Developing countries: Practical proposals to overcome common problems

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The use of DT Mesh in Developing countries

1. Erosion
   i. Impact on agricultural land and wetlands
   ii. Impact on Infrastructure

2. Water supply
   i. Irrigation
   ii. Sanitation

3. Other structures

4. Common advantages
1. Erosion

**Impact on agricultural land and wetlands**
- Loss of land for cultivation
- Water management in area (too dry or too wet)
- Storm surge vulnerability – excess sudden erosion
- asdasd

**Impact on Infrastructure**
- Limited resources
- Journey time increases
- Transportation hazard
- People movement – health / trade / food
- Community isolation
River characteristics vary:
- **Climate**.
- The type of **soil**.
- The **particular location** along the river course.

- Each river is different and therefore requires solutions according to its characteristics.

**Mountain regions**
Steep gradients (5-10%),
High flows, low discharge.

**Valley regions**
Flat slopes (< 0.01-1%),
Low flows and high discharges.

**Mid slope regions**
Moderate gradients (1-5%),
Mid flows and discharges.
High flows passing over weak surfaces

- Steep gradients
- Narrow channels
- Flash flows / storm surges
- Critical velocity of the protection required

Resistance to abrasion and erosion of the material on the surface influences the rate of damage.
Unstable river beds – seasonal flooding / flash floods
Uncontrolled rill erosion / wetland stabilisation

Ref: Piet-Louis Grundling, Working for Wetlands
Meandering rivers

Critical velocity for fine sand
0.2m/s to 0.5 m/s

Transportation of stones and pebbles

Transportation of rocks
Loss of critical infrastructure

Unsuitable scour protection at the base of bridge piers / bank protection
Control structures - failure

Erosion of culverts
Control structures - failure

River protection structures are designed for multiple purposes;

- Day to day control of flow for irrigation, sanitation, supply
- Additional capacity for flood conditions
Solutions

- Weirs
- Longitudinal works
- Groynes
- Culverts
- Low-level water crossings
Transverse structures = Weirs and Bank protection

Designed to:
- Reduce river gradient
- Control erosion
- Stabilize river bed level
- Dissipate excess water energy
- Reduce solid transport
- Retain water for supply purposes
Weir function

During flood

During normal use

During low flow
Water retention structures

Generally gabion weirs are permeable structures, but when applied geomembrane MacLine and geotextile MacTex® behind the weir, they can also serve as water containment structure.
Solutions – Mid-slope region

Longitudinal works aimed to reduce river bed movement which can be braided showing patterns of main flow during severe floods.

Longitudinal structures = Weirs, Groynes and Bank protection

Designed to;

- Control erosion
- Stabilize river bed level
- Dissipate excess water energy
- Reduce solid transport
Solutions – Valley region

Mainly longitudinal works to contain the water within its course, thus correcting its pathway as well as providing bank protection.

Longitudinal structures = Weirs, Groynes and Bank protection

Designed to:
- Control erosion / meanders / land loss
- Stabilize river bed level
Community involvement

Ref: Piet-Louis Grundling, Working for Wetlands
Culverts

Van Stadens River Pass
Bridge pier protection
2. Water Supply – Irrigation / Sanitation Management

- Controlled water flows
- Settlement ponds
- Containment structures

Ref: Piet-Louis Grundling, Working for Wetlands
Irrigation management

- Delay water leaving catchment
- More effective use of scarce water
- Maximise potential growth

Ref: Piet-Louis Grundling, Working for Wetlands
3. Housing & Other Structures

Sand filled bottles as fill to gabions

Above, above right: BBC
Right: Heinsdorf, Stehr, Naidoo
Montana Winery

Ian Ritchie: La Terrasson greenhouse
Gabions as walls

- 35% voids (traditional rock fill)
- Air flow through building
- Cooler inside than out – thermal mass of gabion fill
- Structural consideration – column support

[Diagram]

http://www.bdonline.co.uk/rock-of-cages/1000880.article

BDP Architects: Film Vaults
4. Common advantages

Social
- Community involvement
- Simple to install
- Empowers local labour
- Benefits obvious
- More productive land – water controlled

Technical
- Flexible
- Permeable
- Easy to transport
- Local materials to be used wherever possible
Community engagement

- Creating work
- Teaching skills
- More self-sufficient communities
- Reduced need for external support/intervention

Ref: Piet-Louis Grundling, Working for Wetlands
Flexible Structures

- Flexible
- Resistance
- Tensile strength
- Permeable
- Structural continuity
- Low construction cost
- Excellent integration into the environment.

These valuable and positive characteristics make gabion and Reno mattress structures really competitive in the whole field of hydraulic protection works and soil conservation.
Double twist mesh

Our double twisted steel mesh products are manufactured to SANS 1580:2010

Why Double Twist mesh?

Hexagonal steel wire mesh gabions and revet mattresses
Gabion basket

3 x 1 x 1m unit (L x W x H)
Reno Mattress

DIAPHRAGMS

LID

Length

Width

Thickness
Transportable: Bundles

- Flat-packed
- Easy to transport
- Filled on project-site
Preferred stone sizes

100 to 300 mm for gabions
and
75 to 150 mm for mattresses

Always overfill gabions ± 25 to 50mm

D= 80mm for gabions
D=60 mm for mattresses
The smaller sized stones permits improved and more economical filling of the cage and allows better distribution of the imposed loads.
Gabions & Lacing wire
Installation – simple guidelines

Unfolding

Assembling

Lacing

Placing
Straining

Filling

Bracing

Closing
Simple tools for installation

1. Pliers
2. Pliers with nipper
3. Nipper

Manual Spenax Tool

Closing tool

Figure 4
Unfolding
Assembly

Edges laced
Bracing
Straining

Steel frame to aid tensioning

Tension
Filling

*Bracing Wire*

**Phase 1**

**Phase 2**

**Phase 3**
Bracing
Closing
PACKING OF GABIONS

- ROCK TO BE PACKED FLAT AND AS COMPACT AS POSSIBLE
- GABIONS TO BE PACKED IN 1/3 LAYERS AND BRACED
Back up
Bundles:

2x1x1 – 44 No. – 2m x 1m x 0.8m – 800kg
4x1x1 – 24 No. – 2m x 1m x 0.8m – 800kg
6x2x0.3 - 25 No. – 2m x 1.5m x 1m – 1130kg
2 x 1 x 0.3 – 80 No. – 2 x 1 x 1m – 680kg
Francis Kéré – Architect using local building material lifting roofs to improve air circulation
Francis Kéré – Architect using local building material lifting roofs to improve air circulation
Australia – gabions under foundation to improve air circulation
Australia – gabions under foundation to improve air circulation
Italy Sicily – Refugee arrival coast - Gabions filled with PET Bottle parts
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Italy Sicily – Refugee arrival coast - Gabions filled with PET Bottle parts
Africa - Markus Heinsdorff – Gabions filled with PET bottles
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Any Questions?

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