

S T R O M B E R G
ARCHITECTURAL PRODUCTS

Glass Fiber Reinforced Concrete (GFRC)
Glass Fiber Reinforced Polymer (GFRP)

Glossary of Architectural Terms

Volume I - Abacus through Balustrade

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GFRC | GFRP | GFRG | CAST STONE | MARBLE | BRONZE



Abacus

The abacus is the top part of a column capital. Abacus may be a square slab or a molded shape. In GFRC (glass fiber reinforced concrete) or Architectural Fiberglass column capitals, the abacus may be cast as part of the capital or as a separate piece. Latin: "abacus" = table, tablet.

Found in classical Greek and Roman architecture and derivatives, including Beaux Arts Classicism, Classical Revival, Federal, Georgian Revival, Greek Revival, Neoclassicism, Renaissance Revival, Second Empire, Gothic and Gothic Revival. Abacus may be cast stone, FRP (Architectural Fiberglass,) GFRC (glass fiber reinforced concrete,) GRG (glass fiber reinforced gypsum,) plaster, bronze, granite or marble.



Abacus of a Roman Ionic Column Capital cast in GFRC

Abated

In stone cutting, hammered metal work, and the like, cut away or beaten down, lowered in any way, as the background of a piece of ornament or a bas relief panel, so as to show a pattern or figure in relief. Abated work may be cast stone, FRP (architectural fiberglass,) GFRC (glass fiber reinforced concrete,) GRG (glass fiber reinforced gypsum,) plaster, bronze, granite or marble.

Abrasive Finish

A flat and grainy surface texture. In cast stone, GFRC (glass fiber reinforced concrete) or architectural precast concrete this is accomplished by acid washing or sand blasting. In GFRP (architectural fiberglass) or GFRC (glass fiber reinforced gypsum,) plaster or bronze, this is accomplished either in the mold, or with sandblasting. With granite or marble this is accomplished with sandblasting.

Abrasive Hardness

A measure of the wearing qualities of marble, granite, GFRC, architectural fiberglass or other materials. Mostly applies when those materials are used for floors, stair treads, and other areas subjected to abrasion by foot traffic. Refer to ASTM C241.

Abut

To touch, or join at its end; as in a beam where the end is planted against another member of a structure, but without trim around it; or where a GFRC arch bears upon a pier, course of stone, skew back, or the like.

Acanthus

A can thus. Acanthus leaves are the stylized leaves of the acanthus plant, used in decoration on column capitals of the Corinthian and Composite orders. Because of the deep undercuts, special rubber molds are used when casting them in GFRC (glass fiber reinforced concrete,) architectural fiberglass, GFRG or Cast Stone.



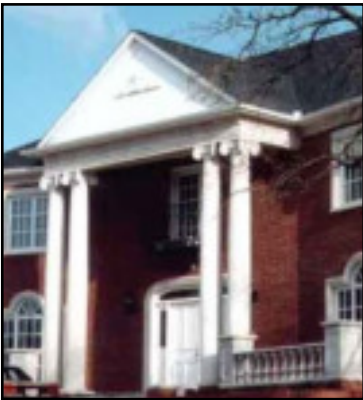
Drawing of an Acanthus Leaf

Corinthian column capital in architectural fiberglass (GFRP) featuring stylized Acanthus leaves.



Accouplement

The placing of two columns or pilasters very close together. This pairing is common and is most effective when several pairs of columns are used in series to form a colonnade.



Italian Ionic GFRC columns used in accouplement

Accolade

An ornamental treatment of the archivolt or hood molding of an arch or of the moldings of an apparent arch, or of a form resembling an arch, as in late Gothic work.



Accolade in architectural fiberglass (GFRP)



Accolade in architectural fiberglass (GFRP)

Acorn

An ornament in the shape of an acorn sometimes used as a pendant or decorative element. In GFRC (glass fiber reinforced concrete) and GFRP (architectural fiberglass) acorn finials are generally cast with a dowel or threaded insert for attaching them to the substrate.

Acoustics

Acoustics is the science concerned with the production, control, transmission, reception, and the effects of sound. The term refers to the natural laws governing sound and the design of structures to utilize sound in the best way. These laws are similar in many ways to those for the reflection and refraction of light. Architectural acoustics with interior GFRC or GFRG panels is primarily applicable to the design of opera houses, concert halls, churches and other religious meeting spaces, convention centers, hotels and similar facilities. GFRC and GFRG panels can be curved and shaped to reflect sound in the desired direction. Both GFRC and GFRG can be textured in various degrees to reflect, diffuse and absorb sound as may be required. The weight per square foot of GFRC and GFRG can be varied depending on the desires of the acoustical consultant. For a good example of acoustic panels see the Ave Maria page.

External links for more information:

Acoustical Society of America

<http://asa.aip.org/>

American Institute of Architects

<http://www.aia.org/>

(continued on next page)

National Council of Acoustical Consultants

<http://www.ncac.com/>

Acroterion or Acroterium

From the Greek word "acroterion" - the summit or extremity. An ornamented pedestal at the corner or peak of a roof. Acroterion may be a palmate, a statue or a pedestal. GFRC, glass fiber reinforced concrete, may be used for new acroterion, or GFRC, glass fiber reinforced concrete, may be used as replacement for stone or terra-cotta acroterion. Attachment in GFRC or GFRP (architectural fiberglass) is through metal straps that attach to the roof.



Acroterion by Stromberg

Adam Style

A style which developed in the late 18th century, from the work of Robert Adam and his brothers. Adam was born in Scotland and educated at the University of Edinburgh. Robert Adam was the architect to the king, until 1768, when he was succeeded by his brother James. The Adam style strongly influenced the American colonies and is the basis of the Federal style. The Adam style is noted for its elegance and lightness, subtle detailing and unified schemes of interior design, including fan ornaments, festoons, wreaths, urns, ribbons, and classical elements. Both GFRC (glass fiber reinforced concrete) and GFRP (glass fiber reinforced plastic or architectural fiberglass) is uniquely suited to the replication of Adam style ornamentation. Adam style GFRC, columns, capitals, fireplace mantles, balustrade, ceilings, garden urns and planters, etc.



Adam Style Fireplace Mantel in GFRC

Aggregate

A granular, inert material, such as sand, crushed limestone, marble, etc. which is mixed with Portland cement, glass fibers, and polymers to create GFRC, glass fiber reinforced concrete. The type of aggregate used helps determine the color, texture and durability of the GFRC. In architectural fiberglass (GFRP) aggregate may be used for a stone like surface gel coat.



Close up of acid etched GFRC showing the grains of fine aggregate in the cement matrix.

American Institute of Architects (AIA)

An organization founded in 1857 for the purpose of promoting the professionalism and accountability of its members, and a devotion to design excellence. AIA, 1735 New York Avenue NW, Washington, DC 20006. American Institute of Architects <http://www.aia.org/>

American Society of Landscape Architects (ASLA)

Founded in 1899, is the professional organization of landscape architects in America. ASLA 4401 Connecticut Ave. NW, Washington, DC 20008

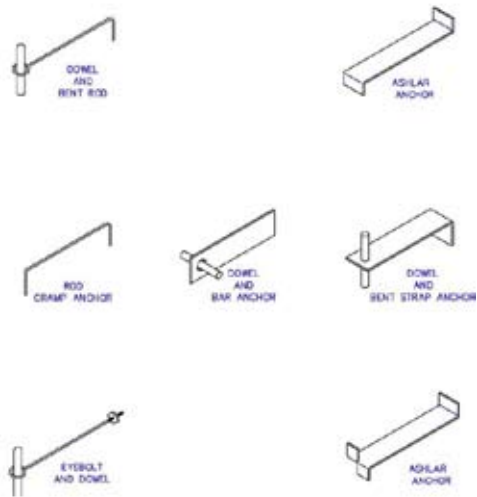
American Society for Testing Materials (ASTM)

Establishes test standards for materials and products in the United States, including those used in building construction. ASTM 1916 Race Street, Philadelphia PA 19103

Anchor

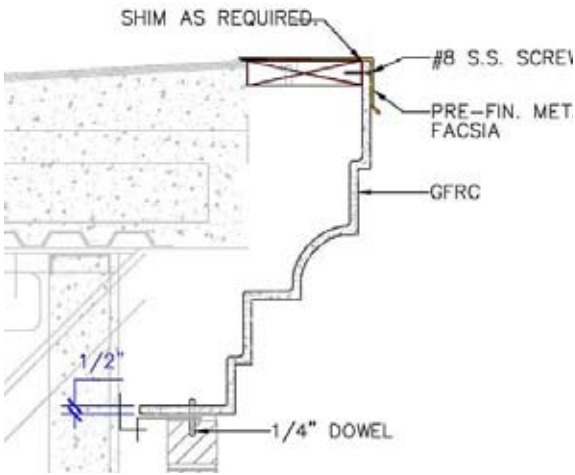
A fastener used to secure GFRC (glass fiber reinforced concrete) or GFRP (architectural fiberglass) to a structure. Anchor types for GFRC include dowels, weld plates, straps, dovetails, threaded inserts, screws and Z clips. When metal frames are used with GFRC, glass fiber reinforced concrete, flex anchors are bent metal rods, used to connect the GFRC face, to a metal frame. The flex anchors, which are typically stainless steel or galvanized steel, allow for variations in thermal expansion and contraction, between the GFRC and the steel frame. The anchor must carry gravity loads, wind loads, seismic loads, etc and transfer them from the GFRC (glass fiber reinforced concrete) to the structure.

GFRC anchors • Some types of GFRC and cast stone anchors are illustrated below:

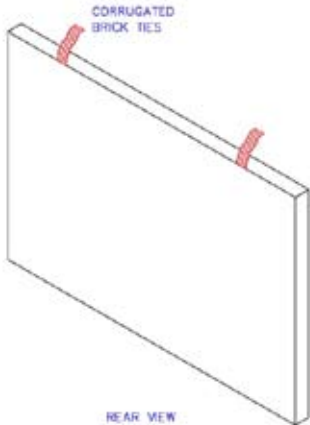


Stone type anchors for GFRC veneer

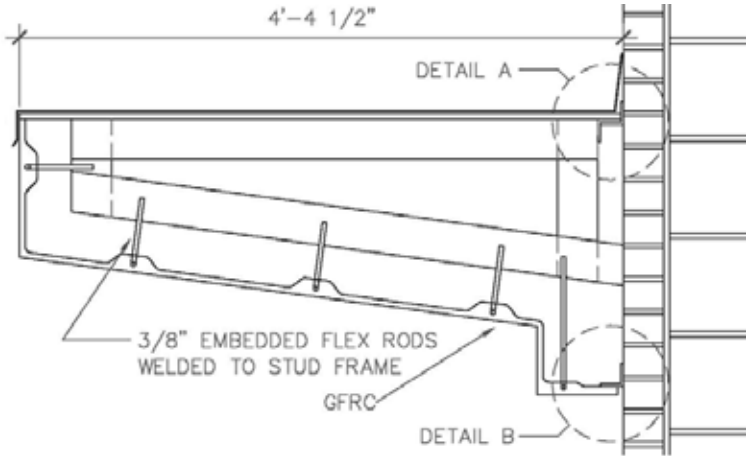
Anchors for GFRC can be designed to anchor the individual element or to attach the GFRC to a light gauge metal frame which is in turn anchored to the wall.



Screw anchor attachment of GFRC cornice



Cast in anchor straps for GFRC panels



Flex anchors on metal stud frame for GFRC panels and cornice

View of a GFRC cornice showing the use of galvanized metal stud framing and stainless steel flex anchors.



Anchors for architectural fiberglass are similar to GFRC anchors. Anchors for architectural fiberglass include cast in straps, screws, threaded inserts, light gauge metal frames and tube steel frames, stainless steel dowels, wedge anchors and bolts.

Ancon

From the Greek: "ancone" - elbow or hollow. A decorative or scroll bracket that supports a cornice or entablature over a mantle, door or window. Both architectural fiberglass (GFRP) and GFRC, glass fiber reinforced concrete, ancons, are lighter and easier to install than traditional carved stone or terracotta.



Ancon (a console or scroll shaped bracket)

Angle Capital

With Ionic capitals, a special angle capital is sometimes used for the column on the outside corners. The four volutes project equally on a diagonal toward the corner. With GFRC, glass fiber reinforced concrete, angle capitals are not always available in standard molds, and if desired must be special ordered.

Angular Pediment

Also known as a triangular pediment. The pediment having slanting sides and a horizontal cornice. In GFRC (glass fiber reinforced concrete) large angular pediments are cast in segments. Small angular pediments may be made as one-piece GFRC units.



*Angular Pediment in GFRC by Stromberg
Examples of Angular*



*Pediments at Caesars, Las Vegas
Angular Pediment in GFRC by Stromberg*



Antebellum

Antebellum architecture refers to structures that existed before the United States Civil War. GFRC (glass fiber reinforced concrete) and Architectural Fiberglass by Stromberg have been used in the restoration of several antebellum structures.



Example of Antebellum style of column and entablature, cast in GFRC for Antebellum architecture.



Antebellum style columns and trim for the University of Virginia.

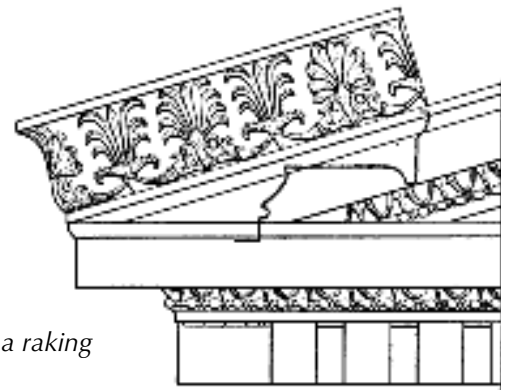
Antefix

A decorated upright ornament at the eaves or at the peak of a triangular gable.



Anthemion

A commonly used Greek decoration shaped like a palm leaf. They are used singly or as a running ornament. Also referred to as honeysuckle ornament. Found on moldings, cornices, pediments and bands. Also found on the necking of some Ionic capitals.



Anthemion design on a raking cornice.

Appliqué

An ornamented work applied to a structure. GFRC (glass fiber reinforced concrete) and Architectural Fiberglass (GFRP) appliques may be attached by dowels and epoxy or by specialty clip hangers.

Apsé

A nearly semicircular part of a building, the interior forming a large niche.



Apsé in GFRC

Aquarium

A tank or vessel for filled with water for keeping live fish or other water dwelling creatures.



Stromberg architectural fiberglass and GFRS aquarium backs at Atlantis

Arbor

An open structure of supports and beams, usually supporting vines or flowers. GFRC (glass fiber reinforced concrete) and GFRP (architectural fiberglass) arbors offer the advantage of being relatively light, weather resistant, and durable. The word arbor comes from the French herbere, which originally meant a place to grow herbs. An arbor defines a space and has an open-work roof for shade or capable of being used for supporting plants. Arbors are of three main varieties: The true arbor, the pergola (a colonnade with a flat roof) and the gallery (a tunnel like arbor with an arched roof).



Tuscan columned Arbor / Pergola



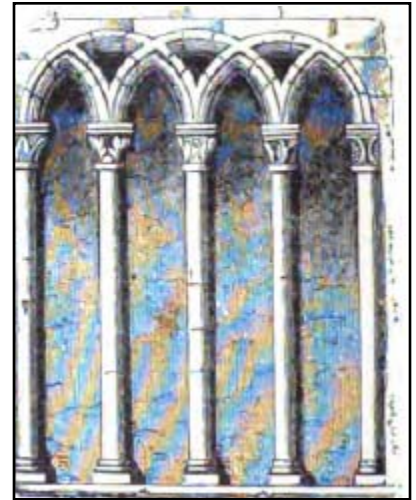
Arbor / Pergola at Atlantis Bahamas Custom columns. Beams are cast in wood timber texture in architectural fiberglass. This arbor / pergola has stood up to the tropical sun and 2 hurricanes.

Areostyle

Term in classical column architecture for having columns separated by a clear space of four or more column diameters. See Intercolumniation.

Arcade

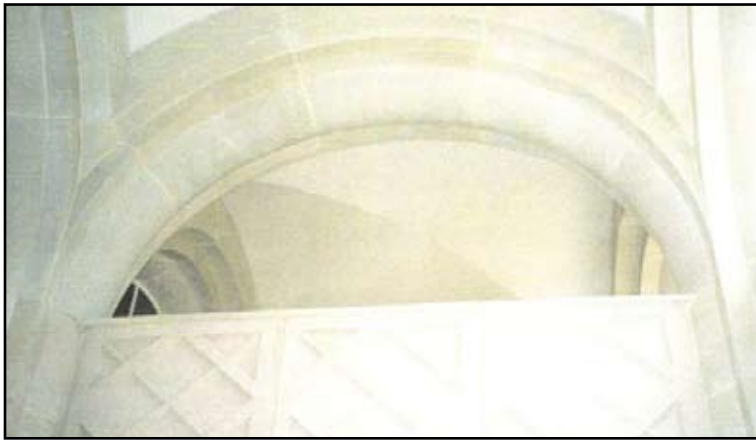
Two or more arches, usually a entire series of arches, with their columns, imposts, piers, pilasters or the like taken together and considered a single architectural feature.



Historic Example of Intersecting Arcade

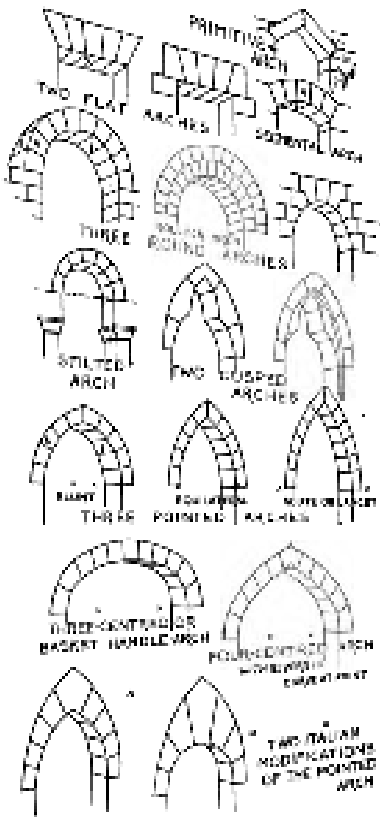
Arch

The shape that spans an opening, usually curved. If it is made wedge-shaped blocks, these blocks are called voussoirs. There are all types of arches, from those with little or no curve to pointed arches. GFRC (glass fiber reinforced concrete) and GFRP (architectural fiberglass) may be used in arch cladding, wrapping a structural member, to provide the appearance of the arch. Occasionally, the GFRC (glass fiber reinforced concrete) actually functions as an arch to support the GFRC above it.



Arch at the Mansion residences, Dallas.

Types of Arches



Cast arches by Stromberg in architectural fiberglass (GFRP)



Arch cast in Stromberg architectural fiberglass

Arched Dormer

A dormer with an arched roof. Often found in the Beaux Arts Style, French Style or Second Empire Style, etc. GFRC (glass fiber reinforced concrete) and GFRP (architectural fiberglass) dormers may be one-piece units, or the dormer face only.

Architectural Style

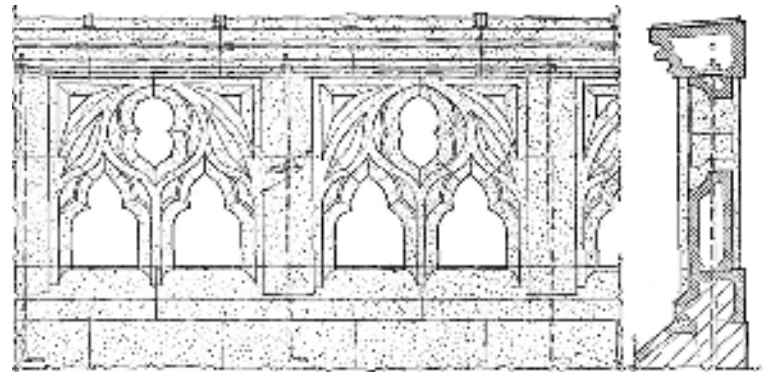
A way of classifying buildings that share common attributes. Architectural styles are often related to a particular period of time, country of origin or region.

Architectural Terra-cotta

A glazed burnt Clay architectural unit. Terra-cotta was used as a facing on buildings in America mostly from around 1860 until the 1930s. In historic restorations, because of difficulties in replacing terra-cotta, color matching and durability issues, GFRC (glass fiber and first concrete) is often used as the terra-cotta replacement. Stromberg produces a special glazed GFRC which closely resembles glazed terra-cotta. Custom color matching is available, and new GFRC can be created with molds taken from existing terra-cotta, or from historic drawings and photographs if the terra-cotta no longer exists. When properly preformed, GFRC or FRP replacements of terra-cotta should be virtually indistinguishable from the original material. GFRC (glass fiber reinforced concrete) offers great benefits in replacing glazed architectural terra-cotta.

Benefits of GFRC:

- Anchoring provisions are included in the GFRC casting.
- Color compatible.
- Non combustible material, GFRC will not burn.
- Light weight.
- Durable and long lasting
- Suitable for seismic zones.
- Fast production times.



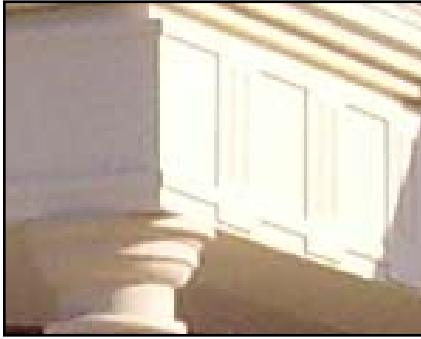
Top: Architectural terra-cotta railing replaced with GFRC.



Right: New Corinthian column capital as a terra-cotta replacement.

Architrave

An ornamental molding or band above or around a door or window opening. In the classical orders, the architrave was the lowest member of the entablature or beam that spans from column to column. GFRC (glass fiber reinforced concrete) and GFRP (architectural fiberglass) architraves are typically U shaped beam wraps.

*GFRC Architrave***Archivolt**

The inner most part of the arch.

Arch Stone

A wedge-shaped GFRC, Architectural Fiberglass, or masonry unit in an arch. Sometimes called a voussoir.

*Arch stone or voussoir in GFRC*

Carved voussoirs or arch stones. Cast by Stromberg in a custom color and texture architectural fiberglass.

Arris

The external angle intersection between two flat or curved faces, as between two flutes of a column, or the flat raised area between the columns concave flutes.

Arris on an architectural fiberglass (GFRP) Corinthian column

**Art Deco**

A decorative style characterized by angular, ribbon, zigzag or other geometric ornamentation in low relief on buildings facades. Became popular in American architecture in the 1930's. GFRC (glass fiber reinforced concrete) and GFRP (architectural fiberglass) Art Deco elements include moldings, columns, domes, fireplaces, windows surrounds, entryways, medallions, finials, ceilings and others. Art Deco is sometimes referred to as "Style Moderne".

*Column element in the art deco style (Hollywood Casino)**Art deco medallion / ceiling in architectural fiberglass by Stromberg.**Art Deco slab edge molding**Bas relief architectural fiberglass panels*

Art Nouveau

A style of architectural and applied art characterized by organic forms, curving designs and dynamic shapes. Similar in many ways to the foliage motifs used by the American architect Louis Sullivan. GFRC (glass fiber reinforced concrete) and GFRP (architectural fiberglass) Art Nouveau elements include statuary, moldings, medallions, fireplace surrounds and fireplace mantels, planters, bas relief, door and window surrounds, panels, domes and ceilings.

Ashlar

Is the term for rectilinear, squared-off blocks of stone used in building. GFRC (glass fiber reinforced concrete) and GFRP (architectural fiberglass) are produced in various ashlar types. The GFRC and Architectural Fiberglass ashlar may be individual blocks, but is often large panels with scored "false joints" and interlocking joints.



Ashlar panels, Stromberg GFRS (glass fiber reinforced stone) a type of architectural fiberglass, Atlantis, Bahamas.



Panels in ashlar pattern

Types of Ashlar include:

- Ashlar rock-faced: A block whose face has been roughly hacked.
- Ashlar masonry: Smooth rectangular stones laid in horizontal courses.
- Coursed ashlar: Ashlar masonry built of stones having the same height within each course, but each course varying in height from the others.
- Random ashlar: Ashlar masonry where the stones appear to be laid without a specific pattern, although the pattern may be repeated.

Astragal

A half round shape, with the fillet on one or both sides. An example is the neck molding at the top of a column shaft directly below the capital.



Astragal on a GFRC column capital

Astragal

**Atlantes**

A human figure, that acts as a pier, column or pilaster supporting an entablature. Found in Greek architecture. Female figures are Caryatid, male figures are Atlantes.

Atlas or Atlante in GFRC (glass fiber reinforced concrete) for use as a pier, column, fireplace mantel support or pilaster.

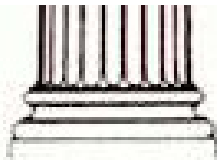
Atlas

The singular form of Atlantes.

Attic Base

A column base with two rings (An upper and lower torus). Attic bases are most often used with Corinthian columns, composite columns and Ionic columns.

Tuscan columns have a single ring at the column base and Doric columns (if they have a base) use a single ring or torus.

**Axed work**

A "stone type" surface which shows tool marks from a bush hammer, ax or pick. In GFRC (glass fiber reinforced concrete) axed work is produced by casting against a custom made mold. May be used on panels, quoins and other Architectural Fiberglass elements where a more rustic texture is desired.

Back hearth

Is the part of the hearth within the fireplace. For wood-burning fireplaces, GFRC (glass fiber reinforced concrete) fireplace hearths typically end with the front hearth, and the back hearth is made from firebrick.

Balconet

Is a false balcony, in front of a window. GFRC (glass fiber reinforced concrete) and GFRP (architectural fiberglass) Balconets may include support brackets and balustrade. Balconets are typically cast with either threaded rod or a Z clip type fastener and are bolted on or clipped to the structure.

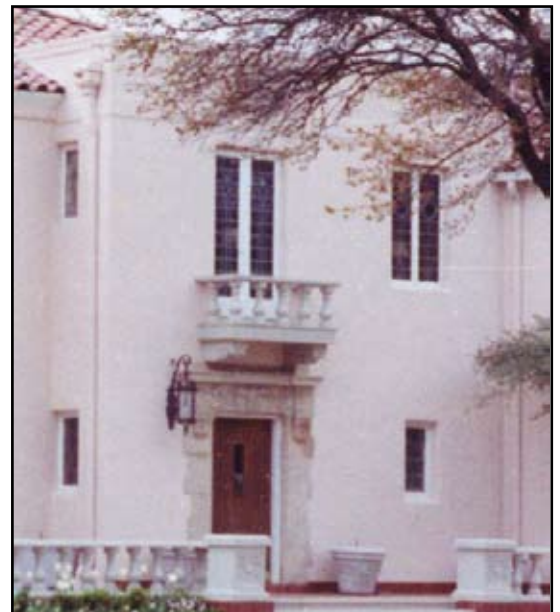


Door surround / entry with a false balcony or balconet.

Balcony

A platform projecting out from a building, enclosed with a railing or balustrade. GFRC (glass fiber reinforced concrete) and GFRP (architectural fiberglass) Balcony components include brackets, balustrade, face molding and soffit. Columns and pilasters may be incorporated into the balcony design. Because

it's lightweight, GFRC and Architectural Fiberglass can give the look and feel of stone, without it adding an excessive amount of weight to the balcony.



Balcony with GFRC balustrade, brackets or corbels, and balcony trim.



Balcony at Shalimar (private residence) California



Balcony with cast arch and balustrade



Corinthian columns and balustrade (style G29) cast in a white limestone color and texture. Balusters are hollow and are attached to the structure with threaded rods.

Balcony with curved front and balustrade balcony railings. Architectural fiberglass by Stromberg.



Balcony Railing

The railing around a balcony. In GFRC and Architectural Fiberglass, it may be a balustrade or a solid railing. It is important that the building codes be followed in any balcony railing installation. In most areas, these require a 42" height to the top of the railing and a railing that a 4" ball cannot pass through. With Architectural Fiberglass and GFRC balustrade, there are various ways of meeting these requirements. The balusters are typically attached to the structure with threaded rods. For drainage, baluster rails may be elevated above the balcony to allow water to flow under the balustrade, or scuppers can be incorporated into the base rail of the balustrade. Alternately, balusters may be used with no base rail and the water is allowed to drain off between the GFRC or Architectural Fiberglass balusters.



Balcony railing for a hotel and resort. This balustrade railing was delivered and installed in full sections. The ends have clips for attachment to the structure. This balustrade / railing meets all the code requirements for height, spacing and strength. Water drainage for the balustrade is accomplished with the raised bottom rail. Material is Stromberg architectural fiberglass.



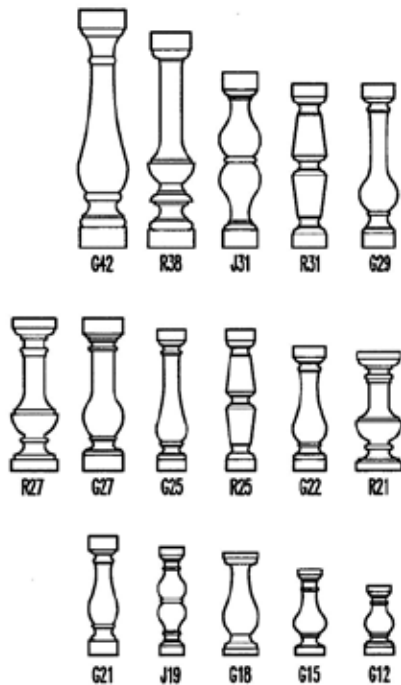
Balcony Railing in a Gothic tracery rather than a balustrade

Ball Flower

A round ornament found in Gothic architecture resembling a flower.

Baluster

One of the short, vertical support members of a balustrade. Balusters of GFRC (glass fiber reinforced concrete) and GFRP (architectural fiberglass) offer a relatively light, durable balustrade. In areas where the balustrade protects from a fall off, such as on the balcony, code requires minimum spacing of the balusters. The word **baluster** (sometimes called banister or bannister) is derived from the Italian balaustro which means "pomegranate flower" from its resemblance to the flower's vase like shape. (The French balustre, in Italian balaustro, Latin balaustum, and Greek balaustion.) The baluster dates back to ancient Assyria where it was used in windows. Balusters and balustrade was used in several renaissance palaces and balconies in Venice and Verona. Architect Giuliano da Sangallo used the baluster on the terrace at the villa at Poggio a Caiano around 1480. Donato Bramante used balustrade on his famous building the Tempietto in 1502, which set the style of high renaissance architecture. Famed sculptor, painter and architect Michelangelo is reported to have



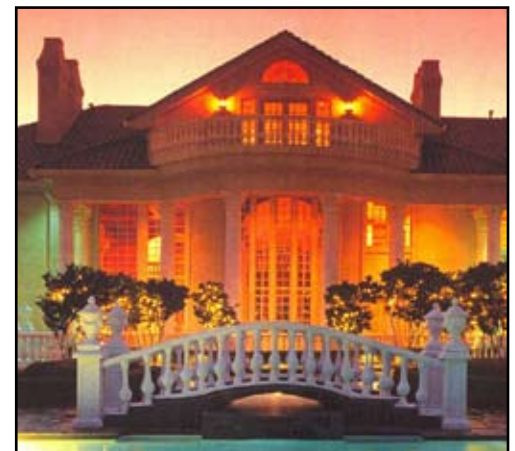
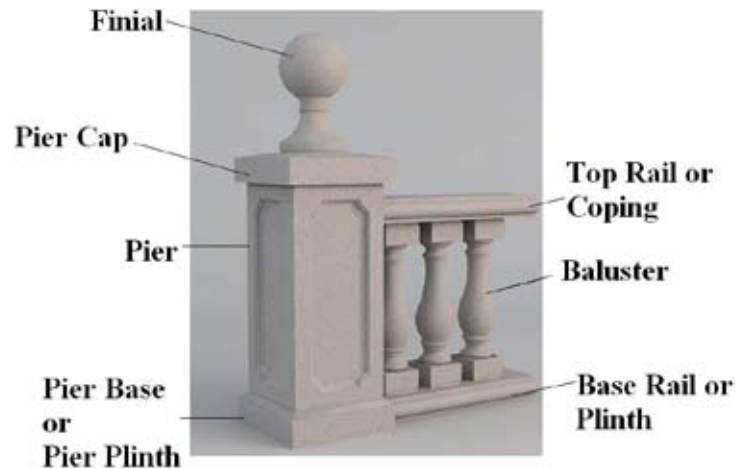
designed the first simple vase shaped baluster and used balustrade on several of his works. Balusters and balustrade can be found in almost all architectural styles.



Balustrade with rough travertine texture • Cast in architectural fiberglass

Balustrade

The complete railing system consisting of the Baluster, top rail and sometimes bottom rail. Balustrade is typically used at the edge of a patio, porch, balcony or roof. Several styles of balustrade are available in GFRC (glass fiber reinforced concrete) as well as GFRP (architectural fiberglass).



Balustrade at private residence