Versatile, Swift, and True

Wood and cement composite boards are key components in this lightweight, stay-in-place formwork system

by Jeffrey Hoskins and Jim McGovern

Based in Austria, VST Building Technologies AG offers a unique stay-in-place formwork system comprising 24 mm (less than 1 in.) thick cement-bonded particle boards made of 70% wood fiber and 30% portland cement. The system is used to construct cast-in-place, reinforced concrete load-bearing walls, floor slabs, columns, and stairs rapidly and accurately.

The forms are currently manufactured in Slovakia and shipped to construction sites throughout Europe and the United Kingdom. Shipped in bundles that are lifted into place for easy and quick assembly, the technology helps to minimize field labor and construction waste. The company is seeking partners to introduce the technology to the North American construction market.

System Highlights

The VST formwork system has achieved widespread use in the construction of multistory residential, mixed-use, and commercial buildings (Fig. 1 and 2). The lightweight product arrives at the project site with formwork for approximately 200 m^2 (2150 ft^2) of wall per truckload. This simplifies deliveries, especially in congested sites in cities.

The lightweight VST formwork system minimizes crane time by maximizing the amount of formwork in each lift. Formwork is packaged in reusable steel carriers. A carrier can hold, for example, formwork for 70 m^2 (750 ft^2) of wall. The formwork system also minimizes jobsite waste and field labor, as the formwork assemblies are custom built for each project and they are delivered with factory-installed reinforcement. Further, because it is a stay-in-place formwork system, the VST system also eliminates the crew time required to strip (strike) and move formwork.

Wall formwork comprises two composite boards connected with specially developed steel spacers and ties (Fig. 3), and it can include unique bends and end closures (Fig. 4). Floor slab formwork consists of one composite board with preinstalled steel reinforcement (Fig. 5). Beams and columns are also supplied with reinforcement at the production factory, and they can be used with all other VST formwork elements.

Because concrete placements made using stay-in-place formwork cannot be inspected, self-consolidating concrete is generally used to eliminate the risk of honeycombs or voids. Wall concrete is placed in stages. For example, if the wall height is 2.9 m (9.5 ft), the VST formwork is filled to a height of 1, 2.2, and 2.9 m (3.3, 7.2, and 9.5 ft) in Stages 1, 2, and 3, respectively. Stage 2 and Stage 3 placements occur 1 hour after the previous placement has been completed, and the ceiling concrete (floor at the top of the wall) is placed immediately after the Stage 3 placement.

Field Experience

Jim McGovern began working with the VST formwork system in 2004 and used it on 15 structures over the following 3 years. The pace of construction was drastically reduced during the great recession, but it has since recovered.

On these projects, three or four VST walls were lifted at a time onto the building, which equated to 70 m^2 (750 ft^2) for each crane lift. This freed up crane time and allowed crews to get a lot of output. For the typical floor plate of 750 m^2 (8070 ft^2) and using only eight people, seven apartments, the circulation areas, with lift (elevator) shaft walls, stair risers, and the party walls, as well as all the services, were built on a 10-day cycle.

Continuity of the factory-installed reinforcement was achieved by installing U-bars into adjacent wall panels and lowering vertical bars through the resulting overlapping loops to provide full anchorage. No concrete was cast until all the deck formwork was in place (slab, stairs, and everything).

The floor system helped to keep the VST wall system in place and gave workers a platform for the wall concrete placement.

The composite boards were also used to form all slabs. Conventional shoring systems can be used to provide support, with primary beams at 1200 mm (48 in.) centers. Because the floor formwork stays in place, the shoring systems can be left in place as a backprop system. Progression of the building to the next

Fig. 1: Clarion Hotel Sign, Stockholm, Sweden, built in 2005 using 18,335 m² (197,360 ft²) of VST wall formwork and 19,165 m² (206,290 ft²) of VST slab formwork

Fig. 2: Apartment complex, Stockholm, Sweden, built in 2016 using 38,100 m² (410,100 ft²) of VST wall formwork

Fig. 3: VST wall formwork is assembled from three key components: 24 mm (nearly 1 in.) thick cement-bonded particle boards, clip angles, and spacers. The clip angles are attached to the facing panels by a computer-controlled drilling machine that ensures precise spacing. Spacers lock into slots in the clip angles and precisely set the wall thickness

Fig. 4: Completed VST wall formwork can include unique bends and end closures

Fig. 5: VST panels are used for floor formwork as well as wall formwork. The panels are supported using the same propping systems as used with conventional formwork panels

Fig. 6: The VST formwork system can be used to optimize processes beyond concrete construction. Here, a prefabricated corridor formwork assembly is being prepared for installation of ventilation ducts, piping, and electrical and communications conduits—all in a controlled environment. In the field, the systems will be connected to adjacent assemblies, minimizing overhead work

level is not dependent on lifting of the shoring and form sheathing to the next level.

Toward Greater Productivity

Recently, one of McGovern's clients proposed using the stay-in-place formwork system to further optimize their construction processes. By factory installing ventilation ducts, electrical conduit, and piping into the VST beam and slab formwork assemblies for building corridors (shown in Fig. 6), the general contractor can minimize the amount of overhead work required to complete a building. The assemblies therefore minimize construction time and maximize overall quality.

—VST Building Technologies AG, **www.vstbt.com/en**

Selected for reader interest by the editors.

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