

# Technical Brief

## Design for shear transfer in composite action and installation

C-GRID™ carbon fiber grids are used to transfer shear between concrete elements, like wythes, in CarbonCast™ Enclosure System elements (insulated wall panel or architectural cladding products). The current AltusGroup CarbonCast Design Engineering Standard in place (2007; Section 6.0-6.3) shall apply to all CarbonCast Enclosure elements.

The carbon grid must be placed in a plane perpendicular to the concrete wythe(s) and parallel to the span under consideration. The carbon grid must be placed in a manner such that the grid elements are oriented at a 45° angle relative to the plane of the concrete wythe and partially embedded into the concrete wythe or rib. An embedded depth of the shear grid of approximately ½ in. has been found to be adequate (Ref. AltusGroup Report 4.8). It is recommended that the target embedment be 0.75 in. with a minimum embedment of 0.5 in.

In thin panels, excessive embedment may be more detrimental than too little embedment because it can cause a plane of weakness in the panel and cause splitting of the concrete leading to complete loss of shear transfer. This problem can be minimized by limiting the embedment to 0.75 in. and by limiting the length of the plane of weakness by using only the required lengths of shear grid. Data suggests that the effect of strain in the shear grid due to flexure may be detrimental. The unsupported depth of shear grid can be reduced by beveling the foam on a 45° angle to create a V-shaped concrete projection on the concrete wythe surrounding the shear grid.

Shear grid must be a nearly symmetric C-GRID design with the same element fiber area and spacing in both the warp and weft directions. C-GRID C50-1.8x1.6 shear grid trusses supplied by Chomarad to AltusGroup, Inc. members in accord with their specific license and independent purchase and supply agreement is required for all CarbonCast Enclosure use. Width of grid truss to be used shall be determined by the manufacture in accordance with foam thickness needed to satisfy ASHRAE 90.1 and Insulation R-Value specification requirements for the panel plus the additional .75" embedment in each wythe.

There are many design and panel configurations possible to achieve a successful CarbonCast enclosure. Design must be in accordance with local code requirements and producer fabrication techniques can vary. Therefore, specific placement and location of carbon grid truss shall be determined by the AltusGroup producer. C-GRID shear grid placement is shown on individual shop drawings designed and drafted by the producer.

Grid installation in the casting process may be done by manual insertion or by pre-affixing the grid to the foam (using spray pressure sensitive adhesive or stapling) in advance of foam billet installation into the wet concrete during fabrication. Sufficient pressure should be applied to the foam billets in the precast mold to ensure the foam is wet with adequate bond and proper grid embedment is achieved. Use of measures, depth and feeler gauges as quality control tools are common precast practice.