Autoclaved Aerated Concrete

Autoclaved aerated concrete, or AAC, is made with fine aggregates, cement, and an expansion agent that causes the fresh mixture to rise like bread dough. In fact, this type of concrete contains 80% air. In the factory where it is made, the material is molded and cut into precisely dimensioned units.

Cured blocks or panels of AAC are joined with thin bed mortar. Components can be used for walls, floors, and roofs. The lightweight material offers excellent sound and thermal insulation, and like all cement-based materials, is strong and fire resistant. In order to be durable, AAC requires some type of applied finish, such as a polymer-modified stucco, natural or manufactured stone, or siding.

Key aspects of AAC, whether designing or building with it, are described below:

Advantages –

- AAC combines insulation and structural capability in one material for walls, floors, and roofs. Its light weight/cellular properties make it easy to cut, shave, and shape, accept nails and screws readily, and allow it to be routed to create chases for electrical conduits and small-diameter plumbing runs. This gives it design and construction flexibility, and the ability to make easy adjustments in the field.
- Durability and dimensional stability. A cement-based material, AAC resists water, rot, mold, mildew, and insects. Units are precisely shaped and conform to tight tolerances.
- Fire resistance is excellent, with 8 in. thick AAC achieving a 4-hr rating (actual performance exceeds that and meets test requirements for up to 8 hr). And because it is noncombustible, it will not burn or give off toxic fumes.
- The light weight means that *R*-values for AAC are comparable to conventional frame walls, but they have higher thermal mass, provide air tightness, and as just noted, are not combustible. That light weight also gives a high sound reduction for privacy, both from outside noises and from other rooms when used as interior partition walls.

But the material does have some limitations. It is not as widely available as most concrete products, though it can be shipped anywhere. If it has to be shipped, its light weight is advantageous. Because it is lower strength than most concrete products or systems, in load-bearing applications, it must typically be reinforced. It also requires a protective finish since the material is porous and would deteriorate if left exposed.

Installation, Connections, and Finishes

Due to the similarity to traditional concrete masonry, AAC units (block) can be easily installed by concrete masons. Sometimes, carpenters get involved in installation. Panels are heavier due to their size and require the use of a crane for placement. Manufacturers offer training seminars, and it's usually adequate to have 1 or 2 knowledgeable installers on small projects. Depending on the type of finish selected, they can be directly adhered or mechanically attached to the face of AAC.

- Blocks

    - First course is laid and leveled. Blocks are stacked together with thin-bed mortar in a running bond with a minimum of 6-in. overlap.
    - Walls are plumbed, leveled, and squared with a rubber mallet.
    - Openings and odd angles are cut with a handsaw or bandsaw.
    - Reinforcement locations are determined, rebar placed, and grouting occurs. Grout must be mechanically vibrated to consolidate it.
    - Bond beams are placed at the top of the wall and can be used for heavy-duty fixture attachment.

- Panels
    - Panels are placed one at a time, starting from the corner. Panels are set into a layer of thin-bed mortar and vertical rebar is attached to dowels extending up from the floor before the adjacent panel is placed.
    - A continuous bond beam is created at the top, either with plywood and AAC material or with bond beam block.
    - Openings can be precut or field cut.

- Connections
    - Roof frame/framing is connected to a conventional top plate or hurricane straps embedded in the bond beam.
    - Floor framing is attached with standard ledgers anchored to the side of the AAC assembly adjacent to a bond beam.
    - AAC floor systems bear directly on top of AAC walls.
    - Larger structural steel members are set on weld plates or bolt plates set into the bond beam.
- Finishes

    - Stucco-type finishes are made specifically for AAC. These polymer-modified plasters seal against water intrusion yet allow moisture vapor for breathability.
    - Conventional siding materials are mechanically attached to the wall face. Furring strips should be employed if back ventilation of the siding material is desirable.
    - Masonry veneers can be directly adhered to the wall face or can be built as cavity walls. Direct-applied veneers are typically lightweight materials like manufactured stone.

Sustainability and Energy Considerations

AAC offers both material and performance aspects from a sustainability perspective. On the material side, it can contain recycled materials like fly ash and rebar, which may help contribute to credits in LEED® or other green rating systems. Further, it incorporates such a large quantity of air that it contains less raw material per volume than many other building products.

From a performance perspective, the system leads to tight building envelopes. This creates an energy efficient envelope and protects against unwanted air losses. Physical testing demonstrates heating and cooling savings of roughly 10% to 20% compared to conventional frame construction. In consistently cold climates, the savings may be somewhat less because this material has lower thermal mass than other types of concrete. Depending on the location of

manufacturing relative to the project site, AAC may also contribute to local materials credits in some green building rating systems.

Manufacturing

First, several ingredients are blended into a slurry: cement, lime, water, finely ground sand, and often, fly ash. An expansion agent like aluminum powder is added and the fluid mixture is cast into a large billet. As the slurry reacts with the expansion agent to generate air bubbles, the mixture expands. After its initial set, the resulting “cake” is wire cut into precisely sized blocks or panels and then baked (autoclaved). The heat helps the material to cure faster so that blocks and panels maintain their dimensions. Reinforcement is placed within panels prior to curing.