

**Zeitschrift:** IABSE structures = Constructions AIPC = IVBH Bauwerke  
**Band:** 13 (1989)  
**Heft:** C-48: Structures in Portugal

**Artikel:** Secil silo, Outão (Portugal)  
**Autor:** Muralha, J.  
**DOI:** <https://doi.org/10.5169/seals-21559>

#### **Nutzungsbedingungen**

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften auf E-Periodica. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. Das Veröffentlichen von Bildern in Print- und Online-Publikationen sowie auf Social Media-Kanälen oder Webseiten ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. [Mehr erfahren](#)

#### **Conditions d'utilisation**

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. La reproduction d'images dans des publications imprimées ou en ligne ainsi que sur des canaux de médias sociaux ou des sites web n'est autorisée qu'avec l'accord préalable des détenteurs des droits. [En savoir plus](#)

#### **Terms of use**

The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. Publishing images in print and online publications, as well as on social media channels or websites, is only permitted with the prior consent of the rights holders. [Find out more](#)

**Download PDF:** 23.02.2026

**ETH-Bibliothek Zürich, E-Periodica, <https://www.e-periodica.ch>**



## 8. Secil Silo, Outão (Portugal)

**Owner:** Secil SA  
**Engineers:** Profabril SA  
**Contractor:** Gremetal  
**Service date:** 1986

### General

The silo was built at the Secil cement factory at Outão (Setúbal), 30 km south of Lisbon.

It is a construction with polygonal plan of 102 m circumscribed diameter, fundamentally formed by a peripheric wall of reinforced concrete, with 0.25 m thickness and 4.50 m height, upon which a steel supporting structure rests with a roof coating of aluminium sheet.

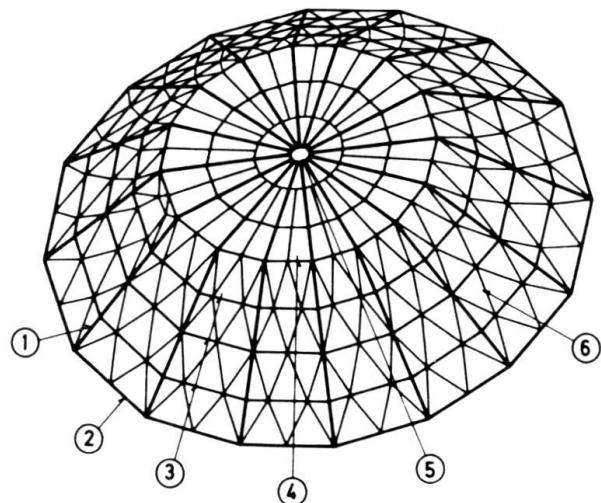
It is positioned in the production line (dry process) and it is destined mainly for the storage of marl dispatched from the stone quarry, followed by a purely mechanical operation of mixing and pre-homogenization. For such an activity, ample space, duly enclosed and covered, is required for storage of all the necessary equipment as well as protection of the marl from the weather.

### Global construction shape

The global construction shape was inspired by the deposit process of marl in heaps. The marl is collected with a changeable jib on the entering top conveyor and spread all around by a central conveyor which can be raised in accordance with the height of the natural slope (Fig. 1).

Thus, suitably being the form of growth in circular plan, for both the support wall and roof, with a minimum clearance to allow the movement of the conveyor, in order to reduce construction volume.

However, work shop recommended the adoption of straight members instead of curved ones, which modifies the circular shape to polygonal.



1 Main meridian arches

2 Spring ring

3 Slope binding rings

4 Slope transition rings

5 Crown ring

6 Secondary bracing

Fig. 2 Main structural members

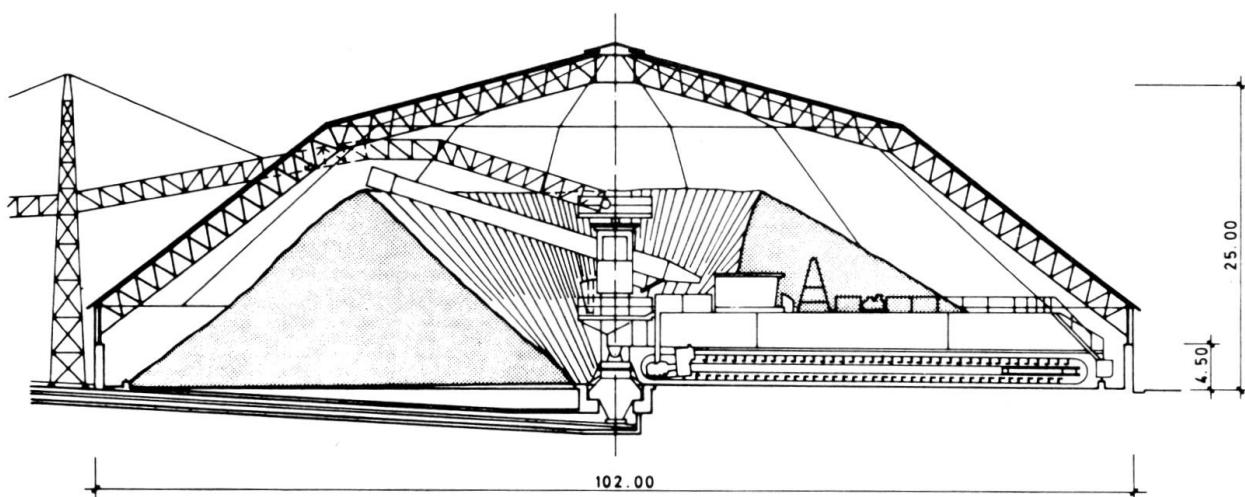


Fig. 1 Main cross section

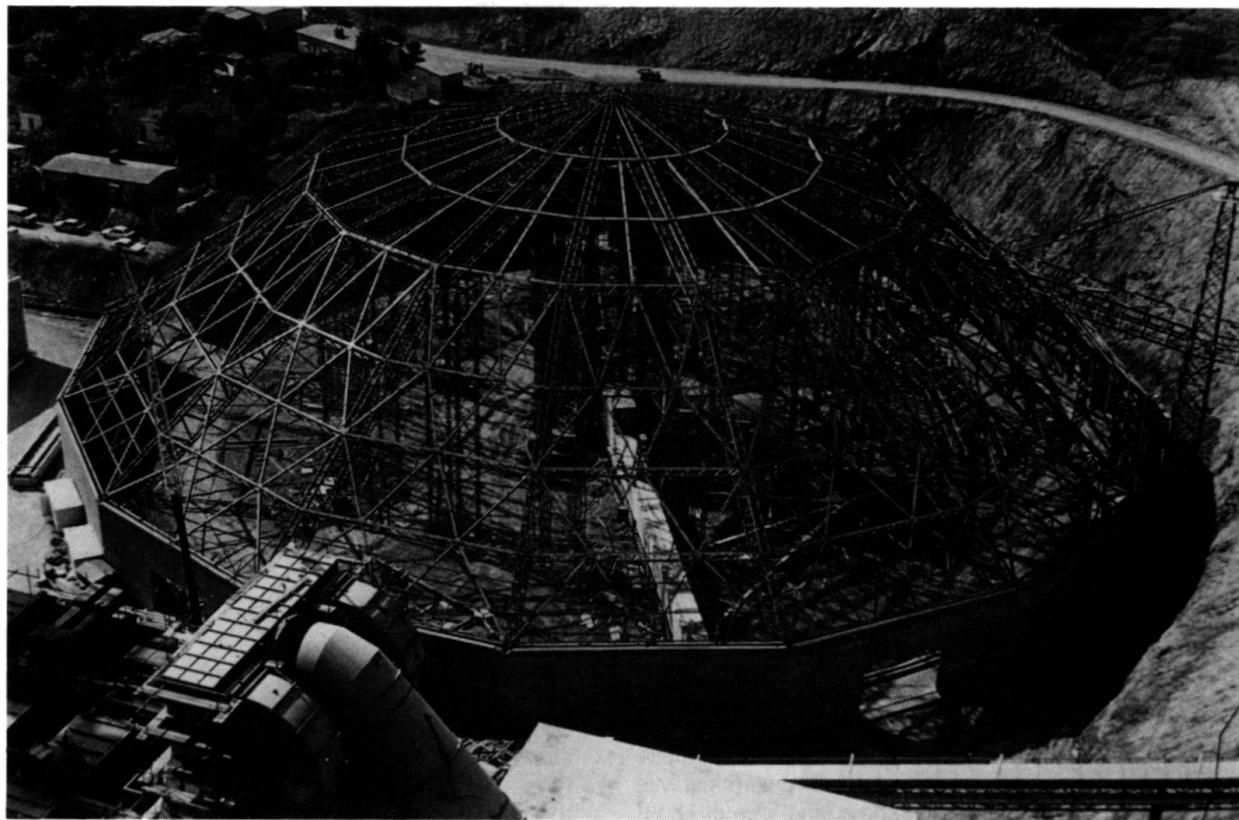


Fig. 3 Erection. General view

#### Main dimensions:

Polygon's diagonal with a 16 sided base	102 m
Maximum height of roof	25 m
Total open covered area	8 000 m <sup>2</sup>
Total open construction volume	150 000 m <sup>3</sup>
Total weight of steel structure	4 000 KN

#### Steel superstructure

The axis-symmetric distribution of the more relevant loads, dead weight, live load, dust disposal, variation of temperature, was significant in determining the sustaining arrangement of the structural members. Effectively, main support members angularly equidistant have a radial and axis-symmetrical disposition which contribute to the formation of eight meridian arches whose radial deformations are restrained by circumferential rings.

The main ring is placed at the spring level binding all bearings, other rings incircle the whole structure at different heights, being the one of crown level imposed by construction requirements.

Complementarily, cross-bracing was arranged diagonally on the slope's plane in order to reduce deformations, as well as, to gain stiffness during erection (Fig. 2).

#### Assembly and strut dismountable

The necessity of having an equally symmetrical erection, so that the relevant strut dismountable could be easily managed and secondary forces would not appear, was taken into consideration during conception of the erection of the above structure (Fig. 3).

During the first phase of the construction was built a central tower, followed by 16 secondary towers which were positioned in such a way to sustain the inferior elements of the arches which also rest on the neoprene devices. The superior elements of the mentioned arches were radially sustained between the central and the intermediate towers. Consecutively, it was proceeded with the connection of the superior elements to the crown ring and to the inferior elements.

During the second phase of erection the circumferential rings were fitted and during a third phase cross-bracing of natural slope were dealt with. Finally, the strut dismountable was removed.

(J. Muralha)