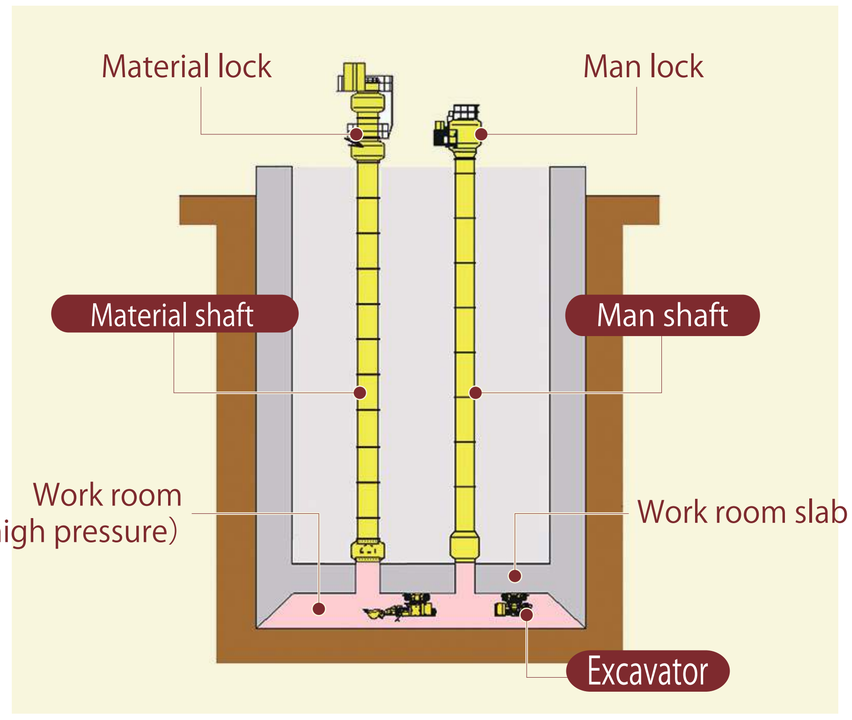
PCM The Pneumatic Caisson Method

The name " Pneumatic Caisson Method" literally explains itself. This construction method uses pressured air to maintain a dry environment which allows excavation and sinking in then installing the structure in a predetermined position. A reinforced concrete caisson with a work chamber at the bottom is built on the ground in advance. And when it's placed, pressured air is sent into the work chamber to evacuate the groundwater.
This method is widely used for underground structures such as bridge foundations, shield starting shafts and pumping stations.

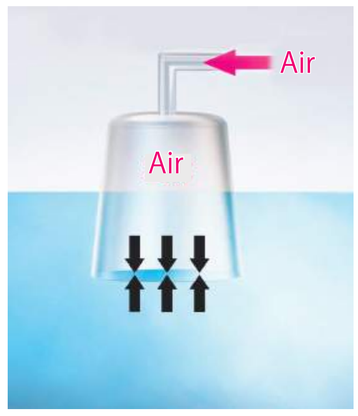


How to works

The pneumatic caisson method applies the principle that when the cup is turned upside down and pushed into the water and air is blown into the cup, the inflow of water can be prevented by the pressure of the air.
Essentially, pressuerd air is sent into an airtight work chamber which is built at the bottom of the caisson to evacuate groundwater and allow excavation without water.The inside of the cup is the caisson work room, and the tip of the cup is the cutting edge of the caisson.

When the cup is turned upside down and pushed into the water, the internal air pressure in the cup and water pressure become equal.

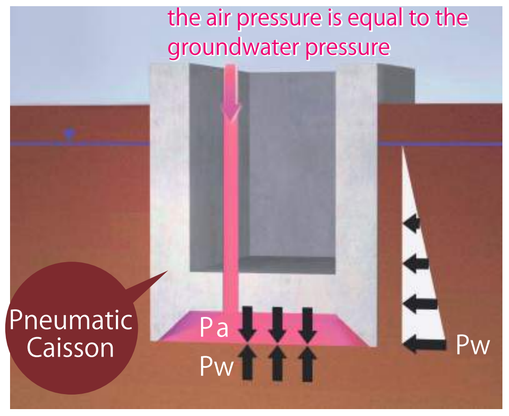
When air is sent into the cup, the air pressure inside rises and evacuate the water.



The same principle !

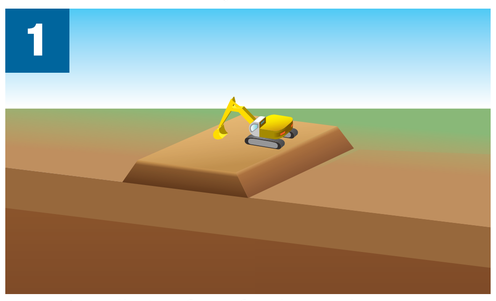
When Pw=Pa water will not enter the work room.

Pw：Water pressure at the bottom of the caisson
Pa：Air pressure in the work room

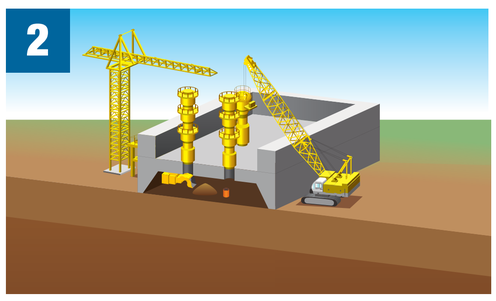


Construction procedure

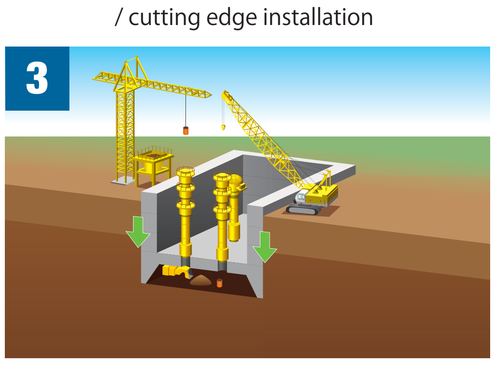
The construction, excavation, and sinking work are repeated for each lot, and after confirming the surpproting ground by a ground bearing capacity test, the work room is filled by concrete in a dry state.



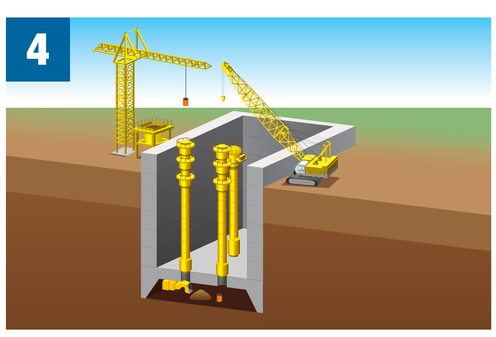
Installation form for the work room / cutting edge installation



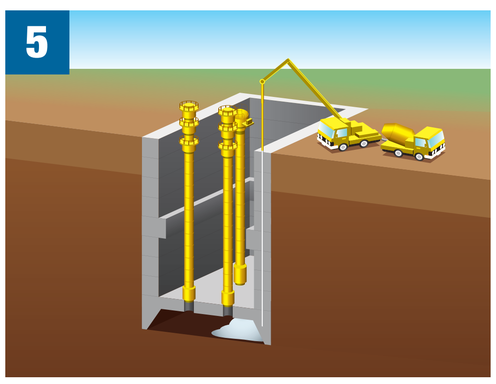
Construction / equipment



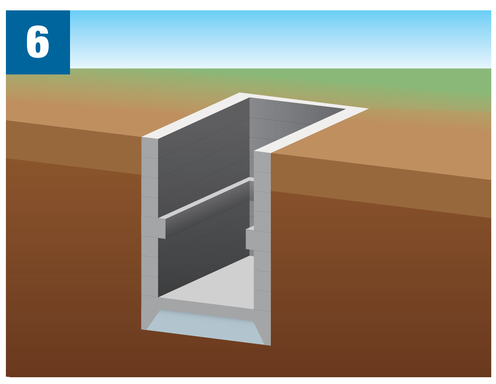
Excavation / sinking



Construction / excavation / sinking



Sinking completed / filled concrete into chamber



Removal of equipment / completion

Special features

Bridge foundations and structures constructed by the pneumatic caisson method have many outstanding characteristics.

1 High reliability as a structure

- Construction is on the ground, and high-quality reinforced concrete structures can be constructed.
- Highly airtight and watertight and has good durability.
- The supporting ground can be confirmed directly and easily, and the external force of action is reliably transmitted to the supporting ground via the filled concrete into chamber.

2 Tenacious

- High rigidity, large load capacity and high earthquake resistance.
- Great resistance to liquefaction during an earthquake.
- Highly applicable to long bridges because it resists external forces with a wide support area.

3 Applicable to all types of soil, from soft ground to rock

4 Reliable process control

5 Existing structures / foundations or unexpected underground obstacles can be firmly secured to eliminate.

6 Little impact on the surrounding environment.

- Low vibration and low noise
- Since groundwater is evacuated by pressured air, deformation of the surrounding ground can be suppressed.

7 Suitable for proximity construction.

8 Various benefits depending on how to use.

- The inside of the caisson can be used as a free space.

9 Economically superior in total cost.

DAIHO CORPORATION

DREAM Excavater

Pneumatic Caisson Method

Adaptation to various grounds

The pneumatic caisson method can be used for all types of ground, from soft soil to rock. The DREAM excavator is equipped with various excavating attachments to handle various types of ground.

Basic Bucket

The DREAM II bucket is a large-capacity bucket with 0.3 m^3, which has twice the capacity of a standard bucket. It reduces work processes and work more competently. Also allows us to reduce the number of excavators.

Breaker

The breaker is an excavating attachment device used for excavating soft rock 1.It can crush hard ground which makes it possible to excavate with a bucket. When multiple excavators are used, they can be as the breaker and bucket to excavate efficiently.

Ripper

A ripper is an excavating attachment device for crushing consolidated hard ground and soft rock I to enable excavation with a bucket. Compared to breakers, there is less impact and vibration, and crushing efficiency is higher depending on the ground conditions.

Ripper bucket

A ripper bucket is an excavation device that has both ripper and bucket functions. Similar to the ripper, the consolidated hard ground and soft rock I are crushed at the ripper part, and then excavated at the bucket part. Crushing and excavating can be done without replacing the excavation device.

Drifter

A drifter is an attachment device for drilling holes for explosives remotely from the ground. It is necessary to use explosives for excavation of soft rock 2 to medium hard rock.

Scope of application of various excavating equipment

Bucket	：DREAM II excavator bucket ：Standard excavator bucket					
Breaker						
Ripper						
Ripper bucket						
Drifter						
B lasting						
G round	Ordinary soil		Gravel soil	Cobblestone mixed sand gravel	Rock	
	Clay soil	Sandy soil			Soft rock I / Soft rock II	Medium hard rock

Since the DREAM II excavator (output 37KW) has a larger output than the standard excavator (15KW), the bucket used is large (0.3m^3), and it is possible to handle sand gravel mixed with large diameter cobblestone.

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Our Works

Pneumatic Caisson Method

Bridge foundation

Rainbow Bridge（Anchorage and main tower foundation）

Hakucho Bridge anchorage

Kitakami Bridge substructure

Shaft

Yokohama Shonan Road shield starting shaft

Shin-Nagoya Thermal Power Plant Shaft

Akabane Shield Starting Shaft

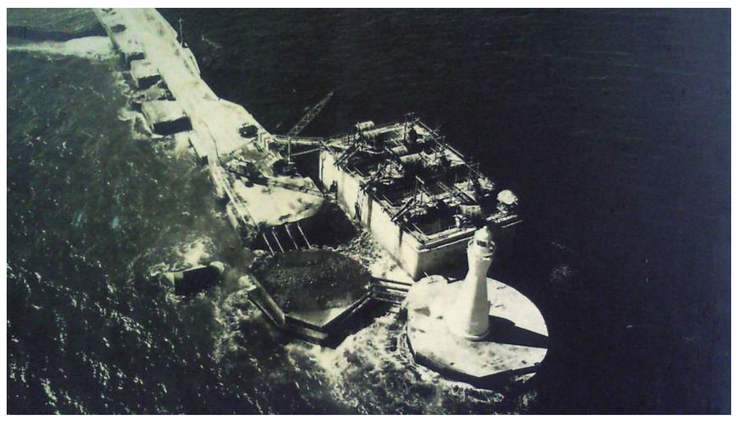
Pumping station

Arakawa Pumping Station

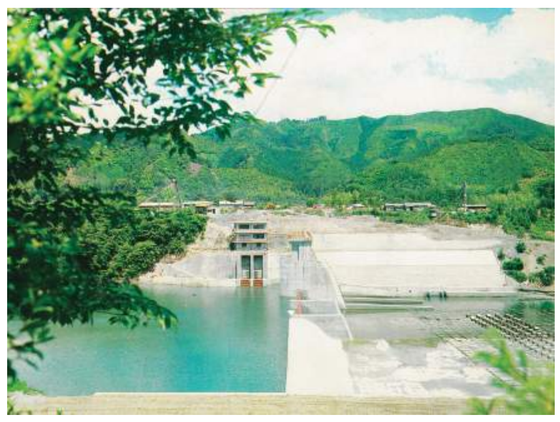
Yamatogawa Pumping Station

Yamato Relay Pumping Station

Structure foundation



Tagonoura Port breakwater foundation



Ao Head Water foundation

Yokohama Thermal Power Plant chimney foundation

Other underground structures

New Wakato Road retaining wall

Nakameguro Ventilation Station

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PCM Recovery from the earthquake

Pneumatic Caisson Method

Reconstruction of the Tohoku region

The Great East Japan Earthquake that occurred on March 11, 2011 caused unprecedented damage to the coastal areas of the Tohoku region.
We contribute to the reconstruction of the Tohoku region by constructing bridge foundations and pumping stations using the pneumatic caisson method.

Pumping station

Ishinomaki Central Drainage Pumping Station

Bridge foundation

Onosaki Bridge

Urajuku Bridge

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