The world's largest cement terminal

With its recent expansion of a 70,000t dome, Beton Provincial's terminal in Québec, Canada, has become the largest single-user cement terminal in the world. Thanks to its 180,000t of storage capacity it receives cement from two suppliers in the Mediterranean in Supramax vessels, a third domestic supply by self-discharging cement carriers, as well as GGBS and fly ash. The terminal's size and capabilities make it an exceptional facility.

■ *by **Ad Ligthart and Marcia Ligthart**, Cement Distribution Consultants, The Netherlands*

A Supramax bulk carrier with 50,000t of cement is being discharged by the barge-mounted ship unloader conveying the cement to the dome via two pipelines. On the opposite side of the port the large flat storage facility can be seen

Beton Provincial is the largest ready-mix and precast concrete producer in east Canada. It has more than 85 ready-mix plants, five precast product plants, 500 truck mixers and its own quarries. The family-owned company dates back to 1960.

Building a presence in the Port of Québec

To complement its substantial purchases of domestic cement with imports the company decided to establish its own cement terminal in the Port of Québec in 2003. The initial terminal consisted of a converted warehouse with 70,000t of storage capacity. Cement was received in Handymax vessels discharging cement with their own cranes into hoppers with dust collectors. Below each hopper a pressure tank system conveyed the cement via pipelines into the warehouse. The terminal was equipped with a cement-only truck-loading station and a truck-loading station with a mixing plant and four silos on top. From this mixing plant, the terminal can supply blended cements per truckload.

In 2015 Beton Provincial implemented plans to increase storage capacity to 110,000t by extending the warehouse, which was also subdivided into five sections. These contain two types of cement (one imported, one domestic), ground granulated blastfurnace slag (GGBS) and fly ash.

The last two years have seen additional significant investment into the terminal. A 600tph barge-mounted pneumatic shipunloader was added to the facility in 2017-18. The shipunloader can handle vessels up to Ultramax and even Panamax sizes. The following year a further large expansion was achieved by the acquisition of a nearby alumina terminal, which the company converted for cement use, adding 70,000t of storage capacity as well as truck and railcar loading facilities.

Today's terminal

As a result of these recent expansion projects Beton Provincial's current terminal consists of the large flat storage facility with a capacity of 110,000t, a blending plant and two truck loading stations on one side of the port. On the opposite side, there is a 70,000t dome facility that includes a truck-loading and railcar-loading stations. The key element of the overall facility is a large barge-mounted shipunloader that can move between the flat storage facility and dome.

As with all terminal construction work, Beton Provincial has acted as its own

main contractor. For the shipunloader and dome expansion Cement Distribution Consultants was hired as project consultant.

The new shipunloader

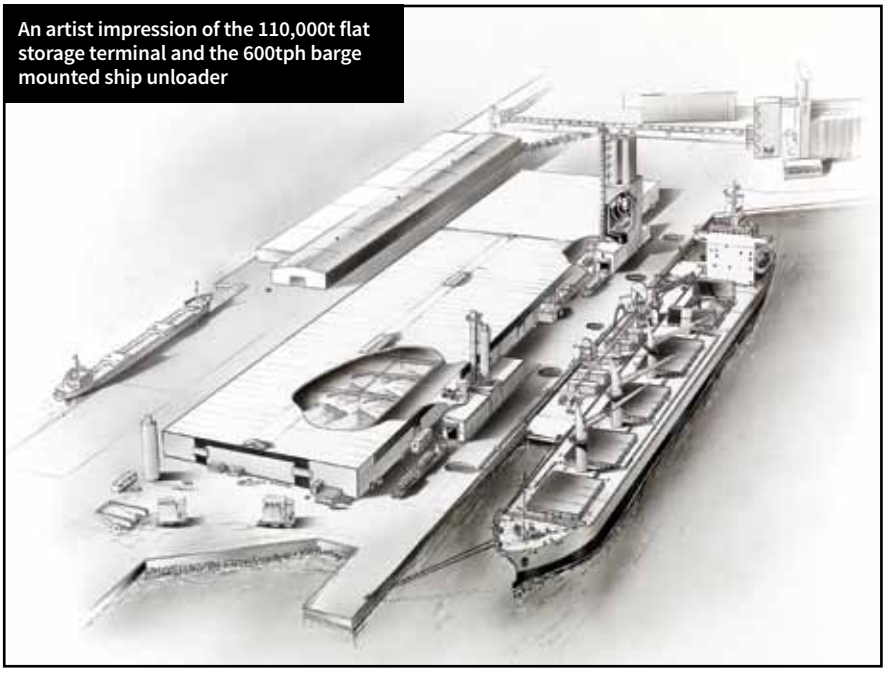
The design requirements for the shipunloader consisted of the ability to:

- move between the different docks
- unload up to Ultramax vessels (and therefore, Panamax vessels, which have the same width and only slightly larger draught) at a rate of 600tph
- convey the unloaded materials to the storage facility using the existing ϕ25cm (10in) pipelines of the flat storage warehouse.

Van Aalst Bulk Handling supplied the electrically-driven shipunloader, which included:

- five machine room containers for the vacuum pumps, compressors and electrical installation
- a vessel skid with the large filter receiver and four pressure tanks
- a very large unloading arm
- an electrical module containing the cable reel, transformers and switch gear for the 25kV installation.

Beton Provincial provided the barge (90x18x7m), installed the shipunloader components and equipped the barge with a pedestal for the unloading arm, hydraulic winches to move the barge along the ship holds, an emergency generator set, a workshop and a hydraulic hose guiding arm capable of providing a solid barge-to-shore connection for the discharge hoses despite a tidal difference of over 6m.



An artist impression of the 110,000t flat storage terminal and the 600tph barge mounted ship unloader

The shipunloader was completed in spring 2018, receiving its first ship in May that year. During the performance test, the 600tph-rated shipunloader achieved a loading rate of over 700tph. This was considered quite a performance as this capacity was achieved on two ϕ25cm conveying lines to the flat storage warehouse, using compressors with 5bar pressure.

The warehouse is filled from either the shipunloader or from self-discharging ships via a ϕ25cm pipeline system. Three large dust collectors ensure that dust is contained in the section that is filled.

Reclaim from the warehouse is performed by front-end loader. The front-end loader deposits the materials into one of two hoppers. One hopper is located at the first truck loading station, which only dispatches one type of cement. From this hopper the cement is conveyed by bucket elevator into a 200t silo. Below this silo, bulk trucks are loaded automatically whilst standing on a truck scale within an enclosure. The second hopper feeds three of the four silos above the blending plant (supplied by IBAU) with cement, GGBS and fly ash. The fourth silo is filled by bulk trucks with silica fume. Below the blending station, trucks can be loaded with either single materials or a range of blended cements that is prepared by truckload.

On the other side of the port is a large 110,000t flat storage warehouse while on the near side a new 70,000t dome facility was built

Beton Provincial's Vice-President Large Projects Stephan Keet and Owner André Belanger (Owner) together with Ad Ligthart of Cement Distribution Consultants address Beton Provincial personnel inside the dome during a visit to the terminal

Cement is unloaded by the 600tph barge-mounted ship unloader and conveyed to the dome, via two pipelines over a distance of 360m. The flat storage facility can be seen on the other side of the port just right of the nearby crane.

Conversion of the former alumina terminal

The most recent expansion of the terminal saw the conversion of the acquired alumina terminal, which included a 70,000t dome. Beton Provincial purchased the terminal following the closure of the aluminium plant three years ago. The dome had been used to receive and store alumina, which was then dispatched by railcars to an aluminium plant.

Converting the terminal for cement use was not an easy operation. Alumina is a free-flowing material and requires relatively little fluidisation at low pressures to flow by gravity under angles as low as 30˚. However, cement normally requires a full fluidising floor with angles of 70-80˚ and requires fluidisation at a significantly higher pressure. To modify the floor to these angles and to provide full fluidisation would not only have been prohibitively costly but would also have significantly reduced the storage volume.

The solution developed by Beton Provincial and Cement Distribution Consultants was to maintain the floor in its original state and concentrate all existing fluidisation pads in the centre of the dome, using a vacuum-pressure system to extract the cement from the dome and convey it to the truck and railcar loading station. A total of 13 suction points have been provided inside the dome, of which eight have suction points to a fixed vacuum-pressure unit in the dome's existing machine room and five have suction pipes that run to the side of the dome, where they connect to a mobile vacuum-pressure unit. Compressors and vacuum pumps are located in the existing machine room. With the large number of suction points and by the concentrated fluidisation in the centre of the dome about 80 per cent of the material can be extracted automatically. The remaining cement can be reclaimed by front-end loader.

Vacuum-pressure systems are used for shipunloaders and for self-discharging cement carriers but have never before been used to extract cement from a (very large) dome. Material heights can range between 0-30m and it is necessary to adjust the fluidisation, vacuum pressures and volumes in line with the material height to achieve a controlled flow out of the dome with minimal energy consumption. The components of the fluidisation and vacuum pressure system were supplied by Cargoflexx while the control system was supplied by AIA Automation. Cement Distribution Consultants provided the system operating logic.

The first ship with cement for the dome arrived in June 2019. It was unloaded by the barge-mounted shipunloader, which conveyed the cement to the dome via the two pipelines over a distance of 360m. However, the start of the reclaim operations had to wait until the conversion of the existing rail car loading system for alumina into a combined truck and railcar loading station for cement was completed. The truck and railcar loading equipment was supplied by DCL. Early August saw the start of operations and the first trucks were loaded. The terminal has been in continuous operation since. In September the mobile vacuum-pressure unit was commissioned, completing the conversion of the alumina terminal to cement.

Conclusion

Very large single-user terminals such as the one of Beton Provincial are rare. They are exceptional because they are able to receive cement from multiple sources in the largest-possible ships as well as cementitious materials. In addition to the Beton Provincial terminal, there are only two other facilities that have this capability. Houston Cement combines two terminals in the Port of Houston with a total storage capacity of 160,000t while the terminal of Riverside Construction Materials (Silvi Group) on the Delaware river just north of Philadelphia has a storage capacity of 170,000t. All other large cement terminals suitable for cross-ocean cement trade have been designed for cement supplies from single sources in Handymax vessels and as such, have storage facilities with capacities ranging between 60,000-70,000t.

It is likely that more cement terminals will expand in the coming year as the shipping industry is moving away from Handymax vessels towards larger Supramax and Ultramax ships. In addition, continuously developing technology that enables large storage facilities at a relatively low capital cost and increasing seaborne trade in cementitious materials are further supporting this expansion drive. ■