PRECAST CONCRETE FOR HOUSING PROJECTS

SMART EVOLUTION

ELEMATIC

General remarks

- It should be noted that many of the presented solutions may not be applicable in seismic regions but with small modifications resembing solutions have beenintroduced in heavily seismic conditions (Japan, South korea, Taiwan, California et.)
- In order to find complete mutual understanding of the requirements of the project and the customer and possibilities of Elematic's technologies, it would be necessary to have a face-to-face meeting between the parties involved
- Elematic wishes to have that opportunity soon and offers to meet e.g. in Dubai where its regional office is or any other location convenient for the other parties

EXAMPLES OF MULTI-STOREY RESIDENTIAL BUILDINGS AND VILLAS BUILT WITH LOAD-BEARING PRECAST WALLS, PRESTRESSED HOLLOW-CORE FLOORS AND INSULATED FAÇADE PANELS

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STRUCTURES AND JOINT DETAILS

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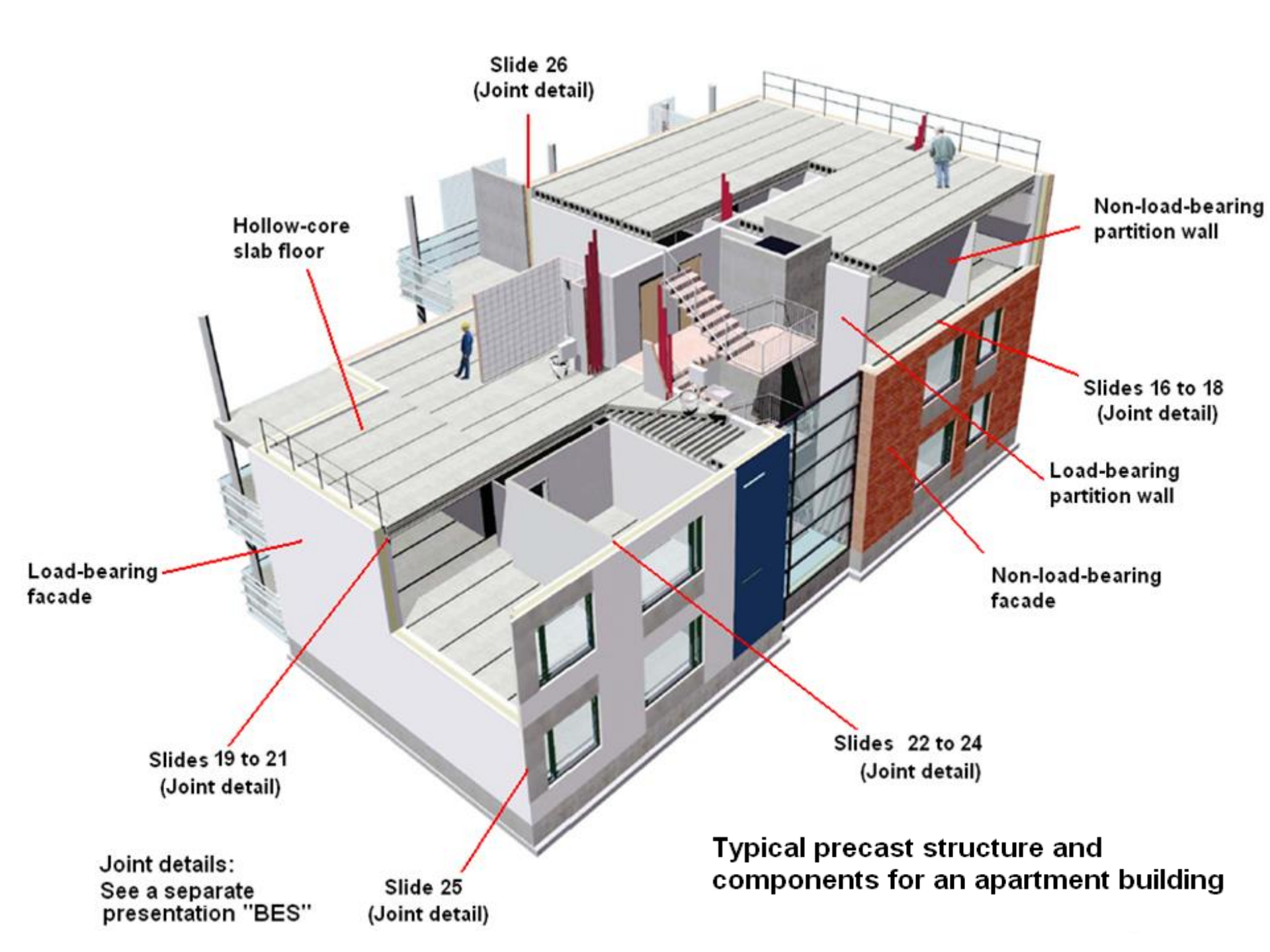
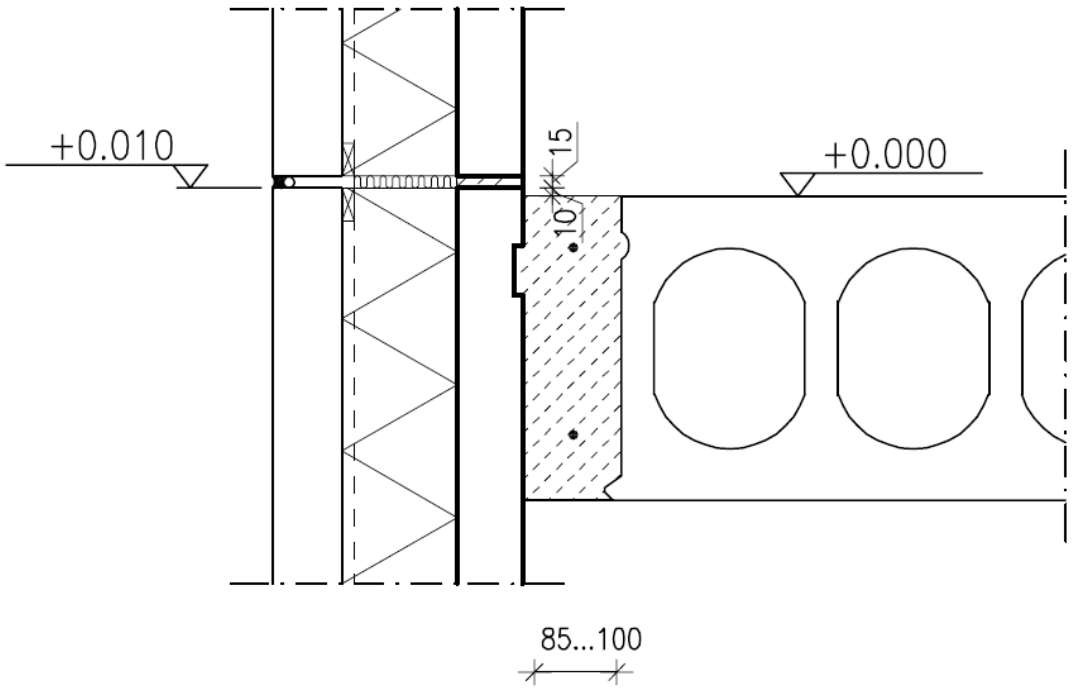


Typical precast structure and components for an apartment building

Non-load-bearing façade/floor joint (I)



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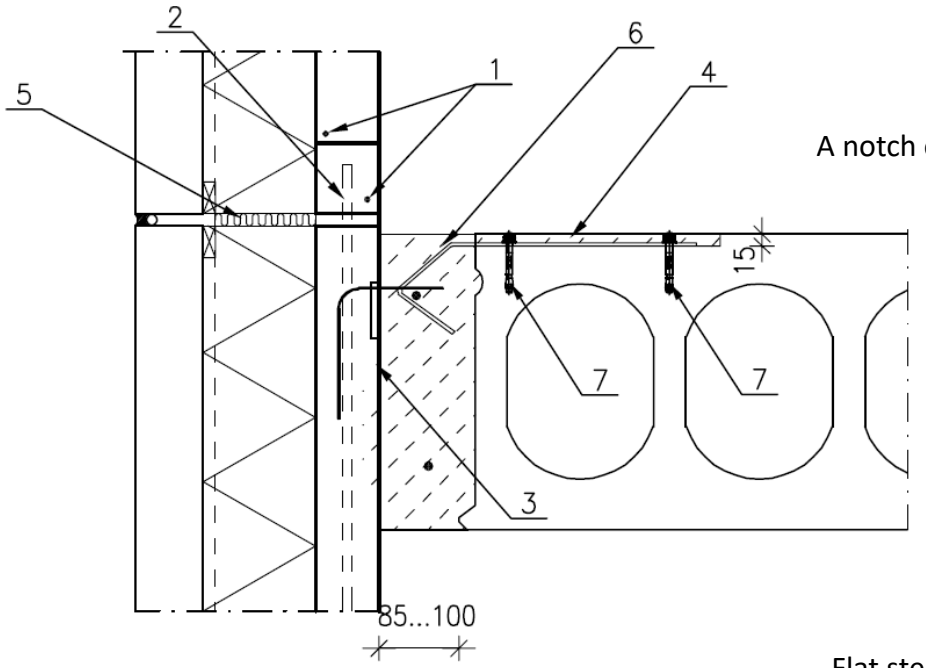
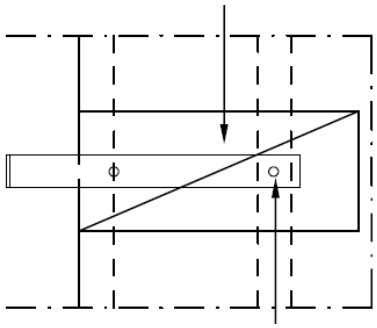
Non-load-bearing façade/floor joint (II)

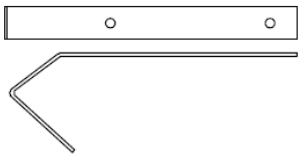


A notch on the top of the slab



Holes in the webs

Flat steel 4x50 c/c < 2000 mm



1. Edge bar in the wall panel
2. Pin or splice (12 mm), c/c < 2000 mm
3. Steel loop
4. Notch on the top of the slab, 15 x 150

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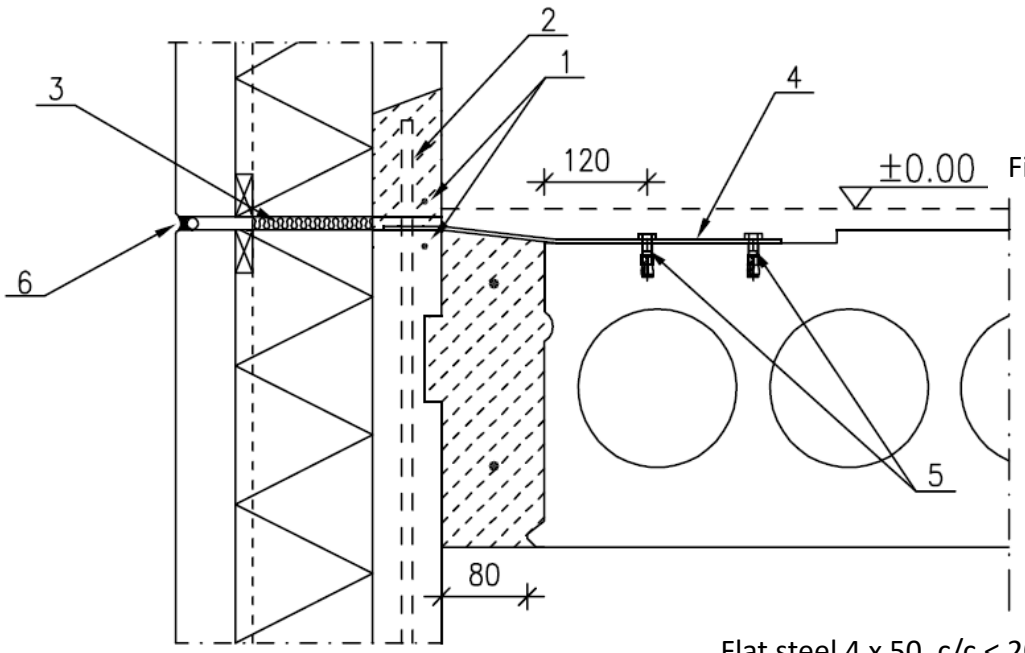
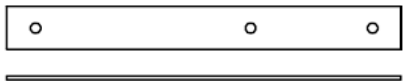
Non-load-bearing façade/floor joint (III)

Not in scale!

Applicable for 370 mm slab

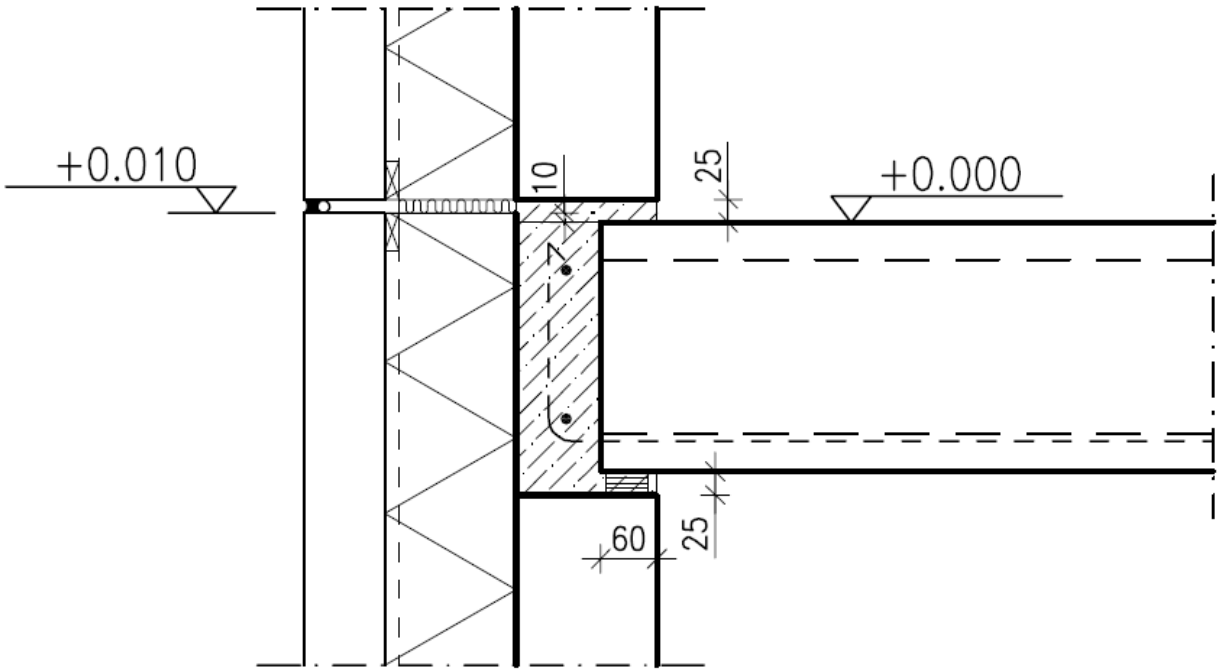


Flat steel 4 x 50, c/c < 2000 mm



- Distance between fixing points max. 2000 mm, not next to a door opening

Load-bearing façade/floor joint (I)



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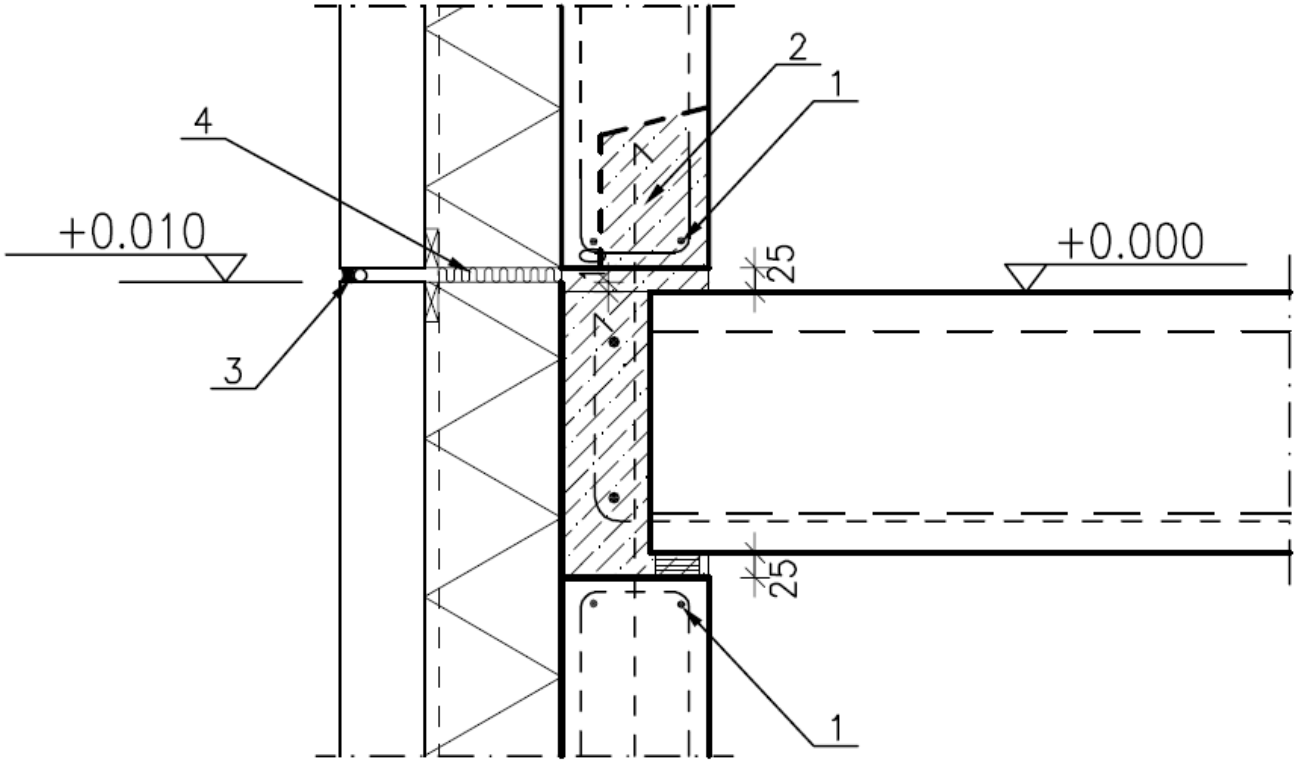
Load-bearing façade/floor joint (II)



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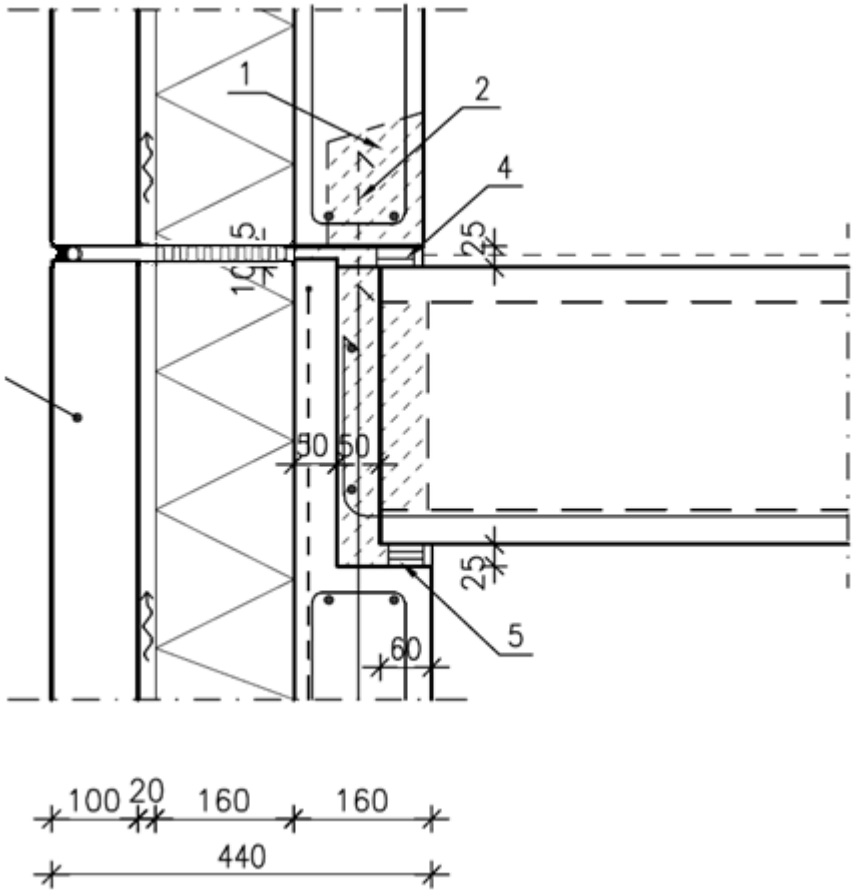
Load-bearing façade/floor joint (III)

2-layer exterior concrete layer



1. Recess in the panel
2. Pins (16 mm) c/c 1200 mm in the slab joints. Every second (c/c 2400 mm) into the recess above

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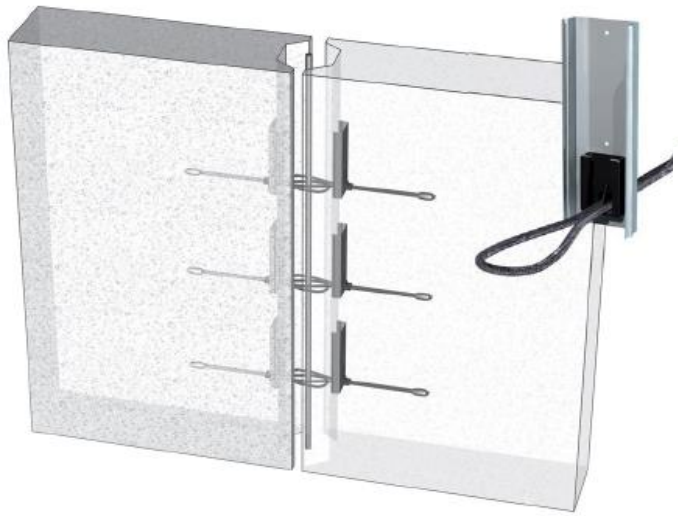
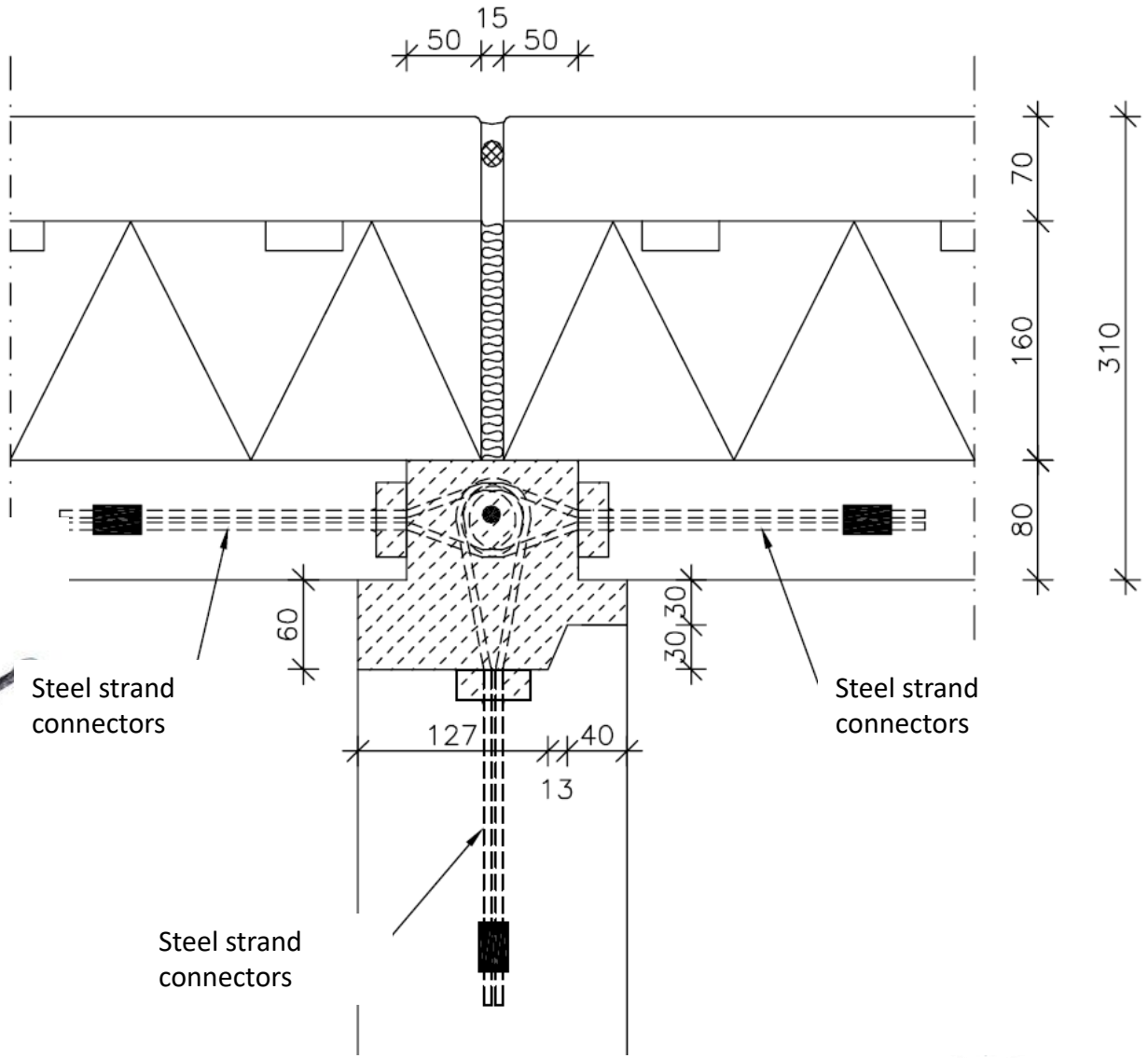
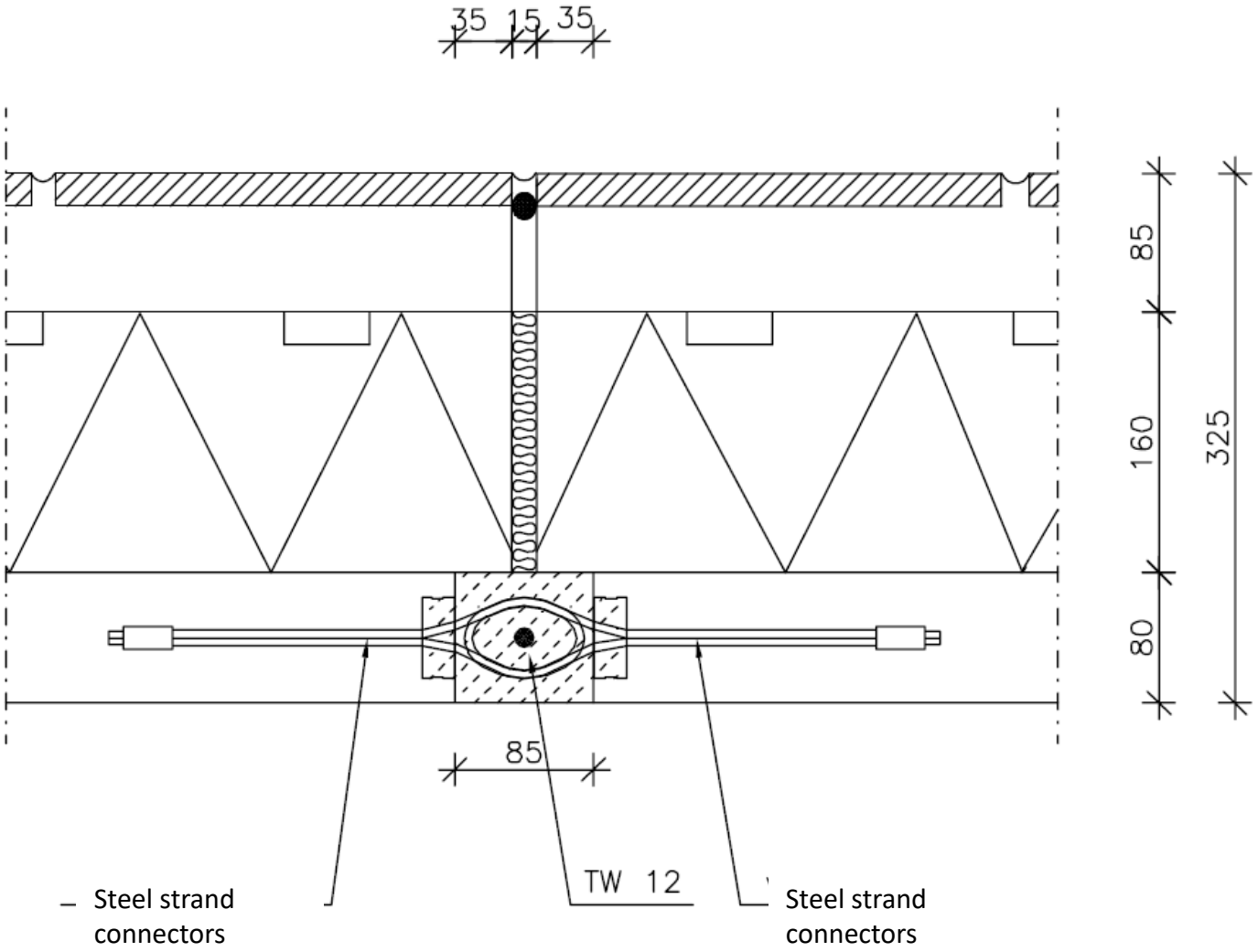
Joint between partition wall and plain façade

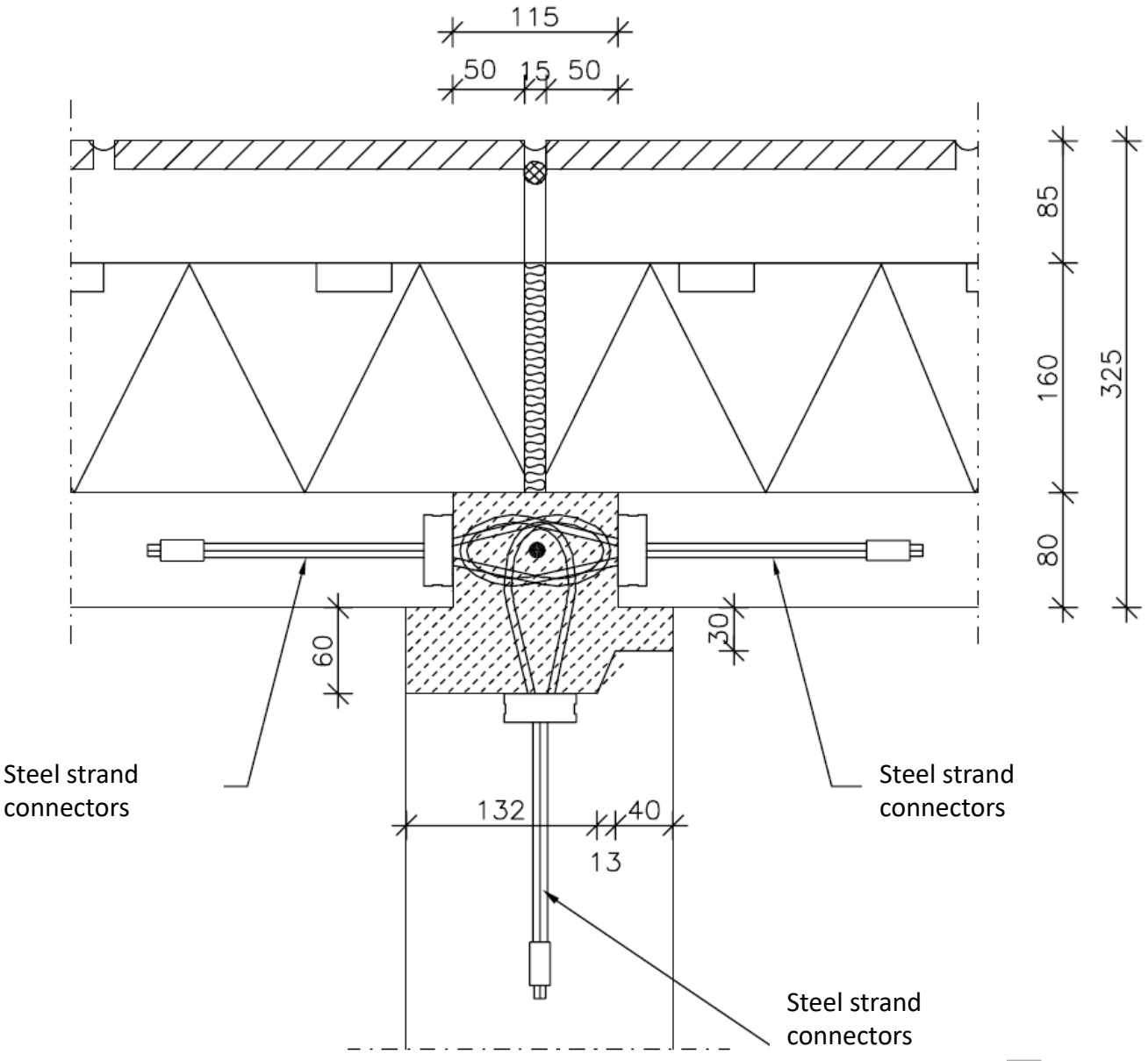




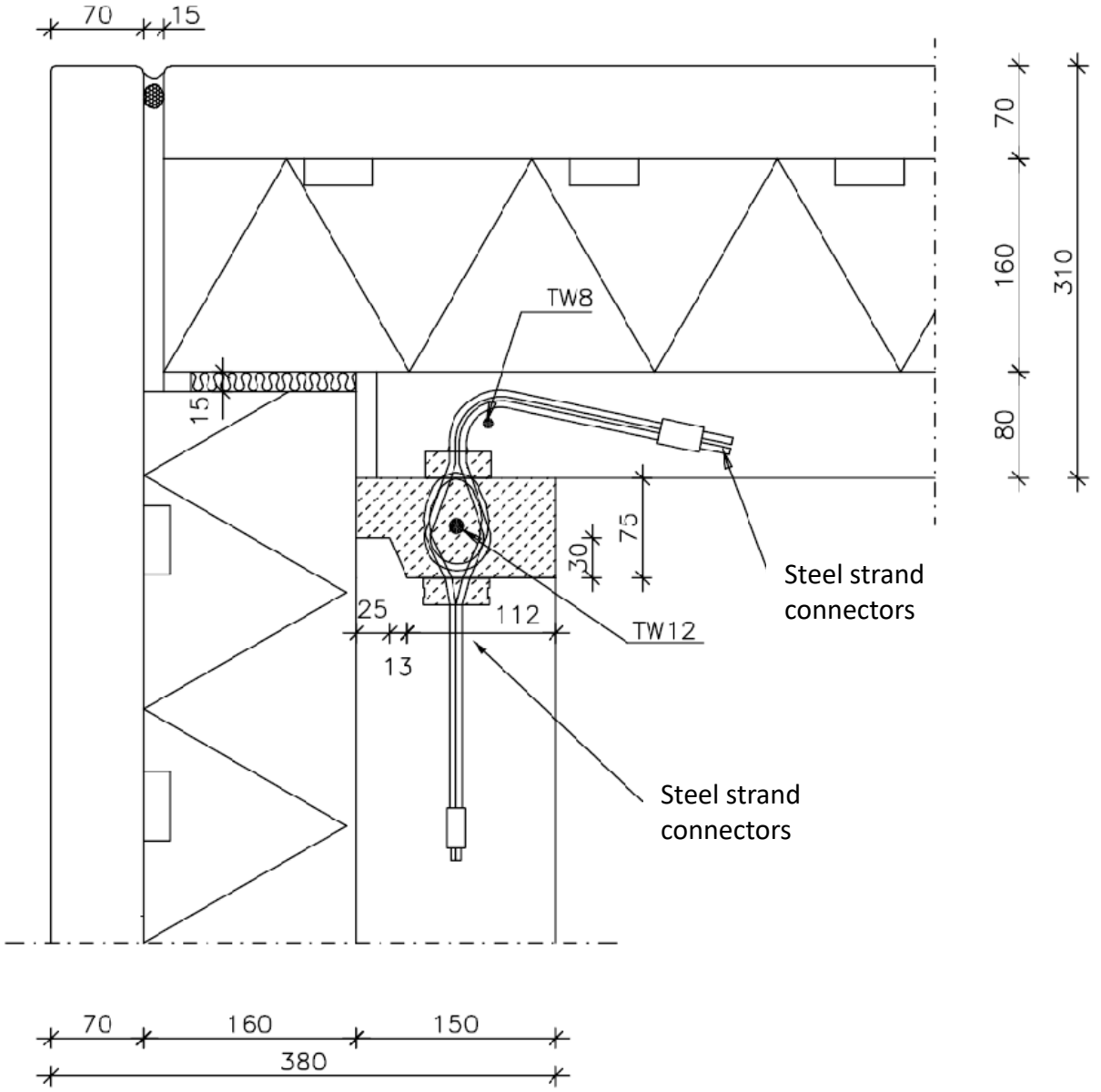
Joint between two non-load-bearing façade panels



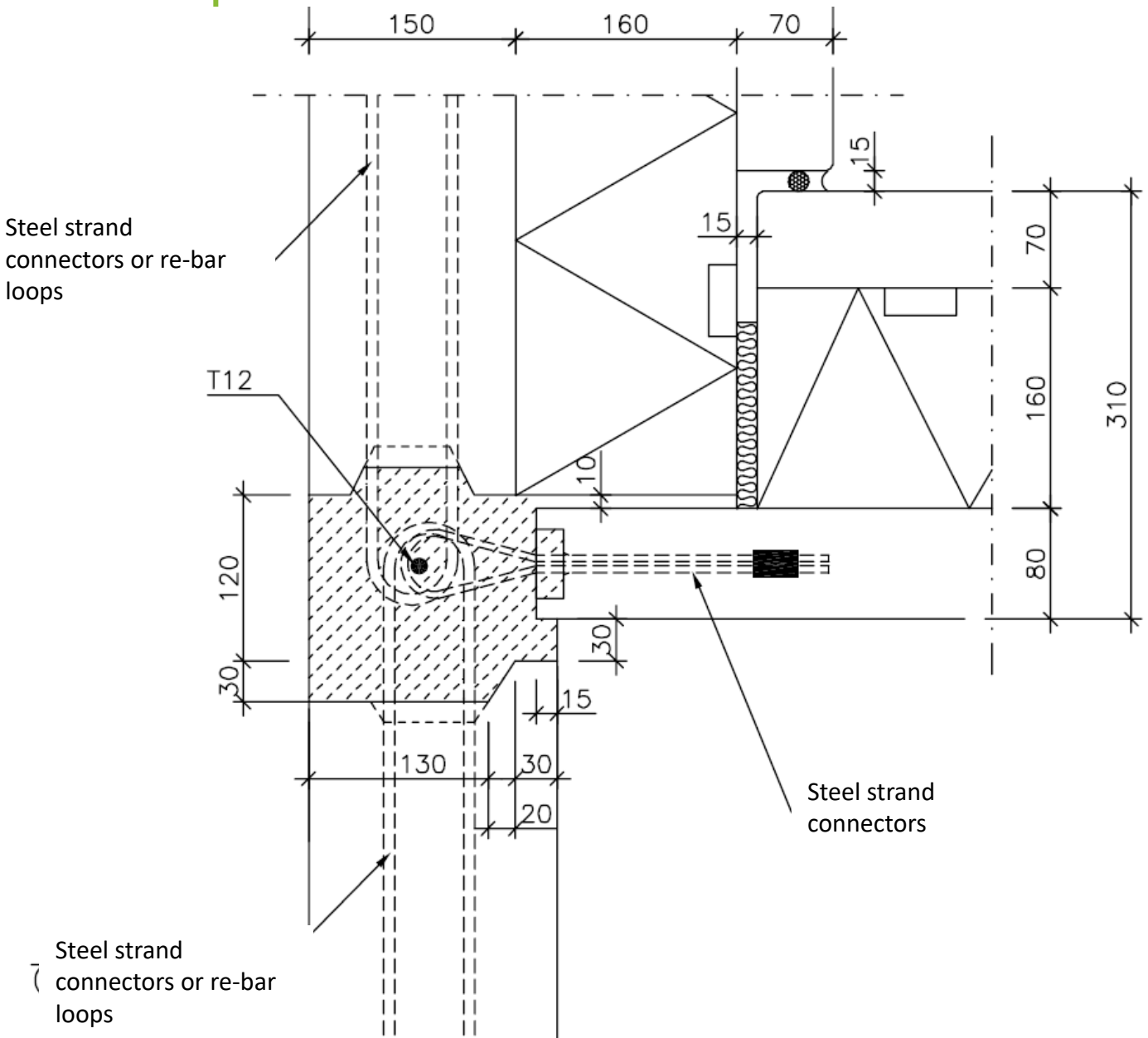
Joint between partition wall and façade with cladding



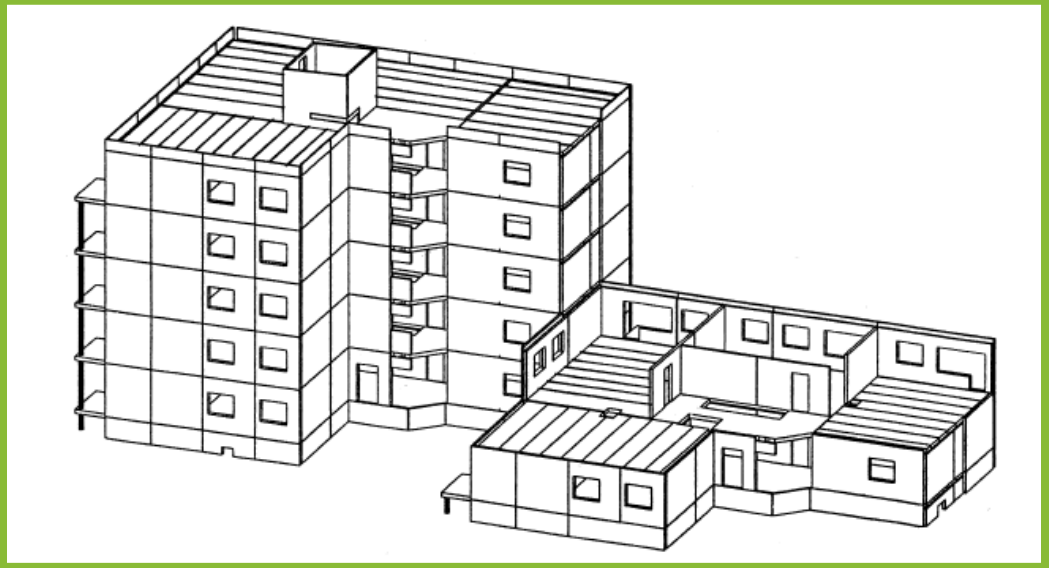
Corner joint between load-bearing and non-load-bearing façade panels

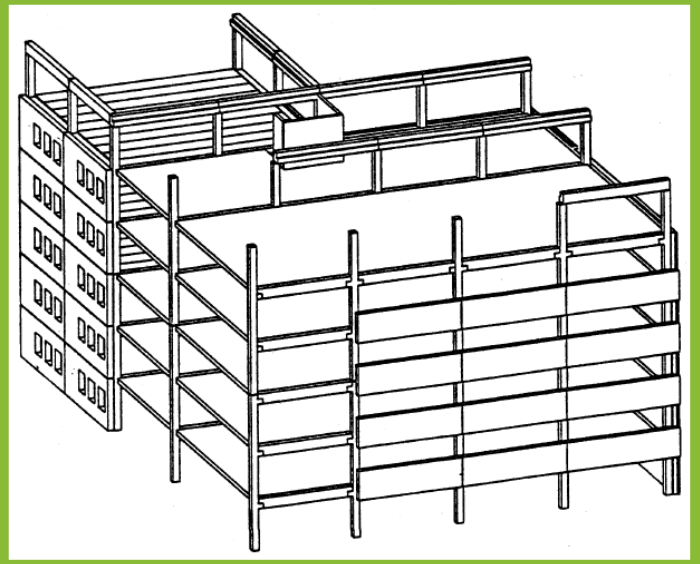


Inner corner joint between load-bearing, non-load-bearing façade panels and partition wall



LOAD-BEARING WALLS OR BEAM-AND-COLUMN FRAME STRUCTURES





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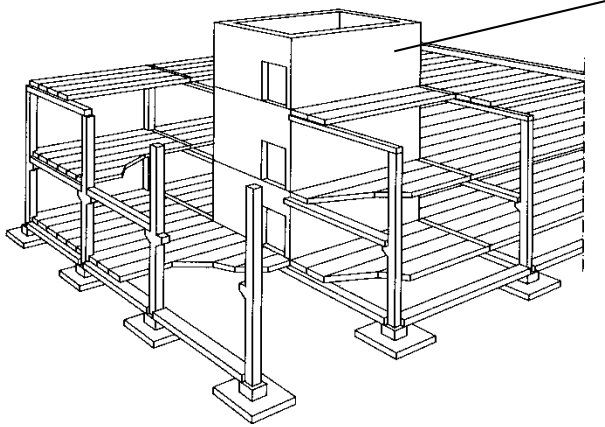
Beam-and- column frames

- Beam-and-column frame structures of concrete are commonly used in offices, schools, hospitals, parking garages and high-rise residential towers (say 15 floors and up)
- Beam-and-column frame requires certain sections in the structure to ensure sufficient rigidity



Stairwell and elevator shaft are often the poured-in-place section for rigidity of the frame

Beam-and-column frame vs. load-bearing-walls frame

- In residential multi-storey buildings with less than 10 floors the load-bearing-walls system combined with prestressed long-span floor structure, is proven to be cost-efficient plus architecturally and structurally superior in comparison with beam-column frame

  NOTE: There are certain **parts** of residential multi-storey buildings which are feasible to build using beams and columns. They can be for example ground floor or underground parking and balcony structures

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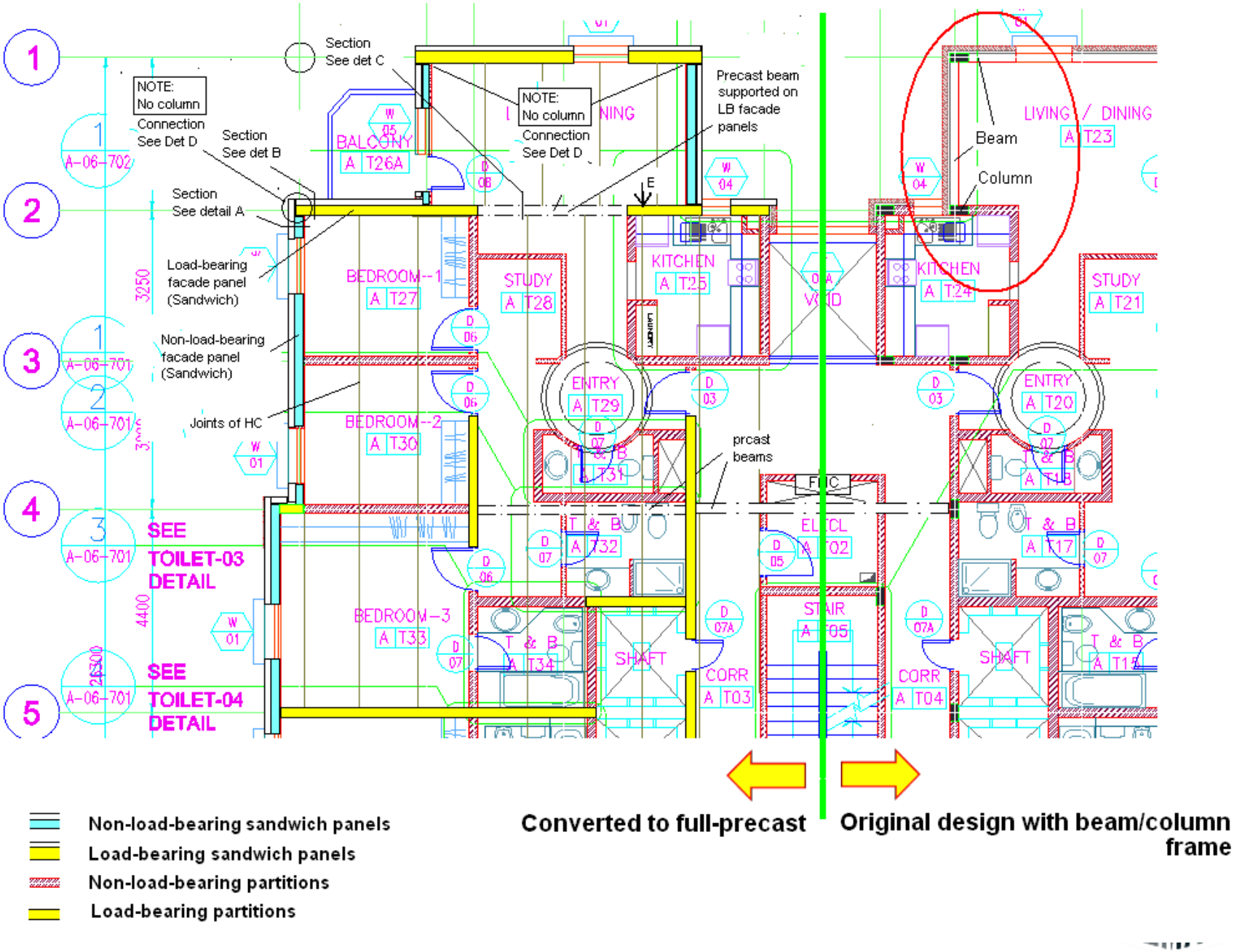
- Beam-and-column frame can be made of precast concrete components which are erected at the construction site, OR it can be poured in place which needs extensive formwork
- Masonry blocks, bricks, metal/glass panels or precast concrete panels can be used as exterior walls for enclosing the openings between the columns and beams
- Any combination of the above-mentioned alternatives lead to significantly more work to be done at site which makes the duration of the project longer and jeopardizes the work safety and quality
- Significant savings can be achieved by making the necessary number of walls load-bearing members of the structure and as a consequence, all the columns can be discarded

Savings achieved by converting to Load-bearing-walls system

- The time saving comes from the fact that the total erection time is directly depending on the number of the precast components to be lifted, installed and grouted. By leaving the beams and columns out, the number of components can easily be reduced by 30 to 40%.
- In the same way, by leaving the beams and columns out, the total quantity of concrete is significantly less. It is safe to estimate the difference to be 15 to 20% depending on how the beam grid is designed.
- In addition, the columns often take part of the floor area and make the floor layout unaesthetic. (See the slide # 32
- I attach one floor plan (the next slide: “Apartment Floorplan” (example)) which shows how we converted a housing project in Qatar from Beam an Column (and masonry walls) to full-precast.


NOTE: No column Connection See Det D
Section See det C
Section See det B
Section See detail A
NOTE: No column Connection See Det D
Precast beam supported on LB facade panels
Beam
Column
Load-bearing facade panel (Sandwich)
Non-load-bearing facade panel (Sandwich)
Joints of HC
prcast beams
SEE TOILET-03 DETAIL
SEE TOILET-04 DETAIL
BALCONY A T26A
BEDROOM--1 A T27
STUDY A T28
KITCHEN A T25
KITCHEN A T24
LIVING / DINING A T23
STUDY A T21
ENTRY A T29
ENTRY A T20
BEDROOM--2 A T30
BEDROOM--3 A T33
SHAFT
CORR A T03
CORR A T04
STAIR A T05
Converted to full-precast
Original design with beam/column frame
Non-load-bearing sandwich panels
Load-bearing sandwich panels
Non-load-bearing partitions
Load-bearing partitions

PRECAST PLANT

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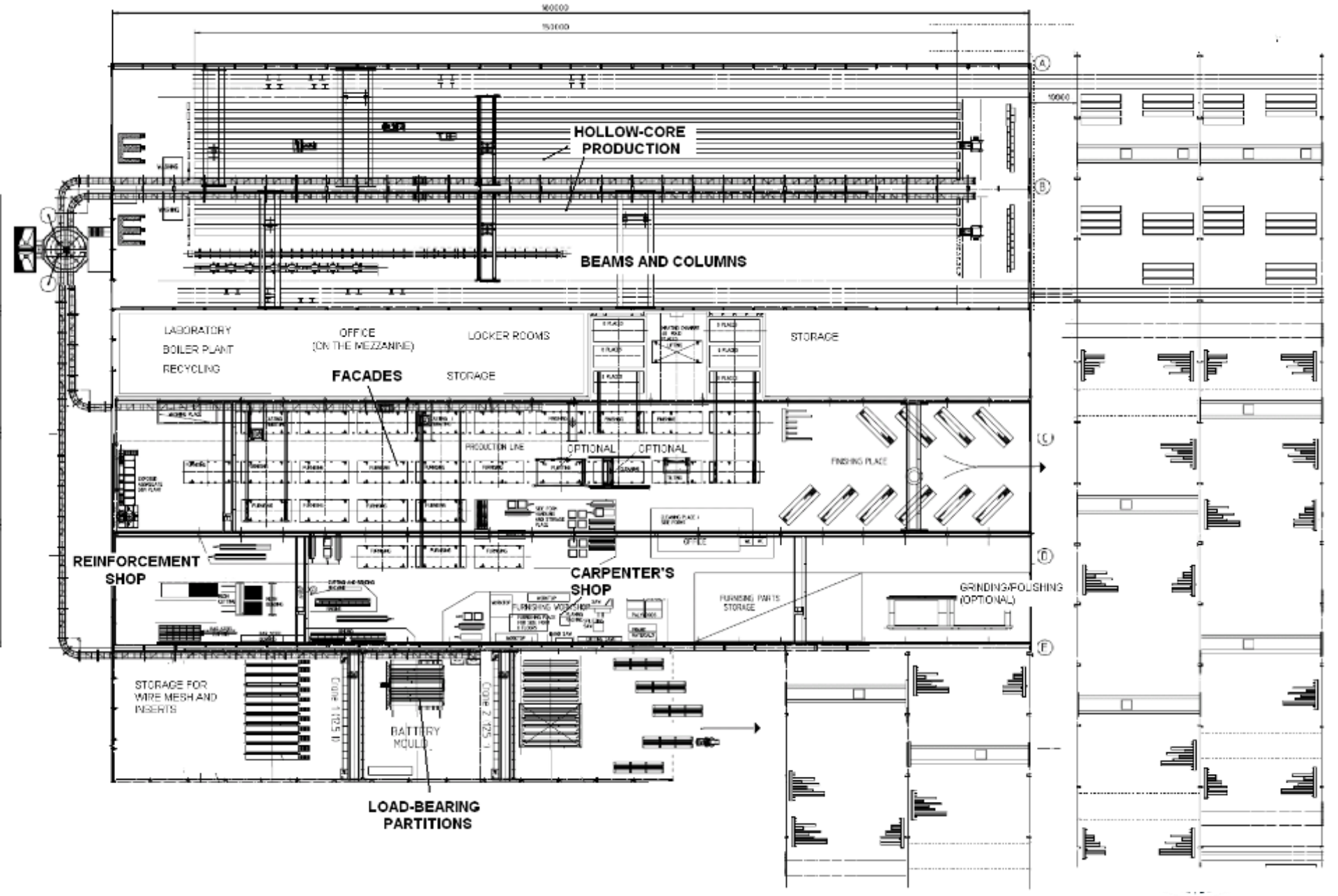

HOLLOW-CORE PRODUCTION
BEAMS AND COLUMNS
LABORATORY
BOILER PLANT
RECYCLING
OFFICE
(ON THE MEZZANINE)
LOCKER ROOMS
STORAGE
FACADES
STORAGE
STORAGE
PRODUCTION LINE
OPTIONAL
OPTIONAL
FINISHING PLACE
REINFORCEMENT SHOP
CARPENTER'S SHOP
FURNISHING WORKSHOP
FURNISHING PARTS STORAGE
GRINDING/POLISHING (OPTIONAL)
STORAGE FOR WIRE MESH AND INSERTS
BATTERY MOULD
LOAD-BEARING PARTITIONS

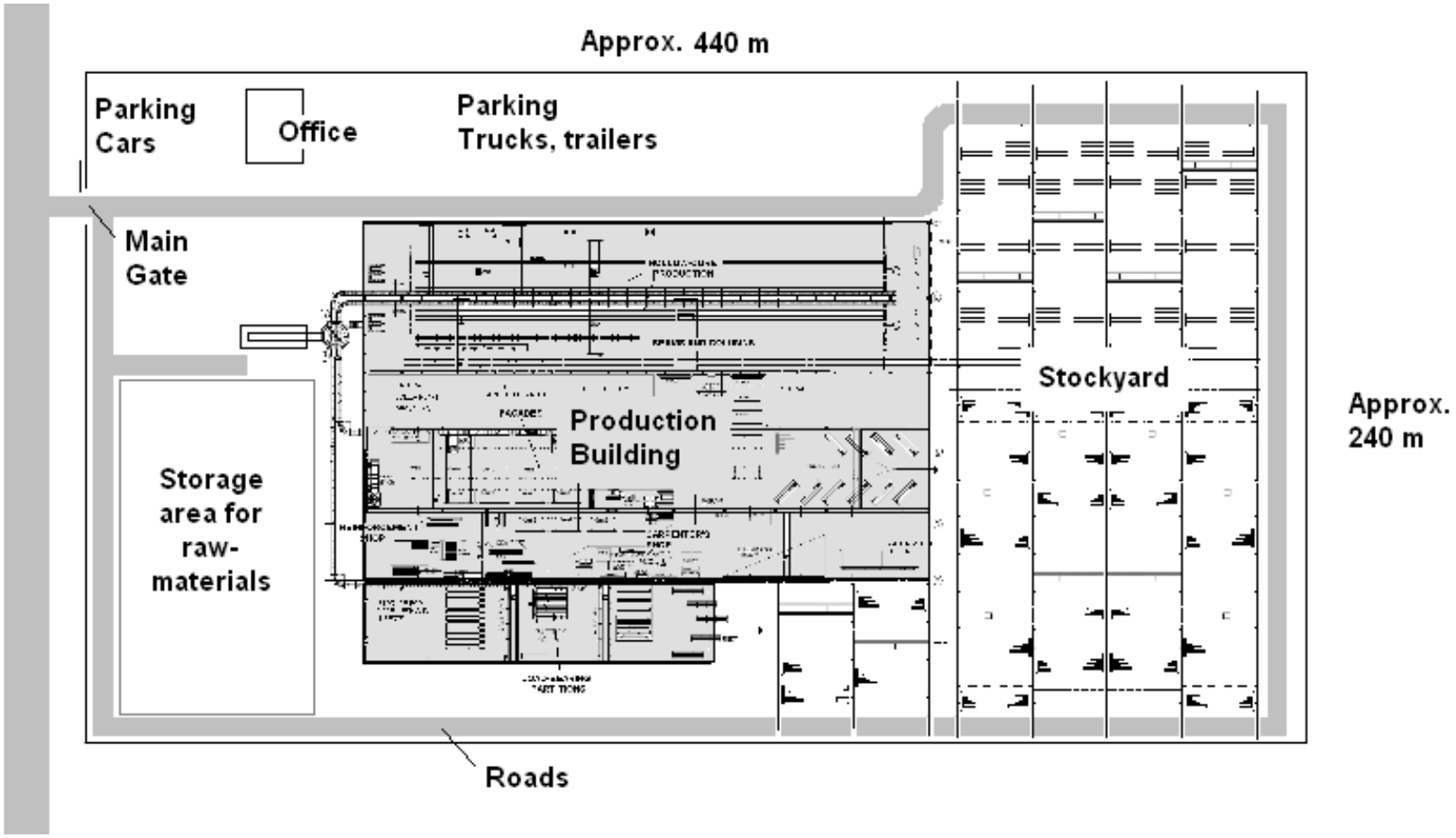
Floor and Land Area requirements

Indoor area:		21,120 sq.m.
Outdoor stockyard area:		20,500 sq.m.
Other:	approx.	64,000 sq.m.
Total land area:	approx.	105,600 sq.m.

Divided as follows:

Hall Number	Production and other functions	Area
1	Hollow-Core Slab Production, casting beds 8 x 150 m	24 m x 180 m
2	Hollow-Core Slab Production, casting beds 4 x 150 m	24 m x 180 m
	Beam and Column Production	
3	Curing Chambers for Circulation Line of Hall 4	18 m x 180 m
	Laboratory (about)	
	Recycling	
	Boiler plant	
	Storage	
	Locker room	
	Factory office on the mezzanine	
4	Circulating Table Moulds Line	20 m x 180 m
5	Reinforcement shop	18 m x 180 m
	Carpenter shop	
	Storage	
6	Battery mould	20 m x 120 m
	Storage for wire meshes and inserts	
Stockyard 1	Hollow-core, beams, columns and exterior walls	180 m x 100 m
Stockyard 2	Partition walls	50 m x 50 m

General Plan



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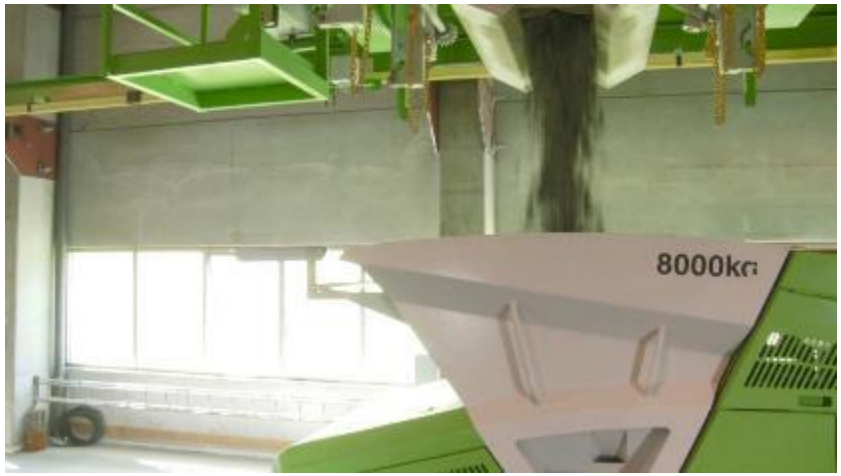
Typical precast plant for housing project

Hansung,
South Korea

Hollow-core bay



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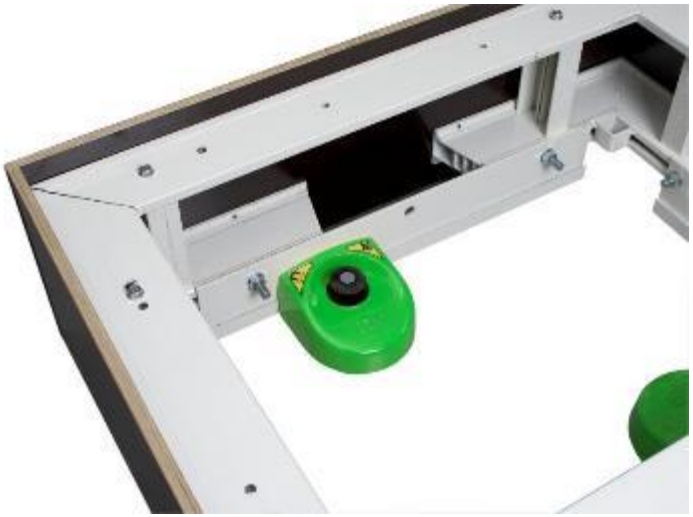
Façade production bay



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CAPACITIES

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Estimated production capacity

The calculations are based on working methods, raw materials and temperatures that are customary at Finnish precast plants.

The capacities of the offered lines are as follows:

		Capacity **(m^2 /d)**	Concrete consumption **(m^3/h)**
1.	**Floors**		
	Hollow-core slab line in halls A and B , 12 beds casted once per day12 x 150m x 1,2 m x 0,95 (= efficiency ratio)	**2 050**	
	Need for concrete:		
	slab size H = 200 mm, A = 0,12 m^2		
	• casting with two extruders simultaneously		
	• need for concrete (casting speed 1,7m/min) 12 m^3 / h / extruder		
	• need for concrete 2 x 12 m^3 / d		**24,0**
2.	**Facade panels**		
	• circulating line in halls C and D, casting once per day		
	• mould size 3,5 x 9,0m = 31,5 m^2		
	• efficiency ratio 0,65 = 20,5 m2 / mould		
	• 40 moulds on line, 1 cycle a day casting 40 moulds / d	**820**	
	Need for concrete:		
	• sandwich panels, layer thicknesses 80 / 50 / 150 mm		
	• concrete layers total: 80 +150 = 230 mm		
	• 0,230 m x 820 m²/d => 188,6 m^3 / d		
	• casting time 16 h / d =>		**11,8**

Continue...

Continued…

3.	**Partition walls**		
	• standard partition walls in hall E-F with one battery mould, 1 cycle a day		
	• mould size 3,1 x 8,1m => 25,1 m^2		
	• efficiency ratio 0,65 => 16,3 m^2 / casting cell		
	• battery mould with 10 double-cells, 2 partition walls in each		
	• 1 cycle a day => 40 partition walls	**650**	
	Need for concrete:		
	• wall thickness 150 mm (50%) and 100 mm (50%)		
	• average wall thickness 125 mm		
	• 0,125 m x 652 m^2/d =>81,5 m^3 / d • casting time 16 h => m^3 / h		**5,1**
4.	**Batching and mixing plant**		
	• needed capacity 24,0 + 11,79 + 5,1m^3/h =>		**40,9**
	NOTE: Available capacity from Elematic B&M Plant with two 2 cu.m. twin-shaft mixers is **60 cu.m. / hr** which gives more than **45 % reserve**		

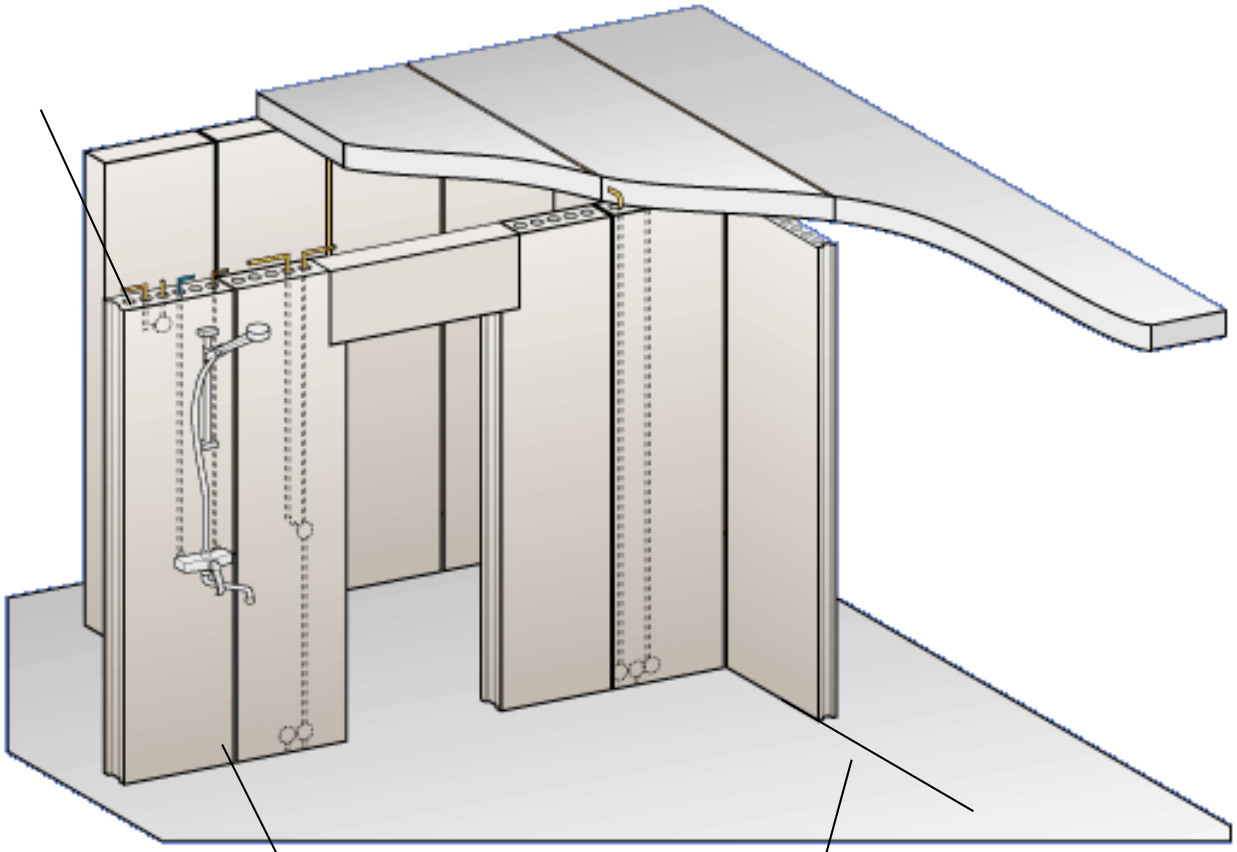
NOTE:

1. We have rechecked the capacity calculation and the capacities are sufficient for production of the buildings you have submitted drawings for (in particular “the Mid-size building”).
2. Please note that the non-load-bearing partitions are not to be made of heavy concrete but of some light-weight materials (gypsum board, light bricks, AAC etc.). Another possibility is Acotec partitions (See the next slide for “Acotec”)
3. The output of the facade and partition wall lines can be increased by adding thr third shift

Acotec Partition Wall Panel

(made of light-weight concrete with expanded clay)

VOIDS CAN BE USED FOR ELECTRIC CONDUITS AND FOR CONCEALED PIPEWORK



FILLING OF INSTALLATION JOINT WITH MORTAR

WALL POSITIONING LINE AND ERECTION SIDE

For more information on “Acotec”, please visit
www.precastfountain.com/en/precast_products/acotec

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MANNING

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Manning

- The following table contains the estimated needed number of laborers in each section of the plant
- The numbers are based on availability of well-trained laborers and productivity rate customary in European plants

SECTION OF THE PLANT	Descriptions	No. of men per shift	Total no. of men
1. BATCHING AND MIXING PLANT	Production with two mixers	1 to 2 men per shift	2 to 4 men
2. CONCRETE TRANSPORTATION	Capacity of the concrete transport shuttle 2 m^3 (wet concrete) and 1.5 m^3 (0-slump concrete)	Automatic system	0
3. HOLLOW CORE PRODUCTION	12 x 150 m casting lines Daily production 2000 m^2, working in two shifts	6 to 8 men per shift • Reinforcing and furnishing: 4 to 6 men • Casting: 2 men	12 to 16 men
4. BEAMS AND COLUMNS PRODUCTION	Assumed production schedule: One cycle in two days and one shift/d		6 to 8men
5. EXTERIOR WALL PRODUCTION	Number of table moulds: 40 Daily production 800 m^2 Number of 8-hr shifts: 2	16 to 22 men per shift: • Reinforcing and furnishing: 8 to12 men • Casting: 2 men • Finishing: 2 men • Demolding: 2 to 4 men • Panel handling, finishing: 2 to 4 men	32 to 44 men

Continue…

Manning

Continued…

6. PARTITION WALL PRODUCTION (BATTERY MOULD)	One cold shutter battery mould, size 3,1 x 8,1 m, 5 + 5 casting cells Daily capacity 320 m², one working shift, staggered	7 to12 men per day (one shift) • Furnishing, reinforcing: 4 to 8 men **(NOTE: Depends on the complexity and surface material of the panels)** • Casting: 2 men • Product handling: 2 men	14 to 24 men
7. SERVICE, MAINTENANCE AND REPAIR		• mechanical service 2 - 3 men per shift • electrical service 2 men per shift	8 to 10 men
8. STOCKYARD	1 to 2 men per shift in each storage bay	Total number approx. 4 to 6 men per shift	8 to 12 men
		TOTAL	**82 to 98 men**

NOTE:

Plant management and foremen in each line are not calculated in the above

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