6. CONCRETE WALLS & FLOORS

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CONCRETE BLOCKWORK

(CONCRETE MASONRY)

Concrete block is used where a heavier, durable, gravity load-bearing, lateral load-resisting is desired – without the need to build a cast in situ concrete wall, which would involve the use of shutters (formwork).

Like a concrete wall, a concrete block wall is reinforced with steel bars, but the matrix material comprises discrete, hollow masonry units held together with mortar then infilled with a fine-aggregate concrete (grout). Because of many potential and actual gaps a concrete block wall, it is designed the same as a concrete wall but with the “concrete” assigned a strength less than half the strength normal concrete.

The strength of a final wall is highly dependent on the workmanship of the concrete blocklayer and the degree of supervision. There is a formal hierarchy of strengths (Type A, B or C blockwork) depending on the degree of supervision specified.

Contrary to popular (ie layman’s) belief, having “a lot of steel in the wall” does not mean that it is “good”. The position of the reinforcing steel within a wall is important. In particular the exact position of the starter bars in a retaining wall is crucial to the proper performance of the wall and is the single most important matter to be checked when inspecting a wall.

In the process of laying the blocks, it is inevitable that mortar droppings accumulate at the bottom of the wall. The line of connection between wall and foundation is very important to the strength of the building and the mortar droppings must be removed. How to do this when it is trapped at the bottom of a hollow wall? The trick is to use inverted bond beam blocks in the bottom course of the wall. Bond beams, laid upside down leave a continuous channel along the bottom of the wall. By cutting side openings (cut-outs) at intervals in this channel, the mortar can be washed out. Better still to throw a layer of sand along the bottom of wall so that the mortar does not stick to the concrete. Or poke a rod along its length from the end – if you can get access.

Walls built from hollow masonry units and with the reinforcing steel rods in place are filled with a wet grout, which is a concrete mix made using cement, sand and smaller-than-usual aggregate (stone chips). There are many hollow channels vertical and horizontal, within the wall, and every gaps should be filled with the grout. To assist the grout get everywhere, we would always specify that a small (pencil) vibrator be used to further “liquefy” the grout and drive it into every possible gap. Using the “high-lift” method of grouting we would place about a metre height of grout along the bottom of the wall, working from one end to the other, vibrating as we go. We would then return to the beginning a place another metre of grout, stabbing the vibrator through the new grout and into the previous “lift” thereby mixing the two lifts. The purpose of placing the grout in “lifts” is to avoid causing the excessively high hydraulic pressure to build up which could cause the wall to burst.   The water in the grout (which allows it to flow) is quite quickly absorbed into the pores of the dry blockwork and reduces the pressure. Evidence of this can be seen as the blockwork and mortar joints become visibly damp. In a 2.400m high wall we would expect the vibrator to cause the grout to drop by 75mm. Yet there are blocklayers, apparently with many years experience, who claim to have never vibrated their grout. Instead they claim to achieve adequate compaction by mixing an expansive agent into grout.   We have yet to see evidence that this can be achieved and always insist on the use of a vibrator.

Generally we would design a wall to be built into a rebate in the concrete slab or foundation. The rebate allow the floor/wall joint to be finished nicely, but also has an engineering function in a retaining wall (help resist lateral soil pressure) and a weather-tightness function in external walls (help prevent the ingress of water).

Unfortunately, all concrete block walls leak to some degree since every mortar joint is an opportunity for water to enter the structure. Various systems are incorporated in the grout or applied to the outside surface to try to minimize the leaking and are successful to some degree. A water proofing coating system applied to the inside surface to try to prevent leaking is an act of desperation on the part of the owner and is unlikely to succeed.

CRACK-CONTROL JOINTS IN BLOCK WALLS

Variations in temperature will cause walls to shrink or grow, with movement proportional to length. Movement in a wall can result in cracks forming sometimes in a staircase pattern along the mortar joints. Cracks can be controlled by breaking a wall into shorter lengths with vertical crack-control joints at say, 6m apart. The cracking occurs at the weakened joint locations and is hidden by the sealants.

POLYSTYRENE “BLOCKWORK”

In reality this is a polystyrene permanent formwork system, but installed using the blockwork analogy. Because the walls of the “blockwork” units is polystyrene material, it has no strength at all. However because the two faces of the polystyrene “blocks” are joined by galvanized steel strips or plastic, the infill grout forms a very homogeneous mass, stronger than ordinary blockwork of the equivalent thickness. (Note that to using a 250 thick polystyrene wall will only give a 150mm thickness of concrete – usually not enough for structural purposes.) The polystyrene provides insulation to the wall sufficient to meet the energy efficiency requirements for the walls of a residential building. It is practical to glue or otherwise fix gib board or similar to the inner polystyrene surface, however plastering the outer polystyrene layer with a textured finish to achieve watertightness still leaves it vulnerable to impact damage and seems counter-intuitive to achieving reasonable durability.

CONCRETE FLOORS

The first thing to say about concrete floors is that, unless they are post-stressed in both directions, they will most likely crack.

SLAB ON THE GROUND

Floor slabs can vary in thickness from 100mm (residential) to 200mm (heavy warehousing). For heavy duty use, a floor should be designed including factors such as soil properties, wheel loads and frequency of use. Generally floors are reinforced with mesh or smaller diameter steel bars, but these need to be cut or weakened each side of a proposed crack-control joint to allow a crack to form at the preferred position. Recent experience from the floors of earthquake damaged buildings suggests that higher strength mesh should be used. Because of the constraint imposed by the perimeter foundations, and from experience, cracks are likely to form within 1.5m of a perimeter foundation beam and the floor should be cut along this line. The rest of the floor should be cut into approximately square panels of less than 40 sq metres area. In special cases these saw cracks need to re-sawn and a proprietary system installed provide support to the edge of the saw cuts when trafficked by fork-lifts. However the system is only sometimes successful and in time the edge spalls.