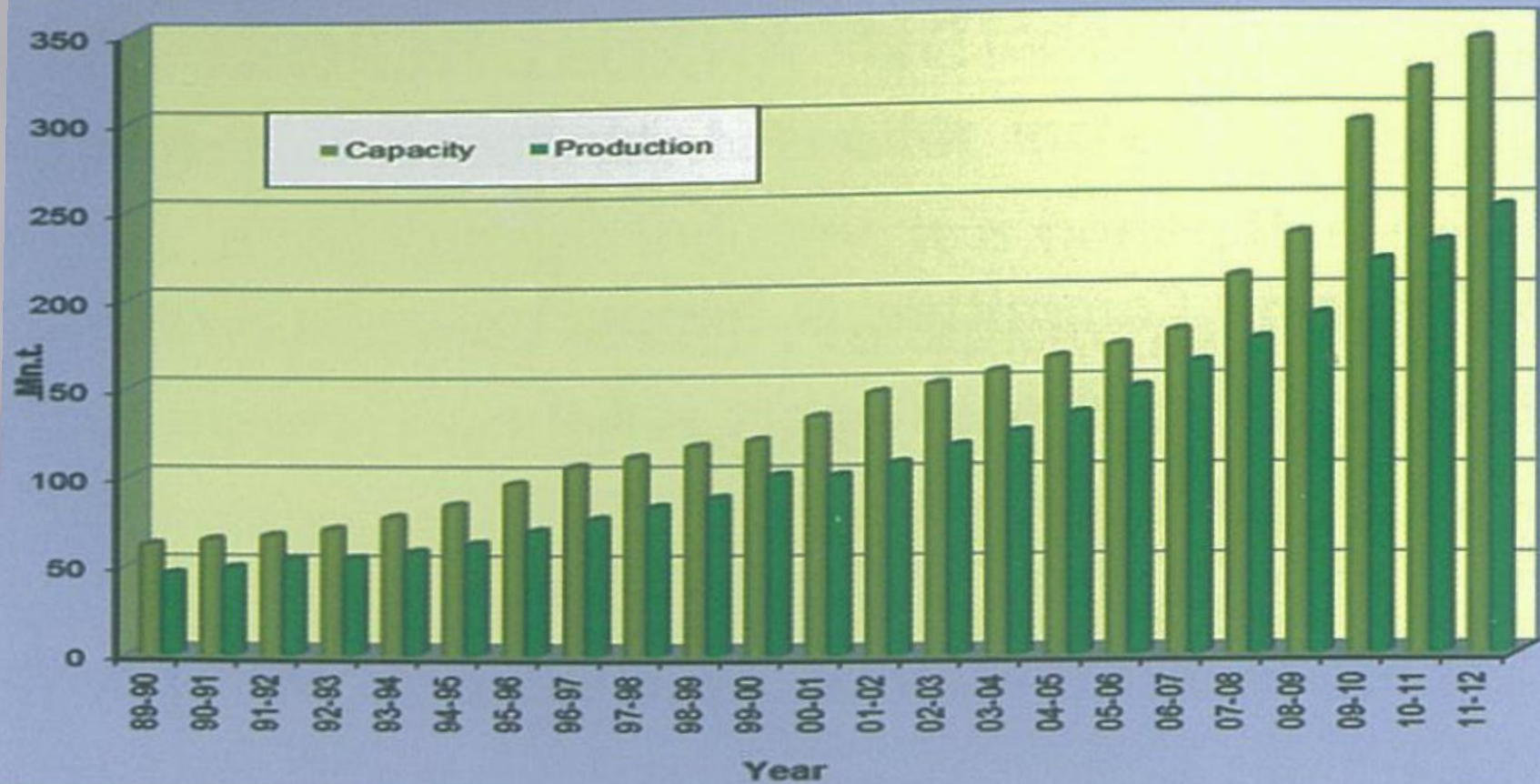


UK

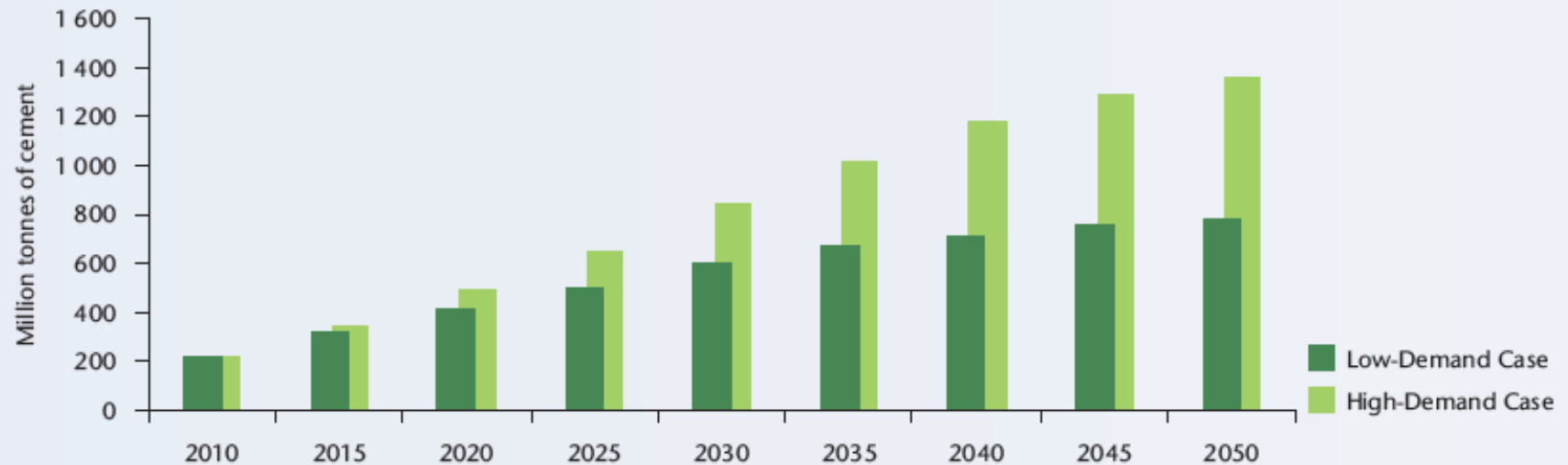


UKIERI
UK-India Education
and Research Initiative

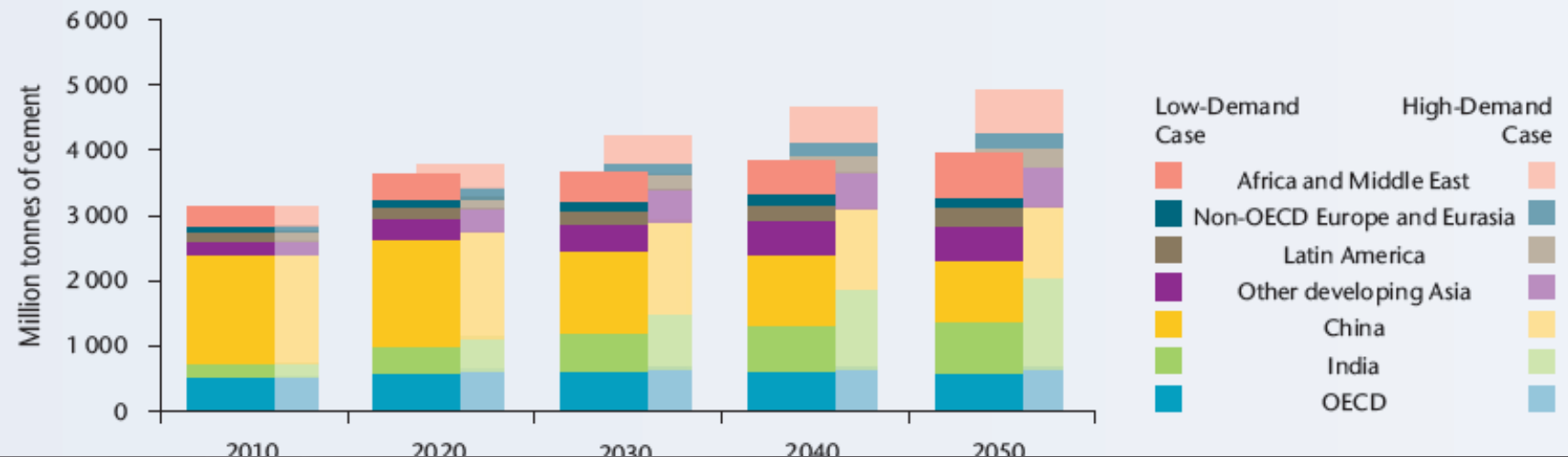
Growth of Cement Industry



Projected cement production in India



Projected cement production globally



PRESENTING

world renowned



concrete slab extruder machines

Apollo's giant leap in providing solutions for Cost-effective Precast Projects in collaboration with its partner SPIROLL (UK)



During the 6th Vibrant Gujarat Global Investor's Summit held at Gandhinagar during 11-13 Jan'13, **an MoU worth INR 5,000 Crore was signed between Apollo/Spiroll and Govt. of Gujarat** for Affordable Mass Housing using New Precast Technology including design, manufacturing, erection and commissioning of building construction.

Hon'ble CM of Gujarat Sri Narendrabhai Modi, Mr. Mitul Patel, MD of Apollo Infratech and Mr. Stephen Carr, MD, Spiroll Precast Services (UK) are seen in the pictures taken during the signing of MoU.

partnered in India by



Apollo Infratech Private Limited
Rajpur 382740 (Gujarat) India
TEL.:+91 2764 232217,
FAX:+91 2764 233117,
M.:+91 90991 44644
sales@apolloinfratech.com
www.apolloinfratech.com



PRECAST FOR AFFORDABLE HOUSING

VIBRANT GUJARAT
12th January 2013



ECONOMIC ADVANTAGES OF PRECAST AND TECHNOLOGY

- Material Cost Savings
 - 30% less concrete
 - 40% less steel
 - up to 35% saving on total cost
- Long Spans
 - Lighter frame
 - Saving on foundations
 - Large open floor areas
- Fast Building Technique
 - 5000 m² per month
 - Immediate work deck
 - All weather construction

Thermally efficient, tailored to requirements...

The high density of precast concrete can act as a thermal sink to provide year-round comfort and reductions in energy use.

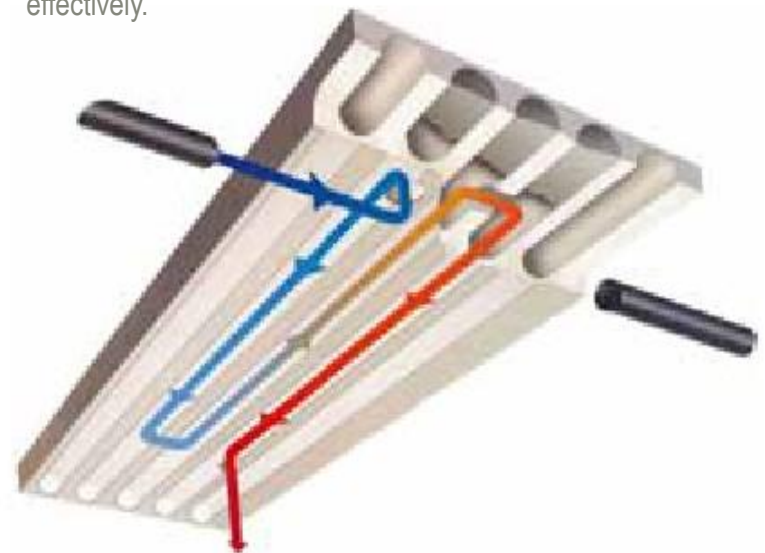
When insulation is combined into a precast concrete sandwich panel, the best of both worlds is achieved. The combination of high thermal mass and insulation results in significant energy-saving benefits in all climates.

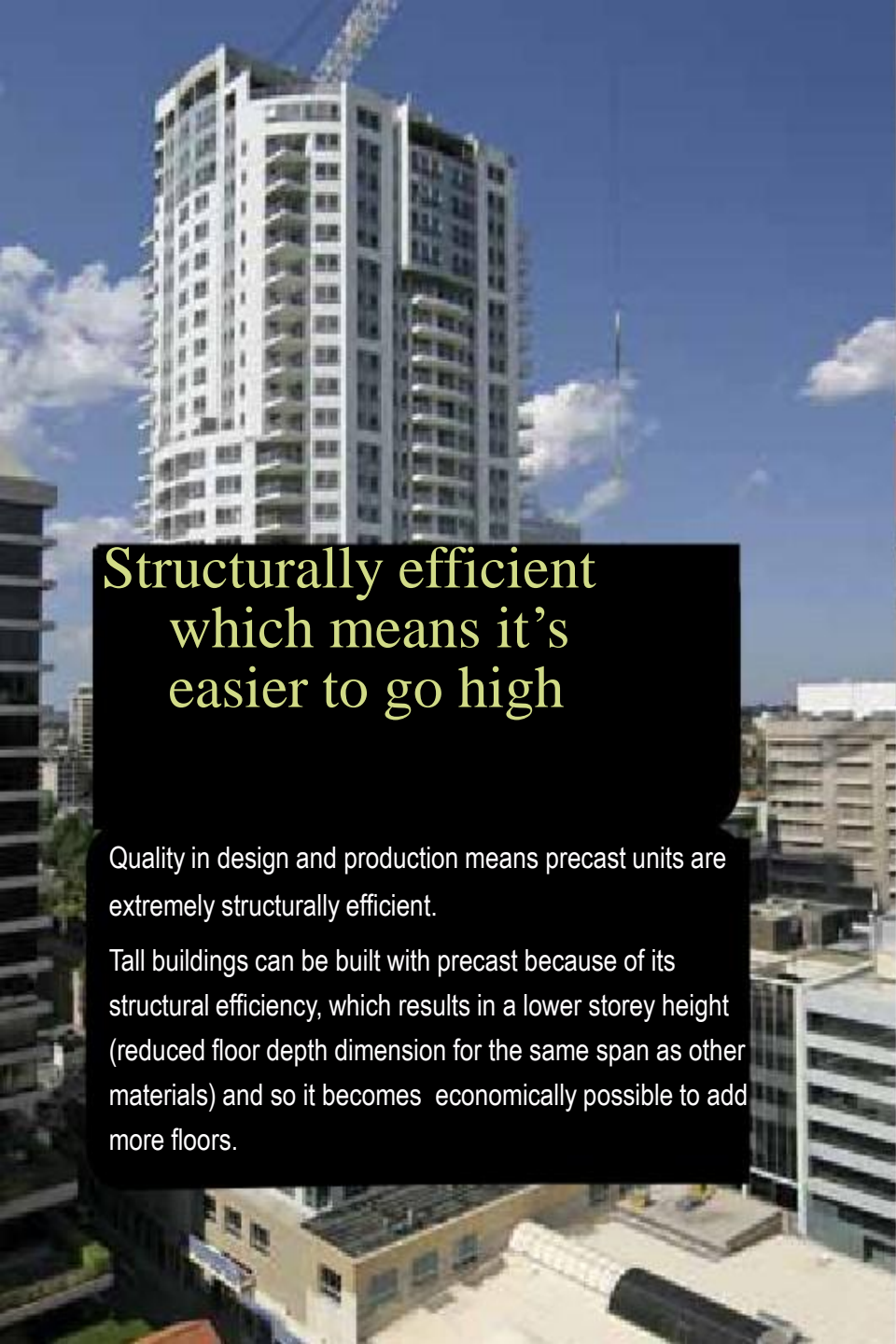
...and thermally versatile

Precast concrete can easily be used to create heating and cooling systems that use up to 50% less energy.

Ducting pipe systems can be cast into panels and slabs, or alternatively, the hollow cores in precast floors can be excellent conduits for circulating hot or cold air.

The concrete protects the heating or cooling system within and slowly absorbs the heat or cool, then releases it into the building's interior, further improving the effectiveness of the system. And the embedded ducting means that room spaces can be used more effectively.





Structurally efficient which means it's easier to go high

Quality in design and production means precast units are extremely structurally efficient.

Tall buildings can be built with precast because of its structural efficiency, which results in a lower storey height (reduced floor depth dimension for the same span as other materials) and so it becomes economically possible to add more floors.



Long clear spans

Precast's inherent strength provides the ability to create long clear spans without any additional structural support. This provides the designer maximum flexibility to create spacious interiors and column free offices and car-parks.

Hidden services ... ready to roll

Precast concrete can carry pre-installed services and fixtures, whether these are communications, electrical, plumbing or even windows! Services can be cast within a precast element and can include connection plates ready to receive heating and lighting fittings on site. This makes both construction and maintenance easy.



Wi-fi compatible

With homes and offices increasingly designed for information technology, it is good news that precast concrete buildings do not interfere with radio signals, local wi-fi or internet networks. This makes precast a technology friendly material for homes and places of work.

WHAT ARE SUITABLE BUILDINGS FOR PRECAST

- Shopping Malls
- Hotels
- Hospitals
- Housing
- Car Parks
- Retaining walls



Considerations for a Precast Building

What is the first step to using precast?

What buildings are suitable for precast?

What products are appropriate for a building?

What manufacturing facilities are required?

What size factory is necessary?

What codes are used in the design?

What are the correct connection details?

What are the production issues?

How are the products handled?

What fixing issues will we have on site?

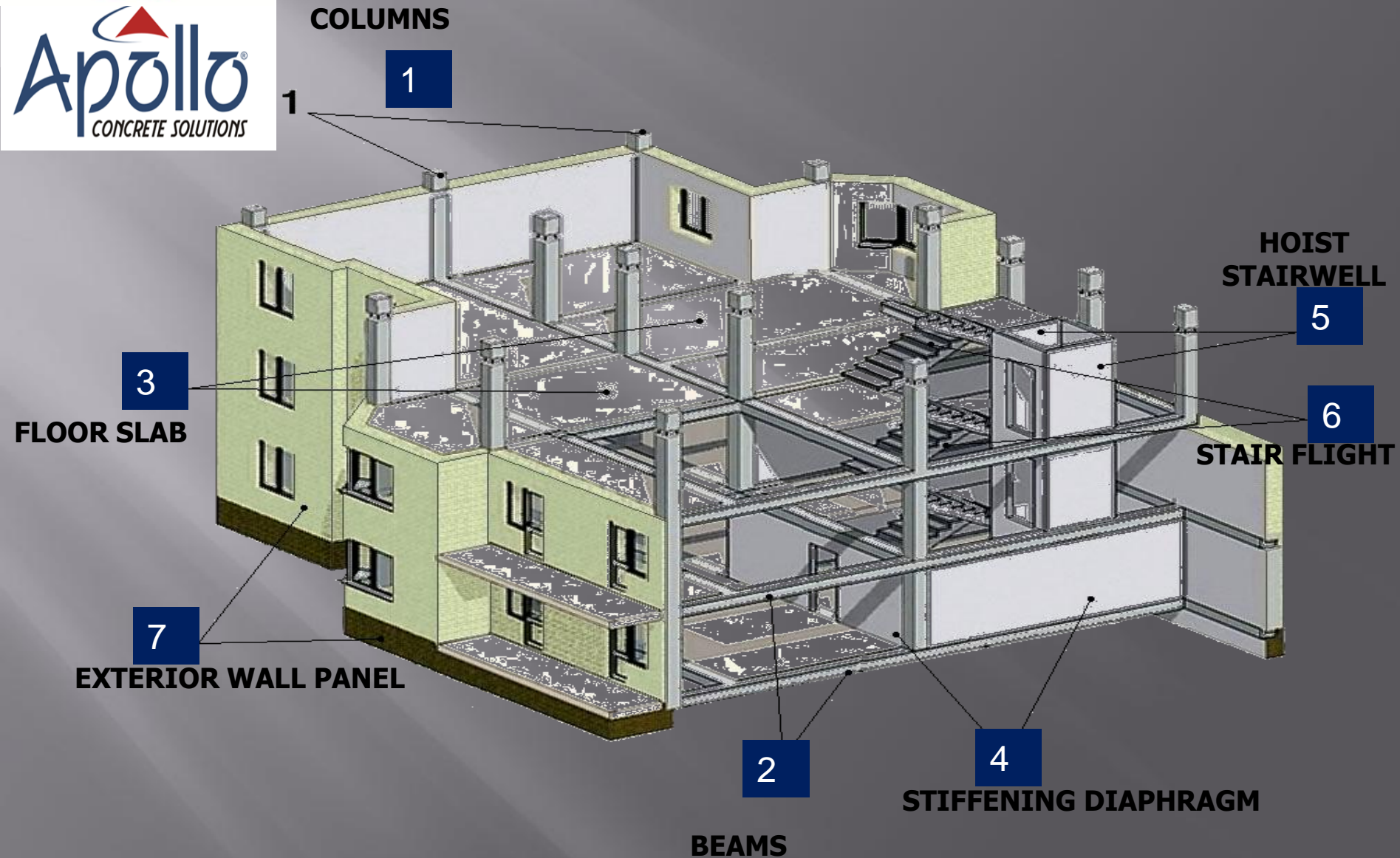
Etc etc

Subjects to be Covered

Stages of Project

- 1 Components**
- 2 Building Design**
- 3 Precast and Hollowcore Detailing**
- 4 Factory and Production**
- 5 Site Requirements**
- 6 Transportation and Fixing**

WHAT PRODUCTS





FOUR MAIN ELEMENTS





HOLLOWCORE
Prestressing Technology to make
strong light weight slabs

MOST IMPORTANT



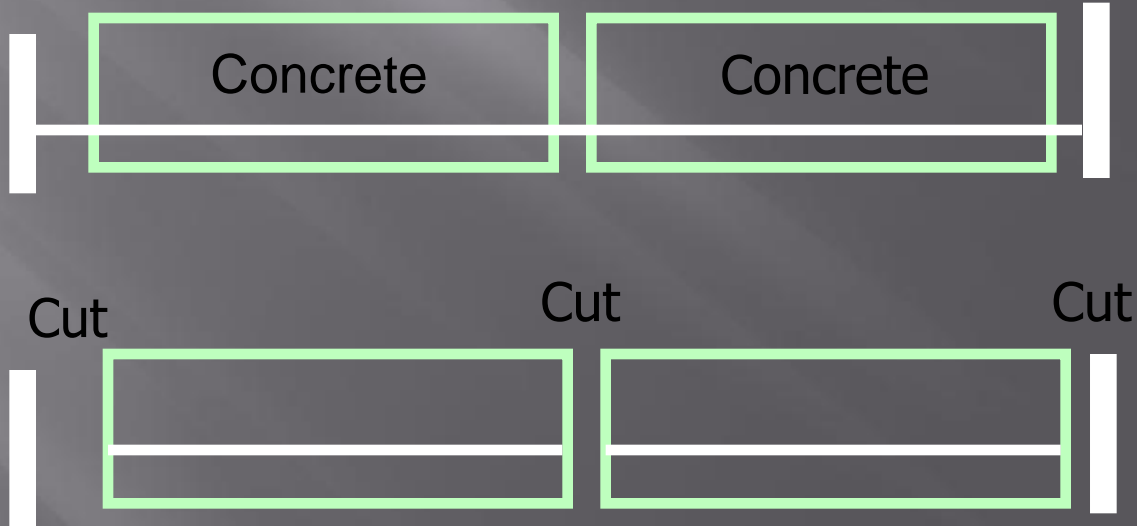
PRESTRESSING TECHNOLOGY

Strain Energy

Live End



Dead End



General Awareness Training

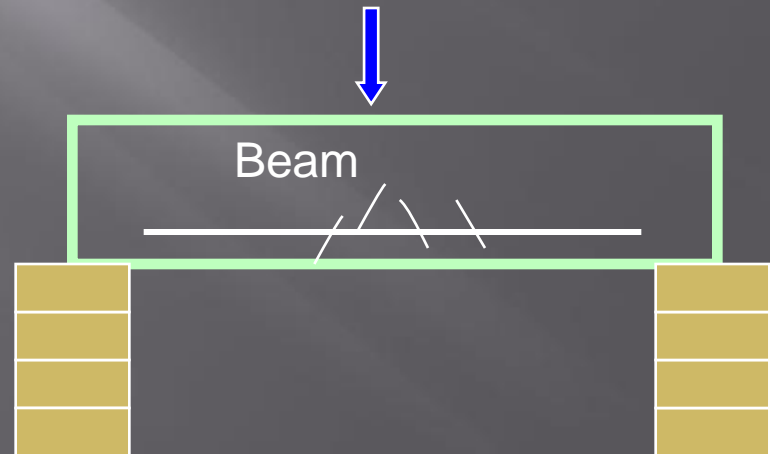
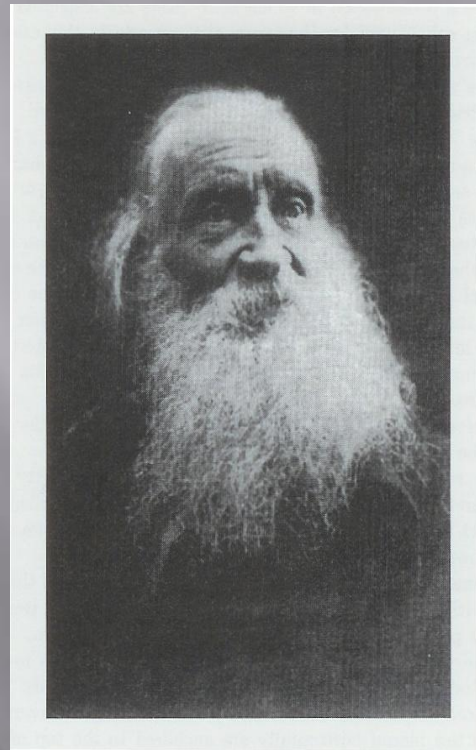
Principal of Stressing

Hyatt 1816-1901

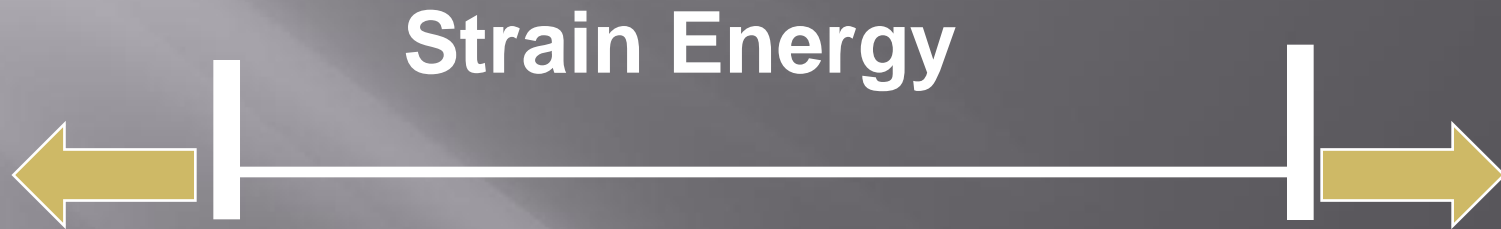
Tension in bottom

Coef. Expansion Steel and Concrete

Importance bond



Loads Applied during Stressing



**Tendon Stressed to 70 to 75% of UTS
If extended to 100% it will break**

Typical UTS (Breaking Load) Standard Strand

5mm Wire	32 kN
9.3mm Strand	92kN
12.5mm Strand	164kN
15.2mm Strand	232kN

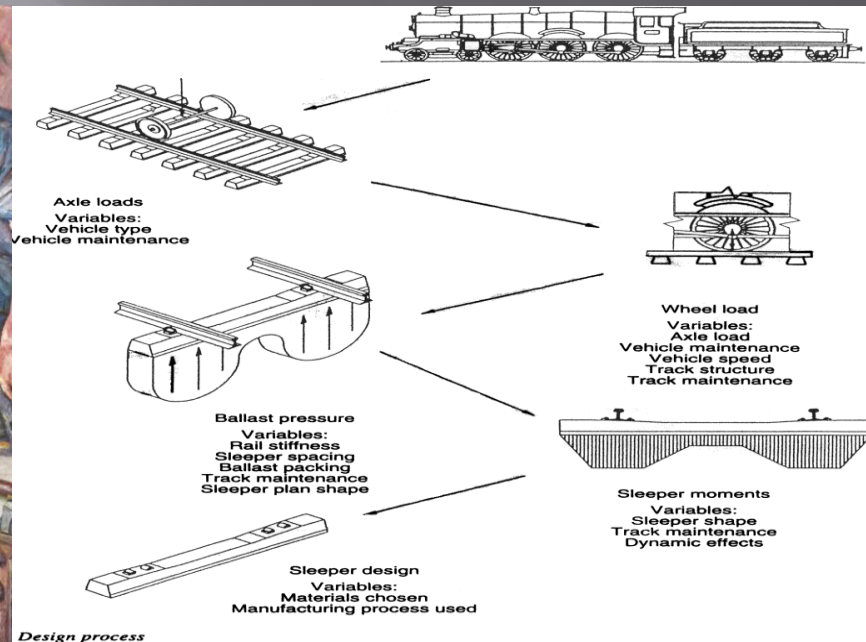
BEAM TESTS



Test regime done on a rolling system to cover all products cast, 1 proof and 1 destructive tested per week.

History

1943 Early Commercial Product - Railway Sleeper



General Stressing Awareness Training

Prestressed Products

Bridge Beams
Double Tees
Wall Panels
Flooring Systems
Lintels (Headers)
Railway Sleepers
Sign Gantries
Stairs



Site Issues

First understand issues.



Precast Project Management

End-to-end project management

- Feasibility studies at the initial conception
- Develop construction scheme
- Review build ability
- Prepare method statements
- Prepare Risk/COSHH Assessments
- Prepare site layout and induction of site teams
- Training of installation teams

Precast Project Management

Additional end-to-end support for your project

- Training of Precast manufacture operatives
- Site Management support part time or full time
- Supply of site management/operatives
- Develop and provide lift plans for craneage

Project Costing

- **12 Storey Apartment, Surgut, Russia**
- **220 mm Hollowcore**
- **Columns 400 x 400 mm**
- **Floor Height 3m**

№	Description of element of construction	Precast concrete frame method 12 storey apartment,				In-situ method 12 storey apartment house,			
		Concrete		Reinforcement		Concrete		Reinforcement	
		total, m ³	m ³ / m ²	total, tones	kg/m ²	total, m ³	m ³ / m ²	total, tones	kg/m ²
1	Columns	214	0,0253	43	5,11	214	0,0253	43	5,11
2	Beams	198	0,0234	26	3,11	325	0,0385	43	5,11
3	Stiffening diaphragms	55	0,0099	7	0,001	55	0,0099	7	0,001
4	Hollowcore slabs	745	0,0883	38	4,527	1 121	0,1328	169	20,02
5	Balcony slabs	86	0,0101	11	1,278	86	0,0101	11	1,278
6	Joint grouting	198	0,0292	28	3,346	-----	-----	-----	-----
7	Casting palce concrete	91	0,0273	30	3,534	-----	-----	-----	-----
	Total:	1 587	0,1862	183	17,372	1 941	0,2166	273	30,241

Bill of Quantities with In-Situ Construction

Nº	Description	Measure	Quantity	Cost per unit, including VAT, INR	Total cost, including VAT, INR
1	Beams	m ³	325	33472	INR 10,878,400.00
2	Columns	m ³	214	33472	INR 7,163,008.00
3	Hollowcore slabs	m ²	7004	4480	INR 31,377,920.00
4	Stiffening diaphragms	m ³	53	33472	INR 1,774,016.00
5	Balcony slabs	m ³	86	33472	INR 2,878,592.00
6	Reinforcement, frames, mesh	tones	262	37184	INR 9,742,208.00
7	Staircases	m ³	24	29888	INR 717,312.00
8	Embedded items	tones	5	89280	INR 446,400.00
9	Ventilation units:	items	234	166208	INR 38,892,672.00
10	Elevator hoistways:				
	Type 1	items	13	45056	INR 585,728.00
	Type 2	items	1	36096	INR 36,096.00
	Type 3	items	1	35904	INR 35,904.00
	Type 4	items	13	30016	INR 390,208.00
	Type 5	items	1	24064	INR 24,064.00
	Type 6	items	1	23936	INR 23,936.00
11	Other expenditures (inert materials, board, slab), etc.				INR 5,581,376.00
12	Transport service 8%				INR 6,050,240.00
Total price:					INR 116,598,080.00

Bill of Quantities with Precast Construction

Nº	Description	Measure	Quantity	Cost per unit, including VAT, INR	Total cost including VAT, INR
1	Beams	m ³	198	37440	7,413,120.00
2	Columns	m ³	214	20864	4,464,896.00
3	Hollowcore slabs	m ²	6774	2240	15,173,760.00
4	Stiffening diaphragm	m ³	55	22400	1,232,000.00
5	Balcony slabs	m ³	86	26496	2,278,656.00
6	Cast-in-place concrete:				
	Concrete M - 400 B 30 type	m ³	91	6720	611,520.00
	Fine-aggregate concrete B – 30 type	m ³	198	6720	1,330,560.00
7	Reinforcement, frames, mesh	tones	58	37184	2,156,672.00
8	Staircases	m ³	24	29888	717,312.00
9	Embedded items	tones	5	89280	446,400.00
10	Ventilation units	item	234	17408	4,073,472.00
11	Elevator hoistways:				
	Type 1	item	13	45056	585,728.00
	Type 2	item	1	36096	36,096.00
	Type 3	item	1	35904	35,904.00
	Type 4	item	13	30016	390,208.00
	Type 5	item	1	24064	24,064.00
	Type 6	item	1	23936	23,936.00
12	Other expenditures (inert materials, board, slab), etc.				1,116,288.00
13	Transport service 8%				3,361,984.00
14	Contractor's service (frame assembling)	m ²	8439	2240	18,903,360.00
Total cost:					INR 64,375,936.00
Cost per m ² of the frame					INR 7,628

Savings Using Precast

Insitu Cost	116,598,080
Precast Cost	64,375,936
Difference	52,222,144
Percent Saving	45%

Building Design Review

Issues to be considered

- Volumes/Repetition
- Cellular Walls vs Frame Buildings
- Codes
- Finishes
- Layout
- Loads
- Beam spans
- Timescale
- Cost

Precast Concrete – What can be Achieved

King Edwards Wharf in Birmingham UK 2008



Second Example of Precast and Hollowcore

University of West of England – Student Accommodation 2009



Precast Design

Facts and Figures - University of West England

Reference	Drawings (GA)	Drawings (Mould)	Drawings (RC)	Volume m3/(m2)	No. Off	Ratio Drawings/No. Off
Layout	52					
RC Beams		8	4		163	20:1
External Panels		65	11	5960	2829	43:1
Floors Slabs		80	35	9944 (49720)	5723	71:1
Internal walls		40	4	4590	2181	54:1
Stairs		10	5	695	556	55:1
Steelwork		13			1030	

BUILDING DESIGN

PLAY TO STRENGTHS PRECAST

Repetition

Mould Set-Up

No Units

Minimum Ratio 5:1

50,000 m² Hollowcore
13 metre beam spans

BUILDING DESIGN CRITERIA

Key Issues from the drawings and the client a layout can be prepared

Look at line of the vertical loads?

Is the building in a seismic area?

What codes are to be applied

What Insulation characteristics are required?

How important is Noise Control?

Sandwich or solid panels?

Where is the nearest precast facility?

What weight of product can be handled?

Most important, the connection details

Precast Hollowcore Layouts

King Edwards Wharf Elevations



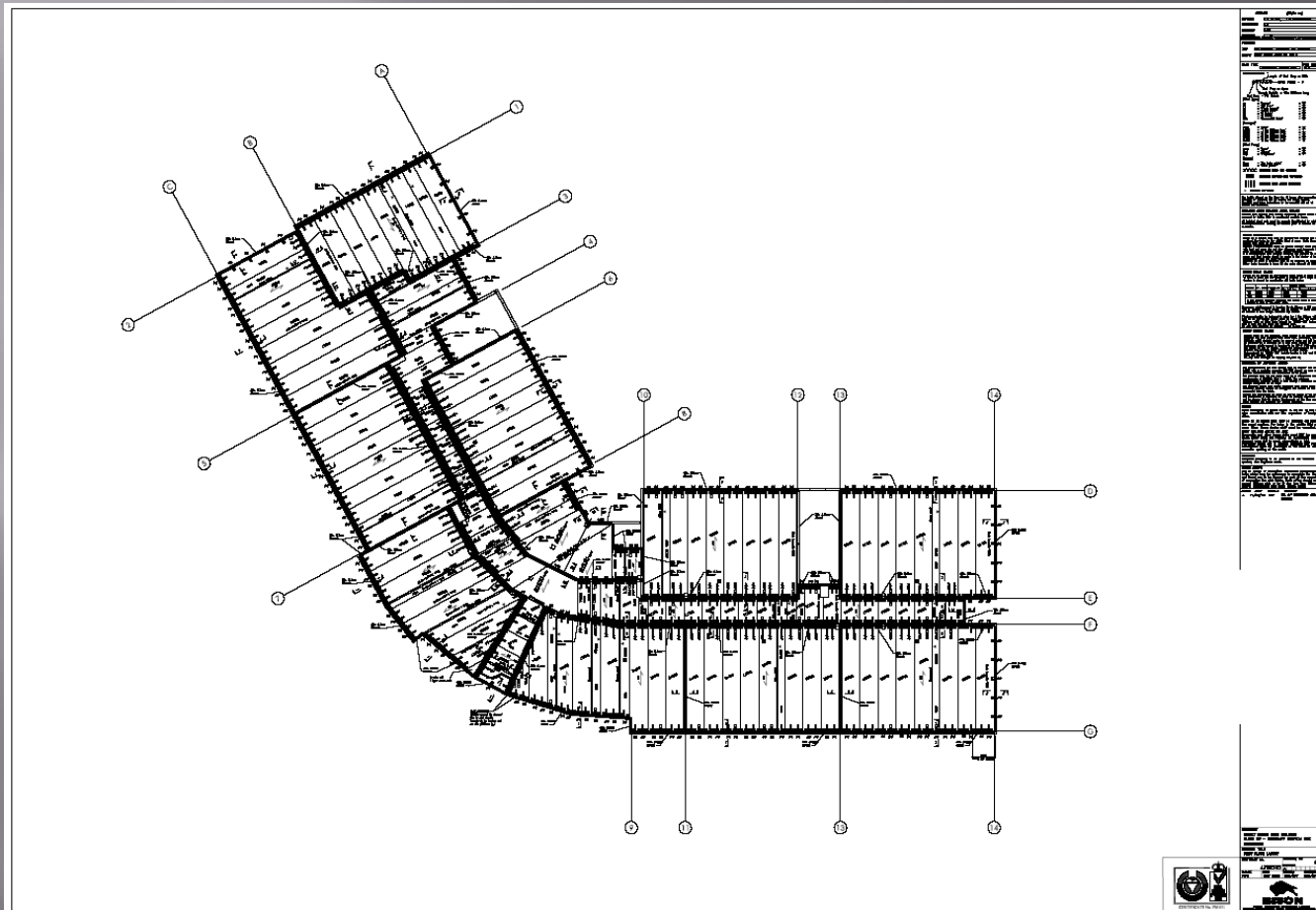
BLOCK B & C – NORTH ELEVATION TO CANAL



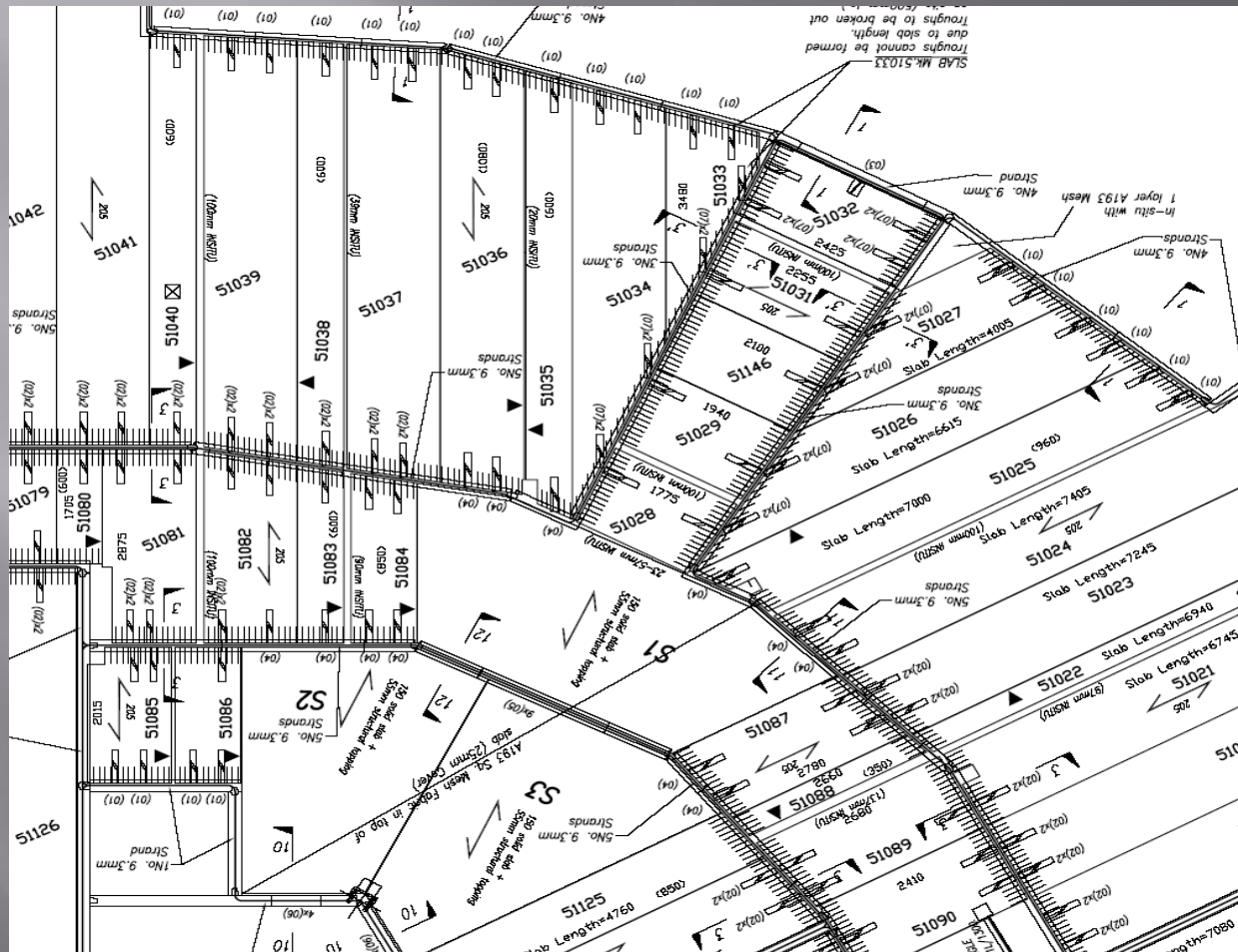
[illegible]

Precast Design

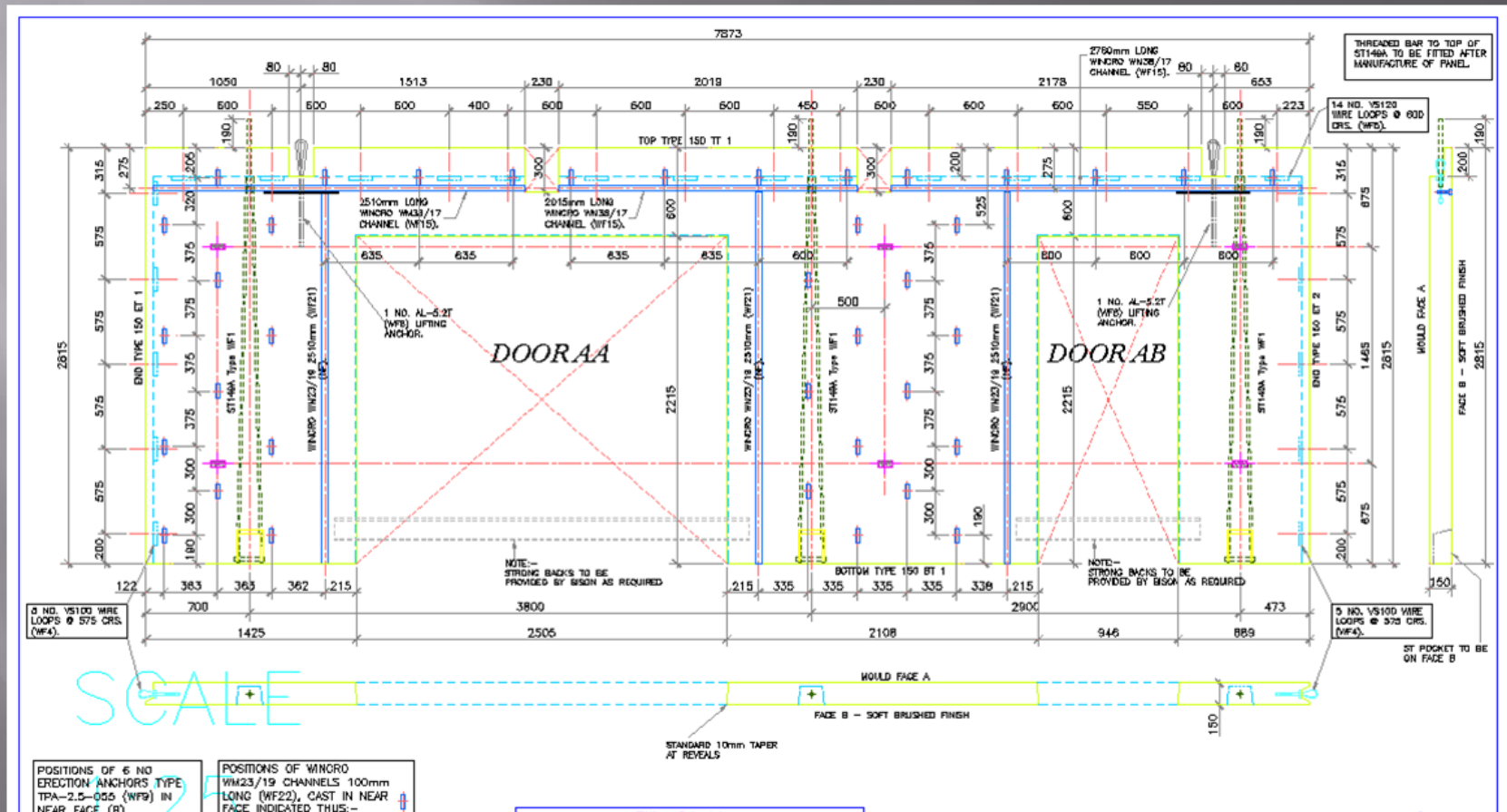
Preliminary Hollowcore layout



Detailed Layout and Design



Typical External Wall Detail



Typical Site Connection Details

**Examples of Typical
Connection Details Used on
above projects**



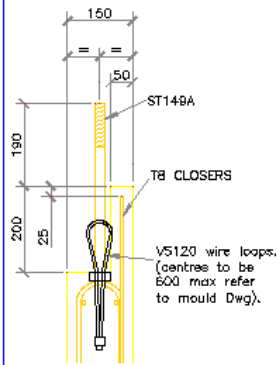
**Wall Connection
ST Connector**



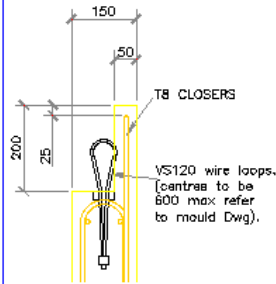
**External Wall
Connection - Loops
and vertical Bar**

Precast Concrete in Cellular Buildings

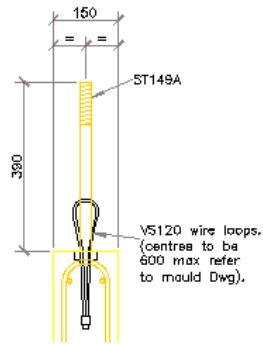
Typical Connection Details Loop Connectors



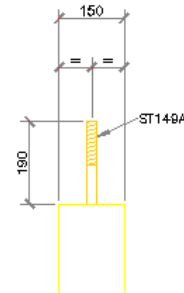
TOP TYPE 150 TT1
(Intermediate Floor Panel)



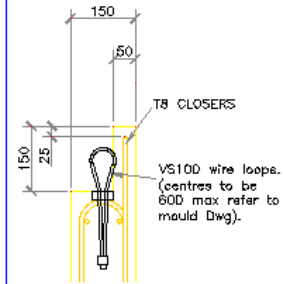
TOP TYPE 150 TT2
(ST145 in Btm of Panel)



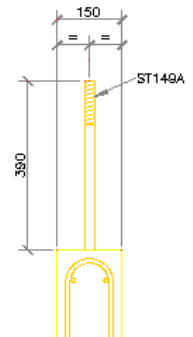
TOP TYPE 150 TT3
(Intermediate Floor Panel)



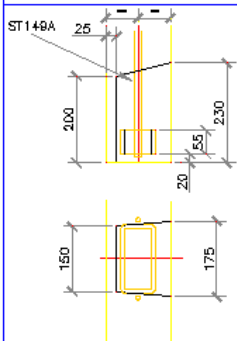
TOP TYPE 150 TT4
(Intermediate Floor Panel)



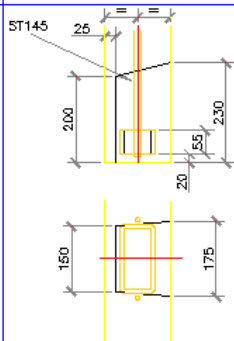
TOP TYPE 150 TT6
(ST145 in Btm of Panel)



TOP TYPE 150 TT7
(Intermediate Floor Panel)



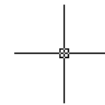
BOTTOM TYPE 150 BT1
(Use with TT1 or TT3 or TT4)



BOTTOM TYPE 150 BT2
(Use with TT2 or TT6)



BOTTOM TYPE SQ

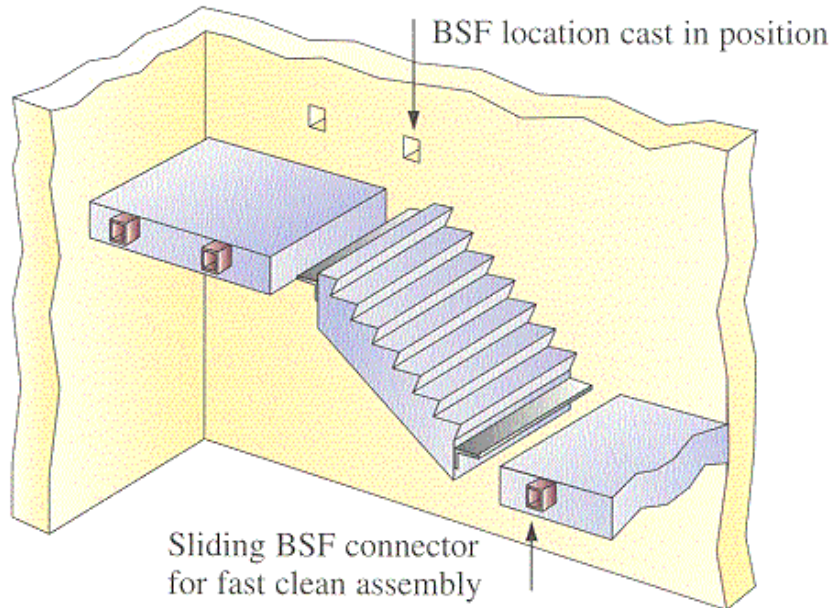


Precast Concrete in Cellular Buildings

Typical Connection Details

RVK Type Stair Connection

PRECAST CONCRETE CORES USING THE BSF CONNECTOR

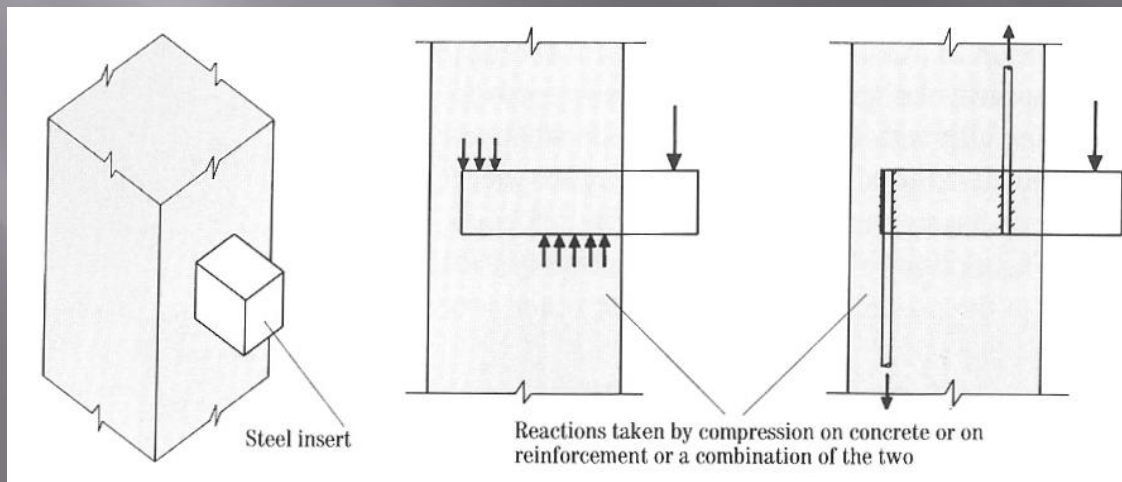
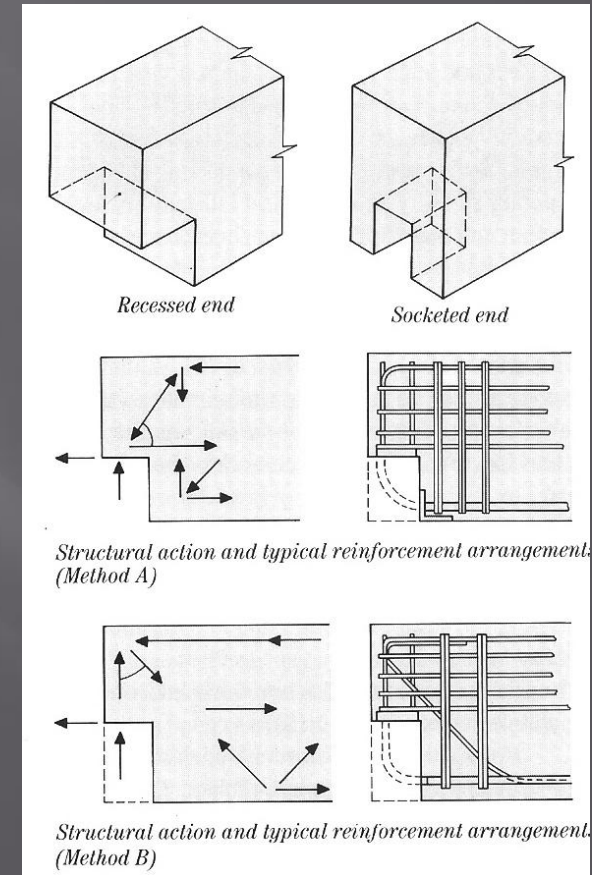
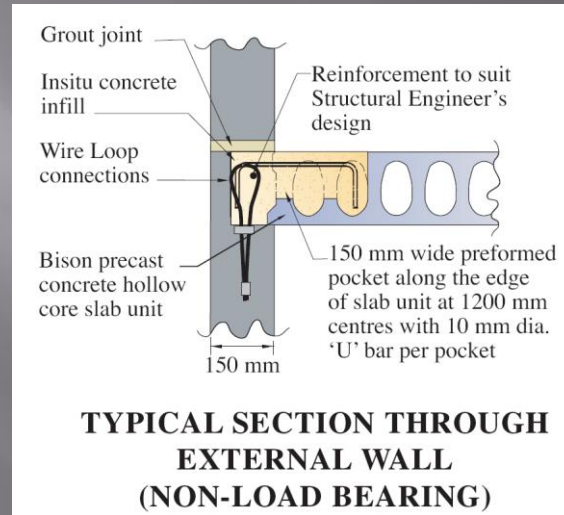


RVK 40 and RVK 100

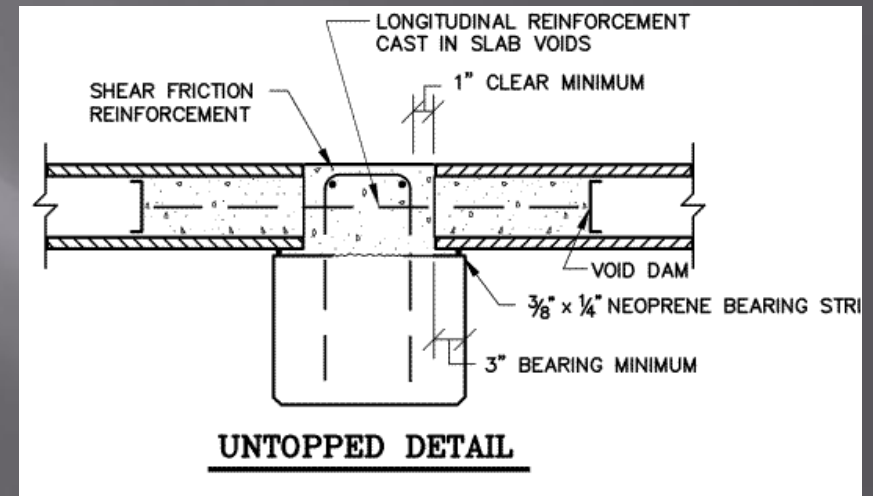
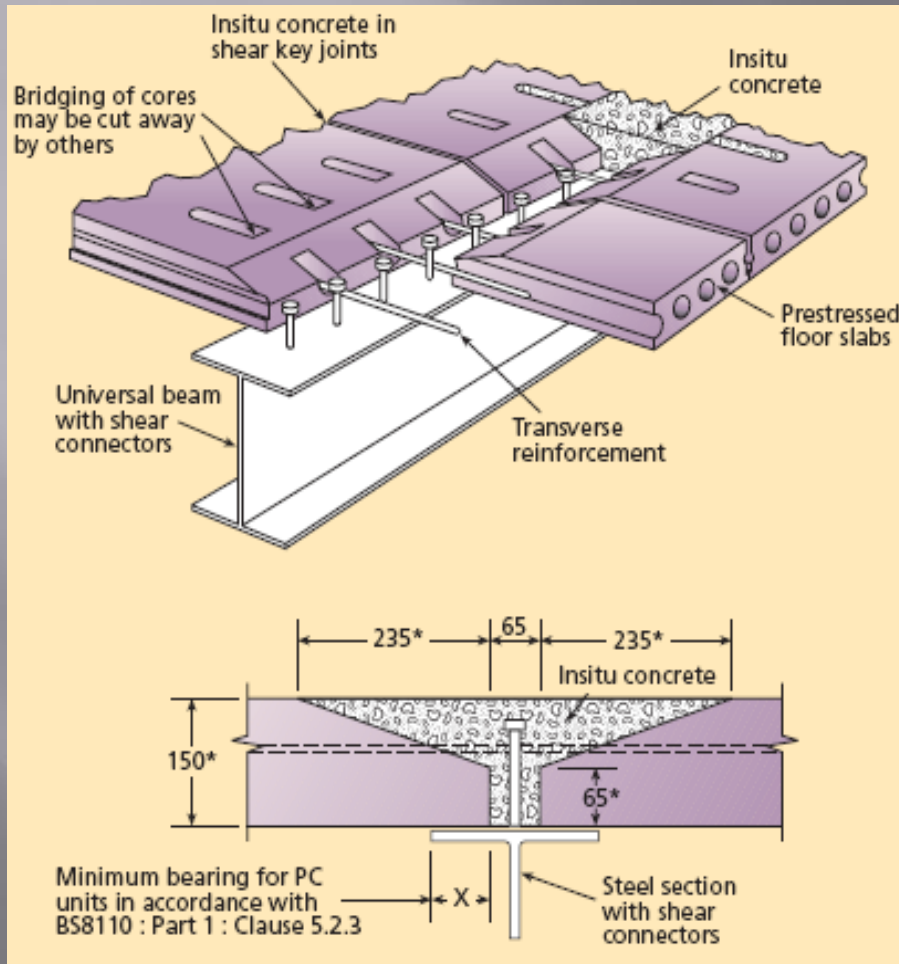
Design Precast

Typical Connection

Details



Design Hollowcore Connection Details



Site Finishing Details for Hollowcore

Typical Site Connection Details





FACTORY EFFICIENCY

MANUFACTURE OF PRECAST CONCRETE PRODUCTS

I HOLLOWCORE

II PRECAST PRODUCTS



FACTORY LAYOUT



EFFICIENT FACTORY LAYOUT

- **Scope of plant layout**
 - **Volumes**
 - **Degree Automation**
 - **Existing Facilities**
 - **Other Products**
 - **Distribution Concrete**
 - **Stripping Beds**

FACTORY EFFICIENCY



**LENGTH BED
TYPE EXTRUDER
CONCRETE DISTRIBUTION
STRESSING SYSTEM
TYPE SAW
LIFTING AND HANDLING**



CASTING EFFICIENCY



SLIP FORMERS/EXTRUDERS
SPIROLL EXTRUDER
DESIGNED SPECIFICALLY FOR
HIGH QUALITY HOLLOWCORE



BENEFITS OF DENSE WELL COMPACTED CONCRETE ARE HUGE

**Low cement 330kg to
350kg**

Low curing times

Strong product

Good bond

Good control camber

Goof soffit finishes



**QUICK CHANGE WITH MODULES FOR
DIFFERENT DEPTHS**



QUALITY CONTROL PROCEDURES



Check quality,
profiles and
structural
integrity

Check wire
positions
+ - 5mm



Check depths of
units + - 6mm

Check timber
alignment



Production Precast Concrete Wall Panels

Manufacture Panels



Production of Columns and Beams



Precast Concrete in Cellular Buildings

Manufacture Stairs



Transportation and Site Fixing

Issues Associated with Site Work

Haulage

Access

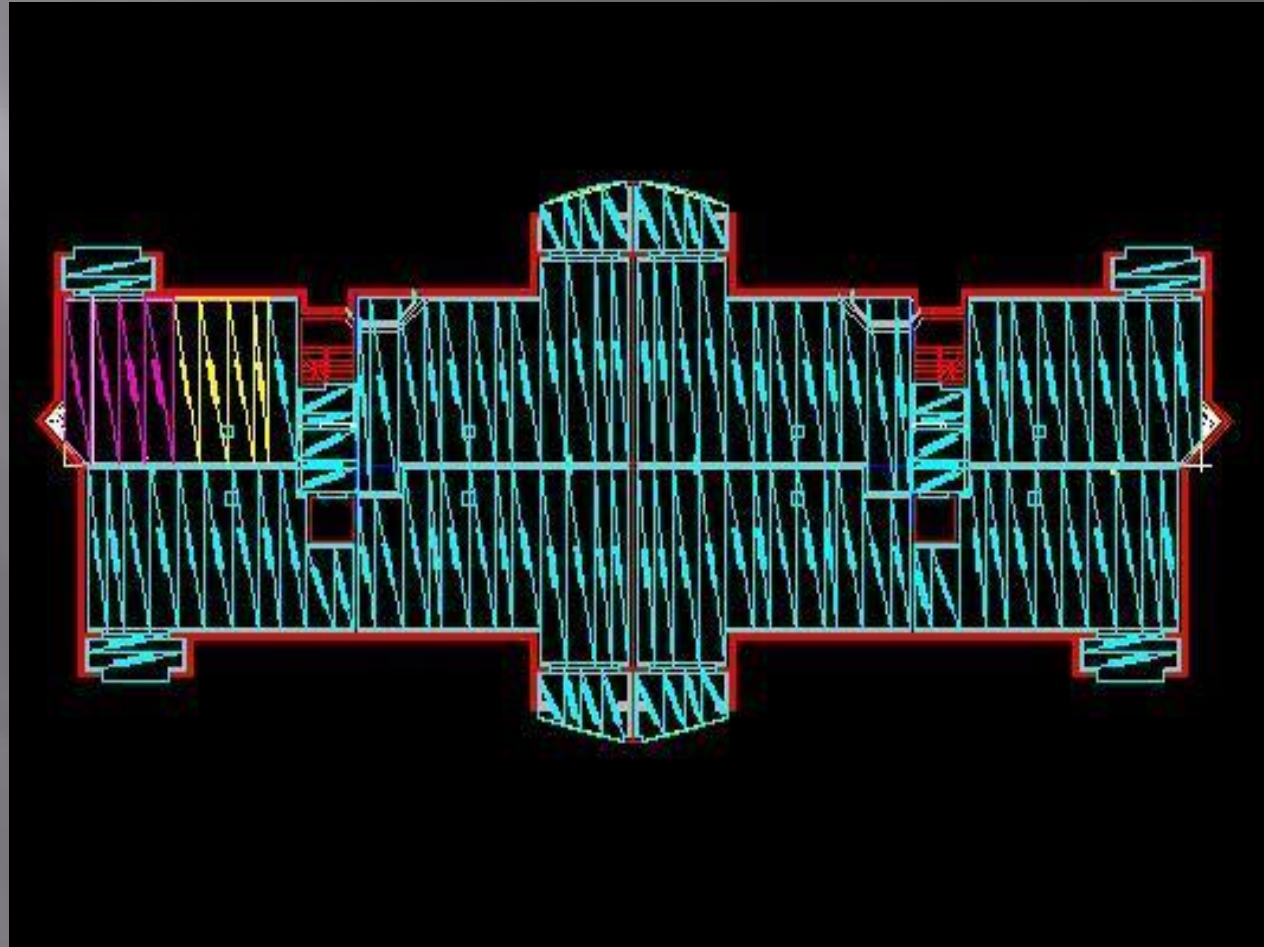
Fixing Volumes

Connection Details

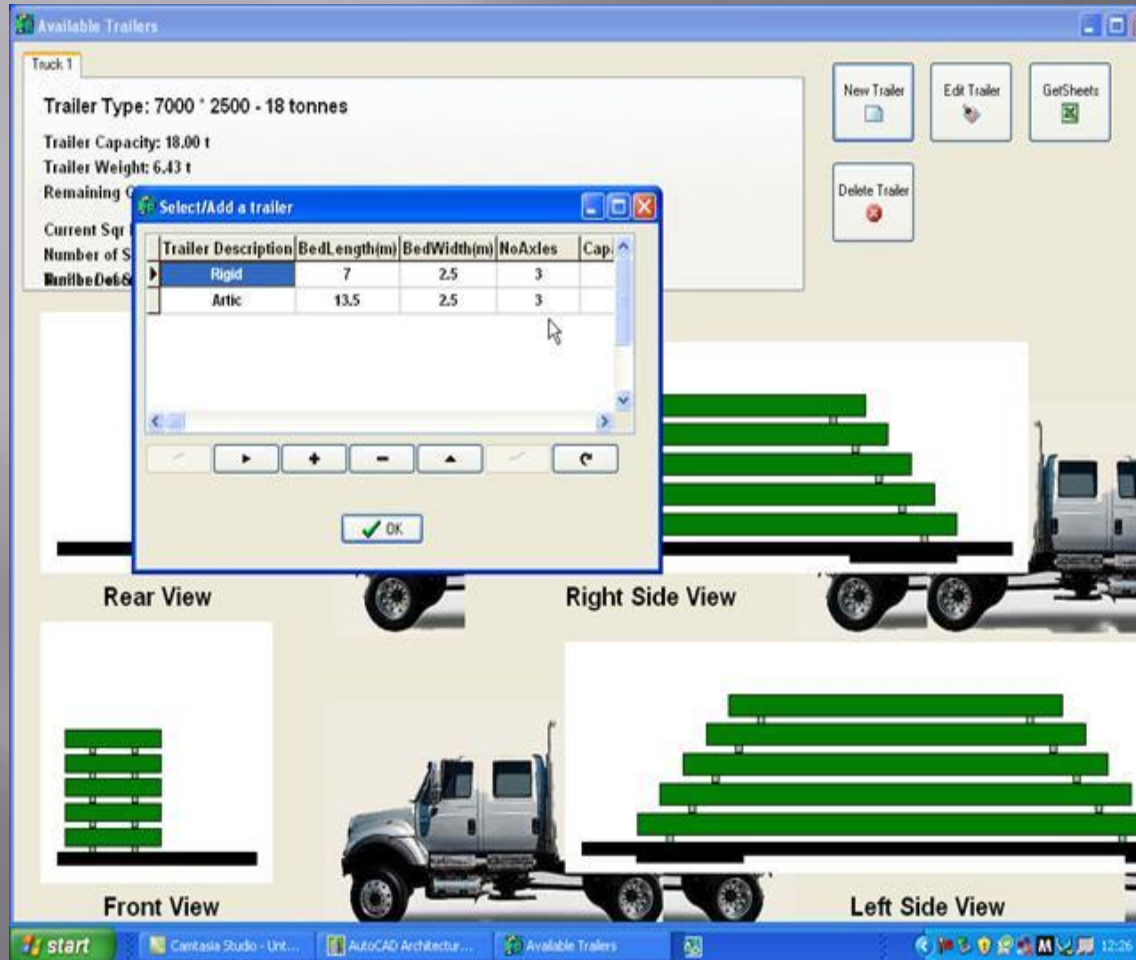
Safety

DESIGN AND LOGISTICS - SpirollCAD

- Design
- Bending Moment
- Shear Capacity
- Project Schedules
- Production Planning
- Bed Utilisation
- Production Scheduling
- Labelling
- Stock Yard Control
- Loading Schedules



Site Fixing -- Haulage, Lifting and Handling



Site Production



Mr Islam Skills Promoters

Sarath City Capital



Site Fixing - Daily Fixing Volumes

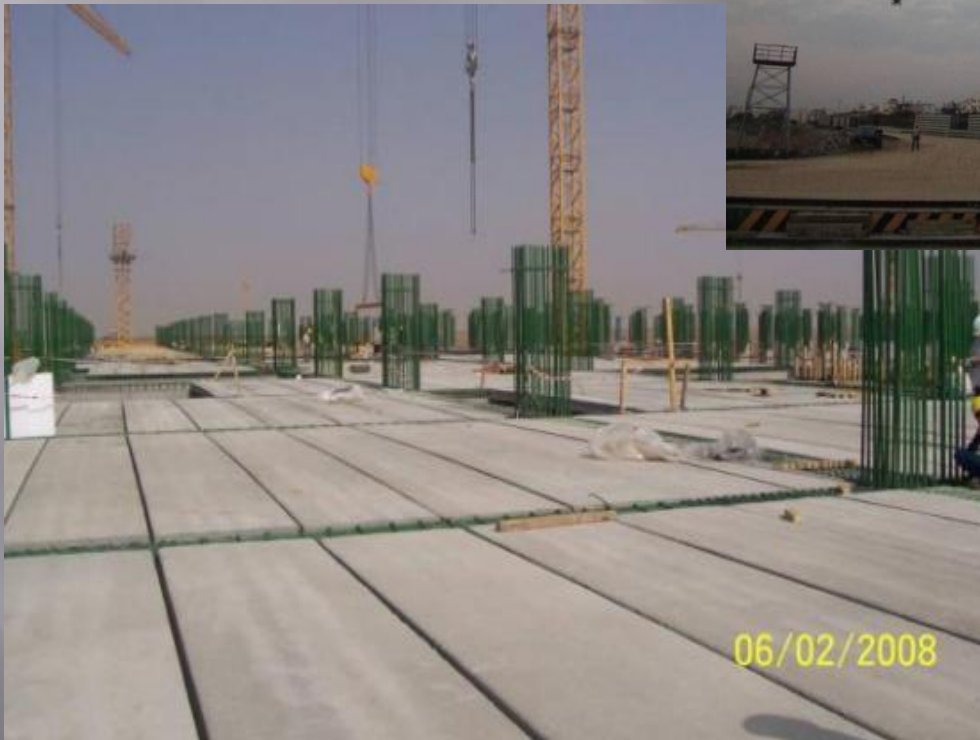
Hollowcore



Crane Dictates

Typical 15 lifts per
day per crane

(i.e. 40 minutes
per lift)



Site Fixing - Daily Fixing Volumes

Hollowcore

Hollowcore



Hollowcore
typically

250/400 m² pr
day per crane

Site Fixing - Daily Fixing Volumes

Panels

Panels

Crane Dictates



Typical 12 to 15 lifts per day per crane

(i.e. 40 minutes per lift)

Panels Max 10 tonne

Site Fixing - Safety

Intensive
Activity
Variety
Trades
Restricted
Area

Well thought
out
Plan



Site Fixing Precast Elements

Construction, Design and Management - Vital

- **Training & certification**
- **Design stage Consideration**
- **General contractor's responsibilities**
- **Installation companies role**
- **Transportation of components**
- **Safe use of cranes, fork lifts etc.**
- **Access**



SEQUENCE TASK

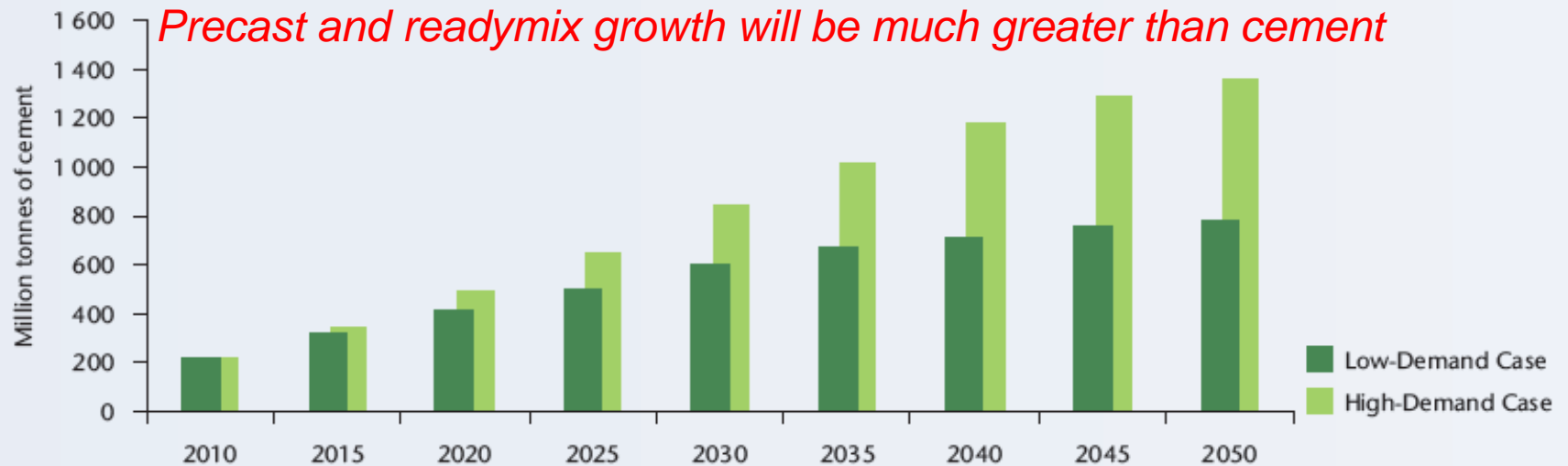
Product Range
Product Volumes
Land Available
Factory Layout
Equipment Required
Project Partner
Project Management
Fixing Management

**APOLLO /SPIROLL
CONSULTING SUPPORT**

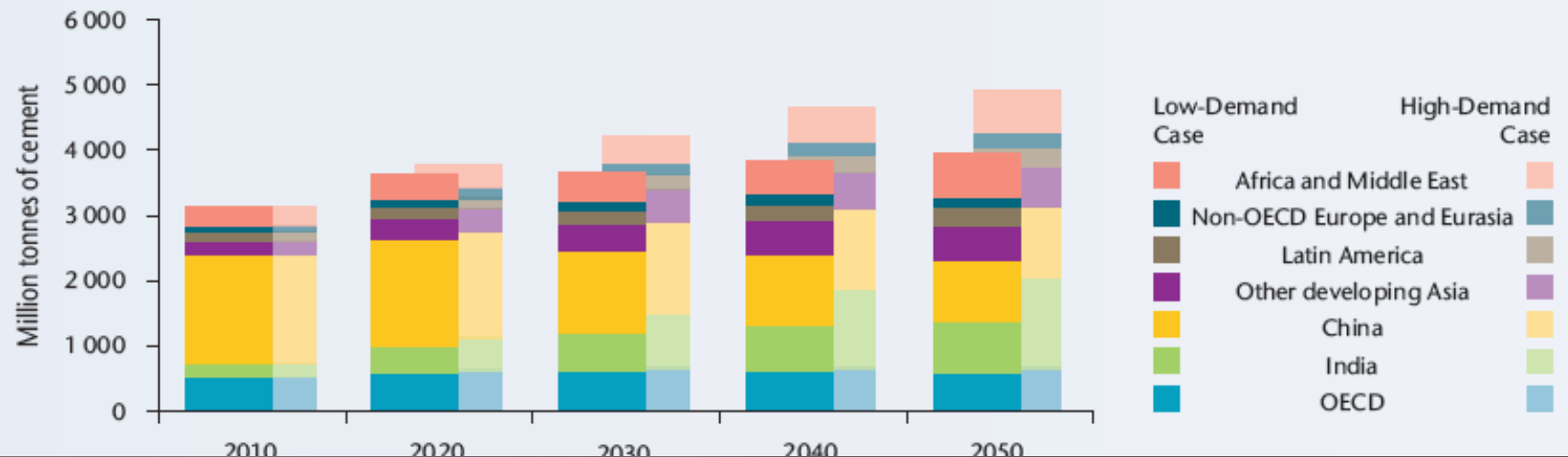
DESIGN SUPPORT
PROJECT MANAGEMENT
TURNKEY OPERATION

This is the opportunity for concrete

Projected cement production in India

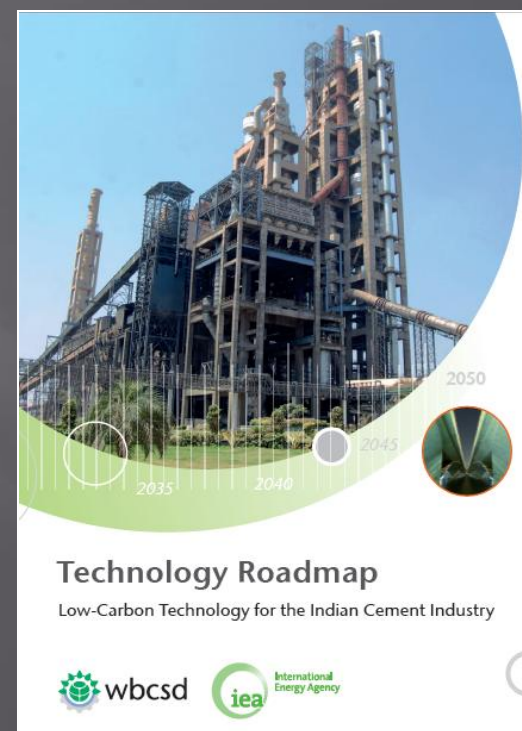


Projected cement production globally





- the Indian precast concrete industry needs to develop its own trade organisation
- working with the cement, ash and slag sectors is a must
- Contribution of associate members
- Now appears to be the right time to do it.....but how ?



SUMMARY

1. Precast Technology best solution for economic building of affordable housing
2. Prestressing Technology brings big benefits
3. Site Fixing is an integral part of the technology
4. Factory must be designed for efficiency
5. Project must consider at an early stage
6. Select the right equipment
7. Ensure staff are fully trained

**APOLLO SPIROLL ARE IN INDIA TO SUPPORT THE
PRECAST INDUSTRY ----- www.spiroll.co.uk -----**

Consultancy Services

Stephen Carr Managing Director
Mitul Patel MD Apollo
Pravin Sharode Sales Manager Apollo

Spiroll Precast Services Ltd.
Kingsway Industrial Park
Derby
DE22 3FP
United Kingdom

Mob: +44 (0)752 5987511
Tel: +44 (0)1332 365 131
Fax: +44 (0)1332 291 736

Email: enquiries@spiroll.co.uk
Web: www.spiroll.co.uk