



PRECAST SKELETAL TOWER BUILDINGS

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Past chairman *fib*

Commission on Prefabrication

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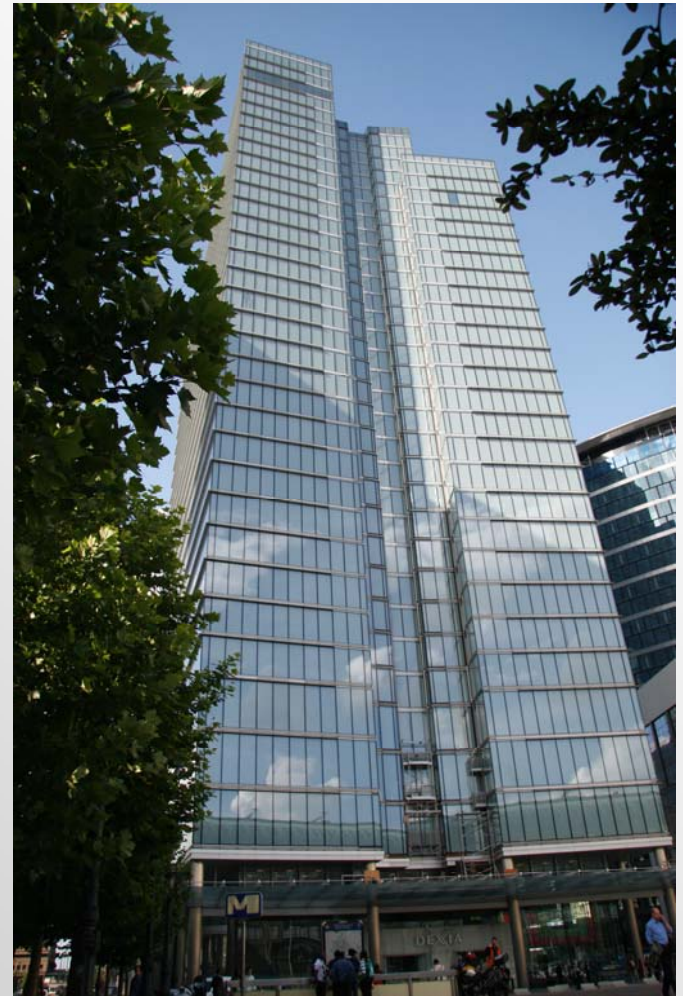
Tower buildings

- Office buildings in Brussels

Office buildings
20 to 37 storeys
High strength circular
concrete columns
Slender prestressed
floor beams
Prestressed hollow
core floors



Ellipse building 26 storeys



Dexia Tower 37 storeys

Examples of recent realisations

Tower buildings



Tower buildings

- First project in 2003



Initial design: steel frame + composite steel deck floors

After tender, variant solution in precast concrete :

- ⇒ 7% cheaper
- ⇒ double speed of erection
- ⇒ 2 hours fire resistance without additional protection
- ⇒ less deformation of the precast concrete floors

North Galaxy twin towers 36 storeys – 156.500 m² floors

1. Structural concept

Structural concept

- Construction principle

- ⇒ Precast columns, beams, floors
- ⇒ Central core
- ⇒ Light façades

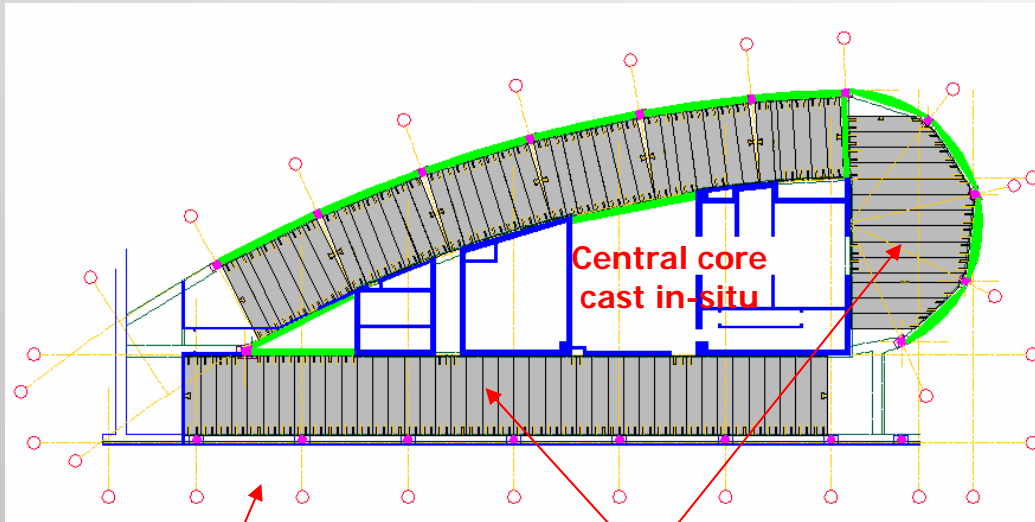
Columns in high strength self-compacting concrete 80/95 MPa



Hollow core floors

Floor lay-out

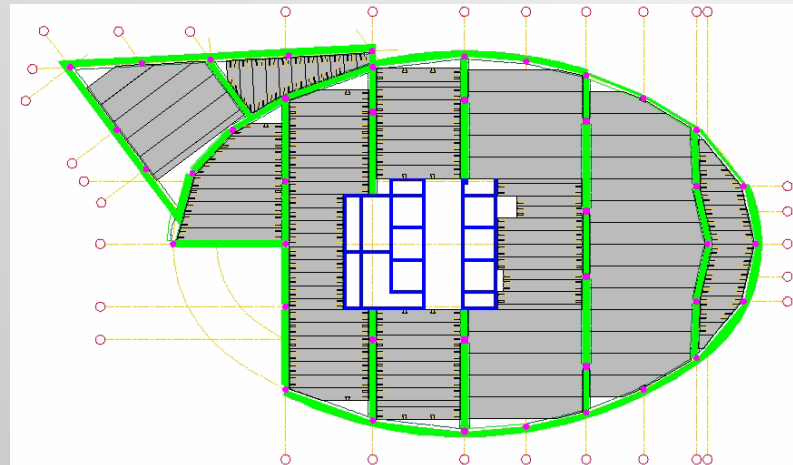
- Large architectural freedom



Column distance 8.10 m

Floor spans HC 200
6.20 to 9.47 m

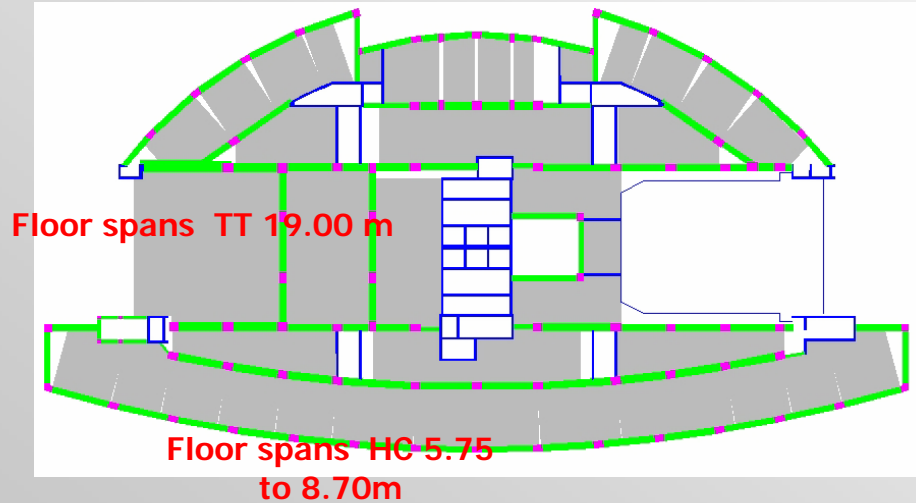
Orthogonal lay-outs are ideal but
other shapes are equally possible



Floor lay-out

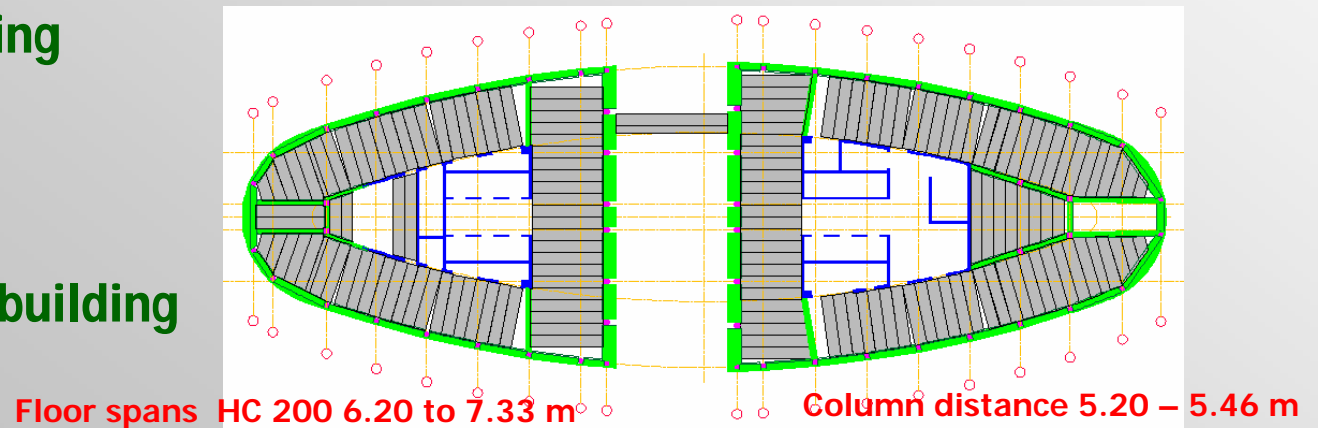
- Other examples of realisations

Column distance 7.20 m



“Lex” building

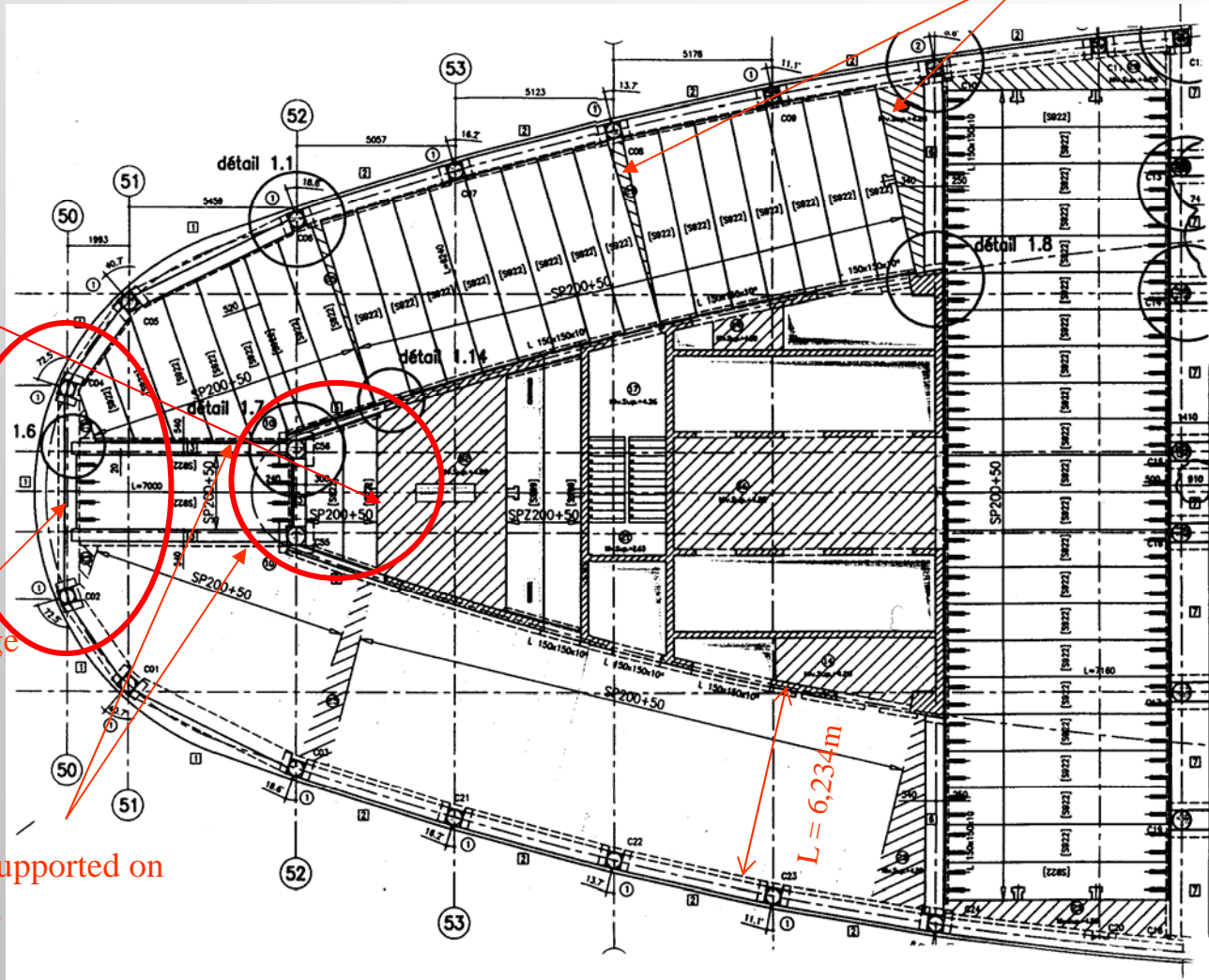
“Ellipse” building



Skeletal system

- Floor lay-out ellipse building

Cast in-situ wedges



See detailing

Floor beam with curved upper flange

Floor beams supported on the edge beam

L = 6,234m

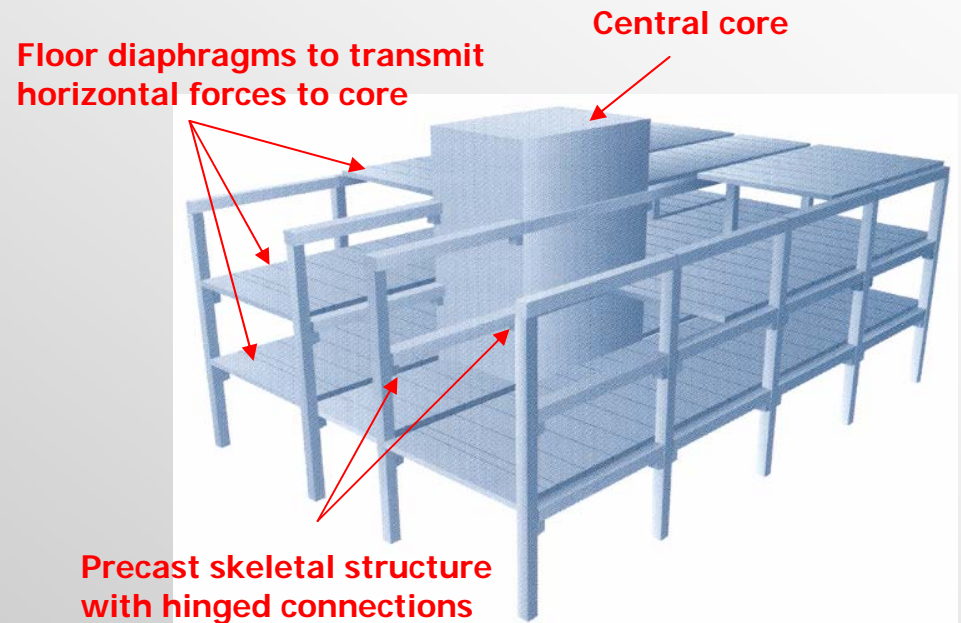
2. Structural stability

Structural stability

The horizontal stability of medium and high rise precast buildings is realised through:

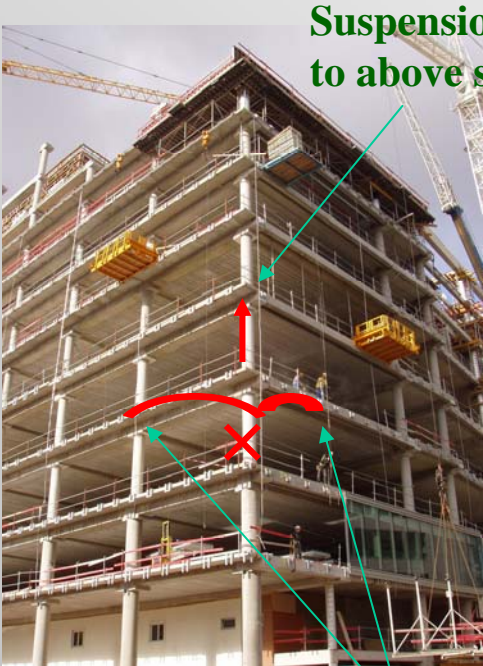
⇒ Central cores

⇒ Floor diaphragms



Robustness

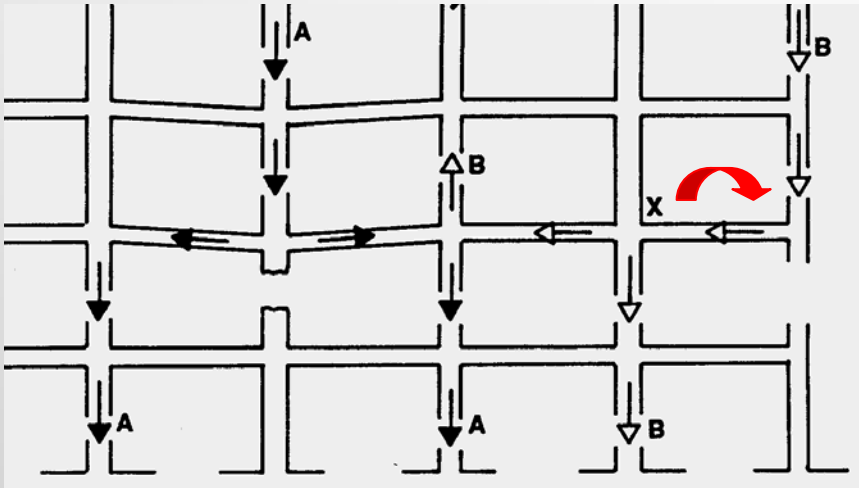
- Design to prevent progressive collapse



Suspension via column to above structure

Corner column taken away

Cantilever action of floor beams



Mechanisms to provide for alternate load path

Failure of corner column

Robustness

- Design to prevent progressive collapse

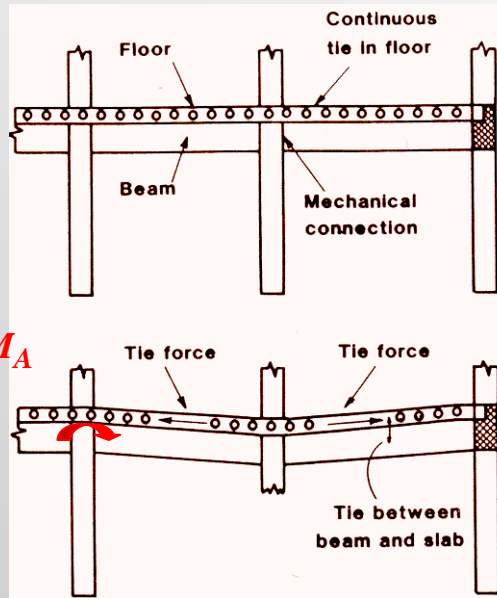
Suspension via column to above structure



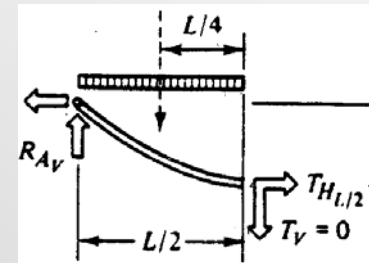
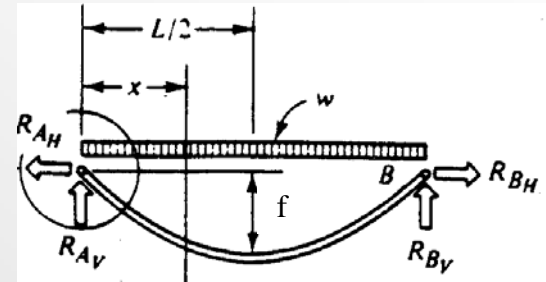
R_H

Cantilever action of floor beam

Cable action of floor beam



M_A



Failure of intermediate façade column

3. Precast components

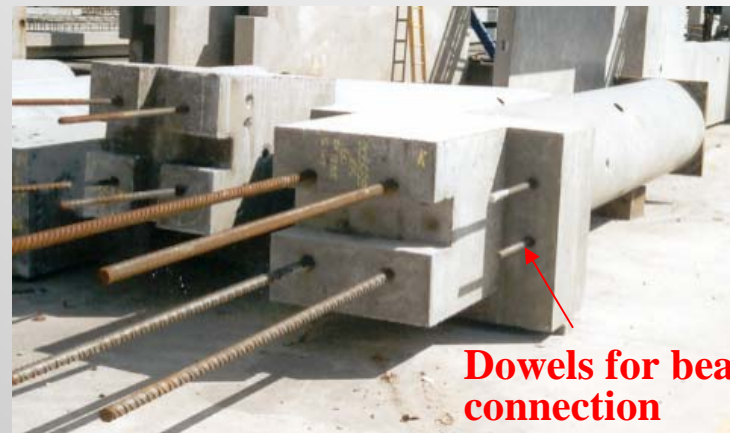
Precast components

- Columns



2 storey columns Ø 500 or 600 mm

High strength concrete C 80/95



Dowels for beam connection

Projecting bars for column splicing

Precast columns

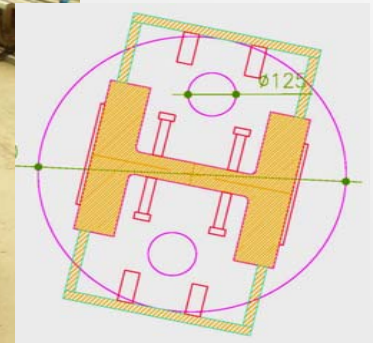
- Composite, C 80/95 and C 45/60 in same project

Normal strength concrete
C 45/60 at higher levels



High strength concrete C 80/95
at intermediate levels

Composite steel-concrete
columns at lower levels



Precast columns

- Vertical casting single storey columns



Casting upside down



One storey columns

Precast columns

- Horizontal casting two storey columns



Two storey columns

Horizontal casting self-compacting concrete

Tower buildings

- Floor beams



Booth height 80 mm



Normal booth height ≥ 150 mm



Booth height 120 mm

Beam end with half joint



Slender booth height

4. Detailing

Detailing

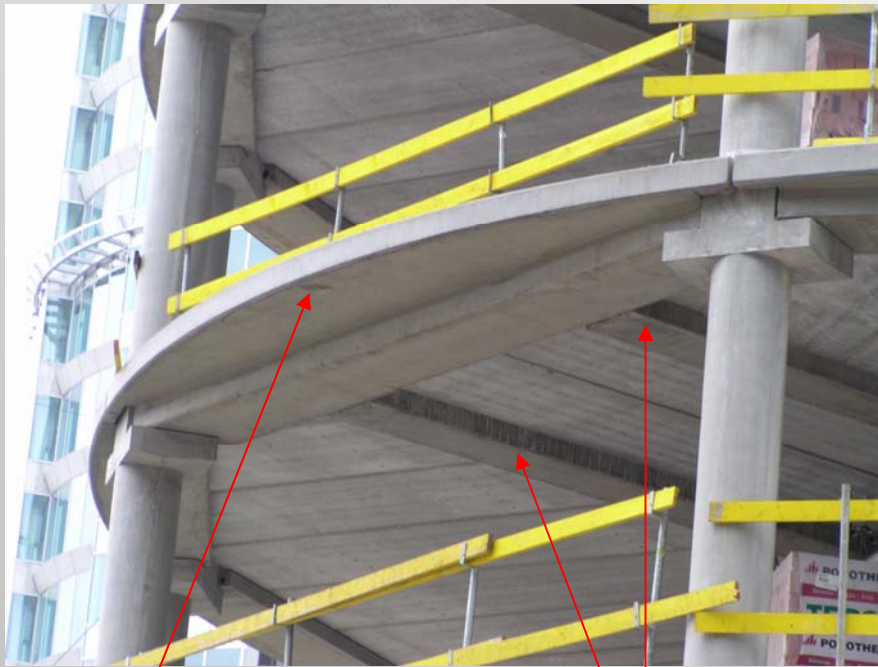
- Joining of elliptic – rectangular building parts

Small floor corner
cast in-situ



Detailing

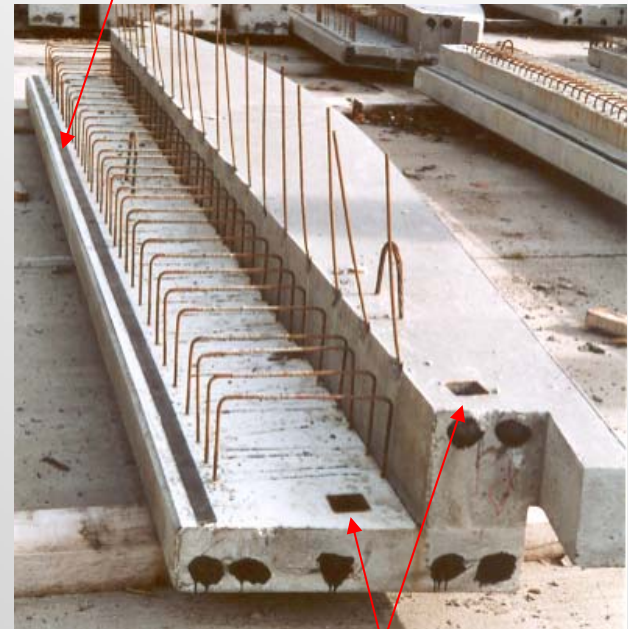
- Edge design elliptic floor



Edge beam with cantilevering top flange

Floor beams supported by edge beam

Neoprene strip for floor support



Holes for pinned connection

Detailing

- Floor arrangement ellipse building



Detailing

- Projecting façade part

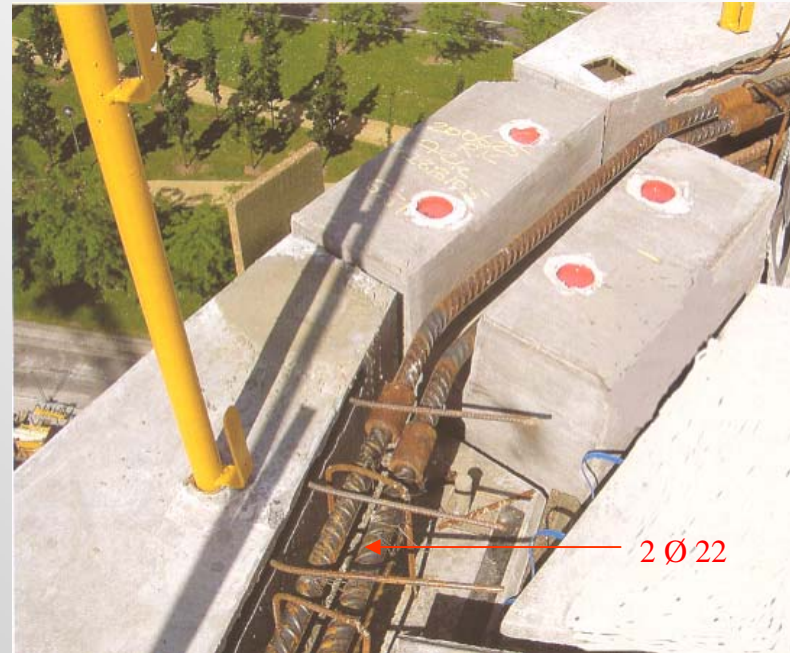


Detailing

- Peripheral tie reinforcement



Ellipse building 26 floors



Detail tie reinforcement calculated to prevent progressive collapse

Detailing

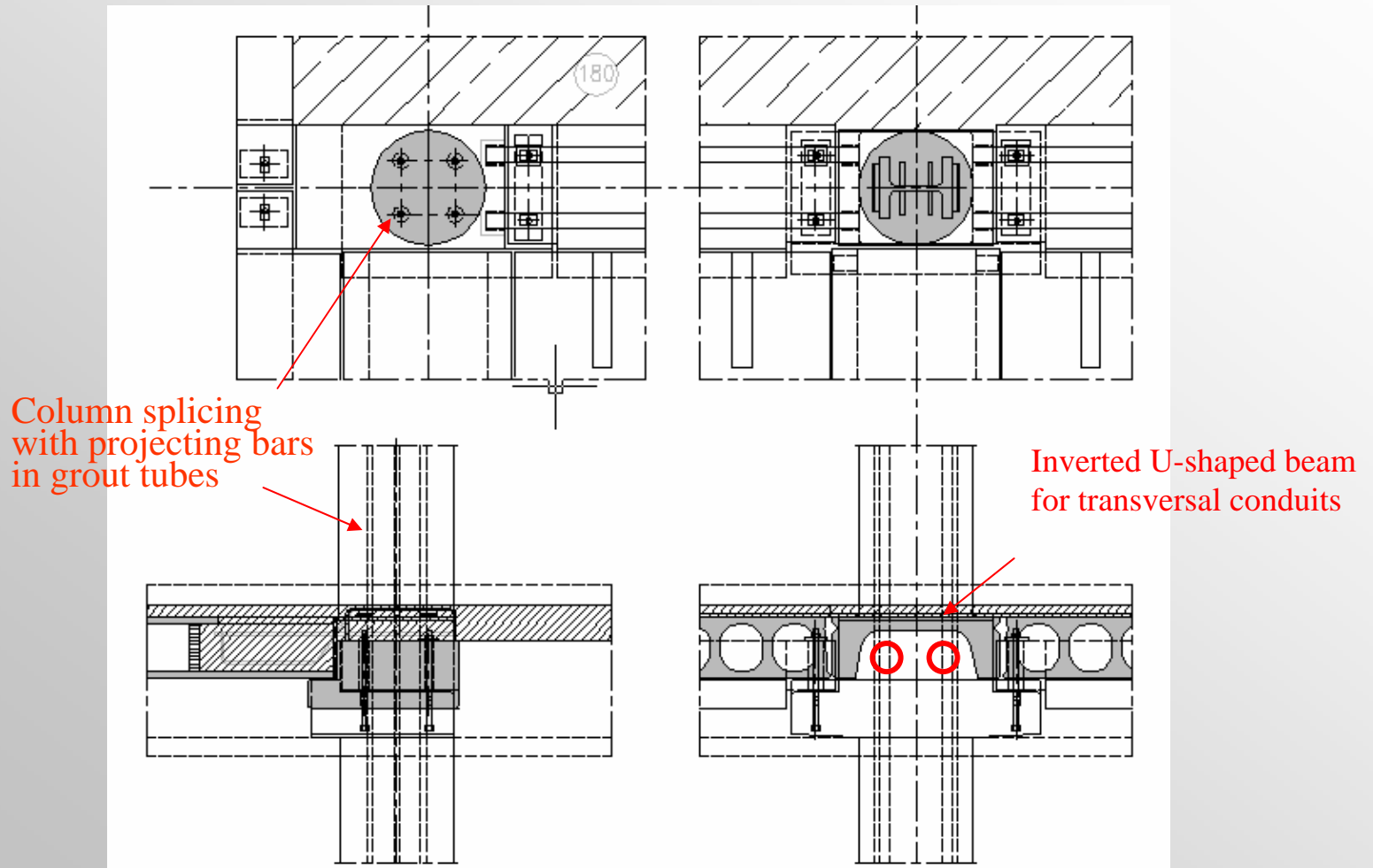
- Passage for technical conduits



HC on bottom fange steel beam

Detailing

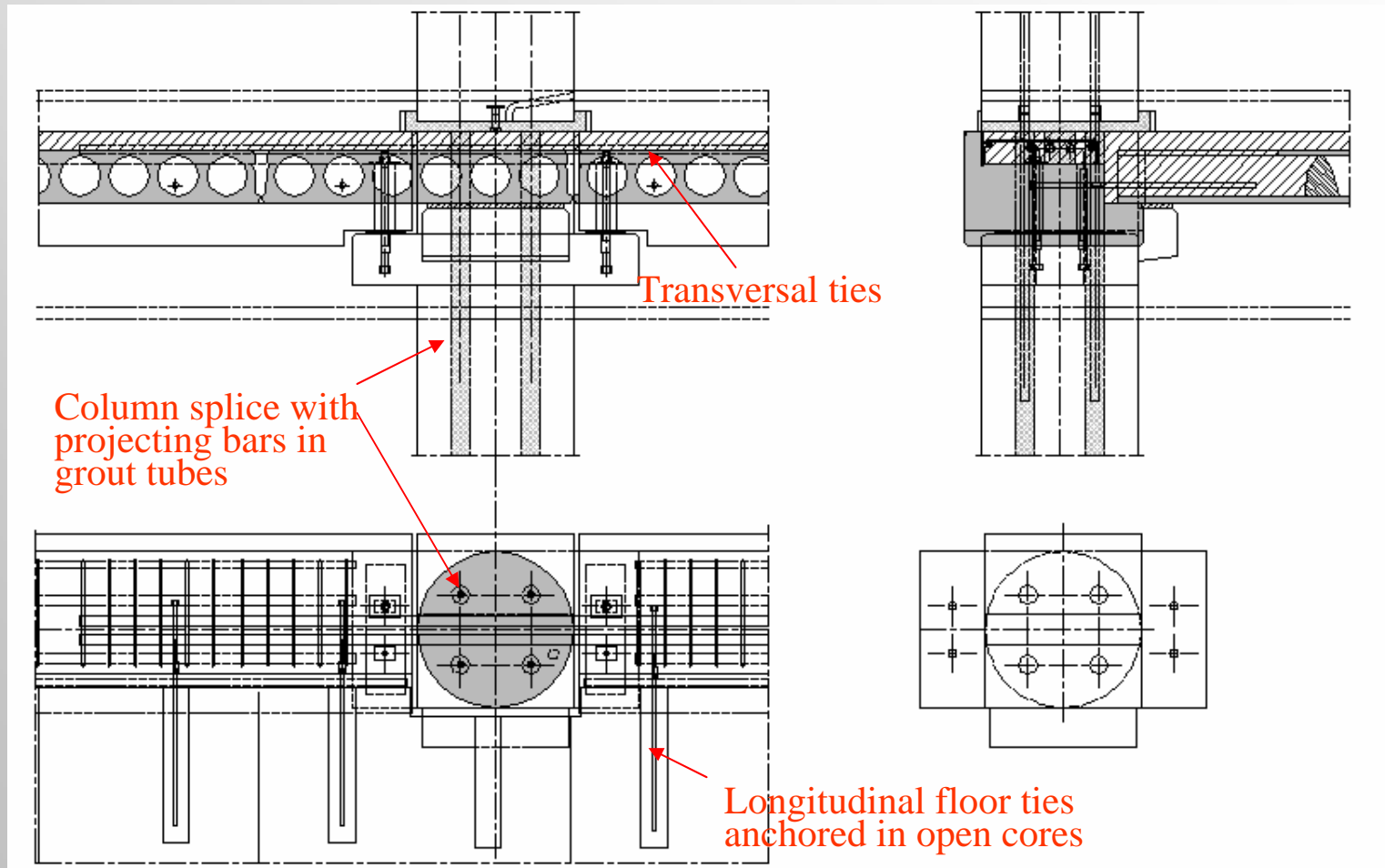
- Installation technical conduits



5. Structural connections

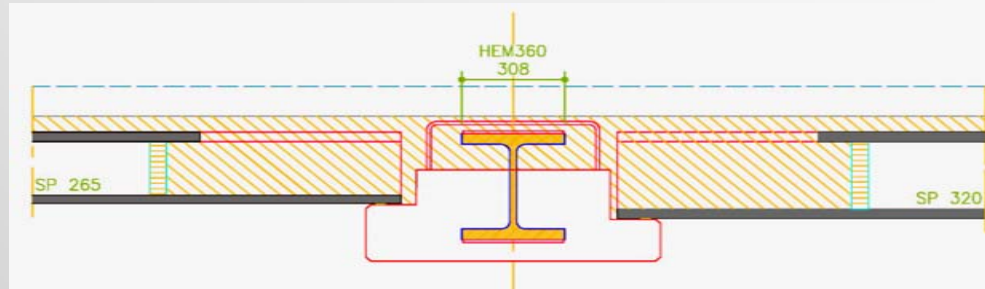
Connections

- Edge column - to - beam and hollow core floor

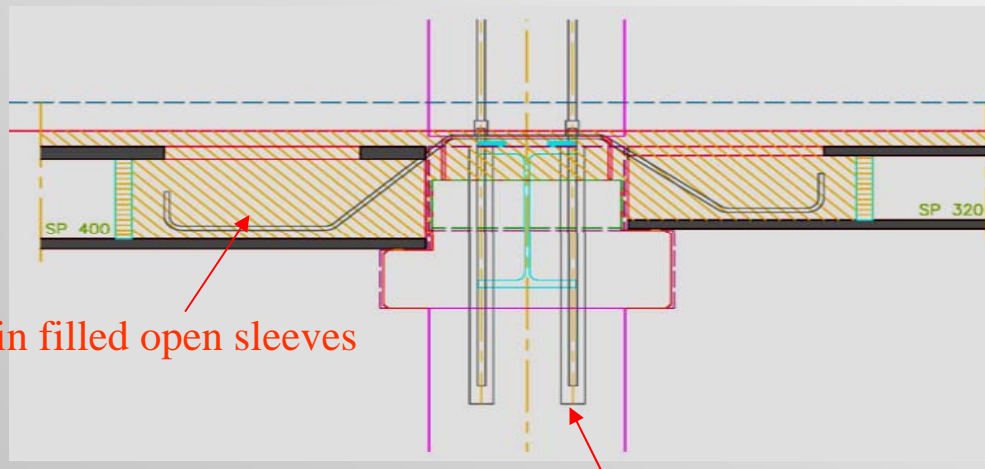


Connections

- HC Floor - to - composite beam



Slender composite floor beam



Tie bars in filled open sleeves

Column splice with projecting bars in grouted tubes

6. Erection

Erection

- Columns



Erection

- Dexia tower (37 storeys)



Erection

- Simultaneous erection and building finishing



Erection

- Installation glass façade.



Basement construction

- Up and down at the same time



Piles for basement wall (41.7 ton)

Length 14.70 m

Longitudinal pipe for
positioning control



28 precast foundation piles

Basement construction

- Installation in excavated slot filled with bentonite



Temporary pile suspension
during casting of footing



Footing reinforcement
fixed to pile

Conclusion

Precast concrete is a modern industrialised and environmentally friendly method of construction, with a bright and promising future.

**Thank you for
your kind attention**

