Photo credit: James P. Hohner Jr.

Profitable Pins

New Pin and Drive Systems Help Contractors Make the Connection to Lower Costs

By: Robert J. Shluzas

Have you been on a commercial construction jobsite lately? The perceived "bedlam" from materials meeting design by each skilled trade can be either overwhelming or something of a marvel! And oh, don't forget your hardhat! One might look at a combination of dissimilar materials and the skills needed to bring them together and wonder if there's a "common thread" to it all. Well, there is; it's the fastener! Choose the right one and your job is "design perfect" and maybe ahead of schedule. Choose the wrong one and well; serious delays if not disaster can occur. Don't believe me? Just try and drive to Boston's Logan Airport today! Oh and don't forget your hardhat there either!

Let's get back to that jobsite. Look around you and what do you see being used for fasteners? Nuts, bolts, screws, nails, pins, crimps, rivets, welds, wires, rods, and adhesives just to name a few! One fastener in particular has been commonplace in commercial construction for over 50 years, the steel pin. Specifically, one made of hardened steel with a ballistic point has been used for many years to successfully attach a variety of materials to concrete and/or structural steel. More recently, the pin has evolved and is used to mechanically fasten materials to cold formed steel (CFS) framing, and in some cases the "steel to steel" itself! Roof, floor, and wall systems are being designed using pins and CFS. The tools used with these pins can be lighter, faster, and even more versatile than a screw gun!

HOW THEY DO THAT?

Pin connections to CFS use a combination of forces to perform their job. The first is the impact force of the chosen drive system on the pin itself. This enables the pin to make its way through a variety of materials including the CFS. Second, the friction forces created at the drive and destination points of the pin. These add to a pin's withdrawal resistance. And lastly, there's the compressive force of the steel itself backing against the pin after penetration. They all complement each other for exceptional withdrawal resistance. Add to the withdrawals the superior "shear" values from hardened steel pins, and you have what design professionals need to make the right fastening selection.

Laborers continue to experience faster and faster driving systems that are now five to seven times quicker than conventional methods. Pretty good, eh? Think about it: A worker who "screws off" (I could say "screws up," but that's another article) a 4' by 8' sheet of exterior gypsum to CFS might take 19-25 minutes, while a worker using air tools and pins is done in four to five minutes! It's true. I've seen it, timed it, and watched an average of 25 percent of the screws dropped while every pin was being used.

WHAT'S NEXT?

More CFS is being used than ever before for commercial low- to mid-rise structures like office buildings, condominiums, schools, hotels, hospitals, and others. One reason why is that a five- story CFS building can be put up with significantly fewer fire-control systems than are required by code in a four-story wood structure.

Design criteria in these CFS buildings many times call for the attachment of multiple layers of CFS of a variety of gauges and tensile, and often

in hard-to-reach places too. Good examples are the extra straps or shear wall construction sometimes used for hurricane resistance. Sometimes we can even see CFS being fastened to the structural "red iron" steel itself.

Pin design is morphing to meet these new CFS fastening requirements. Just as pins went from fastening into concrete and then into CFS steel, they now show new head sizes, shank configurations, and point designs. These pin features can combine to offer optimal shear and tensile values. For example, a change in shank configuration may not only improve withdrawal values, but also facilitate driving through multiple layers (three-plus!) of CFS.

Conventional delivery systems for pins include powder-actuated 'pin & load', the old reliable pneumatic tools operating at 80-120 psi, newer "gas" internal combustion tools, and of course the die-hard "do-it-by-hand" workers. Hint: the latter are easily recognized on the job by their slow movement and big arms!

New to the market is a revolutionary delivery system to accompany the new generation of pins. That is the high-pressure (HP) pneumatic system of tool(s), compressor, hoses and fittings. They operate from 250-400 psi and offer advantages of high initial impact, less recoil, noise, or deflection than conventional systems.

The tools are typically lighter weight and smaller in size than not only other air tools, but also electric screw guns! They handle two, three, and four layers of CFS with ease, and even fasten steel to concrete!

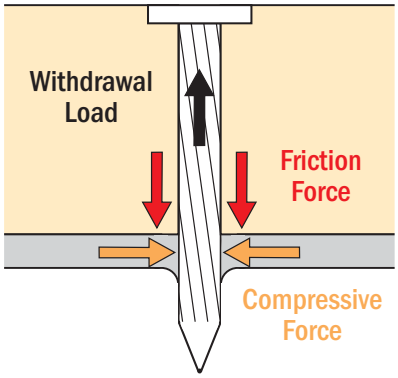
Today, the speed of pneumatics can be used with the CFS commercial construction connections to cut time, cost and design restrictions. The productivity gained from the use of these tools often leads to a tool investment "payback" on the first job!

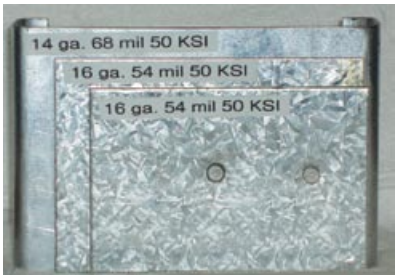
'HOW DO THEY PERFORM?'

Several low-rise (five floors or less), multi-use, commercial CFS buildings are being built with over three dozen connection designs that caused over 100 steel-to-steel combinations to be rigorously tested under AISI CF 92-1 "Test Methods for Mechanically Fastened Cold Formed Steel Connections."

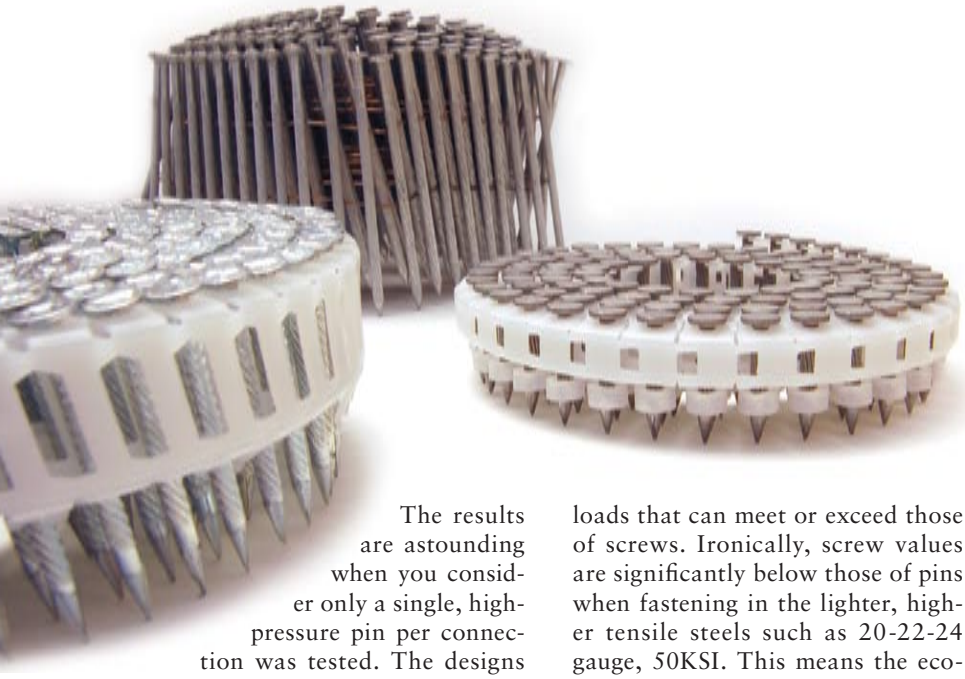
IT COSTS 32 PERCENT LESS TO APPLY PINS THAN SCREWS

	SCREWS	PINS
Fastener cost/piece	$0.01	$0.05
Multiply by 64 fasteners/screws per sheet	x 64	x 64
Subtotal Fasteners	$ 0.64	$ 3.20
Hourly Labor rate w/o burden	$15.00	$15.00
Multiply by 20 minutes screws, 5 minutes pins	x .33 hrs.	x .05 hr.
Subtotal Labor	$4.95	$ .75
Waste:	16	
25% screws, 0% pins	x .02	
Subtotal Waste	$ .32	$ .00
Total Cost	**$5.91/sheet**	**$3.95/sheet**





Today's pins can quickly attach multiple layers of steel.



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The results are astounding when you consider only a single, high-pressure pin per connection was tested. The designs were loaded to failure per AISI CF 92-1 protocol and "Ultimate Shear Capacities" achieved started at 294 pounds for 25-gauge materials to a high of over 1200 pounds for multi layered 14- and 16-gauge materials! On average the tests yielded over 840 pounds of Ultimate Shear Capacity per all connections.

In many cases the shear and withdrawal values of pins exceed those of similar sized screws. Remember that 50-year history of "pins"? The length of service of pins can actually work against them. Let me explain: The new designs are being tested to old standards and generating results that lead many design professionals to use safety factors as high as five.

Today, with new technology and pin applications in not only concrete, but also many varieties of steel we see supporting test data that can lead the enlightened design professional to use a safety factor in the range of 2.6 to 2.9. This means a similar number of pins or screws may demonstrate similar performance.

Thus, the "ultimate shear" of 840 pounds could translate into a design load of 315 pounds per pin! It is easy to see why pins are gaining in popularity:

- Improved design flexibility
- Faster installation
- Greater shear, tensile, and withdrawal strengths
- Greater value

THE ECONOMICS OF STEEL PINS

Ultimate shear values for pins now can convert quite easily to design loads that can meet or exceed those of screws. Ironically, screw values are significantly below those of pins when fastening in the lighter, higher tensile steels such as 20-22-24 gauge, 50KSI. This means the economics of using pins in all gauges improves drastically. So, on many jobs the same number of pins or screws can be used. Here is a simple example:

More and more, contractors are transitioning to pins. Indeed, in a recent survey by the Cold-Formed Steel Engineers Institute (CFSEI) more than 47 percent of builders and contractors ranked "pin fastening" as their Number 2 priority for framing with cold-formed steel (CFS)! First was "training." And why not? Traditional methods for fastening CFS can be laborious, use excess materials, and not accommodate many of the fastening combinations encountered on today's job.

Common uses for pins include fastening various materials or fixtures to a wide variety of steel gauges. Many have attached plywood, OSB, and gypsum to CFS. But many are not aware that pins are being used successfully to join up to four layers of "steel to steel," and fastening structural steel. Many are not aware that pins are five to ten times faster than conventional fastening methods. (Our example cited here used a factor of four to be conservative).

The growth of CFS framing has created innovative designs for structural assemblies that require new fastening methods to create new economic viability for steel. The demand is growing rapidly, and pin fastening has kept ahead of the curve with innovative new pins and unique high-pressure installation systems.

WHAT ELSE IS BEING DONE?

The Technical Development Committee for CFSEI has begun work towards creating new standards and design guides to increase the use of pins for CFS construction. They are causing the development of:

- Minimum test standard results that can be used to interpolate/extrapolate fastener performance.
- Data to support new "Safety Factor" recommendations for various Building Code Evaluation Services.
- Evaluations of various fastener testing in 20-gauge to 22-gauge and 33ksi to 90ksi steels.
- Evaluations of various fastener installation speeds.

For more information on pin fastening of cold formed steel, contact the Steel Framing Alliance in Washington DC at www.steelframingalliance.com or the Light Gauge Steel Engineers Association at www.steel.org

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