Section 7

VST PERMANENT FORMWORK SYSTEM

with BZSPlus cement-bonded particleboard

2021

CSP BZS

JOINT LIMITED LIABILITY COMPANY

Contents

Photographs provided by VST Building Technologies AG.

1. VST permanent formwork system and its advantages

VST permanent formwork construction technology gained international approval a long time ago. This highly efficient yet easy-to-use method allows to build custom as well as standardized buildings with any number of floors — residential, sports and entertainment complexes; public, office and industrial buildings; medical and social institutions, nursing homes — promptly, precisely and proficiently.

VST technology, developed and patented by VST BUILDING TECHNOLOGIES AG (Austria), is a monolithic construction method with formwork consisting of two 24 mm cement-bonded particleboards, which remain permanently in the concrete structure. The main advantage of VST technology is prefabrication of all its elements (large hollow wall and ceiling formwork elements) at the plant. Wall elements and slabs have built in wire conduits and LV cables, sanitary and heating pipes. They are delivered to the construction site ready for assembly, which considerably reduces the work required on site and shortens construction time.

Fast and easy assembly of the elements, no need for installation and removal of formwork and for wet plastering works (perfectly smooth CBPB surface is ready for filling and painting or wall papering) allows to reduce the construction time by up to 50%.

Besides, minimum number of workers is required on the construction site for installation of the building superstructure, which results in considerable reduction of labor costs.

The formwork elements are connected by patented steel spacers and profiles, which are fixed using galvanized screws. Reinforcement is installed in the elements before assembly. Wall panels are assembled on the construction site, and then filled with self-compacting concrete (SCC) in layers (layer height — 1–1.5 m), at the intervals required for concrete curing. Importantly, no vibration is required for concrete compaction.

The walls can be vertical or sloped. Reinforcement is installed at the factory based on static calculation. Total thickness of one wall element is the thickness of the concrete core plus the thickness of two formwork boards. CBPB and concrete produce a jointless monolithic building structure.

Patented permanent formwork system is suitable for all load-bearing and non-load bearing structures. Based on the project requirements, various structural elements are available — walls (vertical or sloped), slabs (horizontal or sloped), columns, beams, stairs, formwork and special elements.

The most important advantages of VST technology are remarkably short construction time, low overall costs, high quality and excellent indoor climate due to humidity levelling.

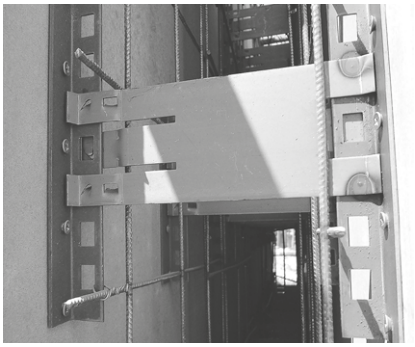
The concrete core provides stability, effective sound insulation and optimal thermal storage. CBPB boards on both sides of the concrete core and external thermal insulation layer provide accumulation of heat, which results in significant reduction of heating costs.

VST wall is a formwork element consisting of two cement-bonded particleboards, connected by metal spacers.

The elements are connected by specially developed metal clips, consisting of two parts:

- U profile, L240 (female angle);
- UT profile, consisting of welded together L240 and DS profiles (male spacer).

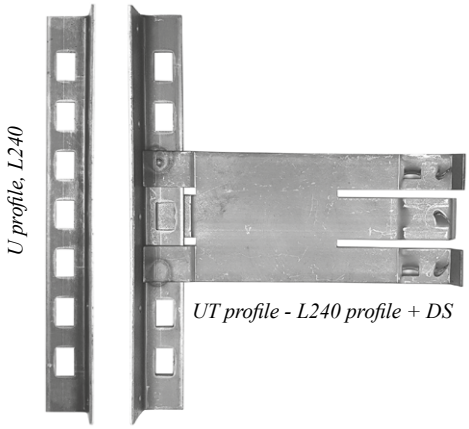
The spacers are fixed to cement-bonded particleboards from the inside with 5x25 mm galvanized countersunk screws, without driving the screw through the panel. This preserves the ready-to-paint surface of VST walls.



VST wall structure

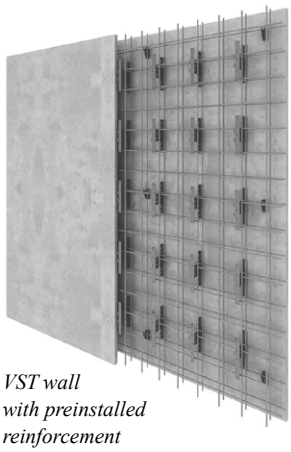
VST walls of the following sizes can be manufactured at the plant:

D = 175 mm (concrete core thickness d = 127 mm);
D = 200 mm (concrete core thickness d = 152 mm);
D = 215 mm (concrete core thickness d = 167 mm);
D = 230 mm (concrete core thickness d = 182 mm);
D = 250 mm (concrete core thickness d = 202 mm);
D = 300 mm (concrete core thickness d = 252 mm).

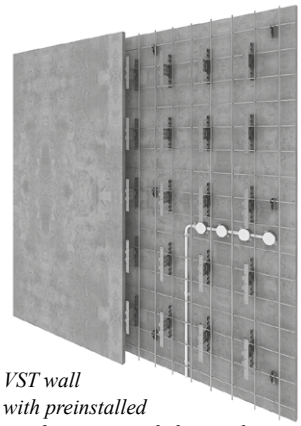


U profile, L240

UT profile - L240 profile + DS



VST wall with preinstalled reinforcement



VST wall with preinstalled reinforcement and electrical wiring

The overall thickness of one wall element (architectural dimension) is the thickness of the concrete core plus the thickness of two formwork boards. However, walls of different required thickness can be manufactured by varying the spacer dimensions.

All kinds of openings and cutouts can be made in VST walls at the factory, and electrical conduits, sanitary and heating piping can be installed.

The maximum weight of one VST wall is approximately 70 kg per 1 m^2, excluding reinforcement and fittings. The inner formwork panel of the wall serves as the edge support for the slab, so no additional edge support is needed.

With solid construction method, which produces a jointless structure, good sound insulation values are achieved for all wall widths provided by VST.

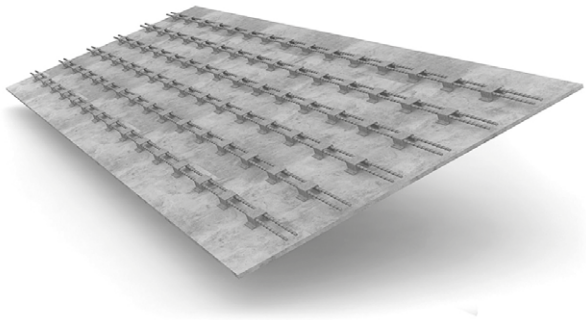
3. VST slabs

A VST slab consists of a cement-bonded particleboard, a hat profile (pre-installed at the factory), concrete and additional reinforcement installed on site. The axial spacing of hat profiles is 40 cm. The maximum weight without reinforcement is approximately 38 kg per 1 m^2. Reinforcement bars installed in the slab elements can be counted in the calculations as reinforcement (9.93 cm^2/m). They serve as supporting elements during the lifting process and before concreting.

Slabs are made of 3200x1200 mm panels. The panels can be cut or jointed to produce longer or shorter elements. Hat profiles and 10 mm reinforcement bars are fixed along the long edge of the slab at specified intervals. The profiles are screwed to the cement-bonded particleboards using countersunk galvanized screws.

There are two types of standard slab elements:

- width = 1200 mm, max. length = 6400 mm;
- width = 2400 mm, max. length = 6400 mm (this slab element consists of four 3200x1200 mm slabs connected to each other by steel angles and joint plates).



Additional reinforcement is installed on the construction site before concreting VST slabs. Concrete bonds to the cement-bonded particleboard which is not removed, but becomes part of the building as permanent formwork.

VST slab

VST slab with additional reinforcement

Concreting of the VST slab

VST stairs

4.

VST stairs are produced at the factory using 24 mm cement-bonded particleboard. The required reinforcement determined by static calculations is also installed at the factory. These formwork elements are also produced with all the necessary openings, stopping elements, etc. Prefabrication allows to achieve the highest accuracy.

VST stairs consist of cement-bonded particleboards, steel connectors and angles, hat profiles and pre-installed reinforcement. Flights and landings are manufactured and assembled separately. VST system does not provide for spiral stairs. Connecting reinforcement is installed in the walls (half landing), in the slabs and landings (top and bottom steps) on the construction site.

Stair stringer serves as the side form for concreting. The risers are made of wooden formwork, which is removed after concreting.

VST stairs

VST columns and VST column capitals

5.

VST columns are produced at the factory from cement-bonded particleboards based on the customized drawings. The required reinforcement determined by static calculations is pre-installed at the factory. Column formwork elements are fully ready for concreting.

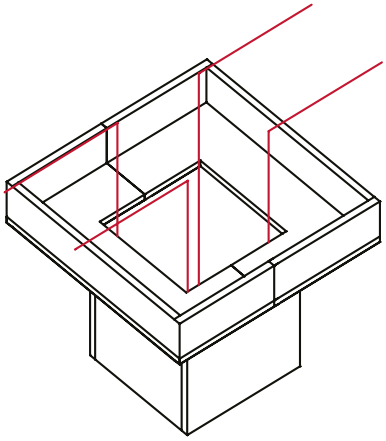
VST columns consist of cement-bonded particleboards, steel connector plates and pre-installed reinforcement.

Column capitals consist of cement-bonded particleboards, connected by steel connector plates. Reinforcement is installed on the construction site based on static calculations.

Columns and column capitals are manufactured separately. They are connected on site during formwork assembly. Formwork of the capitals is also permanent and serves to increase punching shear capacity of the slab.

VST column

VST column capital and VST column



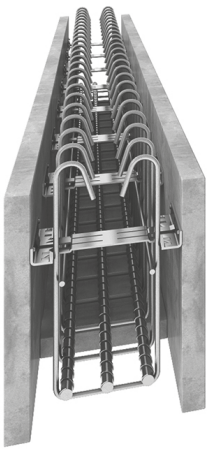
VST column capital

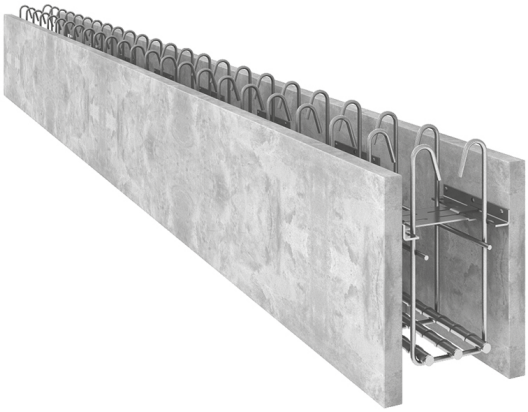
Cross-section dimensions and length of the columns are chosen based on static calculations and architectural requirements. For concreting of long columns, you should provide special openings in the forms and pour concrete in stages.

6. VST beams

VST beams are produced at the factory from cement-bonded particleboards based on the customized drawings. The required reinforcement determined by static calculations is also installed at the factory. Formwork elements are manufactured with all the necessary openings, stopping elements, etc.

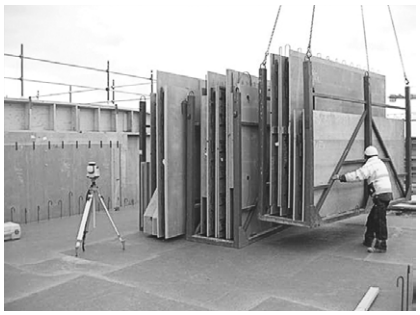
VST beams consist of cement-bonded particleboards, steel connectors and angles and pre-installed reinforcement (bottom layer and stirrups). Connection bars in the walls and columns and top reinforcement layer in the beams are installed on the construction site.



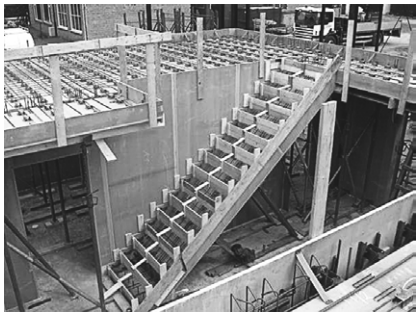


Assembly of formwork elements on the construction site
(construction of a typical floor)

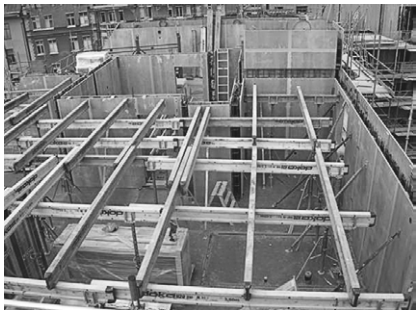
7.



Day 1.
Unloading of transport racks with VST wall elements.

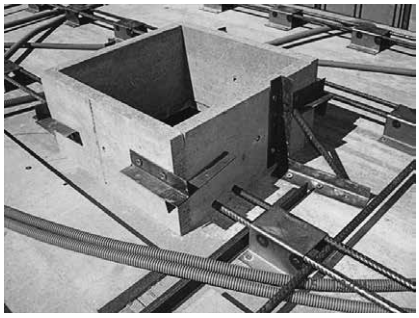


Day 2.
Assembly of walls, columns, stairs; performance of main and auxiliary works.

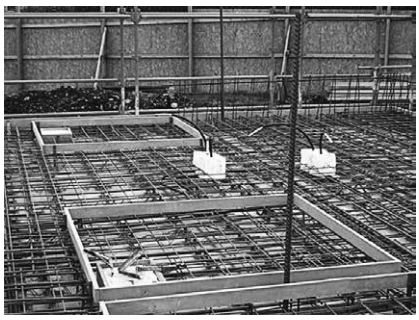


Day 3.
Finishing of walls and stairs assembly; installation of struts.

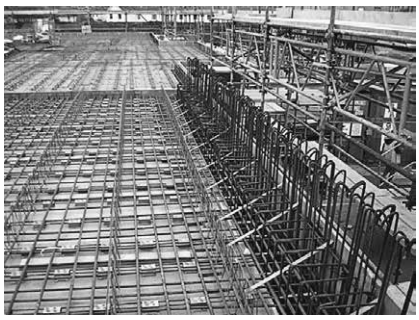
Day 4 and 5.
Assembly of slabs; beginning of installation of mechanical and electrical equipment.



Day 6.
Installation of bottom reinforcement layer in the slabs.



Day 7.
Installation of reinforcement, completion of installation of mechanical and electrical equipment.



Day 8 and 9.
Installation of girders, completion of installation of reinforcement; concreting of walls, columns, girders and stairs.

Day 10.
Completion of wall concreting; concreting of slabs.

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