Gypsum Board . . . Design Versatility

Flat Planes, Squares and Angles are Giving Way to Curves and Arches

In case you haven't noticed, the building industry is in the midst of an accelerating design revolution. Many flat planes, squares and angles are giving way to curves, arches and contoured surfaces.

At the heart of this revolution is CAD . . . Computer Aided Design. CAD allows the design professional to preview, explore and modify ideas with relative ease . . . even in three dimensions.

From display screen to blueprint is now almost a matter of pushing a few keys instead of laboring over a drawing board for many hours. This high technology "freedom of expression" presents new challenges for the wall and ceiling trades . . . those who must bring into reality the visions in the designer's mind . . . and on the computer screen.

These design innovations are not change just for the sake of change. There *are* sound engineering principles and good practical reasons for rounding corners and creating contours—especially for buildings subject to high wind velocities. Rounding reduces negative wind loading. This was vividly demonstrated by analysis of the damage caused by hurricane "Alicia" that struck downtown Houston, Texas on August 18, 1983. Contours stiffen a wall and improve lateral deflection and compression resistance.

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Drywall traditionally has been perceived as essentially a rigid material suitable for application to flat surfaces. Occasionally, it has been used for the soft curvature of a circular stairway, an arch or bowed wall, but usually in applications with not less than a ten foot radius.[1]*

Gypsum board is actually a moderately flexible product. It can absorb the shock-wave of a high-speed elevator or respond to the sway of a high-rise building that can move as much as one inch per one hundred feet of height.

But today, the wall and ceiling trades are being asked to apply gypsum board to curves as tight as a thirty-six inch circular column while maintaining structural integrity and meeting a fire resistance rating. *Is it possible??*

In considering solutions to problems presented by applying gypsum board to curved surfaces, one should keep in mind the physical attributes and the physical limitations of the product.

To begin with, gypsum board consists of a specially formulated and reinforced core of primarily gypsum rock surfaced with highly calendared papers. The paper stock is generally made of from five to seven individual plies of recycled news or virgin kraft "Furnish" of celulosic fibers. Over 65 percent of the product's flexural strength is derived from its paper surface.

Gypsum board has "grain" much like a piece of solid wood. It is approximately two and a half times stronger in the longitudinal (or machine) direction than in the cross direction. This is due to the tensile strength of the paper which is dependent on the orientation of the fiber and various binders. (See Figure A)

As manufactured, the overall strength and working characteristics of gypsum board may also be affected by humidity factors. The celulose fiber of the paper surface absorbs moisture and slightly expands or relaxes. This inherent property can be used to advantage in making the panel even more flexible.

There are basically three methods of

*Refer to References

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bending gypsum board. The choice of method is directly related to the severity of the desired curve to be achieved:

1. *Dry flexure* — gypsum board will, under normal ambient conditions, conform to a moderate curvature. This would usually be no more than a ten foot radius for ½-inch thicknesses applied perpendicular (at right angles) to the framing. Framing would be spaced at least twice as close as normally detailed. Fastener spacing would be reduced by one-third.

Dry flexure capability is a correlation of core thickness—the thinner the core, the more flexible and tighter the possible curvature. For instance, when two thicknesses of one quarter inch panels are used in lieu of one layer of one half inch, the radius may be reduced to five feet. However, when a fire rating is necessary and the test details require Type X core or parallel board direction, then this method may not work.

2. *Wet flexure* — by moistening both surfaces of the paper, gypsum board may be bent to an even shorter radius. Success may require some experimentation and patience. First, use as long a piece of board as practical. Support the panel ends on saw-horses face up or face down depending on whether the curved surface is to be convex or concave. Apply water evenly over the entire face and back with a spray applicator and allow the board to stand for at least one hour. Standing the panel along a wall at a 45 degree angle also works. A temporary stop fastened to the floor will keep the panel from slipping (See Figure B).

Allow the wetted board to remain in suspension until it develops about two-thirds of the desired curve. The remainder of the curve can usually be accomplished with gentle pressure, although additional applications of water may be necessary. End supports and temporary bracing may also be required under some circumstances. These supports should be left in place until the formed surface has been allowed to dry thoroughly.

Care must be taken not to over-soak

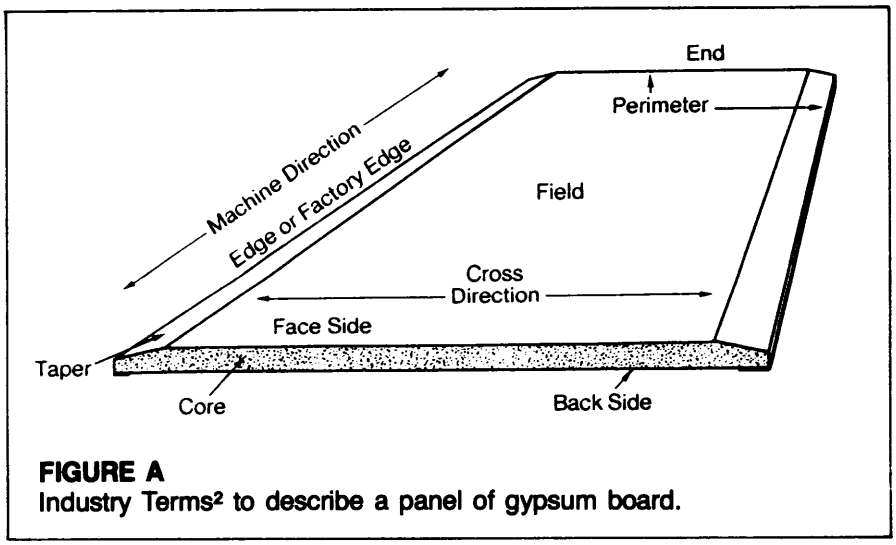


FIGURE A
Industry Terms[2] to describe a panel of gypsum board.

Dropped in circular design for architectural interest.

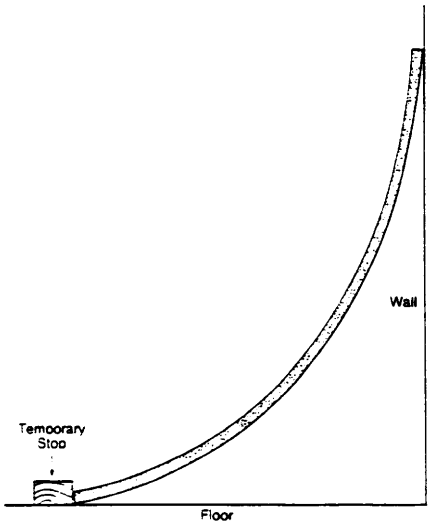


FIGURE B
Prebowing gypsum board using spray applied moisture.

Office Building in Irving, Texas.

Bonadventure Hotel
Los Angeles, California

and peeling or ply separation may occur.

Mold and mildew are also a possibility if the wetted panels are not allowed to dry before the surface is sealed with the final wall finish. Application of two tablespoons of TSP (Tri-sodium phosphate) per gallon of spray solutions may be advisable in warm weather to inhibit mold growth.

3. *Multiple scoring technique* — one of the best methods for achieving a very. tight radius is progressive scoring on one side of the board at one inch or more intervals. Convex curves can then be filled with several coats of joint compound and finished to a proper aesthetic degree. This method is adaptable to either perpendicular or parallel applications (See Figures C & D).

It is important to adjust the framing spacing, perhaps as close as a few inches (on center) if necessary. The stud face may even need to be canted to accommodate very short radii. Be certain to address horizontal blocking at least every 48 inches o.c.

With metal framing, consider forming a solid backing with sheet metal for corners of twelve inch radius or less. Using a round metal duct section that can be spread or closed, may save time and money in the long run.

As CAD continues to expand the building industry design revolution, the wall and ceiling trades in turn must rise

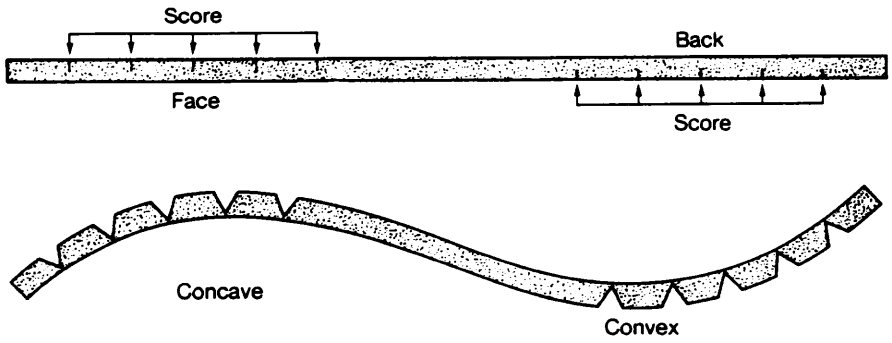
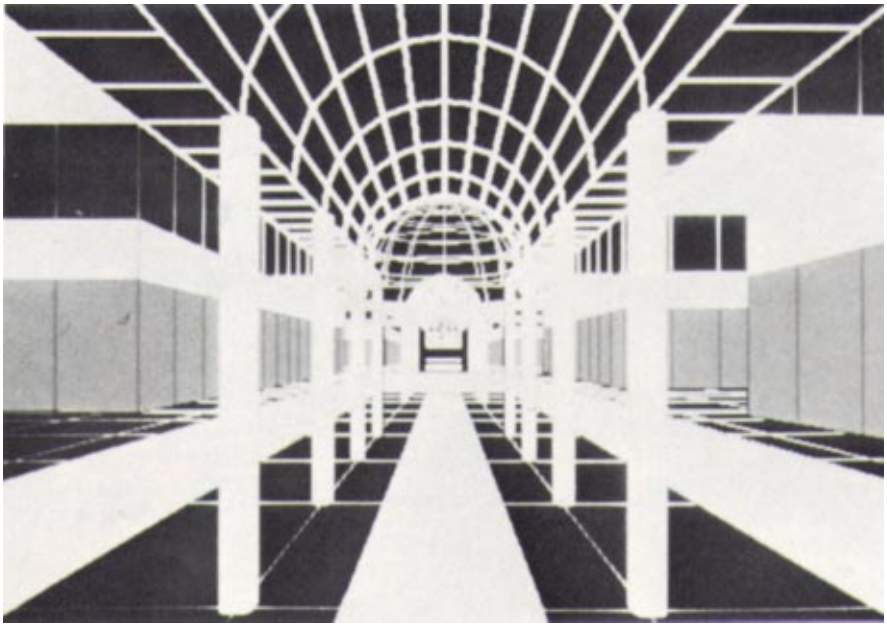


FIGURE C
Multiple scoring technique—fill convex score crevices with joint compound in several coats.

Temple-Eastex Inc., Diboll, Texas

Retail Shopping Center
Houston, Texas



Computer Aided Design (CAD) displayed on monitor screen.

to meet these challenges. That gypsum board continues to be designed into new and unique applications comes to no one's surprise. After all, there are few building materials as versatile or as aptly suited for their intended use. Gypsum boards are fire resistant, nontoxic, durable and dimensionally stable and resistant to sound transmission and impact. Features that provide important economic advantages to the construction industry.

The Gypsum Association has recently published a "Special Recommendation Sheet" on the application of gypsum board to curved and contoured surfaces[3] it should be part of your reference material. Copies are available from the Gypsum Association or from any of its member companies.

REFERENCES:

1. "Recommended Specifications for the Application and Finishing of Gypsum Board"—GA-216-86
2. "Gypsum Board Products Glossary of Terminology"—GA-505-85
3. "Application of Gypsum Board to Curved and Contoured Surfaces"—GA-226-87

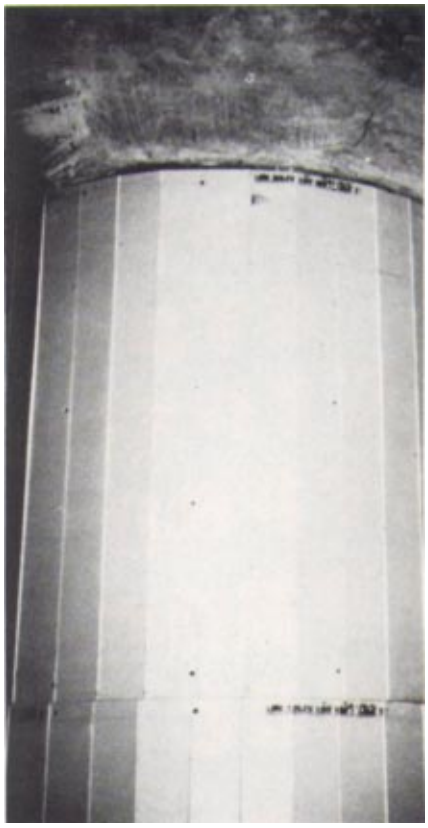


FIGURE D Field application of multiple scoring technique.