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Pin vs Plated Trusses: The Devil is in the Details

By Wilson Antoniuk, P.E.

For an architect or engineer, the saying “The devil is in the details,” plays out to be true for every structural design. Each component of the building needs to work together to benefit the overall purpose of the structure. This article will help you explore one aspect of those devilish details in light commercial roof construction.

One of the first, important questions a designer needs to answer is, “What structural members are my best choice for the type of roof shape and the spans I need to consider?” When wood is the chosen material, two types of wood trusses typically come to the forefront: metal pin connection, and metal plate connection. Pin-connected trusses are constructed of wood chords, tubular steel webs, and pinned connections. These trusses are the type RedBuilt manufactures, and are commonly used in offices, schools, banks, and retail structures. Metal plate-connected wood trusses are typically manufactured with solid sawn wood chords and webs with metal plates that fasten the wood members together. These are typically used as roof framing in residential construction and some light commercial construction.

To better understand the “details” of these two product options, following is a side-by-side comparison of the engineering considerations needed when specifying one or the other.

Pin-Connected Trusses	Plate-Connected Trusses
High-grade metal pins connect 45 ksi minimum yield strength steel webbing with wood chords (see diagram).	Light-gauge metal plates with teeth fasten lumber members together (see photo).
Lumber is high-grade (2100F-1.8E to 2850F-2.3E) machine stress rated lumber. Some products are available with EWP chords such as LVL.	Lumber varies from lesser grades (#2 or #3 visually graded) to higher grades (Select Structural, #1 visually graded machine stress rated, or EWP).
Top and bottom chords may be continuous pieces (for EWP chords) or have glued finger-joints.	Chord material is simply butted and held by plates.
Pin connection: True pinned truss connections allow for rotation during—and recovery from—severe deflections.	Plate connection: A fixed moment connection with limited joint rotation.

Spacing of members may range from 24" o.c. to 48" o.c.	Spacing usually limited to 24" o.c.
Bridging—capable of load sharing—is attached via clips or straps at pin locations, with the fasteners loaded in shear rather than withdrawal.	Bridging connected with nails at bottom chords.
Integral bearing clips provide vertical and lateral load transfer and resist wind uplift. Trusses typically bear on the top chord for easier/safer installation, but may bear on the bottom chord if a project requires it.	Bearing hardware is not integrated and relies on field installers. Most commonly, plated trusses bear on the bottom chord and have a simple, nailed connection similar to that of a joist.
Manufacturers custom-design and custom-detail trusses as part of a structural system, including installation bracing, blocking, bearing requirements, bridging, and consideration for wind uplift and lateral loads. Manufacturers supply placement drawings and details.	Standard industry details for product installation. Engineer of Record responsible for all aspects of product and system performance (i.e. designing uplift restraint and permanent system bracing.) Third-party engineer may stamp calculations but may not see structural plans.
Trusses available with camber per application requirements.	No camber. Long-term creep is another responsibility of the Engineer of Record.
Light weight per load carrying capacity.	Longer spans involve more lumber and create a heavier product.
Third-party inspection of product with consistent Quality Assurance procedures as proven with manufacturer-specific code reports such as ICC-ESR.	The industry uses voluntary standards such as ANSI TPI-1 (2014) to maintain quality.
National manufacturers; consistent quality. May be sold customer-direct or through distributors, depending on market.	Numerous small manufacturers across the country mean local availability, but quality is variable. Lumber dealers may manufacture their own plated trusses; distribution channels vary by market.

In addition to the engineering considerations of pin vs plate trusses, the two truss options each have their own application strengths. Based on the design needs of the structure, one truss might be better suited than the other:

Pin-Connected Trusses	Plate-Connected Trusses
Long-span capability up to 100 feet. Heavy duty series provide solutions on challenging projects with high loads and long spans.	Span capability is limited. 30 feet is optimal, but may be designed for 60 feet or more, in pitched profiles.
Well suited for parallel chord trusses, as well as unusual and complex profiles such as bowstring, barrel, and scissor profiles, which offer design flexibility.	Best suited for simple roof structures with hips and valleys, and pitch profiles of 3:12 or steeper.
Often specified for their aesthetic appearance in exposed applications.	Not usually considered for exposed applications due to product appearance.
An economical system for complicated profiles and long spans.	A cheaper solution for simple profiles and short spans, although it is important to compare cost on a system basis.

Beyond the engineering considerations and design specifications, what else is important? How about a product warranty? When purchasing a car, a mobile phone or even a crockpot, these items come with some form of product warranty. When specifying wood trusses for a structure – a building that must ensure the safety of its occupants – it seems even more critical to understand and expect a product warranty.

RedBuilt warrants that their engineered wood products are free from manufacturing errors or defects in workmanship and material. In addition, provided the product is correctly installed and used, the company warrants the adequacy of its design for the normal and expected life of the building.

Product manufacturers also provide different levels of product support. The spectrum spans from a simple turnkey order, to design assistance, all the way through to field review upon installation. RedBuilt has 13 design and sales offices throughout the United States. Technical representatives assist customers with initial design concepts, building system integration, and detailed specifications to ensure a safe and economical design. Once products are manufactured, delivered to the site and installed, a Jobsite Review is also conducted by a RedBuilt technical representative, to review product installation, as part of the RedBuilt standard service offering.

Modern, light commercial structures are complicated. They require the diligence of architects and engineers to understand their unique features, including which roof and floor trusses will best serve the building. When comparing the pin vs plated truss options, there are quite a few differences. It is the responsibility of the specifier to thoroughly understand “the devil in the details” and ultimately provide the owner and other stakeholders with the best solution.

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About the Author:

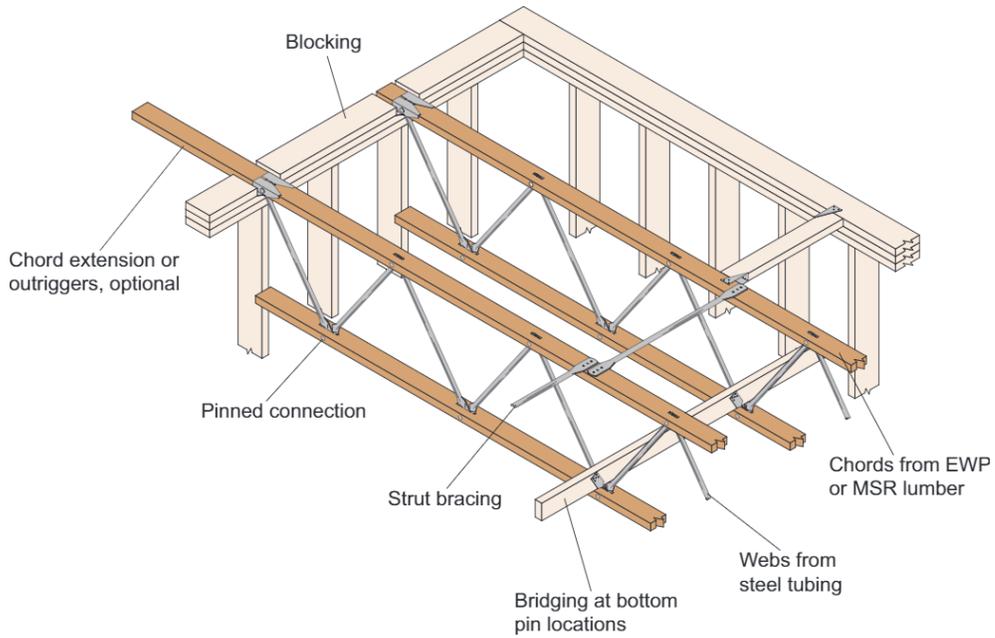
From Boise, Idaho, Wilson Antoniuk is a technical representative with RedBuilt, and has 15 years of experience in commercial construction. RedBuilt is a leading manufacturer of engineered wood products for commercial and multi-family construction. Products include RedBuilt™ open-web trusses, Red-I™ joists, and RedLam™ LVL beams. For more information, visit www.RedBuilt.com.



Example of a metal plate-connected truss.
 Photo credit: Truss Plate Institute



A sample of pins used in pin-connected trusses.
 From L to R: 1.25", 1.0", 0.75", 5/8", 3/8", 1/2" and 3/8".



Example diagram of pin-connected trusses.