Concrete Block Masonry

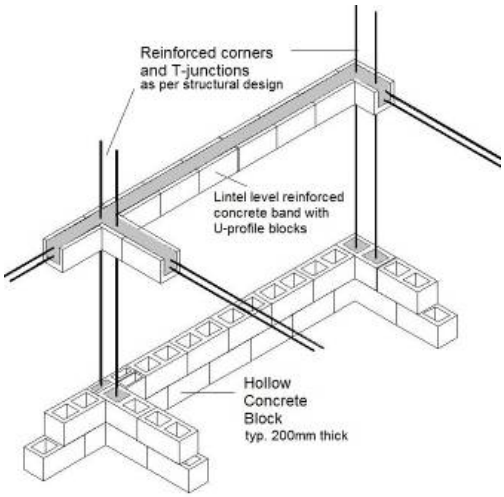

Figure 01: Masonry wall assembly with Hollow Concrete Blocks

Overview

Concrete blocks are masonry units made with cement, fine and coarse aggregate used in a lean mix- 1:9 to 1:13 (1 part of cement: 13 parts of sand and stone aggregates). and mechanically compacted and vibrated. Typically, they are at least 4 times the size of a burnt clay brick and common wall thicknesses possible with concrete blocks are 300mm, 200mm, 150mm and 100mm. For blocks of given strength, say 5 Mpa; wall masonry is 15-20% stronger than masonry with solid burnt clay brick walls, because of reduction in the number of mortar joints – 1 m^2 of wall area can be constructed with 28 blocks as compared to 125 bricks.

Hollow Concrete blocks incorporate at least 40% air cavity in gross volume and masonry can be strengthened with steel reinforcement, which makes them well-suited for low-rise load bearing construction. Typically these would be steam cured blocks produced in semi-automatic production facilities.

A major advantage of concrete blocks is that their strength can be engineered as per structural requirement, so the quantity of high energy material like cement can be rationalized by using stronger mix for ground floor as compared to upper floor. Another advantage is utilization of waste materials such as flyash, industrial slag and stone dust from stone crushers. From the envelope efficiency point of view, hollow concrete block masonry can also be insulated with loose insulation such as vermiculite, perlite or waste thermocol. They are also highly suitable for seismic strengthening because of the possibility of integrating vertical and horizontal reinforcement in customized blocks. Hollow concrete blocks have been used in EWS housing by DDA in the NCR and also extensively in southern part of India. They are highly suitable for on-site production in case of social housing projects.

CATEGORY	ATTRIBUTE	INPUT	SOURCE
Resource Efficiency	**Embodied energy and CO_2 emission**	EE Solid block: 290.8 MJ/m^2 (28.15 MJ/block); Hollow block: 273.1 MJ/m^2 (27.83 MJ/block); CO_2 emission: 67 $kgCO_2/m^2$ (excluding transportation to site);	*Source: Calculated based on data from 'Strategies for cleaner walling materials in India'-SHAKTI Foundation; calculated as per technical specifications for a block of 400x200x200 size,*

	Critical Resource Use	Solid concrete block: 100 Hollow concrete block: 63.6	*Source: Calculated critical use index (0-100)*
	Current Recycled content	Low-Medium, depending on use of stone (quarry) dust.	
	Future reusability	Low-medium. Better reusability if lime mortar is used.	
	Water use during construction and manufacturing	467 L/m^2 for plastered solid concrete block wall; 344 L/m^2 for plastered hollow concrete block wall.	*Source: Calculations based on data from 'Strategies for cleaner walling materials in India'-SHAKTI Foundation'; CSE, 2005, Green Rating project: Concrete Facts.*
Operational performance	**Durability**	High	
	Ease and frequency of maintenance	Low frequency of maintenance	
	Impact on cooling or heating loads	Cooling energy (kWh/m^2/y) savings under different climatic zones: Composite: 1.85 (4%) Warm & humid: 1.52 (3%) Hot & dry: 1.92 (4%) Temperate: 0.76 (5%) Heating energy savings in cold climate: 1.68 (4%)	*Source: Based on simulations of hollow concrete block. Values in savings from base case of: 225mm solid burnt clay brick with 12.5mm plaster on both sides.*
	Noise transmission	*No data available*	
	Thermal mass (absorption, storage and release of heat)	501 kg/m^2 (Solid concrete block); 327.3 kg/m^2 (Hollow concrete block)	*Calculations based on data from 'Strategies for cleaner walling materials in India'-SHAKTI Foundation*
	Thermal performance (flow of heat)	U value 2.14 W/m^2.K for solid concrete block; 1.89 W/m^2.K for hollow concrete block (230mm)	*Source: 'Strategies for cleaner walling materials in India'-SHAKTI Foundation*
User Experience	**Familiarity with the material**	Medium	*Note: has been used in regions where local burnt clay bricks are of poor quality, but awareness among house owners is low.*
	Modification ability	Low	
Economic impact	**Construction cost**	INR 1307/m^2 for solid concrete block; INR 975/m^2 for hollow concrete block.	*Source: Calculations based on Delhi Schedule of Rates 2016;*
	Skill requirement	Medium skill (26%)	
	Supply chain	Medium	
	Duration of Construction	8.6m^2/day (plastered masonry wall assembly)	*Source: Study – 'Strategies for cleaner walling materials in India'-SHAKTI Foundation*
	Job creation	1.37 mandays per m^2 wall including block production and construction;	*Source: Calculated based on CPWD Delhi schedule of rates 2016*