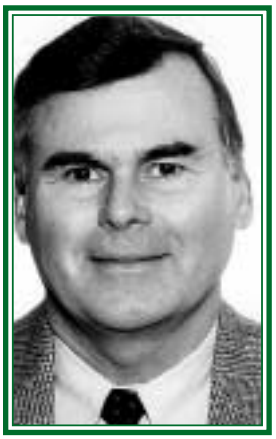
Why The Engineer Of Record Needs To Listen To The Fabricator



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Why should the Engineer of Record (EOR) listen to the fabricator/erector? The EOR should listen to the F/E because they often have ideas and suggestions for an efficient structural system, material availability and lead times, and for efficient connections relative to the project.

The fabricator/erector (F/E) wants to provide a successful project to the owner and at the same time the F/E wants to maximum their profits. By following the recommendations of the F/E design costs can often be reduced thus increasing the EOR's profitability on the project as well as those of the F/E.

The EOR's costs just like the F/E costs are dependent on the time spent on the project. By developing a structural system in which the F/E is "in sync" can save significant coordination time after the release of construction documents. Cost savings can be achieved by the EOR in the review of shop drawings, and in answering questions from the fabricator and erector. In addition field errors can be reduced.

Communicating Project Information

A number of years ago AISC produced a lecture series on the communication of project information.

In this lecture series the advantages of team planning were compared with the traditional project management approachs of: design, bid, build, and the fast track approach. Team planning has the goal of a shorter period for construction since those involved in the actual construction process are consulted before the design phase, e.g. why the engineer of record should listen to the fabricator/erector. The team planning approach emphasizes that only communication of real construction practice to the designer will potentially eliminate errors, misunderstandings, and job delays. The team planning approach involves input from the fabricator/erector both at conceptual planning and design stages. This results in more time to prepare for critical elements and tends to minimize any surprises that might later delay the project.

During the conceptual planning phase, a variety of items can be thought out and valuable information can be provided by the fabricator/erector to the EOR.

These include:

- material availability and prices
- layout optimization
- minimizing complexity options
- construction sequencing
- construction packaging
- stability and erection safety

Likewise, during the design phase a variety of items can be discussed and reviewed by the F/E.

These include:

- initial mill order
- start up of shop drawings
- standard details
- repetition of members
- connection economy
- stiffener/doubler plate options

If the engineer of record listens to these points the majority of projects will be successful in the eyes of the fabricator erector, the EOR, and the owner.

Items Of Which The Engineer Should Be Aware

1. Use standard AISC connections. This would include the use of single plate shear connections and single angle connections.
2. Use field bolted moment connections and shop welded moment connections.
3. Minimization of the amount of loose material for field installation.
4. Keep the design simple readily understandable plans for the fabricator and the erector.
5. Release mill orders and detailing only when complete. And if not complete inform the architect, contractor and fabricator of the areas which are not yet complete.
6. Repeat member sizes whenever possible (least weight is not least cost).
7. Show all reactions on the drawings. Both shear and moment.
8. Use maximum practical column lengths (2-story with splices 4 ft. above the floor).
9. Standardize the use of A992 steel for mill orders.

Other items which the EOR should ask for input from the F/E should include:

- constructability
- fit-up
- mill tolerances
- curving and bending
- galvanizing
- painting
- hole sizes

For example, our firm has successfully designed and value engineered several clear span truss systems primarily based on the following "hints" from fabricators/erectors.

1. Shipping depth limitations should be considered so that shop fabrication can be maximized. The maximum depth for shipping is conservatively about 14'. Greater depths will require the web members to be field bolted which will increase erection costs.
2. Since maximum available mill length is approximately 70', the distance between field splice points is normally set at 70'. Greater distances between splice points will generally require truss chords to be shop spliced.
3. The lateral bracing requirements for truss top and bottom chords should be considered interactively while selecting chord sizes and types (least weight is not least cost).
4. If possible, select truss depths so that tees can be used for the chords rather than wide flange shapes. Tees can reduce the need for gusset plates.
5. High strength steels (F_y = 50 ksi or greater) usually provide more efficient truss members.
6. Utilize only a few web angle sizes.
7. HSS, wide flange or pipe sections may prove to be more effective web members at some web locations especially where subsystems are to be supported by web members.
8. Designs using the AISC LRFD Specification will often lead to truss savings when heavy long span trusses are required. This is due to the high DL to LL ratios for such trusses.
9. The weight of gusset plates, shim plates and bolts can be significant in large trusses. This weight must be considered in the design since it often approaches 10 to 15 percent of the truss weight.

The success of any project depends upon communication. Why should the EOR listen to the fabricator/erector? Because the fabricator/erector has practical knowledge which is not taught in college which he gains on his day to day experiences of putting together many many projects.

This paper is part of the 1999 North American Steel Construction Conference session: "How The EOR Can Benefit From Listening To The Expertise Of The Fabricator/Erector."