FERROCEMENT CHANNELS

For further information on Ferrocement Channels (FC) Please contact:

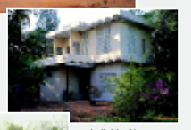
UNITED NATIONS CENTRE FOR HUMAN SETTLEMENTS (UNCHS - HABITAT)
PO Box 30030, Nairobi, KENYA
Phone: (254-2) 621234
Fax: (254-2) 624265
E-mail: Rainer.Nordberg@unchs.org

AUROVILLE BUILDING CENTRE (AVBC / EARTH UNIT)
Auroshilpam, Auroville - 605 101
Tamil Nadu, INDIA
Phone: +91 (0)413-622277 / 622168
Fax: +91 (0)413-622057
E-mail: csr@auroville.org.in


Office — Auroville


Workshop and offices Auroville


Individual house – Auroville


Individual house Auroville

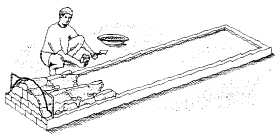

Production shed – Auroville


Cost effective house – Auroville

- A ferrocement is a thin wall of reinforced cement, where layers of continuous mesh are covered on both sides with mortar
- Ferrocement elements are durable, versatile, light and waterproof
- A ferrocement channel (FC) is a longitudinal element of a curved section (often semi-cylindrical). It is precast using moulds
- A ferrocement channel uses less cement and steel while having the same strength as the same RCC
- FC are used for floors or roofs, but are bad thermal insulators
- A major cost reduction is achieved compared to RCC
- A simple and cheap manufacturing set up is needed but the areas for prefabricating and curing need to be quite large
- It is easy to acquire the skill and easy to manufacture
- A constant quality control is needed during the manufacturing process and a proper curing is needed for one month
- If the channels are not manufactured on site, transportation has to be organized while taking care against damage
- Ferrocement channels are lifted into place and can immediately be joined together in order to provide a shelter
- No need of scaffoldings, shuttering, concrete mixer or vibrator

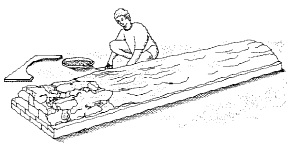
MANUFACTURING THE MOULD, PREPARING THE MAT

Mould: 1. Constructing the Body



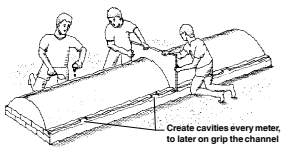
- Use ordinary bricks and mud mortar

Mould: 2. Plastering the Body



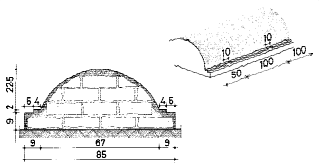
- Use a cement sand mortar (1:3) to plaster the body

Mould: 3. Finishing the Mould



- Apply cement and smoothen the plaster with a trowel

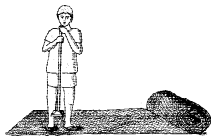
Mould: 4. Details of a Mould



Mat: 1. Materials Required

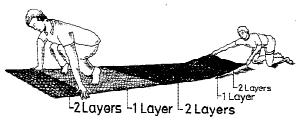
- One layer of galvanized hexagonal wire mesh is needed for the full length of the channel
  Mesh: #12 mm x 0.71 mm thick x 90 cm wide
  (½" x 22 gauge x 3')
- An extra layer of the same mesh is needed at both ends and sometimes in the middle
- Two bottom rods of Tor steel are needed: 8, 10 or 12 mm diameter, according to the span and the load
- One top steel rod (mild steel) of 6 mm diameter is needed

Mat: 2. Preparing the Chicken Mesh



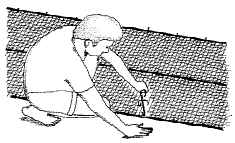
- Flatten the mesh with a rammer

Mat: 3. Stretching the Mat



- Stretch the main mesh and add the extra layers of mesh

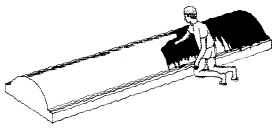
Mat: 4. Fixing the Rods



- Tie the rods with binding wire (both sides and centre)

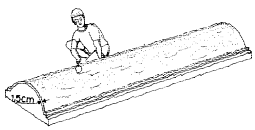
MANUFACTURING A CHANNEL

1. Preparing the Mould



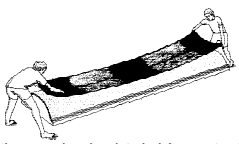
- Fill with mud the cavities reserved every meter
- Before casting, paint the mould with a coat of waste engine oil

2. Laying the First Coat of Mortar



- Prepare at once the full amount of mortar (1st & 2nd coats)
- Mortar proportions: 1 cement: 2 sand: 0.45 water (volume)
- Apply a first layer (1.5 cm thick) of mortar on top of the mould

3. Laying the Mat on the Mortar

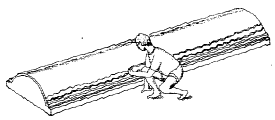


- Lay the prepared mesh and steel reinforcement on the first layer of cement mortar

4. Laying the Second Coat of Mortar

- Use a steel template to maintain an even thickness
- Smoothen the channel with a trowel to get a good finish
- The total mortar thickness is top: 2.5 cm and bottom: 3.5 cm

5. Preparing the Sides of the Channel



- Scratch the lower portions with a nail (+ / - 10 cm high)
- These scratches, on either side, will give a better bonding with a concrete mix while joining the channels together

6. Demoulding the Channel

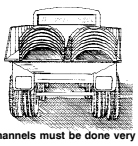
- It is done 3 days after the manufacturing date:
  Remove the mud from the cavities to grip the channel
- Lift slightly the channel on one side to demould it
- Lift the other side and carry the channel to the curing area

7. Curing the Channel

- After manufacturing, water the channel very well, for 3 days, as many times as needed
  Don't let the channel dry!
- After demoulding, cover the channel with a water-retaining material (husk of coconut shell, straw, natural fibres, sand, etc.)
  Select a material which has a very high water retention capacity
- The curing material is kept moist all the time! during 4 weeks
- Never allow the curing material to dry out during the curing period (28 days)

8. Transport of Ferrocement Channels

- They can be stacked, with a maximum of 8 channels in a row
- The transport can be done by bullock cart with a flat platform for short distances, or by lorry for longer distances



- The transport of ferrocement channels must be done very carefully

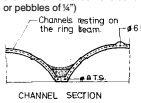
DETAILS AND SPECIFICATIONS

Installation of the Channels

Lifting channels require 2 men per metre on either side

- Care should be taken in handling and lifting the elements
- Build a small scaffolding for lifting the channels

- Place the channels next to each other and adjust them in line
- After cleaning the sides with a wire brush, first water the valley between, and then fill it with a cement concrete ratio of 1 : 2 : 4 (4 stone chips or pebbles of ¼")



CHANNEL SECTION

- Finish the joint by applying a cement plaster. Ink cement milk, painted as a last coating

Ferrocement elements are watertight by themselves, and when the valley between elements is well cast the roof is waterproof

Channel Data

Table 1: Determination of the maximum spans of ferrocement channels for floor and roof applications

Roof application	Ø 6 mm	Ø 8 mm	Ø 10 mm	Ø 12 mm
Max. span with 75 kg/m2	3.4 m	5.9 m	7.4 m	8.8 m

Floor application	Ø 6 mm	Ø 8 mm	Ø 10 mm	Ø 12 mm
Max. span with 200 kg/m2	2.0 m	3.6 m	4.4 m	5.3 m

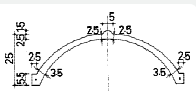
- **Note:** 6, 8, 10 and 12 mm refer to the diameter of bottom steel rods

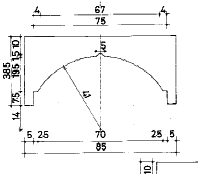
Table 2: Technical details for a channel of typical section (per metre long)

Steel reinforcement bottom		2 rods Ø 6, 8, 10, 12 mm
Steel reinforcement top		1 rod Ø 6 mm
Hexagonal mesh reinforcement		2 GI layers (22 gauge x 3') # 12 mm x 0.71 mm x 90 cm
Binding wire		
Mortar thickness		2.5 cm on top 3.5 cm at the bottom
Average weight		55 kg per running meter
Mix ratio	1 Cement	13 kg per running meter
	2 Sand	26 kg per running meter
	0.45 Water	6 litres per running meter
Curing period		28 days
Reinforcement preparation		1 mason + 1 helper for 1 hour
Casting		1 mason + 1 helper for 1 hour

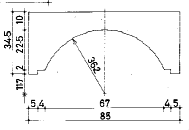
Typical Section of a Channel

- Channel size

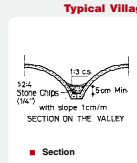




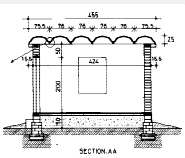
- Channel template (steel sheet 3 mm)
- Mould template (plywood 12 mm)



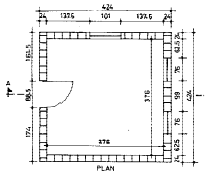
Typical Village House with Channels



- Section



- Plan



- These dimensions and specifications must be rigorously respected! Any disregard to them may cause collapse...