Fall Protection in Residential Construction

Philip L. Colleran, CSP

The only substantive challenge to fall protection in the residential construction industry deals with leading edge work for carpenters. Conventional fall protection in the form of standard guardrails, covers, personal fall arrest equipment, and a wide variety of scaffolds are available to other trades that follow framing operations and can be used in the same manner as the rest of the construction industry. With respect to the kinds of "leading edge work" performed by carpenters, some in the homebuilding industry argue that:

- Carpenters require mobility on partially completed structures and positive fall protection is infeasible;
- No reliable anchorages for personal fall arrest equipment are available until a roof is sufficiently sheathed;
- Other methods of constructing houses are either infeasible or create a greater hazard, and;
- The use a fall protection plan is the only practical alternative.

This thinking is predicated on the following misconceptions:

- Feasibility is synonymous with economic practicability. If it costs money to abide by a rule or substantive standard, an employer shouldn't have to comply with it. This thinking flies in the face of the many direct and indirect costs associated with injuries, not the least of which are higher workers' compensation and general liability insurance premiums. These costs ultimately add to the price consumers pay for homes.
- OSHA, when it provided Appendix E to Subpart M, was effectively saying to homebuilders that fall protection is infeasible or creates a greater hazard for carpenters performing certain framing operations and, because the Agency provided a sample fall protection plan, homebuilders don't have to address fall protection like the rest of the construction industry. The issuance of an enforcement policy interpreting the use of Fall Protection Plans and Appendix E on July 12, 1995[1], reinforced that thinking and stymied a process that the homebuilders, given a little time, could have worked through just like the rest of the construction industry.

[1] Memo from James Stanley to Reg'l. Administrators, Re: Fall Protection Plans – Enforcement Policy, July 12, 1995.

- A "greater hazard" is posed by the use of fall arrest equipment attached to an incomplete structure and therefore it is not incumbent on homebuilders to explore different construction techniques or the use of alternative temporary supports, such as scaffolds, ladders, lifts, etc[2].

  The note which follows Title 29 CFR, Part 1926.501(b)(2)(i) (*Leading edge work*), and (b)(12) (*Residential construction*), appears to place the burden of determining infeasibility on the employer:

  > *"There is a presumption that it is feasible and will not create a greater hazard to implement at least one of the above-listed fall protection systems. Accordingly, the employer has the burden of establishing that it is appropriate to implement a fall protection plan…"*

  Recommended alternative construction techniques and temporary supports that would enable homebuilders to build safely and just as productively are detailed below.

- The kinds of anchorages necessary for the safe use of personal fall arrest equipment require 5000 pounds. In past rule-making, homebuilders exhibited the assertions of trade organizations such as the Truss Plate Institute and the Wood Truss Council of America who understandably state, out of concern for liability, that their products are incapable of serving as anchorages for fall arrest. Individual, unsupported wooden trusses are, in fact, insufficient as anchorages. But contiguous, braced and partially sheathed groups of trusses are an entirely different matter[3].

  If the advancements in fall protection technology that have taken place in the past five years have taught us anything, it is that:

  1. Myriad fall protection appliances have come on the market that effectively reduce fall distances to as little as a foot, thereby reducing the need for anchorages which must sustain arresting forces of 5000 pounds. For

[2] Though unpopular when it was first published, even the Proposed Rule for Subpart M, issued in 1986, got many in construction industry thinking about and, ultimately prepared for the "6 foot rule". It pushed certain specialty groups in construction, such as concrete falsework contractors, to literally reinvent the way they performed their operations. The same could be said for structural steel erectors, many of which resisted the notion that fall protection for connecters and deckers was achievable. Steel erectors argued that "tying off" created a greater hazard. Now they are regularly seen connecting and decking from lifts. Both the concrete industry and many steel erectors are now realizing considerable dividends in productivity and lower workers' compensation premiums because of those changes.

[3] See installation information from Safetystrap™ attached.

example, a simple Guardian™Brand[4], stamped metal anchorage, to which a retractable lanyard is attached, affords anyone working on a single course of roof sheathing a very limited fall distance and vastly diminishes the kinds of arresting forces that might be imposed by a standard attachment (allowing for a six foot fall) to an otherwise unsupported/unbraced truss.

2. No manufacturers of any products, other than makers of fall protection appliances, are going to "endorse" or "warrant" their product for use in fall protection, least of all truss fabricators whose products are, as individual units, quite flimsy in their make-up. Scaffold manufacturers don't want workers tying off to scaffolds even though drop tests reveal certain scaffold members (such as bearers on fabricated frame scaffolding) to be well within an acceptable design limit for use with positioning equipment. Similarly, wire rope manufacturers are probably not going to endorse or warrant their products for fall protection. This should not limit a qualified person from demonstrating some ingenuity and, with the use of accepted engineering principles, developing practical and specialized fall protection components;

3. As an industry, we've made a big mistake in the widespread distribution of six foot lanyards to workers – lanyards that will only serve to increase fall distances, swing falls, and foster a false sense of security - especially when the many variables of a fall arresting episode are taken into account. Fall protection experts now agree that most construction operations don't require that a person get into a fall "arrest" in the first place. Simply put, shorter lanyards mean fewer variables to a fall and far less capacity needed for anchorages. Carpenters performing certain leading edge work can, in fact, tie off to certain building components at certain points in a building's uncompleted state. Those instances are detailed below.

4. OSHA must revise the term personal fall arrest to get the construction industry thinking about personal fall *protection* and the idea of limiting the potential for a worker to ever get into the kind of a fall that requires "arrest" in the first place. There are really three types of personal fall protection: fall arrest, fall restraint and positioning[5].

[4] See diagram of truss bracket/anchorage attached.

[5] Fall arrest involves a free fall that creates arresting forces which dictate that anchorages be capable of supporting 5000 pounds (with a safety factor of 2x). Fall restraint, by virtue of the manner in which a worker is secured, does not allow for a worker to get into a fall-arresting episode. Arguably, while all of the equipment that a worker would use in fall restraint should be rated for fall arrest, given that the equipment will likely be used for different types of fall protection, the anchorage is another thing. When the third type of fall protection, "positioning", is considered, many types of anchorages that aren't considered capable of supporting five thousand pounds (e.g. reinforcing steel, etc.) are used every day. According to the existing standard, positioning allows for a free fall of no more than two (2) feet.

Recommendations: Framing operations where fall protection is warranted

1. Installation of treated sill plates on concrete/masonry foundation walls:

    - On 4' high walls, no fall protection warranted.
    - On 8'-9' walls, use scaffolding, ladders or, if the exterior wall is back-filled, the ground around the structure.

    Note: Walking and/or working on the top of an 8'-9' foundation wall should not be permitted as the surface is irregular, and only a foot or less in width.

2. Installation of 1st floor joists, banding/rim joists, and bridging of joists bearing on the concrete/masonry foundation wall and over interior ledgers (steel, etc.):

    Note: The most common hazard associated with this work is walking on the tops of joists or foundation walls.

    - On 4' high foundation (with crawl) from base of sloped excavation – no fall protection warranted.
    - On 8'-9' high foundation wall – gross placement of joists over outer walls and interior ledgers (steel, etc.) from inside ground (basement) level structure. No diagonal braces are installed at this level as opposed to the upper floors. A much clearer space therefore exists for set-up and use of working surfaces such as a 24" to 36" high box, planks laid over saw horses, straight (manufactured[6]) ladders, or, if the slab is in place, a small rolling scaffold.

3. Installation of decking over joists and completion of joist bridging:

    Note: Regardless of joist to lower level distance, decking should be "played out" from a pile onto the joists in a pattern that enables workers to have a solid surface to move 4x8 material from one location to another. Walking the tops of joists should be prohibited. Gross coverage of what will ultimately be openings for stairwells and mechanical chases often need to be cut before walls around the openings can be installed. However, cut-outs can be the very last thing done. At that juncture, the cut-outs should be guarded or covered. When covers are used, temporary material can often be scabbed onto to sides of the joists to make up a bearing for the covers and allow covers to fit flush with decking.

[6] The original National Safety Council Data Sheet and the early ASA (pre-ANSI) Standards for Job Made Ladders state that the use of job-made ladders should be limited solely to a means for access.

4. Construction of stick-built walls comprised of 2x studs and plates, exterior sheathing and wind-bracing, installation of windows and miscellaneous sub-fascia on the completed deck; alternatively, the hoisting and bracing of pre-fabricated wall panels on the completed deck:

   Fall protection around the perimeter of such a deck, though desirable, is next to impossible given the type of work being performed. Moreover, as with roofs, falls occur preponderantly from unguarded/uncovered holes/perforations in the floor/roof and generally not from the perimeter.

5. Installation of second story joists:

   Joists installed from floor below, working from saw horse-supported planks or manufactured ladders.

6. Installation of second story decking:

   Same as Step 3 above.

7. Installation of second story exterior walls:

   Same as Step 4 above.

8. Installation of pre-fabricated trusses:

   It is a common practice of homebuilders to send bundles[7] of trusses up to the top plates of homes with a single pick of a crane, allowing for less crane time but considerably greater danger for workers who, when they break the bands that hold the bundles together, run the risk of being thrown off the top plate when the trusses spring apart. Another danger in sending the trusses up in bundles is that they must be "goosed" into position by workers who again, must be on the top plate, unprotected from falls.

   OSHA's interim guidelines for truss placement suggest that a safe position for workers installing a succession of trusses, is on the top plate, between the last toe-nailed and braced truss (once the first two "starter" trusses (gable ends, etc.) in that succession of trusses have been toe nailed and braced). In that scenario, a truss is being flown in by a crane as a "blind pick" (an operator typically has one worker on an exterior wall in view but not the other on the far wall). Workers are under crane-suspended loads, which is prohibited by 1926.550 (a)(19).

[7] See attached Truss Plate Institute data sheet which require that individual trusses be flown, and when they exceed 30' in length, should not be flown with a single choker.

The recommended safe and practical alternative for truss placement is as follows:

a. Fly and brace the initial trusses as depicted in the Truss Plate Institute's data sheet;

b. Use tag lines to control all trusses flown to top plates in order that they can be controlled from the floor below;

c. Land the trusses on top plates and, while the crane is still attached, toenail the ends to the top plates from ladders that, in the event of a fall, have the worker falling only to the floor below rather than two floors to the ground;

d. From an A-frame step ladder based on the floor, install initial bracing that is prefabricated in the form of both a jig that serves to uniformly space the trusses, and one of the kinds of braces that will ultimately serve in permanent securement of the trusses to one another. If a pneumatic nailer isn't used, place starter nails on the jig/spacer;

e. Detach the rigging from the crane from the ground by a commercially available hook that can be activated by the use of a rope from deck level;

f. Follow-up bracing by a detail crew, working from within the trusses but well back from the hoisting operation.

Where contractors elect to fly bundles of trusses to top plates to save money on crane time, another very practical and inexpensive piece of equipment, used widely by carpenters in concrete forming and bridge work is a wall bracket, or "Figure 4" type scaffold[8]. The advantage in using wall brackets is that they can be:

a. Attached to a wall (hung over top plates or through-bolted) before it is tipped up. They are generally planked from window openings;

b. Used as a solid surface with which to perform a range of soffit, fascia and detail work;

c. Left in place and used as a starter platform for the first courses of roof sheathing;

[8] See attached "Carpenter's Wall Bracket" drawings.

d. Used as a catch platform in some cases;

e. Used as a scaffold for roofers performing the installation of ice and water shield and starter courses of shingles at roof edges

f. Used for a variety of other purposes by down-stream crafts after framing has been completed, such as a standing surface for the installation of drip edge and gutters.

9. Installation of roof sheathing:

Note: The belief that slide guards, California corners or similar contrivances provide fall protection marries well with the premise that workers installing sheathing (plywood, OSB, etc.) always slide and never pitch backward. This same thinking envisions workers always prepared for a fall, ready to grab the 2x4 nailed at the roof edge just before they go over the edge or in a position to swing and dig the claw of their hammer into the decking sufficiently to bring them to a stop. The only true fall protection for deckers on roofs having a slope of greater than 4:12 is the use of retractable lanyards attached to inexpensive metal stamped assemblies that have been attached to the ridge of trusses or rafters before they are hoisted into position or nailed into place. The first courses of decking can be installed from planks bearing on the bottom cords of trusses. After the starter row of 4x8 sheathing is installed, the truss anchorages are sufficient for use because the trusses are no longer individual units.

While this writer does not endorse one type of fall protection anchorage over another, the Guardian™ unit has been tested in this application and works very well. Most important, with a retractable assembly, the arresting forces placed on that type of anchorage are significantly diminished. If a carpenter is on a second course of roof deck attached to a retractable, he/she doesn't end up sliding far enough to go over the edge. There is absolutely no reason for a carpenter not to have both the freedom of movement and the positive fall protection afforded by such an assembly.

10. Other activities:

a. A roofer, whether applying shingles, standing seam, tile or other types of material on decks with a slope of greater than 4:12 can, and should be provided with the same positive fall protection afforded a carpenter installing sheathing. The very small eye formed by the above-described truss anchorage can be bent over for the ridge vent that is the last material a roofer will install or simply left in place to protect mechanical trades and others, who must go on a roof before or after shingles are applied. In fact most homebuilders are requiring their roofers to tie off as described above. For residential roofers to be afforded special dispensation from a rule they are perfectly capable of achieving is a clear-cut violation of OSHA's fall protection standard.

b. As previously mentioned, fall protection for all trades "down-stream" of framing operations is entirely achievable and, in fact, regularly used.

Notwithstanding approximately ten years of advance notice that a rule contemplating requirements for fall protection in all types of construction would include residential framing, the homebuilding industry was not prepared to make the kinds of changes to its framing procedures when OSHA's Final Rule for Fall Protection first became effective. The industry had received relatively little attention by OSHA when compared with the commercial, industrial and utility sectors. On the other hand, arguments that characterize the homebuilding industry as largely comprised of "mom and pop shops", challenged with an unfair regulatory burden, fails to take into account the direct and indirect costs of accidents and the many large speculative/operative builders that construct thousands of units annually. Just as larger commercial and industrial constructors recognized a profit center in safety long before OSHA was enacted[9], so too, are the large homebuilders now in a similar position to lead their industry away from injuries caused by falls.

[9] See attached AGC Safety Committee comments on OSHA's Advance Notice of Proposed Rulemaking and Solicitation for Comments on Fall Protection for Residential Construction (Question 1), also submitted to members of the Advisory Committee for Construction Safety and Health, August, 1999.