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Polymer Mortar-Sealing Materials for Laying-Down Caissons

Etanchéité de caissons à l'aide de composés mortier-polymères

Abdichtung von Senkkästen mit Kunststoffmörteln

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We have been challenging to apply polymer materials to civil engineering constructions, especially sealing materials, anticorrosion system, buffer system against ship collisions, microwave absorbers and so forth.

This present paper proposes the application criteria of polymer mortar-sealing materials to caissons in laying-down caisson method from among them. (Fig.1)

The laying-down caisson method is one of foundation methods which can be achieved to maintain the security and the reliability of economical construction work in the severe environment of the sea. According to apply this method, it is necessary to seal the clearance between the cutting edge of the caisson and the uneven surface of the sea bed.

Requirements for mortar-sealing materials are as follows.

- 1) To seal in low reaction forces of sealing materials.
- 2) To be easy of work with few submarine work.
- 3) To keep functions against severe natural conditions.
- 4) To have reliability of the sealing material, and to have no use for repair

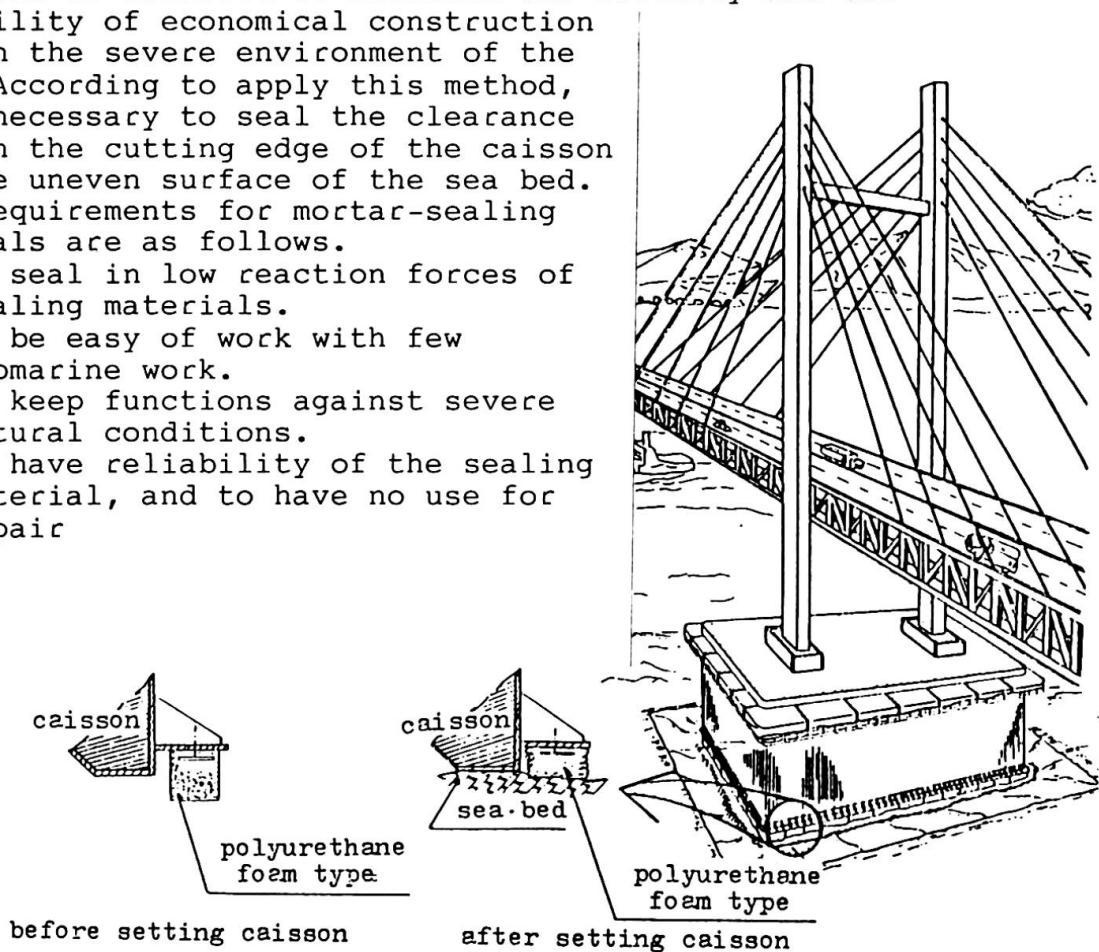


Fig.1 The sponge mat for deep sea concrete works

Usual mortar-sealing materials which are applied to small caissons less than 25m in water depth are not satisfied with the all requirements for a lot of divers work.(Fig.2)

In case of less than 25m in water depth, the cloth reinforced flexible tube or the sponge mat of low-density-type has been applied and achieved perfect seal with no divers work.

In case of more than 25m in water depth, it is necessary for us to evaluate not only polymer materials but the construction of the sealing material due to the above requirements and others such the unevenness height of seabed, the toughness under the high-speed compression, etc. Sponge mat, developed under the guidance of the Honshu-Shikoku Bridge Authority, was concluded to be the best sealing materials in the condition of less than 500mm unevenness. (Fig.3 and Table 1)

Above the unevenness height 500mm, we can recommend the combined type, which combines large scale cloth reinforced flexible tubes in the shape of bellows-type and low-density polyurethane foam.(Fig.4)

As the civil engineering developed, the mortar sealing materials are refined and enlarged various uses.

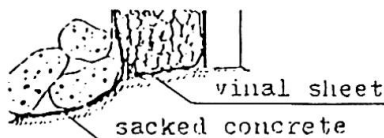


Fig.2 Usual mortar-sealing materials

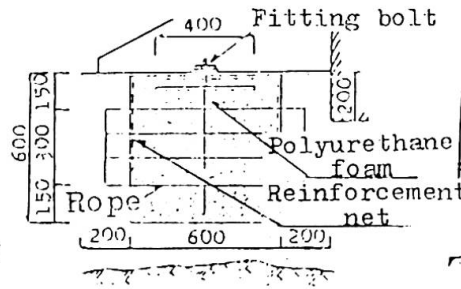


Fig.3 The sponge mat

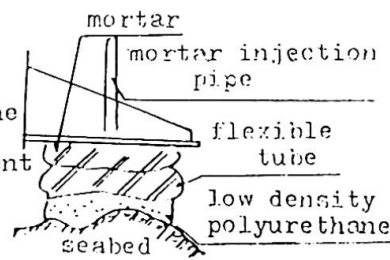


Fig.4 Combined type

Table-1 Actual results of the Sponge Mat for caisson foundations in the Honshu-Shikoku Bridge

Construction name		Substructure works for the South Bisan-Seto bridge			Substructure works for the Mitsuishi island bridge	
		(5P)	(7A)	(6P)	(3P)	(2P)
Place		The Inland Sea in Kagawa prefecture			The Inland Sea in Okayama prefecture	
Customer		Honshu-Shikoku Bridge Authority				
General Contractor (Caisson Maker)		Taisei JV (Nippon Kokan)	Kajima JV (Mitsui JV)	Kajima JV (Mitsubishi JV)	Nishimatsu JV (Nippon Kokan)	Nishimatsu JV (Sumitomo JV)
Year of execution		1980	1981~1982	1982	1983	1984
Natural Conditions	Depth of water(m)	32	50	50	25	28
	Current velocity(kt)	6	4	4	4	4
Dimensions of Caisson	size(m)	27×59×38	59×75×55	38×59×55	29×45×30.5	25×46×32.5
	weight(t)	5000	19500	9700	5000	2800
Sealing Conditions	object	Prepacked-concrete-mortar sealing			tremie-concrete mortar sealing	consolidation mortar sealing
	Sealing Pressure(t/m ²)	14	16	13 ¹	15	3.4
	Unevenness of rock-beds(mm)	200~300				
Spong Mat	Type	600H				400H
	Total length (m)	167	400	189	148	136