

Concrete Block Technology offers a speedier, cost effective, environmentally sound alternative to conventional walling materials. It is based on the principle of densification of a lean concrete mix to make a regular shaped, uniform, high performance masonry unit. Concrete Block Technology can be easily adapted to suit special needs of users by modifying design parameters such as mix proportion, water/cement ratio and type of production system. It is an effective means of utilizing wastes generated by stone crushers, quarrying and stone processing units. The technology has high potential in areas where raw materials are easily available.



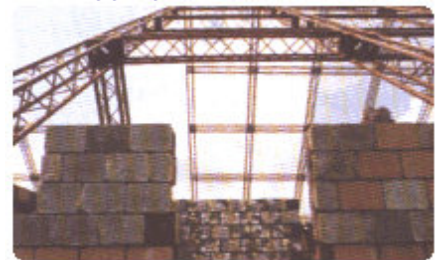
Business

The Concrete Block Technology package is a highly profitable business for micro and small scale building material producers and construction companies. A total investment of about Rs. 1,75,000/- assures a net profit of approximately Rs. 60,000/- per annum. The market for concrete blocks is growing at a rapid rate, especially in the areas where burnt bricks are not easily available or are of poor quality.

Product

The specifications and the characteristics of a concrete block depend on the machine used to manufacture concrete blocks.

The most common size of solid concrete blocks is 300x200x150mm. The basic raw material is cement, fine aggregate and coarse aggregate. Very little water is used. This is possible only with mechanized compaction and vibration and gives the block high quality in spite of the lean mix, which uses very little cement. Weight of a concrete block is about 18-19 Kgs. Concrete blocks can be surface engineered by using pieces of stone or ceramic waste on their face. Another common type is hollow concrete blocks. They are made with a richer mix, but offer a number of advantages, such as lighter weight, easier handling and facility for conducting or reinforcement through the hollows.



Unique features of Concrete Block Technology

- Cost effective compared to other traditional walling systems
- Maximum utilization of wastes and local resources
- Structural performance can be engineered
- Decentralized local production
- Offers business opportunities

Production Process

Concrete blocks are usually produced using a semi-mechanized stationary type machine. The other production systems are - manual moulds that require hand tamping, a mobile semi-mechanized egg-laying machine and fully mechanized system that combines compression and vibration.

High quality machines provide optimum vibration in the mix so that the ratio of cement used can be reduced substantially without compromising on the strength of the blocks. The machine also



Micro Concrete Roofing Tiles - An Alternate Roofing Technology

Micro-concrete roofing (MCR) technology meets the growing demand for high quality roofing. MCR tiles are a cost-effective and extremely versatile roofing material. MCR tiles can be used on steel and wood under structure to make attractive roofs on residences, farm houses, gazebos, highway constructions (*dhabas*), *verandahs* and pavilions. In areas with heavy rainfall, MCR tiles are used extensively for cladding material offering both waterproofing and aesthetic appeal. It has been used extensively in cost effective housing schemes, workplaces, restaurants and poultry farms.



Micro-concrete roofing tiles are ideally suited to replace thatch and fired clay tiles in rural areas. The Micro Concrete Roofing Technology in India has been validated by the Building Materials and Technology Promotion Council (**BMTPC**), Government of India and is promoted by **Development Alternatives** and **TARA (Technology and Action for Rural Advancement)**.

Market potential

The current market potential for MCR tiles is approximately 1.8 million sq mt of roofing every year countrywide. This figure is based on a market study done by HOLTEC Consulting Engineers, the premier advisory group in the cement industry. After surveying many regions all over the India they have concluded that there is a tremendous potential for the proliferation of this technology in almost all parts of the country.

- High durability and aesthetic appeal of MCR tiles - Cement based product
- Replacement of thatch and clay tiles
- Decline in production of burnt clay tile due to increasing energy costs
- Economic growth and increase in purchase power

Over 200 private enterprise are operating in the districts of M.P., U.P., Bihar, Karnataka, Maharashtra, Punjab, and Himachal Pradesh .

Technology Package

The MCR technology package is the result of global research and development work. In India, Development Alternatives has developed the technology and is actively promoting it since 1996, in association with the Swiss Center for Development Co-operation in Technology Management (**SKAT**); a Roofing Advisory Service (**RAS**) partner in the international **BASIN** network.

The production equipment in India is marketed by TARA. It includes:

- A vibrating table, operated by an electric motor of rating 1/4 HP, 2800 rpm
- A set of injection molded HIPS moulds, mounted on wooden frames.
- A complete set of accessories and quality control equipment
- An alignment tool for getting uniform shape of each tile
- A bending test equipment for monitoring the strength of tiles.
- A users manual

Technology for the people

This technology is ideally suited for small entrepreneurs manufacturing cement jali's, chajja's or other similar products used in building construction. Second generation entrepreneurs producing concrete blocks, prefabricated R.C.C. beams can also diversify into roofing material business. Dealers of



under-structure material e.g. suppliers of balli, can take the advantage of providing both tiles and under-structure material from the same outlet, by producing MCR tiles as a parallel business operation.



Cement dealers can take the advantage of dealer price of cement judiciously and earn high return on value addition. Complete turnkey job involving transportation and installation on the roof, which is preferred by the end user will fetch additional market and profits for the service contract of the tune of Rs. 30/- Rs. 50/- per sqm.

MCR as a micro enterprise

An MCR workshop needs compact infrastructure. A standard three table operation can be started in a 60 sq.m. shed. Including raw material storage, a curing tank and finished stock yard, a site of about 1000 sq.m. is recommended. A 7.5 KVA power connection for electricity and 3000 ltrs of potable water is required per day.

The MCR production system is modular. Entrepreneurs can add additional vibrating tables. Each table will enhance the monthly production by 6000 tiles. The tiles can be manufactured at one location and can be easily transported. In the case of large building projects, the equipment can be moved for on-site manufacturing of tiles.

MCR Business Viability

With initial investment of just 1.17 lakhs which will include own contribution of 0.4 lakhs, an entrepreneur can earn profit of Rs. 0.74 lakhs in the very first year increasing upto Rs. 2.6 lakhs by the end of the fifth year.

Low break even point, moderate DSCR and high return on investment makes the MCR Tile enterprise an attractive business venture that will be given credit easily by local lead banks, government institutions and private sources.

Existing network of MCR enterprises in India

Vishwakarma Industries - Chandigarh

Vishwakarma Industries has pioneered the use of MCR tiles for cladding in upmarket bungalows since 1997

COMTRUST - Kerala

COMTRUST a leading producers of fired clay tiles in Kerala for last 150 years has diversified into MCR tiles.

TBRT - a franchising system – Bhopal & Dehradun

TBRT - a joint venture between TARA and BKF (a Dutch Institution) has started franchise operations under TARAcrete brand name in Bhopal and Dehradun. It plans to expand its operations to 1600 franchises by the year 2003.

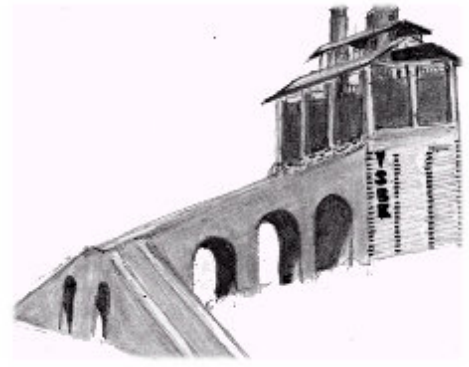
TARAcrete Building Products -- Jhansi

TARAcrete Building Products, established in 1996 is catering to both rural and urban markets in Jhansi and Tikamgarh district.



Vertical Shaft Brick Kiln - For cleaner brick production

"Conventional burnt clay bricks will continue to be the main walling material for meeting the huge demand for housing in the foreseeable future, notwithstanding substantial efforts to develop alternatives. Current technologies for brick production such as clamps, downdraught kilns and Bull's Trench Kilns consume large quantities of fuel such as coal, firewood and other biomass materials. The devastating effect of the pollution caused by huge amount of emissions from the brick industry has attracted the attention of regulatory agencies who have issued deadlines after which the polluting kilns are to "clean up or close down." In the Agra trapezium, the Hon'ble Supreme Court of India has enforced a total closure of brick kilns."



The search for cleaner brick production technologies has led to the identification of Vertical Shaft Brick Kiln (VSBK) technology. The Vertical Shaft Brick Kiln technology originally developed in China is an energy efficient, environment friendly and economically viable means to produce quality bricks. It has been adapted to Indian conditions and successfully field tested at 4 geographical locations. Further, it has received certification from the Central Pollution Control Board (CPCB) for operations in accordance with stipulated environmental norms.

Major Advantages of VSBK technology

- It represents a extremely energy-efficient, low-cost method of firing bricks. The fired quality is high with very low wastage.
- Emissions from the kiln are well within acceptable limits
- The kilns require very little maintenance once constructed and are not complicated to build.
- The kiln is very compact not requiring a large area of land and can be built near to the clay source.
- The construction cost is low.
- The kiln is not affected by variations in the weather as long as dry green bricks are available.
- More than one shaft allows for firing flexibility to cope with seasonal and economical variations in brick production and demand.
- The kiln is highly suitable for use where fuel is incorporated into the brick.

Salient features of existing VSBK's in India

	Location	Organization	No of Shafts	Shaft Size	Production Capacity
VSBK 1	Datia, M.P.	Development Alternatives, NGO	2	1 x 1 m 1 x 1.5 m	~5000 per.day
VSBK 2	Kankia, Orissa	Gram Vikas, NGO	2	1 x 1.75 m 1 x 1.75 m	~ 7000 per day
VSBK 3	Palghat, Kerala	Comtrust, NGO	2	1 x1.75 m – 3nos 1x 2 m – 1no	~14500per day
VSBK 4	Pune, Maharashtra	MITCON-DAMLE Pvt. Ltd.	2	1x 2 m – 1 no 1.25 x 2 m – 1no	~ 9500 per day

VSBK 5	Gwalior, M.P.	Yade Brick Industries Pvt. Ltd.	2+2	1 x 2 m – 4nos	~ 16000 per day
VSBK 2000 Best practice + R&D Kiln	Datia, M.P	Development Alternatives	2(BPE) +1 (R&D)	BPE 1.25x1.75 m – 2nos + R&D 1x1.5 m – 1 no	8500 + 3000 per day
<i>Notes Upscaling to achieve higher brick production (5000 to 9500 bricks per day) Progressive increase in shaft dimensions from 1 m x 1m to 1.25 m x 2 m</i>					

VSBK Construction – Basic Features

The VSBK consists of one or more shafts located inside a rectangular brick structure. the shafts are 1 m wide with nominal lengths of 1 m, 1.5 m, 1.75m or 2m. The inside surface is a brick wall, sometimes lined with refractory brick. The gap between the shaft wall and the outer kiln wall is filled with insulating materials like clay and rice husk etc.



The shaft is loaded from the top with a number of batches of bricks for firing. Each batch contains four layers of bricks set in a pre-determined pattern. The stack of bricks rest on square support bars (which can be removed or inserted) resting on a pair of horizontal beams across the arches in the unloading tunnel.

VSBK – How It Works

During operation, one batch of dried green bricks is loaded at the top at a time. A weighed quantity of powdered coal (less than 6 mm) is spread on each layer uniformly to fill the gaps. The brick unloading is done from the bottom using a trolley which runs on rails along the length of the unloading tunnel. Lifting and lowering of the trolley is done using single screw unloading mechanism. For unloading, the trolley is lifted so that whole stack of bricks in the shaft rests on it. Further slight lifting of the trolley (and the stack) releases the support bars, which are removed from either side. The stack is then lowered till the layer with openings appears, through which the support bars are then re-inserted. On further lowering, the load of the stack is taken by the support bars except for the batch being unloaded which comes down along with the trolley which finally rests on a pair of rails. The trolley is later cooled out along the rails and the bricks subsequently unloaded and sorted out to despatch. The next batch is loaded at the top using green bricks lifted upto the loading platform. The frequency of unloading – loading from 90 to 150 minutes.

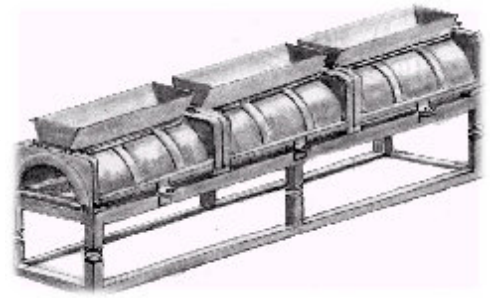
The skill in operation is to keep the firing zone in the middle of the shaft. The draught of air moving up from the bottom cools the fired bricks in the cooling zone and itself gets heated. Maximum temperature of upto 1000^o C are attained in the central firing zone. This recovery of sensible heat accounts for the high energy efficiency of the VSBK technology.

VSBK – Financial Implications & Returns

Project Details	
Daily Production per Shaft	3750
Number of Shafts	2
Daily Kiln Production	7500

Ferro cement Roofing Channel

The Ferro cement technology package for roofing developed by Development Alternatives uses state-of-the-art design principles to manufacture reinforced shells, commonly called channels. They are produced on specially designed vibrating tables and profiled moulds. The production system is uniquely tailored to provide special end details, consistent shape and thickness; all crucial for high performance.



The channels made with an optimized proportion of cement, sand and water, have a very high density, are impervious to penetration of water and provide high structural strength. Ferro cement roofing channels produced on mechanized equipment can be used for intermediate floor applications as well. Ferro cement roofing technology offers a viable alternative to conventional flat roofing systems such as reinforced cement concrete, reinforced brick cement, sand stone, etc. in both rural and urban areas of the country.

Application

Ferro cement roofing channels, offer unmatched speed of construction and can be used for

- Residences
- Primary schools, and other community buildings
- Portico's, verandahs and garages
- Industrial sheds, workshops and godowns
- Farm houses and semi-covered structures



Unique Features of Ferro cement Roofing Channels

- Speedy installation; no shuttering required
- 30% cost saving over RCC roofing
- Lower dead load on the walls
- Usable as an intermediate floor
- High strength to weight ratio
- Elegant profile and uniform sizes
- Large spans possible with intermediate supports



Ferro cement Roofing Channels – Enterprise

Ferro cement technology is a highly profitable business for small scale building material producers or construction companies. A total investment of roughly Rs. 3,80,000/- for a mechanized production system assures a net profit of approximately Rs. 1,50,000/- per annum.

Product

Ferro cement roofing channels have a uniform segmental profile; they are 2.5 cm thick and 83 cm. wide. Maximum length of mechanically produced channels can be 6 meters. Longer



spans for roofing can be built with intermediate supports.

Ferro cement roofing channels are manufactured using a fixed proportion of cement, sand and water to give high strength mortar that is reinforced with a layer of galvanized iron chicken wire mesh of 22 gauge and Tor steel bars of 8-12 mm diameter provided in the bottom ribs of the channel.



Ferro cement roofing channels can be safely transported after a curing period of 14 days,.