The use of insulated precast wall panels can serve as both exterior and interior finished surfaces and can speed construction schedule significantly. However, when considering using insulated precast concrete (sandwich) wall panels on a project, bear in mind the effects of bowing and the design of the wall section where the panels will be used. Bowing in insulated precast concrete wall panels is caused by both environmental and structural factors such as:

- **Temperature** – Differences in temperature between the outside face and inside face of an insulated wall panel can cause the panel to bow noticeably on a daily cycle. Referred to as thermal bowing, this occurs because the warm side expands and the cool side contracts. The panel then bows to relieve the stress caused by this condition, which usually occurs on southern and western building exposures.
- **Humidity** – Low humidity causes concrete to shrink faster. A consistent difference in humidity between the inner and outer face of the panel can induce bow in a panel. Air-conditioned buildings have lower humidity inside. This condition causes the inner wythe to dry out faster and shrink faster than the outer wythe, causing an outward bow.
- **Composite action between wythes** – Panels with stiff shear connections between the wythes act compositely; i.e., the panel acts as a unit in resisting bending forces. This composite behavior produces differential strain between the wythes, resulting in bowing.
- **Creep** – If a concrete panel is stored in a horizontal position and not supported properly before it is installed, it will deflect. Over time, the deflection will increase, and some of it will become permanent.
- **Differences in concrete modulus of elasticity between wythes** – Using different concrete mixes in the two wythes can cause differential shrinkage and the resultant bowing if the two mixes have different values for their modulus of elasticity.

**Predicting the Unpredictable**

While calculations exist that can predict the approximate amount of bowing, unfortunately the magnitude of bowing cannot be predicted accurately to date: Too many variables exist and no precise models have been developed yet. Bowing problems can, however, be minimized through good design. To minimize bowing problems, the following actions are recommended:

- **Allow for bowing in the building design.** Interior building elements should not be connected to the wall panels. For example, a suspended ceiling grid wall angle connected to the wall panel will move with the wall. If the movement is great enough, the ceiling tile could fall.
- **Consider the building conditions along the length of the wall.** If the wall panel spans from the floor to the roof with no intermediate floors or mezzanines, bowing may not even be noticeable. If, however, there is an intermediate floor or mezzanine and bow is not taken into account, then a gap may develop at the floor/wall intersection. A gap can also develop between walls where a wall (on the floor or mezzanine) abuts the precast panel wall.
- **Use corner connections to avoid “fish-mouthing.”** Building corners can be a highly visible area for panel bow occurring in two separate planes. This separation may result in sealant failure. A continuous corner connection to keep this joint from moving should be used.

As mentioned at the outset, insulated pre-cast panels can speed construction schedules by serving as both exterior and interior finished surfaces. Therefore, once the panel is erected, the exterior and interior finished surfaces are complete and ready for use. Of further benefit is that insulated pre-cast panels do not require a mid-point support structure between the foundation and roof steel. Benefits such as these can outweigh potential issues posed by insulated pre-cast panels as long as proper installation guidelines and cautions are undertaken to minimize or even eliminate problem situations.