Building Cladding

The Role of the Specialty Structural Engineer

By Steven Judd S.E.

The Structural Engineer of Record (SEOR or EOR) is responsible for the design of the primary structure and possibly, to some extent, to define or prescribe the elements of the exterior enclosure (cladding) system for the structure. The enclosure system may be cold-formed light gauge framing elements, architectural precast concrete, some sort of panelized (either site built or prefabricated) wall system, other systems, or combinations thereof. The Specialty Structural Engineer (SSE) is generally responsible for the final design and installation drawings of the aforementioned exterior enclosure system(s). The SSE is most often retained by one of the sub-contractors supplying the enclosure system.

It is not uncommon for the exterior cladding design of a typical commercial or institutional structure to be the overlooked piece of the primary structural design, and for the SEOR to only make a few assumptions about the impact of the cladding itself: uniform weight of the skin and assumed load paths of the exterior skin of a building. Detailing might consist of a note here and there about 16 gauge studs spaced at 16 inches on-center, with a slip joint located somewhere near the floor line or window head elevation to represent the preferred design in the bid documents – with the details to be flushed out in the deferred submittal process by the SSE, if specified.

For the design of the primary lateral force resisting elements of the structure, it may be adequate for the SEOR to assume a uniform averaged weight for the cladding and exterior wall system, and assume it is applied in a linear fashion along (or on top of) the edge of the slab. However, the reality is that there are foreseeable instances where a uniform load is not the correct assumption for slab edge or spandrel beam designs, particularly when multiple glazing systems are utilized, such as curtainwall in some areas and punched or ribbon windows in others, interspersed with solid walls.

It is also not uncommon for the SEOR to place somewhat unrealistic prescriptive requirements on the cladding design, such as: "Structural elements at the perimeter of the building have been designed for vertical loads only. Cladding attachments shall not apply moments to the slab edge or lateral loads to steel beams, or introduce torsional loads into steel beams or columns." (Paraphrased from a recent project's structural general notes.). Furthermore, the structural General Notes may state, "Braces, added reinforcing, and ties shall be designed and supplied by the contractor [meaning the cladding sub-contractor] for load eccentricities and lateral loads."

For by-pass cold-formed light gauge steel stud framing – exterior wall framing "passes by" the edge of the slab (for continuity of the framing) – the standard stud clip used to attach the stud to the slab edge creates eccentricities and induces torsions to the slab edge. This is a *foreseeable* condition for the SEOR. The SEOR should address these common conditions, not push that responsibility to design slab reinforcing to the SSE. Parapet framing and spandrel framing for ribbon windows frequently require kickers from the exterior wall stud framing to either the slab or the spandrel beam bottom flange (or spandrel beam web) to stabilize the wall framing that lacks vertical continuity. This is another condition where the lateral loads and moments induced on the primary structure are *foreseeable* and should be the responsibility of the SEOR to resolve (design and detail).

For phased or fast-track projects, by the time the cladding is bid, awarded, designed, and detailed, the structural framing might well be underway and perhaps past the point where added reinforcing in the slab, if necessary, is even achievable. Added reinforcing in a slab is generally not the purview of the cladding subcontractor, nor are copious amounts of structural bracing elements. The most efficient cost model and most efficient construction schedule would have the concrete subcontractor include all concrete reinforcing in their scope (as defined in the bid documents), and for the structural steel contractor to include all hot rolled bracing elements (for spandrel beams and/or columns, as defined in the bid documents) in their scope.

So how does one resolve this dichotomy of design responsibility?

Possibly the best example would be to include the responsibility of the cladding design as an additional scope (with appropriate additional fee) for the SEOR, or to engage an SSE during the design phase to work out at least one viable solution to the cladding design so that what goes out to bid is a full package of information, including all concrete reinforcing required to resolve loads and eccentricities, added bracing to resolve induced torsions, and more. At the very least, it would be prudent to carry a reasonable allowance for concrete reinforcing and structural bracing elements for a specific cladding solution which can then be applied toward the final solution, as represented in a deferred submittal process.

If the cladding design is provided via a deferred submittal process, and that process generates a different solution with regard to added reinforcing and/or bracing requirements, at least the base bid documents can be used as a design guide or as a definitive source for material and labor allowances, or credits for an alternate solution.

As structural engineers, it would be prudent to take opportunities, as they arise, to enlighten owners and clients to the advantages of providing a more developed cladding design for bid documents which does not bifurcate portions of other sub-contractors' scope of work by having the cladding subcontractor add concrete reinforcing and/or miscellaneous hot rolled steel bracing. The optimum way to do this is to engage the SEOR to provide the added scope of a more fully developed cladding design or to engage an SSE to provide the necessary cladding design services for the bid documents. At some point, one way or the other, the owner will be paying for the cladding design and associated connections design impact, whether it is provided by the SEOR on the front end or the SSE on the back end. The advantage of front-end design is that there is cost and schedule savings when all elements are identified and bid as part of a larger volume of work and materials.▪

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