

# TULEAR FLOOD PROTECTION

## TULEAR, MADAGASCAR

### HYDRAULIC & EROSION CONTROL/WEIRS AND GROYNES

**Product:** Gabions and Reno<sup>®</sup> mattresses

#### Problem

Tulear, located on the south-western coast of Madagascar and which has one of the major ports in the country, is subjected to periodic flooding during the fierce cyclonic season.

This is largely due to the overflowing of the River Fiherenana, which runs for approximately 150km and hence, presents a threat to the residents of Tulear and to the adjacent agricultural land.

The catchment area is some 6000m<sup>2</sup> and pluviometric records in January 1999 indicated a daily precipitation from 105mm to 163mm in 24hrs, which corresponded to a flood return period of more than 50 years.

#### Solution

The design parameters for the protection works of Tulear included a discharge of 6000m<sup>3</sup>/s for a 1 in 100 return period and river bed width of 772m which, resulted in a design average water velocity of 3,61m/s and water depth of 20,13m.

In January 2000, BCEOM with design assistance from France Gabions, proposed the use of double twist, PVC coated gabions and Reno mattresses for the protection works at Tulear. Reasons for the use of these materials included:

**Nature of rock:** the local limestone fissures and cracks naturally in fragments of relatively small size and is not suitable for armour rocks but ideally suited for gabion works.

**High water velocity:** the average water velocity was 2m/s but could reach 4m/s around the head of the proposed groynes, therefore a thicker filter would have been required between the armour rocks and the river bed than compared to a Reno mattress lining. This is because of the smaller voids and the resulting lower residual velocity of the water at the interface with the river bed.

**High flexibility:** the structures making up the groynes and the dyke protection required high flexibility due to the dispersive nature of the river bed material and the depth of the alluvial sand.

Client:

MINISTRY OF THE PUBLIC WORKS / INFRASTRUCTURES

Main contractor:

COALS

CONSULTANT:

BCEOM

Products used:

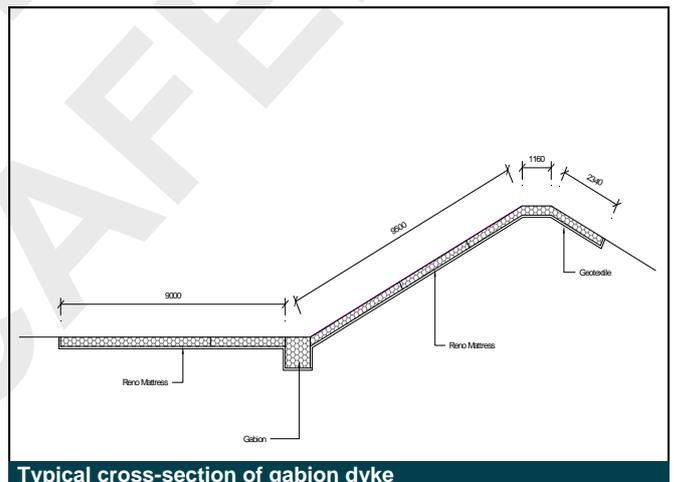
53 000m<sup>3</sup> OF GABIONS AND RENO MATTRESSES

Date of construction

2001-2003 (NO CONSTRUCTION IN 2002)



Aerial view of protection works at Tulear Date:2004



Typical cross-section of gabion dyke



4m High gabion dyke

Date: July 2003

Further recommendations included the rehabilitation of agricultural land and establishment of 11 nursery gardens for the cultivation of vetiver for erosion control.

In 2001 the contract was awarded to COLAS and included amongst other rehabilitation measures the construction of:

12 straight gabion groynes, 27m to 114m long and 5m to 10 wide.

3 bayonet gabion groynes each 55m to 73m long and 5m wide.

The lining of a 9,4km long, 4m high dyke with a 300mm thick flexible Reno mattress apron.

## Benefits

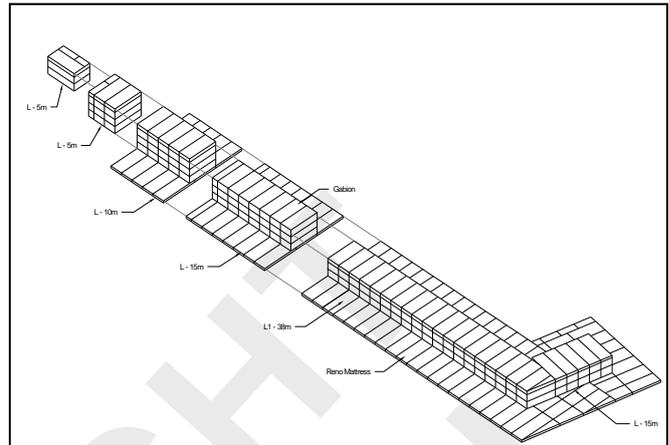
The use of a Reno mattress lining instead of armour rocks resulted in a reduction of the granular filter thickness and thus a significant cost saving.

The gabions and Reno mattresses making up the groynes are highly flexible and therefore can adapt to the changing profile of the river bed due to the dispersive nature of the river bed materials.

As the project took 11 years from initial design to completion, the benefit of using a rapid implementation of a system such as gabions and Reno mattresses, that can be adapted in stages to the modified river bank profile, is clearly evident as opposed to a time-consuming and expensive laboratory modeling process.

The consultants were able to draw upon the worldwide experience and expertise of the Maccaferri group (France Gabions / Maccaferri SA).

The labour-intensive techniques employed in the construction of the protection works resulted in the creation of more than 100 jobs for more than two years and contributed positively to poverty alleviation and skills transfer for the residents of Tulear.



Isometric bayonet gabion groyne



Bayonet groyne

Date: Feb 2001



In 2004, Construction World magazine awarded Maccaferri a special commendation for Best Project - Tulear Flood Protection.



Straight gabion groyne

Date: Feb. 2001

## Officine Maccaferri S.p.A. Global Headquarters

Via JF Kennedy 10, 40069 Zola Predosa (BO) - Italy

T: (+39) 051 6436000 F: (+39) 051 643 6201

E: comes@maccaferri.com

[www.maccaferri.com](http://www.maccaferri.com)