VI. Architectural Design

Options available when using AERCON are limited only by the imagination.

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An Architect’s responsibilities for a commercial project can vary from the site development to the furniture selection. However, when an Architect is developing a concept, the two most critical considerations for a well designed commercial building are the aesthetics and functionality. A talented Architect combines both of these qualities to form an architectural statement vicariously through the building. When an Architect uses an AERCON system, a choice is made to use one of the most versatile and user friendly materials available in today’s market. The options available are limited only by an Architect’s imagination and AERCON does the rest.

This well designed middle school complex combined the attributes of AERCON with metal trusses, columns and studs to achieve a project with both aesthetics and functionality.
B. Design Flexibility

An Architect’s first approach to a new system has to contain certain fundamental principles. The first requirement is design flexibility and the second is compatibility with other building systems. A building concept that is afforded a multitude of options in design flexibility will influence and enhance the building. For a system to be effective and economical for an Owner and Architect, AERCON should be introduced during the early phases of a project to the parties concerned to capitalize on the extensive AERCON product benefits. Some of the many architectural features that can be created with AERCON products are illustrated. Contact an AERCON Representative for additional features.
C. Compatibility

Besides the unique architectural features, the AERCON system is extremely compatible with other building systems and materials. Porte cocheres, entry ways, atriums and other desirable features can be realized with unique styles and flairs. Various materials, such as light gage metal, fiberglass, brick, concrete, wood and glass, can be combined with AERCON products. Many creative designs can be achieved by combining these materials without any loss of functionality.

This school facility combined AERCON non-load bearing wall panels with metal trusses, columns and studs to achieve a functional and aesthetically pleasing project.

AERCON non-load bearing wall panels were used in conjunction with a prefabricated steel superstructure to create the building envelope for this church.

A durable brick façade and a resilient metal roof deck system were integrated with AERCON load bearing wall panels and roof panels to produce this modern, attractive multi-classroom building.

The unique exterior styling and features such as pilasters, gable walls, metal roof deck and brick accent were accomplished using AERCON block and roof panels.
Moisture from both external and internal sources can cause damage to buildings. Therefore, moisture protection is a primary consideration in building design and detailing. External moisture sources include rain and water from the soil. Moisture inside a building, usually in the form of humidity, can cause condensation on the surface of any wall as well as condensation inside the wall itself. Moist walls can allow mold to grow, cause surface discoloration and cause damage to plaster and wall finishes. Buildings with consistently moist walls and floors also promote an unhealthy environment where mold and bacteria can be present. The goal when considering moisture protection details is to avoid allowing moisture, either from external or internal sources, to damage the building or make the building uncomfortable.

While water in itself does not harm AAC products, it can result in some short-term undesirable behaviors. Specifically, when the moisture content of the AAC is high, the thermal conductivity is increased, resulting in lower thermal insulation performance. Determining the various properties of the building material is the first consideration when addressing moisture protection issues. When the properties inherently resist infiltration of moisture into the material, the construction details and coatings become much more simple. However, when the material has a high potential for moisture absorption or infiltration, the construction details become much more significant.

AAC material does not have interconnected porosity, so capillary action breaks down quickly and moisture cannot continue “pulling” very deep into the material. Only the material near the surface directly in contact with the water is affected. Since the absorption of water into the AAC is minimized, coating of the walls during the building construction can be scheduled at any convenient time or sequence. The interior walls and components of the building may be completed without concern of damage due to water migration through the AERCON material.

When AAC is manufactured, curing is achieved in a steam-filled, pressurized autoclave. During that process, the AAC product is saturated with steam and moisture. At the end of the autoclaving process, the AAC usually contains approximately 30% (by weight) water. This internal water dissipates naturally over time to stabilize at its long-term moisture content of 4 to 8%.

During the typical initial drying-out process, two different rates of water dissipation occur. First, while the internal moisture content of the AAC exceeds approximately 18%, rapid diffusion of the internal moisture from the AAC is experienced. Ideally, vapor permeable coatings on wall surfaces and the interior surface of roof panels do not impede this process and, depending on the time of construction, can be at levels approaching or below 18% by the time the building is “dried-in”. When construction schedules require the building to be completed and occupied quickly, mechanical methods such as dehumidifiers become desirable for expediting this
initial phase of drying. After the internal moisture content of the AAC material drops below approximately 18%, the rate of diffusion is reduced. In most cases, the continued rate of drying is low enough that any moisture and humidity introduced into the building can be adequately removed by the air-handling system. The moisture radiating from the walls becomes insignificant and unnoticeable to the occupants. Due to this natural process of water diffusion, the wall surfaces should not be coated with any type of vapor barrier since it would impede the diffusion of the excess moisture from the AAC material.

Overall, excessive moisture levels in many building materials during the first few months after construction is common. Proper design, detailing and construction practices can very easily overcome this issue and alleviate moisture problems for the owner. In an effort to expedite the process of allowing the AAC material to attain its long-term equilibrium moisture content, the following measures are recommended for design and construction.

First, specify and use interior and exterior wall coatings that repel water but allow the AAC to breathe. Specifically, coatings that allow vapor penetration, but not moisture penetration are highly recommended. If a vapor impermeable waterproofing that restricts vapor flow through the exterior surface of a wall is applied, such as in the case of a basement wall, moisture within the AAC can only be diffused toward the interior of the building, thus increasing the time necessary to achieve an equilibrium moisture content in the wall. It is advised not to seal both the interior and exterior surfaces of walls with any type of vapor barrier such as damp proofing on the exterior surface and vinyl wallpaper on the interior surface. If such a combination of two impermeable systems are used, the internal moisture is trapped and the surface under the vapor barriers will have a much greater possibility of allowing mildew to form.

Proper design of air handling systems is critical for any building. It is recommended to always pre-treat outside air before it enters the building. This outside air should then be injected into the air conditioning system clean, dry and at a neutral temperature. It is also necessary to provide air-handling equipment that is properly sized. Air-handling equipment is usually sized using maximum building loads. Since this maximum load usually only occurs during a small percentage of the time, the system is “oversized” during much of the year causing it to only run for short, infrequent cycles. Therefore, it is important that the air-handling system not be “oversized” for the maximum load design.

For buildings with suspended ceilings, the ultimate goal for peak performance is to attain the same quality of air above and below the suspended ceiling. The entire space should be controlled to achieve a common environment – in terms of temperature, humidity and air circulation. When necessary or desired, fans may be placed in the space above the ceiling in order to increase the air circulation.

Finally, when using AERCON Wall and Floor/Roof panels together, a very airtight
Construction is achieved. Therefore, prior to enclosing the building, sufficient time to allow the solid AERCON material to dry-out should be given, typically a few months. The most desirable and cost efficient method is to allow the environment to dry-out the building naturally. As in normal design, the building’s supply air should be controlled using dehumidifiers. The air conditioners should control and re-circulate the interior air only. They should not be used as a mechanism to introduce make-up or supply air into the building. If construction schedules require quick occupancy, dehumidifiers may be desirable during the first year of occupancy. These temporary dehumidifiers would take care of the excess moisture being emitted from the walls and roof systems.

In instances where the humidity levels inside a building are high and the temperatures drop below the dewpoint, condensation will form – regardless of the building materials. As long as the humidity and temperature are properly controlled, the dewpoint temperature should never be realized. Normal building operating conditions are 75°F and 60% relative humidity. As shown on the following graph, 75°F is well above the dewpoint temperature of 60°F for 60% relative humidity and condensation formation should not occur.

All buildings must be protected from the influence of external moisture sources. Since AERCON demonstrates very good moisture protection without any additional treatments, the construction details can focus on simplicity and aesthetics. The most common and effective ways are to apply water-protecting brick façades or stucco, paints or bituminous coatings to the exterior surface of the walls and implement proper flashing and architectural details. Since most coatings such as stucco and plaster are applied to a wetted surface and require water to cure, the internal moisture content of the AAC wall is not normally a concern and does not create bonding or performance problems.

The selection of the exterior wall coating is dependent on the desired aesthetic look of the finished building. Several choices are readily available which will provide the desired moisture protection. Typical selections include painted stucco and brick façades. With either system, proper flashing and construction details should be utilized.
Various moisture-related properties of AAC are given in the following graphs.

**Water Penetration into AAC**

\[ \text{Penet} = (Bcs) \cdot (t^{1/2}) \]

**Absorbed Water into AAC**

\[ \text{Absorbed Water} = (aw) \cdot (t^{1/2}) \]

Ref: RILEM Recommended Practice Autoclaved Aerated Concrete, Section 3.4
Typical absorption and desorption isotherm of AAC
E. Exterior Surface Treatment

Various options for exterior surface treatments are available including stucco, paint, and numerous façade materials. By changing features as simple as color schemes and wall textures, very attractive and different appearances can be achieved. Designing with colors can change the face of a building, creating a special corporate image or adding that personal touch. A broad spectrum of textures can also enhance a building’s image.

The color of AERCON products is natural white to grey-white. Due to the effects of storage, variations in raw materials and the climate, slight variations in appearance may occur. Pores of different size at the surface are an inherent characteristic of autoclaved aerated concrete (AAC) and are not considered defects in the quality of the product.

Coatings for AERCON products are readily available in unlimited color possibilities. They are economical to apply with a brush, sprayer or roller.
depending on the particular application. Two types of patching mortar, specifically designed to be compatible with AAC, are currently available to repair damaged areas prior to coating application. The severity of the damage dictates which mortar should be used.

**Painted Stucco**

Exterior coatings manufactured for AAC are designed to be physically compatible with AERCON products. Lightweight Portland cement stuccos comparable in strength and density are recommended to assure long-term bonding and crack resistance. Additionally, lightweight stuccos are polymer modified to provide enhanced bonding and workability. While lightweight stuccos are highly vapor permeable and thereby assure rapid structural drying, they are also completely hydrophobic and will not allow water penetration. AAC coatings are subject to high thermal tension. Therefore any coatings used must have permanently high elasticity.

For AERCON block projects, exterior lightweight stucco is usually applied in a single coat at a minimum thickness of 5/16 inch, following the manufacturer's recommendations. A texture coat of 1/8 inch is then applied to the hardened surface. Lightweight stuccos are available in numerous textures including a grooved, pebbled or typical sand finish variety. Once the textured stucco has set, apply two coats of vapor permeable masonry paint. Any paint must be vapor permeable to allow moisture inside the block to escape.

Panels with mortared joints must be treated prior to the application of any surface coating. The panel joints are coated with a thin layer of a cement-based compound. Embedded into the cement-based compound along the panel joint is an alkaline resistant fiberglass mesh. A cement-based compound basecoat is applied over the entire surface at a minimum thickness of 1/8 to 3/16 inch. Immediately after the basecoat dries (normally within one hour), skip trowel a light texture onto the basecoat. Once the textured basecoat has set, apply two coats of vapor permeable masonry paint.
Paint
If desired, paint can be directly applied to unmortared panels which have tongue and groove profiles and chamfered corners. Paint used for this application must reliably seal the slight surface irregularities of the panels. For this purpose, acrylic coatings with a higher filling capacity than is customary with ordinary paints must be used. These polymeric coatings are typically applied in two coats to achieve a minimum of 1 mm total thickness.

While paint can be directly applied to AERCON walls made of blocks or mortared panels, extreme care in joint preparation is required to achieve an acceptable appearance. The joints in an AERCON mortared wall are much thinner than in conventional masonry construction and therefore are more likely to reveal minor imperfections. Even with the acrylic coatings noted above, joints may be visible. For applications where appearance is not a dominant consideration, such as industrial buildings or garages, applying paint directly to an AERCON wall can be an inexpensive and time-saving alternative. Any paint that is used must be vapor permeable to allow moisture inside the block to escape.

Façades
The use of ventilated façades as an exterior surface treatment is very appropriate from a humidity and thermal point of view. Therefore, various façades such as wood shakes, brick, stone, metal siding, vinyl siding and cementitious panels can be utilized. A furring strip substructure is advantageous since it allows back ventilation. The furring strips are best attached to AERCON using AAC fasteners. Install all external materials per the specific manufacturer’s recommendations. Typical waterproofing details including weep holes, flashing, lapping, connections and membranes should be incorporated in order to achieve the desired weather tight construction.

Joint Treatment
Listed below are three basic types of joints, classified according to application, requirements and orientation. In any case, the horizontal and vertical joints in AERCON walls must be weather tight. Suggested details are shown. Other options may be suitable depending on the project requirements. All materials must be compatible with AAC.
• Type A – Non-movable waterproof joint
• Type B – Slightly movable waterproof joint
• Type C – Expansion joint

At elastic wall joints, no coating should be applied. This may be achieved by covering such areas with masking tape. Coating or spackling of the vertical joints in a horizontal wall panel system is not recommended.

Ceramic Tiles
Ceramic tiles are not suitable weather protection when applied directly on AERCON exterior walls because of the varied thermal conductivity of ceramics as compared to AAC. In addition, the difference in diffusion-inhibiting properties of ceramic surfaces which cause considerable tension, usually leads to loosening or cracking and finally to the destruction of the ceramic surface.

Designing with colors can change the face of a building, creating a special corporate image or adding that personal touch.
In addition to the energy savings and healthy environment that AERCON provides, many different interior effects can be achieved. Wall treatments can range from smooth or textured paintable surfaces to wallpapers and tiles. Ceilings and walls can be designed with attractive visible joints or smooth surfaces. Different moods can be attained through special lighting arrangements and color schemes. In fact, with proper consideration, almost any conventional interior or surface treatment can be used with AERCON.

Plaster
Interior coatings manufactured for autoclaved aerated concrete (AAC) are designed to be physically compatible with AERCON products. The properties of both skim coat plasters and lightweight interior plasters must be similar to the AERCON material. Bonding agents are typically incorporated into these products to provide maximum adhesion and resiliency. Wall panels should be coated with a skim coat plaster to achieve a smooth finished surface. Over blocks, lightweight interior plasters provide a thicker coating to level and straighten walls and provide a base for decorative interior paints and wall finishes.

Interior plaster applied to wall panels should be a mineral-based compound. The plaster is usually applied in a single coat to a thickness of 3/32 to 1/8 inch, following the manufacturer’s recommendations. The surface is then finished to a smooth and even quality.

Depending on the size and complexity of a project, the typical plaster products can be either sprayed on or troweled on.

Gypsum Board
Gypsum board may be applied to AERCON exterior and interior walls. One method of attachment is to fasten common gypsum board to pressure treated furring strips.
that have been secured to the wall. The furring strips are best attached to AERCON using AAC fasteners. An alternative is to fasten the gypsum board directly to the wall using a commercial adhesive and screws. Consistent with standard construction practice, moisture resistant gypsum board is recommended in high humidity regions such as bathrooms and saunas.

**Wall Tile**

Surface preparation for ceramic wall tile applied to AERCON is only necessary when the wall surface requires leveling. When necessary, a Portland cement or gypsum-based parge coat should be applied to the surface prior to setting the ceramic tile. In moist areas, such as shower areas, only a Portland cement parge coat should be used. The ceramic tile should then be adhered to the prepared wall using either a cement thin set mortar or an organic adhesive. In moist areas, only a cement thin set mortar should be used.

**Paneling**

Wood, plastic, masonite and composite paneling can all be installed using furring strips in the same manner as suggested for gypsum board. Rough or finished lumber can also be used to achieve a rustic look.

**Paint**

While paint can be directly applied to AERCON walls made of blocks or mortared panels, extreme care in joint preparation is required to achieve an acceptable appearance. The joints in an AERCON mortared wall are much thinner than in conventional masonry construction and therefore are more likely to reveal minor imperfections. Even with acrylic paint, which has a higher filling capacity than ordinary paint, joints may be visible. For applications where appearance is not a dominant consideration, such as industrial buildings or garages, applying paint directly to an AERCON wall can be an inexpensive and time-saving alternative. Any paint that is used must be vapor permeable to allow moisture inside the block to escape.

**Wallpaper**

Wallpaper can be directly adhered to an AERCON wall.
When necessary for leveling or smoothing, a Portland cement or gypsum-based parge coat should be applied to the surface prior to installation of the wallpaper. Just like other finishes directly applied to AERCON, any wallpaper that is used must be vapor permeable. Vinyl wallpaper is not recommended due to its inability to allow moisture to diffuse from the AERCON material.

**Ceilings**
Typical surface treatments for ceilings are basically the same as noted above for walls. Additionally, suspended ceilings can also be installed to create space for HVAC, plumbing, ventilation, or other utility commodities, as well as providing an attractive environment. Suspended grids for use with ceiling panels made of gypsum, fiberglass, plastic, wood or metal, can be fastened directly into an AERCON floor/roof panel or into pressure treated furring strips fastened to the AERCON floor/roof system.

**Accessories**
Décor enhancements such as crown molding, chair rails, wall base, wainscot, and trim work can also be readily incorporated. AERCON can be used for fireplace chimneys and as the back-up system for hearth firebricks. Whether a traditional atmosphere is desired or an eccentric flair displaying uniqueness is preferred, an AERCON structure can be utilized to fit your needs.

**Flooring**
AERCON floor panels can accept floor coverings such as carpet, vinyl sheet, vinyl composition tile, ceramic tile, rubber tile, terrazzo, wood and linoleum. The tongue-and-groove profile of AERCON floor panels provides a method of alignment for adjacent panels, resulting in a uniform surface for the flooring to be set on. Normally, a leveling topping is not required, but one can be used if necessary or desired.
G. Acoustic Performance

Noise control in buildings is of great significance for the health and well-being of the occupants, especially in multifamily dwellings, since they must provide an environment that is restful and relaxing. The building envelope must also maintain privacy for the occupant. Noise control is also an important factor in other types of buildings such as schools, hospitals, hotels and offices. AERCON provides a sound insulation value of 7dB greater than other solid building materials of the same weight per surface area. AERCON's high surface mass coupled with the mechanical vibration energy damping within its porous structure produces a construction material with exceptional sound insulation properties.

In addition to using a wall material with superior sound insulation properties, it is always essential to construct the wall in a manner that closes off air leaks and paths by which noise can go around or through the assembly. AERCON’s simple construction methods and details help to eliminate imperfections that allow sound transmission through the walls, thus providing a final wall assembly which offers superior sound insulation characteristics for the occupant.

Also, it should be noted that the results of tests conducted with AERCON block wall construction apply to AERCON reinforced panels. This is due to the fact that the concrete density of all AERCON products is the same for a given Strength Class.

The following examples show the Sound Transmission Class (STC) rating for typical AERCON wall constructions according to ASTM E 90 and German Standard DIN 4109.
STC = 44
AERCON Blocks
(ASTM E 90)

STC = 36
AERCON Interior Wall Partitions
(ASTM E 90)

STC = 65
AERCON Cavity Wall
(DIN 4109)

STC = 57
AERCON Wall with Brick Façade
(DIN 4109)
Transmission of sound generated from internal sources such as machinery or equipment can be significantly reduced by using AERCON.

Values are obtained from either test values or calculations.
Sound Absorption

Sound absorption is a major characteristic of the overall acoustic performance of a wall, floor or roof system. By using AERCON assemblies, the transmission of sound generated from internal sources such as machinery or equipment can be significantly reduced.

The following graph indicates the sound absorption of an uncoated / unpainted AERCON surface. The excellent Noise Reduction Coefficient (NRC) for AERCON surfaces provides great sound absorption without any additional measures.