



Innovation In Coastal Protection Works Using Labuan Blocks

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GENERAL DESCRIPTION

Labuan Blocks is another innovative form of coastal protection structure produced by the DID since 1999. The Labuan Blocks, coined after their first installation site (Labuan), are simple mass concrete blocks designed in-house based on basic principles of material retention, scarp and toe protection. They are cast insitu, often with locally available material and therefore have a relatively low capital cost. Because they are portable and removable they can be easily transported to any place, reducing the cost of coastal erosion control project. Labuan Blocks can be placed as sloping “mattresses” or as near vertical cubic blocks.

Labuan Blocks (backshore) are generally preferred to rock revetment (foreshore) in coastal environments for being less reflective of wave energy and more stable. Sand is also better able to accumulate on Labuan Blocks, potentially softening their appearance. Additional modifications in the form of trapezoidal buttones have been introduced in 2002 to the original smooth-faced design to reduce run-up.

FUNCTION

The purpose of Labuan Blocks is to provide short term (3-15 years) protection from backshore erosion by absorbing wave energy along the dune face. Their application is restricted to the upper part of sandy beaches, since they are not sufficiently durable to withstand regular direct wave action. As they are concrete structures placed at backshore, they will tend to trap sand and sediment and allow the growth of vegetation

under favourable conditions. This only applies to sloping structures.

Labuan Blocks provide a short term alternative to rock armoured structures in areas where large rocks are not

available at an acceptable cost, or where long term protection is not appropriate and there is no space to built huge coastal protection structure (like an island).



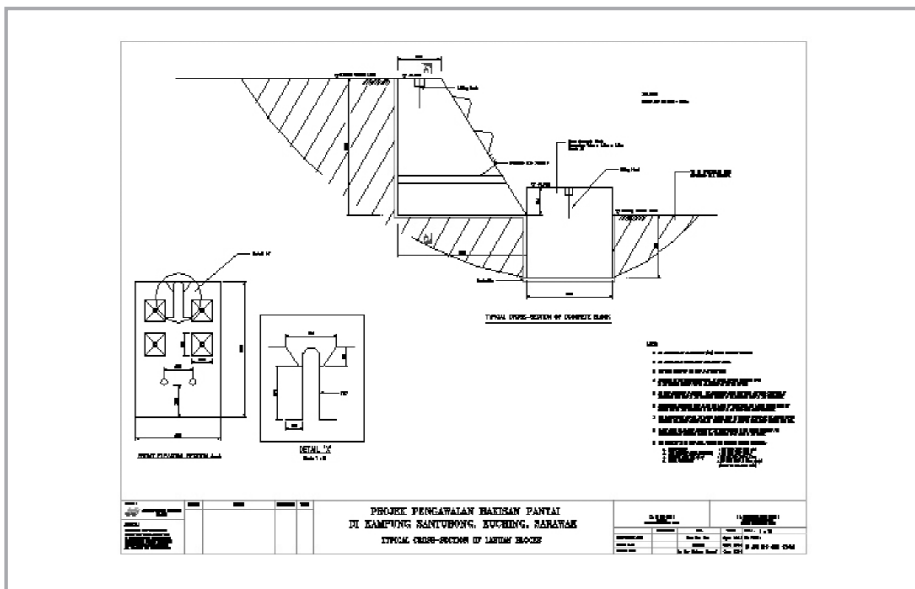
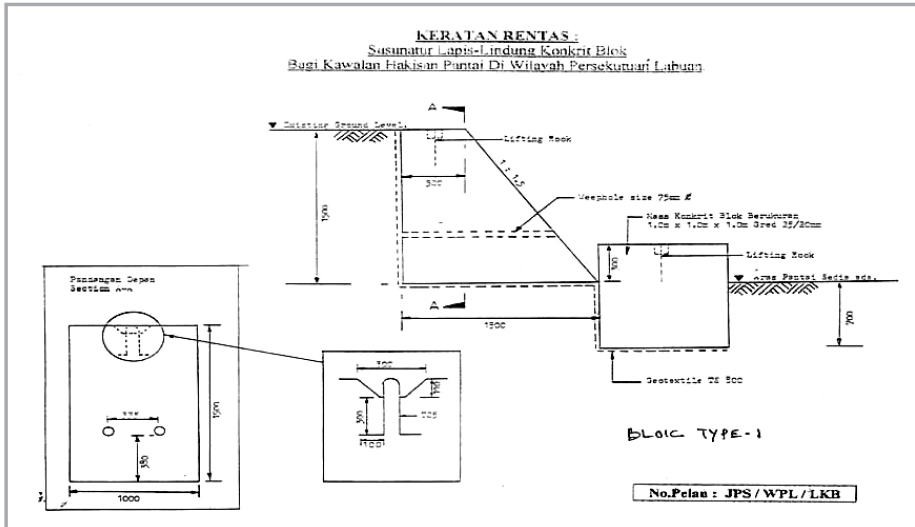
Picture 1: Labuan blocks as vertical cubic blocks (1999)-Pancur Hitam, Labuan



Picture 2: Labuan blocks as sloping “mattresses” (2002)-Taman Robina, Seberang Perai Utara, Pulau Pinang

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Typical Drawing For Labuan Blocks



CASTING INSITU

The moulds for the Labuan Blocks are made locally. Ready-mixed concrete is delivered to site and discharged from the mixer-truck and into the moulds. The next process is the vibration of concrete. This is essential to eliminate the entrapped air and force the particles into a closer configuration. Internal vibrator like poker vibrator is used. Some admixtures can also be used to accelerate the hardening or development of early strength of concrete.

The most common cement used in this case is the Ordinary Portland (Type I) cement with a Grade of 30-35. To avoid sulphate attack (sea water attack), Sulphate-Resisting (Type V) cement is recommended. In Malaysia,

the Pulverised Fuel-Ash cement is more preferred.

The next step in this process is curing at normal temperature; that is to keep concrete saturated, or as nearly saturated as possible, until the originally water filled space in the fresh cement paste has been occupied to the desired extent by the products of hydration of cement. Curing may be aided by wetting the moulds before casting. The blocks must be wetted during hardening. The concrete should be sprayed with water or covered with suitable covering to avoid drying out.

METHODS OF PLACEMENT

Concrete Blocks should be placed as a sloping revetment as shown in

pictures. Gabion and vertical walls are more likely to suffer toe scour and structural collapse as they are less able to dissipate wave energy during storm wave attack (as indicated in DID Guidelines 1/97). They are also much more obtrusive to the dune landscape and will not become buried by new foredunes.

Structure face slopes are a compromise between flatter faces that absorb more wave energy, and therefore suffer less toe scour, and steeper faces that give the structure a smaller footprint. A slope of 1:1.5 is a reasonable compromise, and is in keeping with natural dune slopes.

The approximate limits of wave run-up can be established by

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observing and recording the location of the strand line over Spring tide periods during both monsoon and more normal wave conditions. The toe of a freshly eroded dune face is normally just below the run-up limit of the most recent severe sea.

During placement, regrading of the beach/dunes may have to be carried out so as to adequately bed the blocks. A suitable geotextile should be used to prevent the underlying sand from being washed out through the blocks. Edge details should be carefully addressed to prevent exposure of unsightly lengths of textile. Landward edges can be buried to fix the geotextile during Labuan Blocks

MONITORING

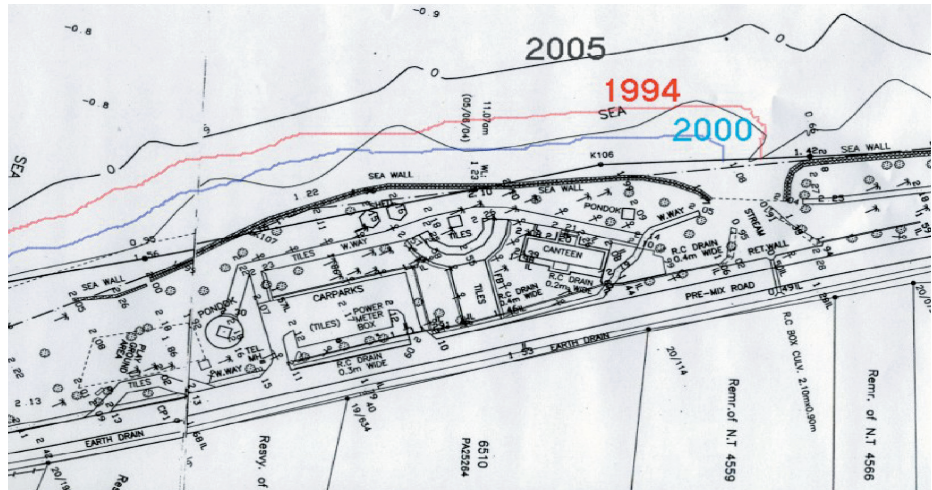


Figure 3: Labuan blocks at Pohon Batu, Labuan

Note:

The **Red line** is the existing shoreline before the installation of Labuan blocks in 1994.
 The **Blue line** is the existing shoreline right after the installation of Labuan blocks in 2000.
 The **Dark line** is the existing shoreline after 5 years of the installation of Labuan blocks in 2005.

CASE STUDY



Labuan Blocks At Kiamsam Beach, Labuan (2000)



Labuan blocks at Kiamsam Beach, Labuan (2005)

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SUMMARY

Appropriate Locations	Sandy beach sites suffering periodic moderate to severe erosion where backshore assets are at risk. Useful for backshore protection.
Costs	Moderate, (RM 1,100 per meter run).
Effectiveness	Well placed Labuan Blocks provide reasonable fixed defences, but have a limited life of 3-15 years due to deterioration of the concrete. Useful solution where armoured rock is considered inappropriate or too costly. Various forms are available. Can be buried by sand and vegetation.
Benefits	Permeable face absorbs wave energy and encourages upper beach stability.

placement. Seaward edges should be trimmed or firmly secured.

The placing device for all the concrete blocks shall be lowered to rest on the ground before releasing the concrete blocks and no blocks shall be dropped from height greater than 0.5 m.

Labuan Blocks, placed on the upper part of shoreline or backshore, will tend to trap sand and allow the growth of vegetation under favourable conditions. ■