

TIMBER FRAMING

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Barn Reconstruction in California

TIMBER FRAMING

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CONTENTS

BOOKS: Wooden Bridges Jan Lewandoski	2
TOPICS: Design for Longevity Thomas Dougherty	8
GLIMPSES OF BELGIAN FRAMING Ian Stewart	9
CALIFORNIA'S COWELL LIME WORKS BARN Bill Hurley, Paul Oatman, Karl Bareis	12
COVER FOR A BRIDGE IN WYOMING Steve Rundquist	18
QUALIFYING CLIENT INQUIRIES Bruce Lindsay	20
DOGLEG FRAMING Ben Brungraber	22
GUILD CONFERENCE SLIDE SHOW 2015 (II)	25

On the cover, last-minute peg trimming at 2015 raising of reconstructed Cowell Lime Works barn, on what is now the campus of the University of California at Santa Cruz. On the back cover, raising proceeds bent by bent. Note wedges for dovetailed tenons at tie beam ends. Photos by Jack Hursh.

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1985



Wooden Bridges

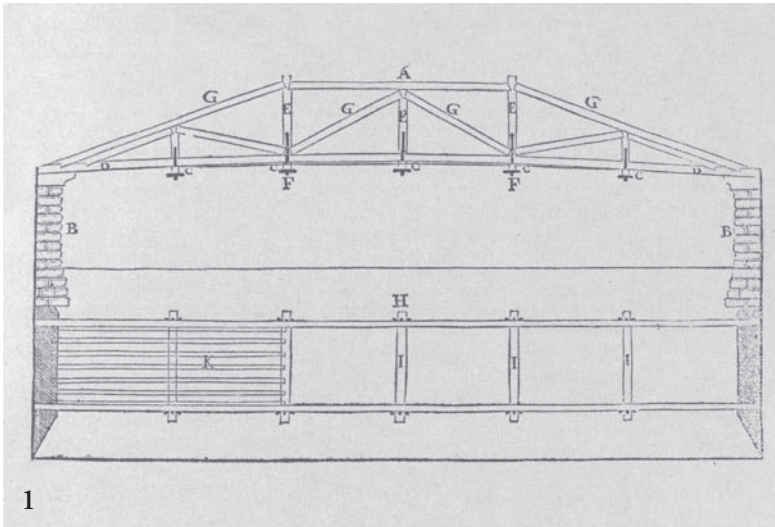
John Soane and the Wooden Bridges of Switzerland: Architecture and the Culture of Technology from Palladio to the Grubenmanns, Angelo Maggi and Nicola Navone, eds. Università della Svizzera italiana, Mendrisio, and Sir John Soane's Museum, London, 2003. 237 pp., copiously illustrated.

THE catalog of an exhibition, this book offers a remarkable set of accompanying essays. John Soane (1753–1837) was an English architect, among the most famous of his time, and professor of architecture at London's Royal Academy, designing public buildings (he spent 45 years on the Bank of England) and churches, the Dulwich Picture Gallery and private houses, but no large wooden bridges. Johannes (1707–1771) and Hans Ulrich (1709–1783) Grubenmann began as village carpenters but gained renown during their lifetimes for their audacious and innovative designs for both wooden bridges and the roof systems and bell towers of churches.

The 84 exhibits are arranged around John Soane's measured drawings and large-format colored illustrations of Grubenmann and other bridges in Switzerland. The exhibits include scale models of the bridges and a great many drawings of extant and extinct bridges, as well as proposals for even grander structures based upon the principles believed to be demonstrated by the Brothers Grubenmann's successful spans. The accompanying essays locate these works in the context of ancient, medieval and particularly 17th- and 18th-century structural engineering and technology. The essayists are mostly architectural historians and historians of science in Italian-speaking academia, but in the volume they are not identified beyond their names.

We all wish we knew more about historic truss design before the 18th century. We do know that while architects and framers in northern Europe struggled with complex roof frames and steep pitches over relatively short spans until the 17th century, builders with almost no trees were framing fully realized, low-pitched kingpost trusses in churches in the Syrian desert as early as the 5th century (Valeriani 14). The opening essay, "From Julius Caesar to the Grubenmann Brothers," begins with Caesar's bridge across the





From *John Soane and the Wooden Bridges of Switzerland*

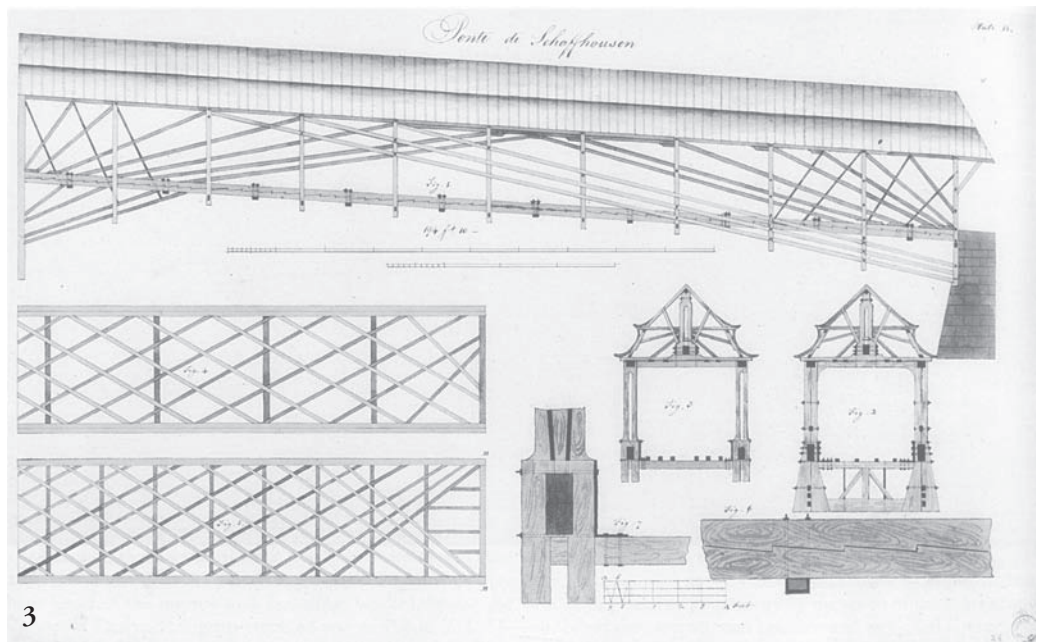


A. Chester Ong, in *Chinese Bridges* (Tuttle 2008). Used by permission.

1 Palladio's design published in 1570 of queenpost truss with added elements for bridge over Torrente Cismon, Cismon del Grappa, Vicenza, northern Italy.

2 Turn-of-the-7th-century segmental-arch stone bridge, Hebei province, China, south of Beijing, variously called Zhaozhou or Anji. Original except for railings. Note iron butterflies crossing stone joints.

3 Contemporary (1799) engraving of construction details of bridge across Rhine at Schaffhausen, Switzerland, 365 ft. in two spans (single span shown), with highly redundant bracing and extraordinarily long bolt-of-lightning spliced chords.



From *John Soane and the Wooden Bridges of Switzerland*

Rhine in 55 BC near Koblenz, a wooden trestle structure (known only from Caesar's written description), and Trajan's series of trussed timber arches on 20 stone piers across the Danube at Turnu Severin, Romania, in 105 AD (illustrated in stone carvings on Trajan's column). The trussed arches, designed by Apollodorus of Damascus, spanned 125 ft. in the clear and may have been the longest clear spans in any material until early modern times. Caesar's bridge has so fascinated scholars that an entire essay toward the end of the book is devoted to interpretations of what it was actually like.

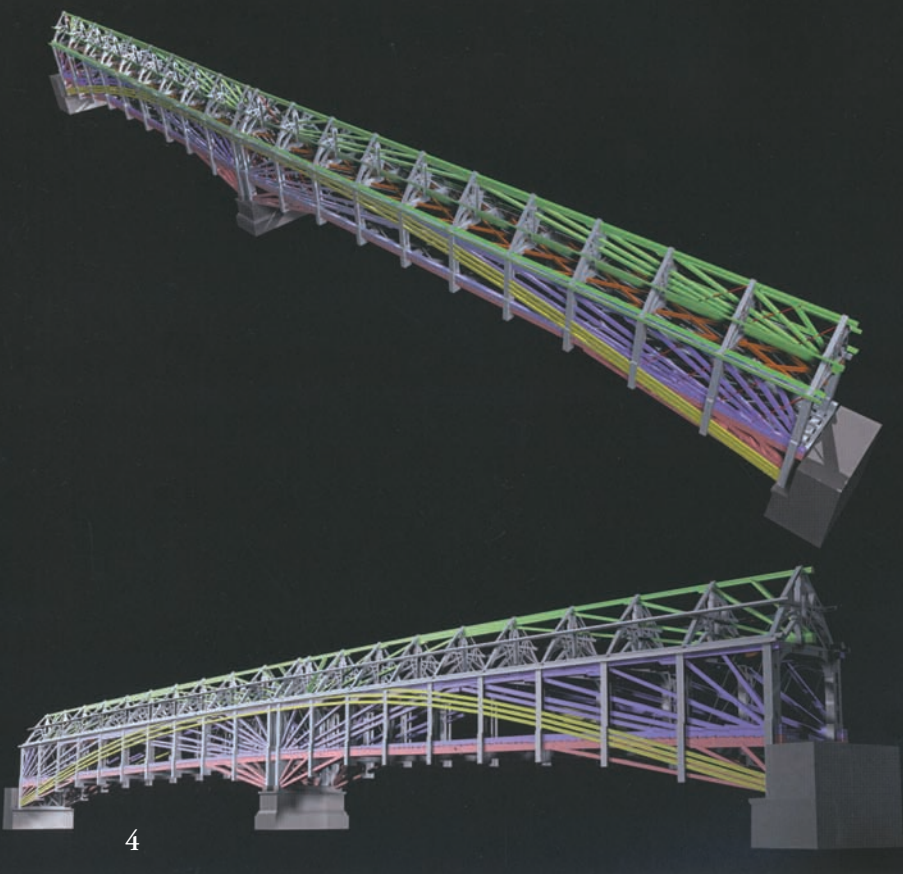
The survey jumps to Palladio's well-known 16th-century designs, including the influential trussed 30-meter span at Cismone (Fig. 1) that was actually built and appears exactly the ancestor of innumerable wooden bridges built in the US and Canada throughout the 19th century, a configuration sometimes called a queenpost truss with captive kingposts (or kingrods).

The essay's author, Howard Burns, speculates that the timber centering of stone vaults and domes probably provided the models for much wooden bridge construction, and this may hold some truth. We know that the period between 55 BC and the 17th century saw the construction of a myriad of wooden bridges of modest span across the rivers of the world. We just don't know much about them, so we fall back upon the few documents that we have to establish chronology and evolution. A look at the

Zhaozhou Bridge (594–605) in Hebei province, China (Fig. 2), a flattened segmental arch with open spandrels, built of limestone with iron cramps and in excellent condition today, will remind us how careful we need be in making generalizations about the evolution of our built heritage. Nothing like this bridge appeared in Europe for over 1000 years, and even in China there is only one other surviving example, and that one smaller. Equally marvelous wooden bridges may have been built and then lost without a record.

Nonetheless, in the 18th century in Switzerland a number of apparently unprecedented wooden spans drew the attention and admiration of architects and engineers from all over Europe. Nicola Navone's essay, "The Eighteenth-Century European Reputation of the Grubenmann Brothers," discusses the large number of visits, measured drawings and models their bridges, particularly their masterpieces at Schaffhausen and Wettingen, inspired.

What exactly is remarkable about these bridges? Schaffhausen is the most widely famous (Fig. 3), partly for its great overall length (365 ft. in two spans), partly for how long each span cleared (as much as 194 ft.) and partly for its innovative although hyperredundant and indeterminate form. Another great source of appeal was the claim, apparently supported by Hans Grubenmann, that the bridge did not need its central pier and could span the 365 ft. in the clear, an unprecedented achievement that could have solved many bridging problems worldwide.



4 3-D model of Schaffhausen with complementary and overlapping structural systems indicated in color.

5 Longitudinal roof truss in the Church at Grub, built by the Grubenmann brothers in 1752.

6 Grubenmann brothers' mighty arch at Wettingen, 174-ft. span.

7 Grubenmanns' double queenpost truss at Schwanden. Drawing tinted by Charles Tyrell in John Soane's office, 1814.

8 Bridge at Näfels, laminated arch supporting *hangewerke*. Drawing John Soane's office, 1814.

Images of the bridge (Fig. 4) suggest this is unlikely. The structural framing is composed of three overlapping systems and a fourth that turns the roof into a form of stiffening. The first system is a polygonal arch composed of parallel timbers that indeed spans the entire 365 ft., but appears too flat to do so alone. Second is a fan of arch braces rising from the abutments and pier and bearing against the bottom chord. The third is a multiple overlapped queenpost truss oriented to each separate span. The fourth system is a multiple overlapped queenpost truss located on the central axis of the bridge within the roof space (somewhat similar to the Grubenmanns' 1752 longitudinal truss in the church at Grub (Fig. 5), with bearing at the portals and over the pier.

Obviously there is a lot of redundancy here, and the bridge at 365 ft. might not have failed immediately, but the vast number of joints and points of bearing, much of them at extremely low angles, would have allowed for considerable shrinkage, horizontal shear and side grain compression regardless of whether the tension connections could be made good. Shrinkage and compression result in sag, and sag leads to both racking and then buckling failure.

That sideward buckling failure may have been Schaffhausen's ultimate fate was suggested by Thomas Tredgold, the British carpentry authority, who observed in 1828: "It is necessary to state, that this bridge, in common with others constructed on the same principle, bends considerably sideways" (Tredgold 127). Divided in half, however, the span stayed in service until destroyed by Napoleon's forces in 1799.

The bridge on the Limmat at Wettingen, at nearly 197 ft. in the clear, was a structure more likely to be emulated (Fig. 6). Its virtues are easy to see, appearing more modern and engineered rather than craft based. Very large laminated arches springing from the abutments were clasped by pairs of posts, which the arch variously supported or hung. The laminae were not discontinuous at the posts but in long sticks joined tightly to each other by both wood joinery and metal rods. One single line of arch bracing rose from the abutments to aid in strengthening the bottom chord against bending and thus tension near midspan. Again the roof system participated through a pattern of bracing in its space, taking

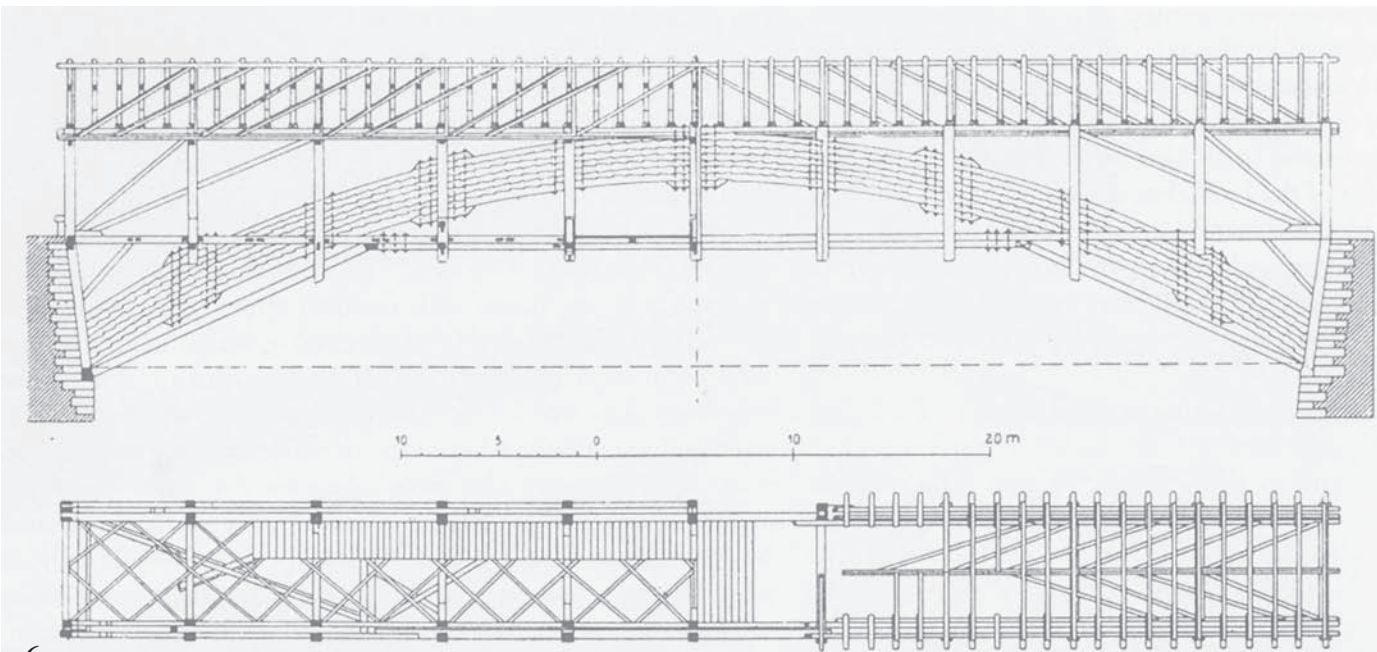
live loads and moving them toward the abutments rather than entirely onto the arches. This bridge also was destroyed by the forces of modern civilization in 1799.

In addition to Wettingen, Soane depicted the Grubenmanns' heavy-duty, uncomplicated queenpost truss at Schwanden (Fig. 7); the mighty arch supporting *hangewerke* (suspended posts carrying deck) at Näfels (Fig. 8); and the bridge at Reichenau (Fig. 9), with its multiple lines of single-intersection and double-intersection kingpost and queenpost bracing, all of which depart from Schaffhausen in their increased simplicity and determinacy.

All of these designs survived in use into the early 19th century in Europe, but eventually interest in iron bridges and the long tradition of stone arch bridges reduced wooden bridges to less significant spans. European travelers, however, began publishing admiring accounts of long-span wooden bridges of novel design built quickly and at very reasonable cost in the New World, including Michel Chevalier's *Histoire et Description des Voies de Communication aux États Unis* (Paris 1840) and David Stevenson's *Sketch of Civil Engineering of North America* (London, 1838).

In 1839, Tsar Nicholas I sent transport engineers P. Melnikov and N. Kraft specifically to the U.S. to bring back the technology, and ultimately the bridge engineers, for railroads and their wooden bridges (Nizamiev and Gasparini 18). Eventually these overtures brought about not a renaissance of 18th-century Swiss bridge types, but rather the adoption of American patented truss forms such as the Howe, Town Lattice and Pratt in a number of European countries, notably Germany, Norway and Russia.

A fact unacknowledged by the Soane book's authors is that wooden bridge construction, much of it designed by talented craftsmen, had a much longer life in 19th- and early 20th-century North America. While forms such as that of Schaffhausen were rejected, Theodore Burr built immense laminated arches hanging bridge decks, and queenpost trusses were built by the thousands. The truss at Reichenau, where lines of nonparallel bracing produce a segmental curve against the posts below a level plate, has one possible likeness in the Taftsville Bridge in Vermont, built in 1836 by Solomon Emmons. This bridge, not of a patented



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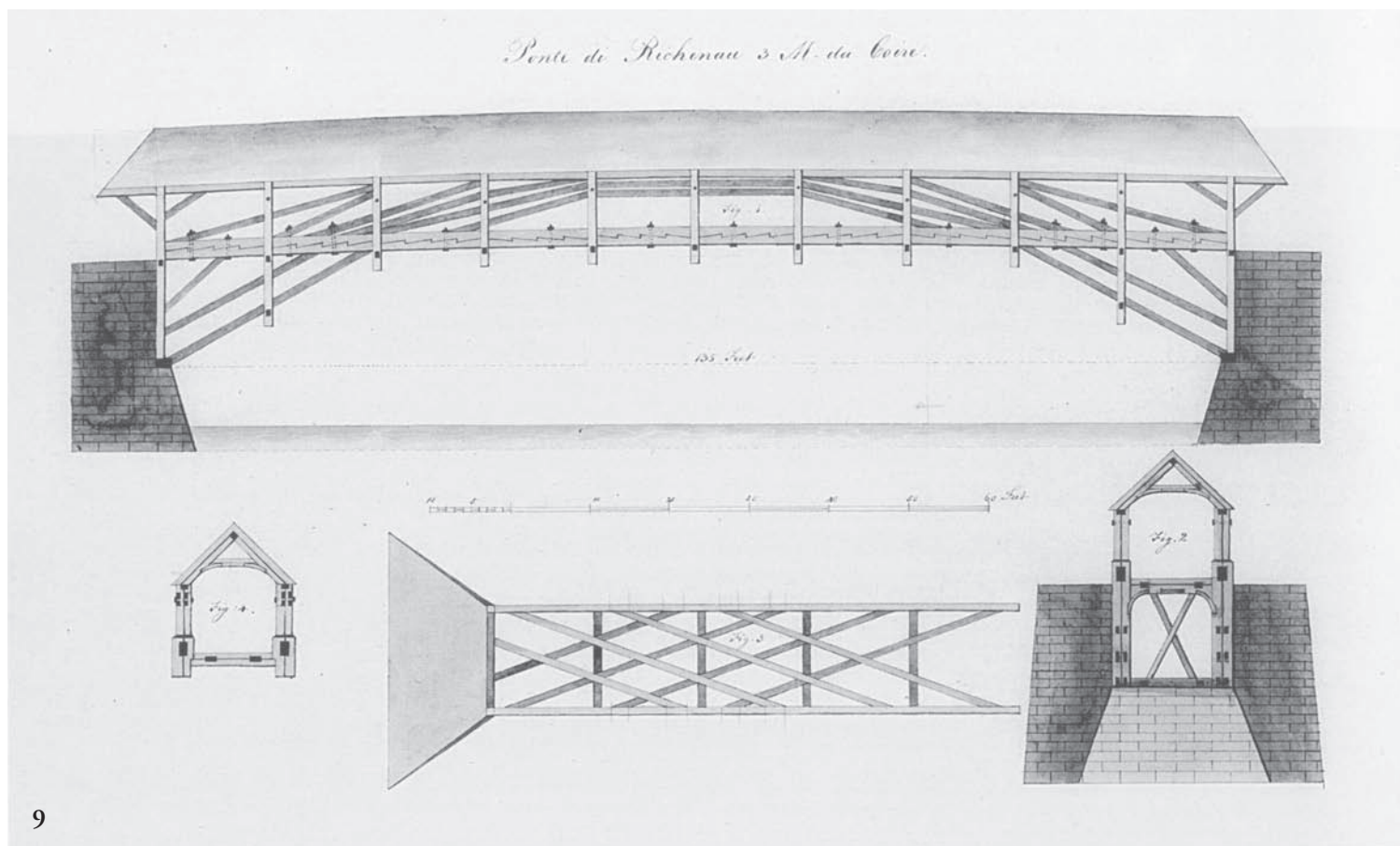
Images from *John Soane and the Wooden Bridges of Switzerland*



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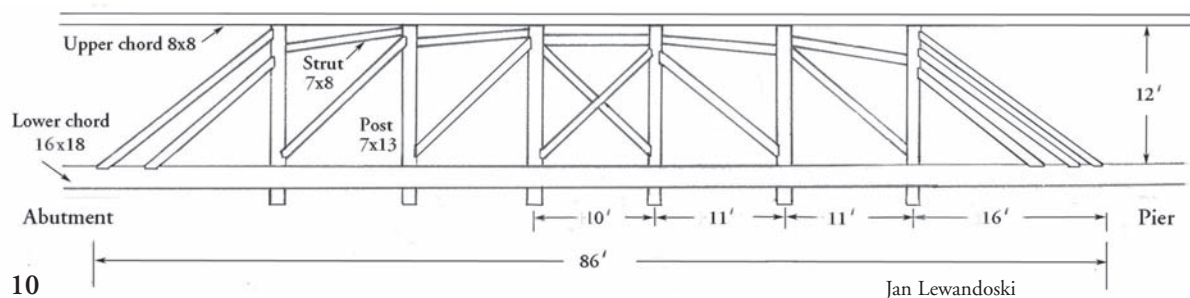


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9 Arch bracing and *hangewerke* at Reichenau. Copy after Cristoforo Dall'Acqua and Michael Shanahan, ca. 1792.



10

type, has certain archaic features, such as gigantic 16x18 bottom chords in 80-ft. lengths joined with 20-ft. scarf joints, and oddly enough had very steep laminated arches springing from the abutments below added in the early 20th century (Fig. 10). The covered bridge authority Joseph Conwill describes it as “early craftsman” with likely Swiss precedents (HAER 1). The truss also bears some resemblance to that in Plate N-O in Francis Price’s *The British Carpenter* (London, 1765), a book that may have been available in Vermont in 1836 (Fig. 11).

The work of the Grubenmanns was well known at the beginning of North America’s golden age of wooden bridge building. Philadelphia’s Owen Biddle in 1805 explained the virtues of the self-taught Timothy Palmer’s “Permanent Bridge” across the Schuylkill River (painting by William Russell Birch, Fig. 12) opened that year, with clear spans as great as 195 ft.:

So far as I have information, this is now the only *covered* wooden bridge, in any Country, except, perhaps, one over the Limmat built by the same Swiss carpenter who erected that of Schaffhausen, since destroyed. I have frequently seen and carefully inspected the draughts of this much celebrated bridge, and am confident that any intelligent and candid Architect, on examining the principles of both, would give a decided preference to the Schuylkill Bridge. The design is more simple, its strength is greater, its parts are better combined and more assistant to each other, and there is no useless timber, or unnecessary complexity in any part (Biddle 96–97).

Schaffhausen is also discussed in Herman Haupt’s *General Theory of Bridge Construction* (1851), probably the best and most influential manual ever published for wooden bridge construction and for “calculation of the strains upon the timbers.” Haupt at the time was chief engineer for the Pennsylvania Railroad and personally designed and supervised the construction of numerous large wooden bridges meant to carry railroad trains. “With many excellencies,” he wrote, “this bridge had also serious defects, and it is certain that a much smaller quantity of timber, judiciously arranged, would have given greater strength. Still, the principle is an admirable one, and originating as it did with an uneducated village carpenter, certainly displays no ordinary capacity. The supports consist entirely of a system of arch-braces, but the details were too complicated, and the execution evinced considerable timidity” (Haupt 145–46).

Later American bridge engineers were even less kind than Haupt to any legacy of European practice. Robert Fletcher and J.P. Snow, designers of large wooden railroad bridges and authors of a seminal essay on wooden bridges history, observed:

Covered or roofed-in bridges were distinctly not a feature in European practice. Two notable Swiss bridges built by the Grubenmann Brothers were exceptional. The picture of the Schaffhausen Bridge has appeared in so many books and atlases as to be familiar to engineers generally. . . . It has been

overpraised. It was a ponderous combination of long and short braces extending from as many points as possible to both abutments, a maze of timbers scarfed, bolted, strapped and clamped together to form nondescript trusses. The roof was top heavy with a needless amount of timber. . . . The assertion of an English writer that these bridges suggested the idea of the American covered bridge, with its roadway between trusses, is not justified by the facts. The early American types developed in the last two decades of the Eighteenth Century, and later, have little resemblance to those structures” (Fletcher and Snow 322–23).

While the Grubenmann bridges were a source of encouragement and instruction to contemporary engineers, they also produced a form of irrational exuberance in architects and engineers who should have known better but were soon engaging large amounts of capital and effort in plans for bridges spanning 600, 700 or even 900 ft. in the clear, with little more beef to them than Schaffhausen but with similar geometry. Historians of science Soraya de Chadarevian and Nick Hopwood refer to the problem of scale that “haunted” engineering in the late 18th century. “Since mechanical reasoning was supposedly governed by scale-insensitive geometry, it seemed hard to understand why projection to larger systems ever failed” (de Chadarevian and Hopwood 73–74).

Galileo had disposed of this problem in an easy-to-understand fashion in *Discorsi 2* (1638), demonstrating that if you increase dimensions by twofold, you increase volume and probably weight by eightfold, but the error is there in Thomas Pope’s 1807 patent for a Flying Pendant Lever spanning 1800 ft. over the East River in New York, or in the great many models and detailed drawings submitted to a competition for a 900-ft. crossing in Londonderry, Northern Ireland. Most were merely expansions of the Schaffhausen design. This sort of reasoning is common today among timber framers and even among engineers who are not specifically experienced with structural timber. It is easy to see a load path, but hard to see how much load is arriving and what effects the trigonometry of its bearing will have on an anisotropic material like wood.

THE central essay and the organizing genius of the exhibition is Angelo Maggi’s “John Soane and ‘the sublime simplicity of the structure’ of the wooden bridges of Switzerland.” This essay includes Soane’s field notes and measured and annotated sketches of the bridges, as well as the colored drawings produced by his office showing their structure in situ. Details such as the bolt-of-lightning lamination of entire chord lengths and the disposition of iron work are in the sketches from the field.

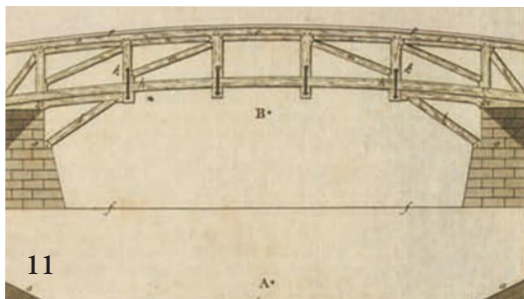
While there are and were few wooden bridges of significant span in Britain, the Old Walton-on-Thames Bridge (1750) is discussed here with its hard-to-describe structural system that nonetheless inspires confidence (detail of Canaletto’s 1754 painting, Fig. 13). Maggi describes the structure of Old Walton as “polygonal segments that were extended until they joined the

10 Taftsville, Vt., bridge, 1836, south upstream truss.

11 Design for wooden bridge in *The British Carpenter* (1765).

12 Palmer’s “Permanent Bridge,” 1805, Philadelphia, soon covered.

13 Old Walton Bridge, 1750, painted by Canaletto in 1754.



Images from *John Soane and the Wooden Bridges of Switzerland*

beam forming the parapet” (81), i.e., as so much triangulation, and the less effective quadrangulation, that yield a shape hard to distort. Alternatively, looking at load paths, Old Walton also can be seen as compression arch bracing repeatedly crossed by tension members that both suspend the arch and stiffen the arch-bracing by reducing its unsupported length. This bridge reminds one of Cambridge University’s “Mathematical Bridge” (see TF 113).

Perhaps the most interesting of the essays to both framers and engineers will be Massimo Laffranchi and Paolo De Giorgi’s “Some Remarks on the Grubenmanns’ wooden bridge structures.” While much of this chapter is spent on engineering analysis, including an excellent 3-D color model of Schaffhausen that does much to clarify the structure (Fig. 4), it begins with an excellent discussion of the craft tradition and individual experiment (sometimes called experience), information on what printed sources on structure and the strength of materials were available in the late 18th century, and which of these the Grubenmanns might have been acquainted with. On the practice of overlapping or combining elementary structures, they remark, “The bridge on the Rhine at Schaffhausen embodied all the experience acquired by the Grubenmann brothers. Combining a number of structural systems, it called for both outstanding skill in design, to cope with the complex joints between the timbers of its overlapped structural systems, and a profound, though intuitive, knowledge of the behavior of structures” (122–23). This notion of “structural intuition” is especially dear to my heart, as it perhaps has made possible the great architectural achievements, worldwide throughout history, by vernacular builders, some of whom may have been illiterate or innumerate. “[They] thought with vigor and were not fettered with the trammels of science,” Sir Joseph Banks wrote to Thomas Paine in 1788 (Cooper 1).

Laffranchi and De Giorgi devote a lot of attention to the arches at Schaffhausen and Wettingen. “At [Hans Ulrich] Grubenmann’s time, uncertainty about the correct form of the arch was combined with the difficulty, in wooden structures, of connecting members acting in tension and of going beyond the natural limits of length and cross section of the members” (126). Modern engineers are still worrying this problem on New World wooden bridges and remain unable to separate clearly the action of arch and truss joined together. For example, the design for 1988 repairs to the 1866 Cornish-Windsor Bridge (two spans, each 204 ft. in the clear) over the Connecticut River between Vermont and New Hampshire eventually hinged on a lack of faith in the arch proposals put forward as the traditional solution, and in the end a design depending upon 112-ft. glulam bottom chord members (exceeding the limitations of natural timber) was accepted. The engineer for this project, the late David Fischetti, went on to install 173-ft. single stick glulams in a Long Truss bridge at Downsville, New York, in the 1990s.

Indeed, the majority of arches we see in historic covered bridges are plank arches and are little better than an added form of bracing. Exceptions existed at Blenheim, New York, and some of Theodore Burr’s great arched structures. The Grubenmanns at

Wettingen designed an arch beefy and well joined enough to span 200 ft. The authors of the essay feel that the inadequate design of the Schaffhausen arch (365 ft.) proves the central pier was needed, and speculate that the arch was only there to keep the bridge from total collapse if the central pier settled or was washed away.

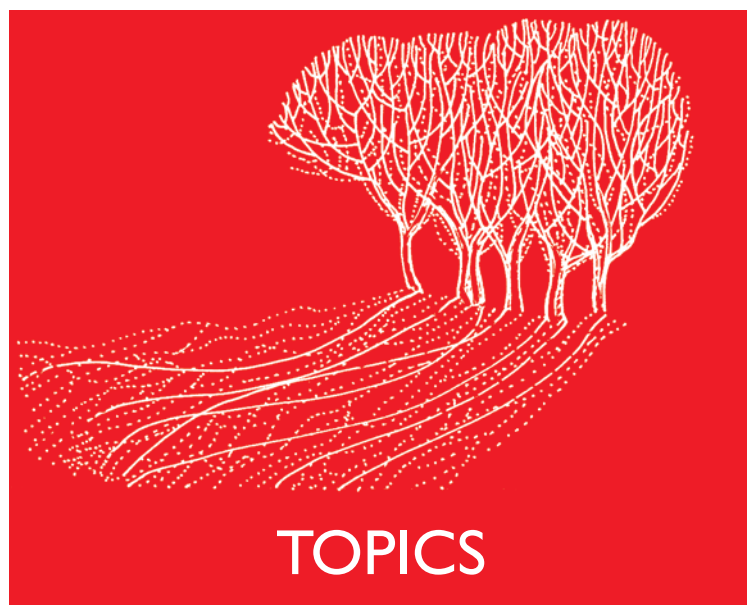
The final three essays of the book deal less with bridge structure and more with the culture and technology of the period. One deals with descriptive sketches of the bridges, covered and in their natural settings. Another discusses Diderot’s *Encyclopédie* and the philosophical value of the mechanical arts. A third is a history of attempts to delineate Caesar’s Bridge on the Rhine.

John Soane and the Wooden Bridges of Switzerland is a beautiful book, with its invaluable illustrations and the hand-drawn and hand-written notes of an extraordinary 18th-century architect, and more sophisticated discussion of historic engineering than is usually encountered. It is not a definitive history of long-span frames and trusses before 1800. (For that you would be better off with David Yeoman’s 1992 *The Trussed Roof: Its history and development*, Simona Valeriani’s 2006 paper “The Roofs of Wren and Jones: A seventeenth-century migration of technical knowledge from Italy to England,” or Patrick Hoffsummer’s 2010 *Roof frames from the 11th to the 19th Century: Typology and development in northern France and in Belgium*.)

But *Soane* is one of the few sources on pre-19th-century wooden bridges in Europe, a joint enterprise between the John Soane Museum in Lincoln’s Inns Fields, London, the architect’s remarkable house and offices, and the University of Italian-speaking Switzerland. The book is not easy reading, but not because the translations are poor. Rather, we are reading about something we think we know a bit about—the construction of wooden bridges, which continued here on a grand scale for another 150 years—but which in the book is set in another context, with different sources of inspiration and unfamiliar terminology, dislocated from any long tradition. —JAN LEWANDOSKI

Bibliography

- Biddle, Owen. *The Young Carpenter’s Assistant*. Philadelphia, 1805.
- Butler, Howard Crosby, and E. Baldwin Smith. *Early Churches in Syria, Fourth to Seventh Centuries*. Princeton University, 1929.
- Cooper, Theodore. “American Railroad Bridges.” *Transactions of the American Society of Civil Engineers*, Vol. 31, 1889, p. 1.
- de Chadarevian, Soraya, and Nick Hopwood. *Models, The Third Dimension of Science*. Stanford University, 2004.
- Fletcher, Robert, and J. P. Snow. “A History of the Development of Wooden Bridges.” *Transactions of the American Society of Civil Engineers*, Vol. 99, 1934, pp. 314–408.
- Haupt, Herman. *General Theory of Bridge Construction*. New York, 1851.
- Historic American Engineering Record*, VT-30, Taftsville Bridge, 2003.
- Nizamiev, Kamil, and Dario Gasparini. “The Howe Bridges on the Nikolaev Railway, 1841–1855.” *Proceedings of the Second National Covered Bridge Conference*, Dayton, Ohio, 2013.
- Price, Francis. *The British Carpenter*. London, 1765.
- Tredgold, Thomas. *Elementary Principles of Carpentry*. London, 1828.



Design for Longevity

I grew up second oldest of a large family on a small farm in Ohio. It was a family farm, though our income did not depend on it. My father, formerly a professional actor, was then a professor. My mother was an artist and had a pottery studio at our house. If our income did not depend on the farm, the majority of our food did. We learned from a very young age the art of growing crops on a small organic scale. Since neither of my parents were farmers by trade, we learned alongside them by trial and error how to sustain and make use of the land and animals. We learned to build barns, how to build fences and stretch barbed wire, to fix and bale hay with old equipment, gardening, and all the other many aspects of working the natural environment.

Our farm felt isolated. There was no community that we belonged to, though we were not geographically distant from other people. There was a busy county road right next to our house, and the nearest gas station was only two minutes away. Because of the busy roads, however, we were not able to bike anywhere. At the age of nine or ten I was already aware of a disconnection between my family, and, as I perceived it, everyone else. Later I came to realize that this feeling of isolation was not primarily a product of the farm, but was a reality of living in the 20th and 21st centuries shared by many around me, despite Erich Fromm's argument in *Escape from Freedom* (1941) that humans are essentially communal, that there is a universal human need to be related to the world outside oneself.

In 2001 I traveled to Rome with my father, there to attend an actors conference. I saw public squares with large beautiful fountains that were meant for everyone, and roads that were used more for walking than for cars. I was struck by the ability to travel by foot and the public transportation that ran all over Rome and northern Italy.

The fall semester of my sophomore year in college I studied abroad in Austria, traveling all over Europe on school breaks and long weekends. I became aware of and developed an interest in the relationships of urban areas, especially public spaces and flourishing community. I saw and experienced how the architecture, the fountains and piazzas, and the pedestrian centers of old cities facilitated human togetherness and interactions that transcended economics and race. In Europe I was also exposed to timber-framed roof structures.

Timber-framed structures struck a chord in me. I had worked in construction throughout high school and college and found the final product unsatisfying. My experience with construction involved poor-quality materials and cheap short-term fixes or renovations. In contrast, in the roofs of churches in Europe I saw timber systems hundreds of years old, built for the future, buildings with longevity at the root of their design. And they were beautiful.

In the early spring of 2012 I discovered the Timber Framers Guild. In May, skipping my graduation walk, I volunteered to work at a Guild-led project to cut and raise a replica of a historic barn in northern Vermont. Guild members from around the United States and Canada volunteered for 10 days of instruction and work, which culminated in a community hand-raising. I continued my relationship with the Guild, which led me to a full-time job as a timber framer in a shop near Philadelphia.

I love the art of timber framing. I love laying out, cutting, and raising frames. In Philadelphia, however, I was not building roof systems for churches, or even for the most part structures that would allow our frames to live out their lives. A solid frame does not redeem a poor foundation. And cutting frames for million-dollar pool houses did not fit my memories of town centers in Europe. Our culture it seems has lost the desire to build for the future. The second half of the 20th century was dominated by cheap construction and alienating architecture. In 1981, Tedd Benson wrote about this shift in building design in *Building the Timber Frame House*: "The loss of timber framing as the dominant building system in the country was simultaneous with the loss of human element in almost everything. . . . At the same time that the needs of a quickly changing world were being provided with ever greater efficiency, a distance began to develop between us and our environment."

This "distance between us and our environment" can be seen in almost every city in the United States. As sprawl grew in the United States during the 20th century, suburban and even urban areas were designed not around human beings, but around cars. Strip malls were built in the middle of parking lots, not in town squares. Housing design lost its geometric symmetry and aesthetics, and also its integrity as meant for the indefinite future. "A simple comparison between an ancient town in Europe, a preserved city neighborhood or small town in America, and the 20th-century counterparts of modernist housing flats and postwar suburban sprawl reveals radically different understandings of man, the family, society and history" (Michael Wallacavage, *My Father's House: Real Ties to the Past*, 1997).

In May I finished my first year of a three-year master of architecture program at the University of Notre Dame. It focuses on traditional building design and materials, not looking at the past nostalgically, but in an effort to inform future design. This architecture program is unique in our modern world in that its purpose is to educate architects to design spaces with humans flourishing as an end goal, and longevity at the root of building design. It's a program that attempts to reflect the qualities that I have found in timber framing.

My professors believe that the art of timber framing as a building method is crucial for our environment—and for humans, lost in the poorly designed spaces we live in today. I believe my experience in timber framing will hugely influence my growing understanding of architecture and urban design.

—THOMAS DOUGHERTY

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Glimpses of Belgian Framing

AFTER ten days wandering around the Netherlands (see TF 116), it was off to Belgium. The only question was whether to go to Bruges or to Ghent. As the town in which I reside in New York state was named after the latter, it seemed only natural to head to Ghent.

Ghent Belgians, with plenty of clay, favor brick construction, with their older buildings constructed from stone, and thus their urban timber framing is found primarily in floor-joist systems. (While I'm certain there exist lovely Belgian roof trusses and frames, I could not access them, more's the pity.) Half-timbering is rare in these urban areas. The area around Ghent (Flanders) seems to be linked stylistically to the provinces of North and South Holland and other western Netherlands provinces, whereas eastern Belgium (part of the original Duchy of Limburg) shows more connection with a Germanic tradition, not unlike the external frames which can be seen in Maastricht. (Limburg is also the easternmost province in Flanders, the Dutch-speaking portion of Belgium, as well as a province in the Netherlands.) I did not make it into the southern French-speaking part, save by car, so I cannot speak to the traditions of the timber framers there.

The interiors of these buildings show a rich tradition of timber framing, which deviates from the Netherlands tradition. The most obvious deviation is in the disposition of floor joists. In the Netherlands, most floor framing rests on the tie beams of tightly spaced (4 ft. or less on center) crossframes with no interstitial joisting and with the flooring running perpendicular to the bents, called *tussenbalkgebint* construction.

In Belgian framing, major carrying members are spaced much farther apart and have smaller, interstitial joists running perpendicular to the main members, and the flooring runs parallel to the main carrying timbers. The framing I saw in Ghent, timber systems carried by masonry (instead of the Dutch fashion of cladding a timber frame in masonry), relied on projecting masonry corbels to carry the load of the floor into the wall. I had seen this sort of arrangement at both the Oude Kerk and Nieuwe Kerk in Delft, but not often in domestic structures.

Gravensteen Castle was originally constructed in 1180 of stone on the foundations of an earlier wood-framed castle from the 9th century. The castle fell out of primary service in the 14th century. It was partially restored beginning in 1885, which puts in question the authenticity of the interior framing, especially the more elaborate framing in the Great Hall.

The entrance to Gravensteen (Fig. 1) has a timbered floor above the passage, with two long sill plates and small stub posts that spring from corbels and tenon up into the sills. The sills in turn support large ties that run perpendicular to the masonry walls. The Long Hall (Fig. 2), now used as the entrance to the rest of the keep, has similar framing members, but without posts. The sills appear to have been hewn on three sides, as the interior edges are still rounded. The Great Hall (Fig. 3), now used to exhibit armor, has the most complicated flooring system in the entirety of

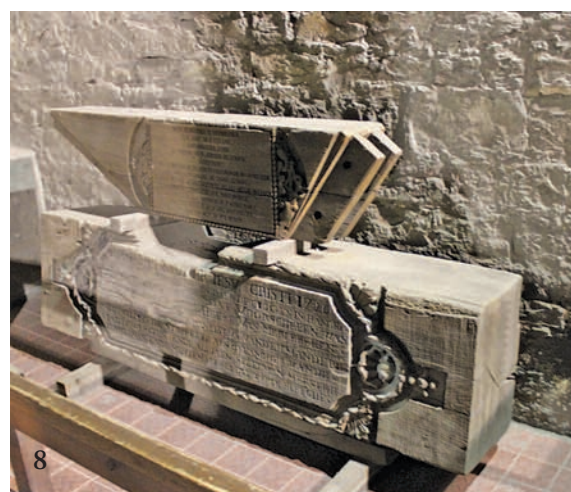


Photos Ian Stewart

1 Gravensteen Castle, Ghent, Belgium, 1180, entrance passage. Corbels support plate rather than joists directly.

2 Gravensteen, looking upward in Long Hall.

3 Gravensteen, Great Hall ceiling framing. Three-part strut rises from corbel to support rafter.



Gravensteen. Canted posts rise from masonry corbels to tenon into the tie beams. Bracing extends from the tie beams to the posts, and bolted wood plates cover the connections. Joists run over the ties and small filler blocks between them give the illusion of solid framing. Below the keep is a large chamber, which has evidence of the earlier castle, as well as previous frames (Fig. 4). Below the joisted floor is a row of masonry pockets spaced evenly, apparently to accept joists similar to those in the high ceiling above.

Leaving Gravensteen, we crossed the Leie river to the bell tower of Ghent (locally, Het Belfort van Gent). Standing between Sint-Niklaaskerk and Sint-Baafskathedraal, home of the Ghent Altarpiece, the campanile was constructed 1313–80 and served as a watchtower and municipal archive over the centuries. The long hall attached to the tower has a more ornate form of floor joisting than that found in Gravensteen. The large ties are supported by

elaborate masonry corbels, and long plates or haunches are bolted to their undersides, presumably to stiffen them in shear at the corbels (Fig. 5).

Once within the tower proper, similar framing can be found supporting the various floors, with the addition of long bracing, mortised into posts on the wall that also sit on a masonry corbel (Fig. 6). The carriage for the main alarm bell in the top of the tower is traditionally framed and has been reinforced (Fig. 7). Next to the carriage are several pieces from earlier carriages, one a twin-tenoned and housed brace, which are elaborately carved and inscribed (Fig. 8).

Antwerp Safely lodged in the Old Town, we inquired of the concierge as to the best place for *moules frites* (mussels with French fries). He provided the information and we set off, unaware that our



4 Gravensteen Castle, under chamber, ties set directly in masonry. Wall pockets evidence of earlier ceiling.

5 Ghent Bell tower, 1380, Long Hall, now made into gift shop. Ties are haunched with bolted, molded plates.

6 Bell tower, long braces supporting floor timbers.

7 Bell tower, bell carriage with later reinforcing and triple-hammer rigging.

8 Bell tower, salvaged bell carriage pieces from 1857 renewal of framing. Unusual housed twin tenon.

9 Vermoeide Model restaurant, Antwerp, 16th century, solid-haunched carrying timber.

10 Museum Plantin-Moretus, Antwerp, pressroom.

11 Museum Plantin-Moretus, domestic chamber with woodwork ornately carved and painted.

12 Plantin-Moretus, passage with finished ceiling.

restaurant, Het Vermoeide Model, was also a 16th-century house. Its floor joisting was similar to that seen in Ghent, but here I saw for the first time a haunched timber upon a masonry corbel, unlike others where the haunch had been a bolted plate (Fig. 9). Wandering after dinner took us to a small pub (its name unrecorded), which had examples of this floor system as well, with haunched and molded timbers. A masonry projection leading up to the second floor and the presence of large timbers surrounding the terminus of the masonry suggested a hearth.

The next morning saw us at the 17th-century Museum Plantin-Moretus, a house and workshop complex, which among other printing artifacts houses the oldest extant wooden printing presses. During the 18th and 19th centuries, the successful operation moved out of the city, leaving the original premises much as they had looked in the 17th century. The pressroom has

both haunched and plated joists, both molded. Timber braces run down from the joists to the presses to stabilize them in operation (Fig. 10). Iron straps are fitted to the ends of the ties, reinforcing the wall connections. The timbers are highly finished.

Within the complex is also the house of the Plantin and, later, Moretus families, which shows a high degree of sophistication. Rich tapestries and paintings line the walls, and the corbels and tie beam haunches overhead again show a high finish, including carved acanthus leaves and gilding (Fig. 11). This pattern is repeated in several rooms, with differing infill colors. Even the exterior passages exhibit this level of care and finish (Fig. 12). This museum houses a deep collection of books and prints, as well as Rubens paintings, and is well worth the visit. —IAN STEWART
Ian Stewart (ian.stewart.preservation@gmail.com) owns and operates New Netherland Timber Framing and Preservation in Ghent, N.Y.



Jack Hursh

California's Cowell Lime Works Barn

The Background

THE Cowell barn in Santa Cruz, California, part of the Cowell Lime Works Historic District, stands on what is now the campus of the University of California, Santa Cruz (UCSC), overlooking the Pacific Ocean. The barn's reconstruction followed a winding path to a winning conclusion (Figs. 1 and 7).

California's built environment, compared with the rest of America, is comparatively new. The Golden State went from a sparsely populated frontier wilderness during the Spanish and Mexican *Rancho* period (1784–1846) to become the most populous state in the Union. With the discovery of gold in 1848, and the subsequent admission of California to the Union in 1850, San Francisco's population, for example, increased 17-fold in four years, from 15,000 in 1848 to 260,000 in 1852.

Miners weren't the only adventurers to make the arduous journey out West during this period, and many stayed. The three initial players in the story of the Cowell barn were all from successful business families back East, in shipbuilding, mining, engineering and timber. Whether they were sent to seek new business or to make their own marks, they had in common access to funding and knowledge of business practices.

Henry Cowell arrived in San Francisco before 1850 and started a successful drayage and storage business. Albion Jordan, an engineer, and Isaac Davis initially worked on the waterfront with steamship operations. They began developing the lime works in

1853 and acquired the land piecemeal. In 1865, Cowell bought Jordan's half of the lime works and expanded the operation, and in 1889 became its sole proprietor. Limestone burned at the Cowell Lime Works came from quarries on the UCSC campus, which is underlain by karst formations (Figs. 2–3).

When heated correctly, limestone (calcium carbonate) turns to quicklime (calcium oxide) and carbon dioxide. Quicklime may be stored dry and, when desired, added to water to produce slaked lime (calcium hydroxide). Slaked lime combines with carbon dioxide in the air to become limestone once again. Combined with sand, slaked lime hardens into the mortar that was used universally in masonry structures until displaced by Portland cement, a harder version with common origins.

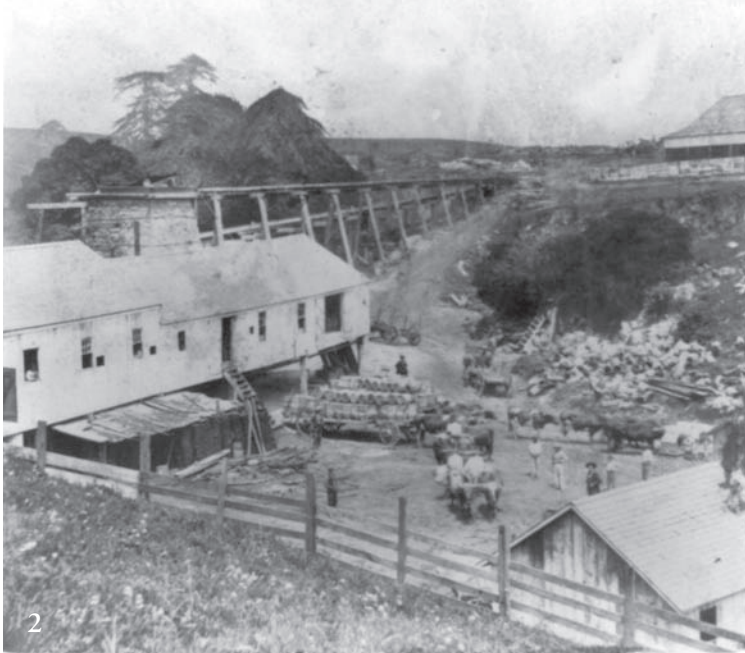
1 Mid-raising of reconstructed Cowell Lime Works barn, 2015. New frame measures 40 ft. 8 in. by 116 ft. 11 in.

2 Historic 1860s photo of Cowell and Davis cooperage and kiln (chimney just behind). Upper trestle brought limestone to top of continuous kiln, quicklime chunks dropped out at bottom. Lower trestle supplied pot kilns, unseen.

3 Cowell Lime Works warehouse near Cowell Wharf. Lime was shipped out to ports along Pacific coast.

4–6 Barn seen in 2010 (upper photos) and interior in 2011.

7 Barn revived and repurposed, opening celebration.



Society of California Pioneers



Santa Cruz Museum of Art & History



Sally Morgan, above and at top

Lime played a vital role during the 19th century as the principal ingredient in mortar, plaster and stucco, and was in great demand during the building boom following the discovery of gold. According to Lime Works historian Frank Perry, Santa Cruz lime was shipped to towns along the coast from Oregon to San Diego, as well as to Hawaii (by way of San Francisco), and some was hauled inland to the San Joaquin Valley. The Cowell Lime Works at its height employed 175 workers, 75 horses and 50 yoke of oxen, operated a cooperage and produced up to 1000 barrels of lime per week. It was responsible for 80 percent of the lime used in California, supplying necessary material for the growth of the San Francisco and other regions from the 1850s into the 1920s.

The Cowell barn was probably built in support of the oxen as their teams were necessary to move the wood to fire the lime kilns, eight cords for each 24-hour cooking period, and to haul the barrels of quicklime. There are indications that the barn also may have been set up for heavy lifting operations in rolling equipment maintenance (Figs. 4–6).

The roof has one unusual feature compared with other California barns, the 6x8 plumb ridge beam. Most historic California barn roofs lack a ridge beam of any kind. Also unusual, the common rafters are let into the ridge to provide its only support. The barn's original framing material is primarily circular-sawn Douglas fir, with braces and sills of Coast redwood.



Damon Adlao



Bill Hurley



Adams Humanities

Early in 2010, the Guild got a call from a member of UCSC's staff for assistance in the documentation of their timber-framed barn in danger of collapse. While documentation of the structure had been done previously, it did not fully detail or address the specific joinery of the structure necessary for a possible reconstruction. Several Guild members responded and the Friends of the Cowell Lime Works, a volunteer nonprofit, hired Dos Osos Timberworks to produce a set of survey documents to assure that the building could be rebuilt as accurately as possible. These survey documents, drawn to Historic American Building Survey standards (nps.gov/hdp/standards/index.htm), now belong to the University.

Around the time of the 2011 Guild Conference at Asilomar in Pacific Grove, a philanthropic proposal was presented to the University to explore the possibility of rebuilding the barn to serve as a center in UCSC's sustainable agricultural program. If this was to be done, it would kick in the formal process of a new building for a UC campus. Besides historic accuracy, salvage of original elements, and seismic standards (Zone 4), the further requirement that all new State of California buildings be LEED (Leadership in Energy and Environmental Design) certified would put this project into new territory for a ca.-1866 barn.

The architectural firm of Fernau & Hartman in Berkeley was chosen by UCSC after many interview rounds. Their multidisciplinary team included a historical architect, a structural engineer, a civil engineer, an electrical engineer, a soils engineer, mechanical engineers, a LEED consultant, a landscape architect, an archaeologist—and a cost-consulting firm! The resulting extensive plan set, to say the least, was pretty impressive. The rebuild requirements put unique constraints on the architects' design program. The finished product keeps the framing of a historic structure in a newly functional building. The contract to cut and raise the frame was awarded to Santa Cruz Timberframes, whose Karl and Ginger Bareis produced a technically and artistically

proficient structure. Karl's account follows on page 16.

Barns are by their very nature adaptive. If a better mousetrap came along that helped the bottom line, farmers and ranchers utilized it. If it meant altering the barn, the alterations were done. In this case, the Cowell barn's new life as part of agricultural education is a leading adaptive use today (Fig. 17).

Though there are numerous historic timber-framed barns in California (see TF 56, 81, 89, 102, 103 and 117), and probably more to be discovered, the state is not a hotbed of new timber framing, and all practitioners out here get used to explaining our work to building officials and engineers (and others). But nothing had prepared me for what the timber frame consultant's role turned out to be in advising and guiding the architect's team. From the scope and requirements of the careful dismantle, overseen and documented by Sherwood Forest Timberframes's Paul Oatman (see below), to the reuse of original frame members (78 in all), to the hugely successful raising in March of 2015 and the building's dedication last September (Fig. 7), it was quite a ride.

—BILL HURLEY

The Takedown

THE catalyst for the reconstruction and reproduction of the historic Cowell Lime Works barn was Sally Morgan of the University of California, the hero of the story, who contacted the Timber Framers Guild, which in turn contacted members of the Guild in California. Through Sally, I met Bill Hurley of Dos Osos Timberworks, and we decided to team up. My work was to identify the layout system and the joinery, take the photographs and provide a description of the extant structure of the barn. Bill's firm would do the drawings. A local foundation, represented by Alec Webster, funded the project.



Paul Oatman, above and below

8 After stabilization, dismantling begins with roof covering.

9 Exceptional supporting housed rafter joint for ridge beam.

10 Modified step-lap joint at seat of rafter.

11 Top side of 6x8 ridge beam showing original U-bolt nuts.

12 Underside of ridge showing U-bolt and rafter joints.

Plainfield Construction of Santa Cruz dismantled the barn, while as field supervisor I recorded each member with shop drawings and photographs (Fig. 8). To me this was the most interesting part of the project. After months of recording this barn, its true purpose remained something of a mystery to me. But the wedged half-dovetail tying joints at the walls, the modified step-lap rafters at the plates, and a fully supported ridge beam fitted with apparently original U-bolts all pointed to hoisting of some nature (Figs. 9–14).

The wall brace tenons were all wedged but the roof braces were not. I believe that the wedges were used to rack the frame into plumb. I would like to say the wedged braces, the strong tie beam joinery and the fully supported heavy ridge were in a one-of-a-kind barn, but the nearby theater barn on the UCSC campus, just below the lime works, was built the same way. So here we had two barns framed for hoisting heavy loads from the ridge, both near a lime works—but no certainty about what was hoisted.

The Cowell Lime Works barn appears to have been built before 1870, since all the scarf joints are pinned with wood, and bolts supplanted wood pins as fasteners in scarf joints about this time. Additional evidence of the construction date is that the straining beams between the purlin plates have been removed, almost certainly to accommodate installation of a hay track and trolley assemblage. This assemblage was invented in 1867 by William Loudon and by 1880 had become a standard fixture in almost all California and Nevada barns.

In addition, the barn as it stood included an interior sill plate and a line of internal posts that ran the length, dividing off about 40 percent of the width from the eastern wall. The most unusual feature was the ridge beam with notched common rafter connections (Fig. 9). The step-lapped rafter seat detail in the top plates I had not encountered in any of 200 California barns that I have inspected (Fig. 10).

That the Cowell barn had a ridge beam was itself unusual, as most common rafters in California timber-framed barns butt together at the peak without a ridge, much less a 6x8 ridge. The U-bolts fastened to the ridge on 10-ft. centers were certainly original, as evidenced by the fact that their nuts were mortised into the top side of the beam (Figs. 11–12). It's possible that these U-bolts could have been used for an early, innovative pulley system for hay forks, which preceded hay tracks, but more likely some heavier load justified the extra-sturdy framing.





13, 14 Half-dovetail tenons at tie beam ends were wedged down onto their sloped seats in wall posts, and pinned for good measure. Wedge, not shown, fitted mortise above housing.

Paul Oatman

I had not encountered the wedged half-dovetail tying joint, though found in historic barns in eastern states, in any other California or Nevada barn (Figs. 13–14). Considering the 40-ft. span of the tie beam, the builder made the right choice, as the wedged half-dovetail puts the forces on the sloped interfaces of the joint rather than on the fixing pins across the joint.

—PAUL OATMAN

The Reconstruction

LOCAL projects usually start with a conversation while standing around kicking dust and looking at what remains of a once proud barn. California barns have been discussed in some detail in previous issues of this journal by Paul Oatman. Suffice it to say the University of California, Santa Cruz, let their heritage barns go for decades before the University architect called and suggested I take a look at their old “hay barn” (as they called it), originally built 1867–68 on the edge of coastal prairie and, more important, over one of the richest lime deposits in the state.

The barn was not actually built to store hay as the name implies. We believe the Cowell barn was used as a hoisting barn (Paul’s term) to rig oxen wagons in the middle aisle and to lower yokes over the heads of ox teams as they were hitched. The large drayage wagons would carry quicklime in barrels to the local wharf.

Our reconstruction of the barn included surveying what amounted to a pile of used timbers salvaged the year before during “deconstruction” of the original. Although we sit on the edge of the largest extant redwood forest, I noticed that most of the strength timbers were Douglas fir, all apparently cut within one mile of the barn and milled on-site using a 6 ft., 8-in. circular saw. By the time we got to it, the barn had deteriorated and there wasn’t a lot of usable wood, so our first challenge after determining what was left was to find suitable replacement timbers.

We immediately thought of the campus itself, as its more than 2000 acres contained enough suitable timber to do the job. With the help of the project manager and the campus architect, we were given a list of 40 large Douglas firs that posed hazards or stood in areas slated for development. Our area has enough forest to keep several small mills in operation, and the University had milled

most of the trees cut over the past several years. We surveyed the trees, thinking in particular of the 40-ft. tie beams used in the original barn frame.

After compiling our lumber list from locally available stock, I was informed by the project manager that the project required “all prospective bids to be based on commonly available materials.” The campus feared that if our bid included materials not known to the other four timber framers bidding, then we would have an unfair cost advantage. Needless to say, we were astounded by the logic, especially as the project had a LEEDS Platinum target for sustainability goal. After pointing out the advantages of remaining local, to no effect, we were forced to widen our search for materials and to source them at a Forest Stewardship Council–licensed facility. We were surprised how difficult it was to find sustainably harvested 40-ft. No. 1 Structural Doug fir beams. After searching all local sources we ended up in the Siskiyou at the very top of California, 500 miles north of the UCSC campus, where we met with and negotiated for salvaged timbers recently harvested after a major fire devastated an area of upland forest. Our team member Matt Lovemark, a native of southern Oregon and familiar with the area, personally inspected the logs in late August of 2014, so we were ready to submit our bid. As it turned out, ironically, the difficulty of sourcing materials limited the competition for this project!

By early January of 2015, we started getting shipments of the timbers, and we spent the next six weeks cutting out the new stock and fitting in the old pieces where they had been in the original building. Our small team of four was augmented along the way as we got closer to completing the layout and joinery. We were able to do most of the assembly in our timber yard in rural Bonny Doon, only four miles from the campus. The scale of the building was a challenge in every way. With eleven bents, we calculated 1460 elements to be replicated and stacked prior to raising. The University had asked for a date six months in advance. As the time of the raising approached, we realized that we’d need help from the local community.

Santa Cruz city has a vibrant craftsman tradition, and over the past few years contractors have created a construction guild. Mostly the work of a single-minded local contractor who saw the need to separate quality from run-of-the-mill construction, his efforts have paid off in many ways for the community. (Local construction guilds are another story and deserve their own discussion.) Our local contractors had been following the stream of local media coverage on the Cowell barn project and jumped at the chance to volunteer for the raising.

In the run-up to the raising, we had to transfer 14 truckloads of finished timbers to the campus and catalog all the pieces in reverse order. The final week was a typical logistics and planning maneuver that our team divided between site prep and the yard. The last three days we met with officials from the University concerned about safety and liability, and the out-of-town professionals began to arrive from as far afield as the Sierra Nevada, with journeyman timber framers borrowed from throughout the region to help coordinate the one-day raising.

In the end, our timber-framing team ballooned to nine members (six in red shirts in Fig. 15), and we had 67 civilian volunteers plus the 40-ton crane! The actual raising scenario played out in several stages, starting with evening meetings at our place in Bonny Doon. I reviewed and assigned responsibilities to the 14 who would have authority over volunteers, rigging, safety

and communications. That strategy session was critical because we had agreed to use sophisticated climbing gear, and two professional arborists had been added to the crew to ensure the rigging was well handled—all to assuage the University’s fears about having so many volunteers on-site. Strategy and logistics are critical, but in the end weather and simple physical constraints have more to do with final results than anything else (Fig. 16).

Pre-dawn on the morning of the beam raising, our yard had mostly been converted into an encampment for the out-of-town gang, some having arrived just the night before. Traditional flapjacks, sausages, eggs and oatmeal were wolfed down as we checked our lists one last time before heading out to the campus. The last load of ridge beams was loaded on the crane truck and we headed down the winding mountain road just as the sunrise was peeking over the eastern horizon. By the time we were ready to hoist the first bent there was a crowd of locals spreading blankets on the hillside above the site, to watch (Fig. 1). —KARL BAREIS
Karl Bareis (karl@santacruztimberframes.com) is the proprietor of Santa Cruz Timberframes in Bonny Doon, California. Paul Oatman (paul.oatman@volcano.net) operates Sherwood Forest Timberframes in Pioneer (Amador County) and has written frequently on California barns. Bill Hurley (wlhurley@dososostimberworks.com) is a principal at Dos Osos Timberworks in Los Osos. Dos Osos’ work last appeared in TF 80.

15 At mid-raising, red-shirted Santa Cruz Timberframes crew members set plate segment over waiting scarf-end and multiple braces. Drone observes.

16 Matt Lovemark, framer, surfer, smoke-jumper, back-country ranger and rock climber, walks ridge of completed frame.

17 Newly finished barn in service, hosting history fair in October 2015. Note wood gutters with rain chains leading to flush drains at grade.



15

Jack Hursh



16

Toby Hargrave



17

Bill Hurley



Photos Steve Rundquist

Composite-deck bridge with framed cover, N. Platte River, Wyoming. Cylindrical abutments are concrete wrapped in Corten steel.

Cover for a Bridge in Wyoming

IT all began with a phone call from a builder. He had a client in Saratoga, Wyoming, who needed a cover built atop a bridge deck spanning a narrow channel of the North Platte River, which runs through his property.

I met the builder and client at the site, gathered input about specifications and general design, and was warned, “It’s all about scale. The scale needs to be correct.” The bridge was to be used not only to get ranch equipment from one side to the other, but also as a family and community gathering spot.

I put together a preliminary design and a realistic cost estimate. The client liked the proposal and asked when we could get started. He was a bit disappointed when I told him I would be unable to start his project for at least a year because of prior commitments. But he shook my hand and said he was anxious to start even though it was a year away.

Over the next few months, a final design developed (after some 18 or so revisions), and the client then requested me to build a section of the structure atop the bridge deck as a mockup. That way, he could put hands on, take a step back and see if the general scale and proportion worked for him. It was done, he was satisfied, timbers were ordered. We took care of prior commitments and our full focus became the structure over the bridge deck.

The footprint of the frame was 16x52 ft., to cover an 18x55-ft. steel and pressure-treated, nominal-4-in.-thick deck on abutments provided by Summit Structures in Laramie, Wyoming. Knife plates were welded to the steel frame below as anchors, fitting 18x4x½-in. internal slots in each post base and through-bolted. Swift Structures and Architecture in Laramie reviewed and okayed

all aspects of the frame as well as the deck, from tiedowns to framing connections and bracing and sheathing requirements, given the local snow and wind loads. The load of timbers, roughsawn unseasoned white oak from a mill in Maryland (whose state tree is the white oak) weighed about 45,000 lbs. when delivered to our yard here in Colorado.

The bridge covering might be the only white oak frame spanning the North Platte. I chose *Quercus alba* for its strength, beauty and exterior durability. The client thought the chunk of weathered and checked white oak I showed him was about the prettiest piece of timber he’d ever seen, and I agreed. White oak is a favorite timber, second only to white pine in my book—which may seem odd for a westerner, but then I learned framing in the East in the 1980s.

I grew up in Lawrence, Kansas, and always loved playing around in the old barns with their massive timbers and solid structure. Hide-and-seek or king-of-the-mountain with my buddies in the haylofts was always great fun, with lots of crannies between the bales to hide in, and if you got knocked off the upper stack you usually had a soft landing in the bales below.

When I moved to Brewster, Massachusetts, on Cape Cod, I hired on as a carpenter’s helper with Andy Shrake in East Dennis, who introduced me to solid historic work, taught me some tricks of the trade, gave me my first slick—and after a couple of years told me to “get out and go do it for yourself.” White oak cuts a crisp edge, gives a tight, long-lasting joint and has a beauty of grain like no other. It reflects a worldwide building history spanning a thousand years.



White oak framing timbers grown in Maryland. Mortise and tenon joinery, with braces, valleys and jacks scribed, butted and fastened.

Once the timbers were delivered to our yard, my partners Mike DuRant and Daryl Sigler and I got right to work. Layouts were double and triple checked. Joinery was cut, with parts preassembled, fitted, trimmed and predrilled whenever possible. We loaded up the finished timbers and hauled them over the mountains to Wyoming.

Assembly took our three-man crew about seven working days. Along with the strong backs and good sense of the crew, we had occasional help from a crane, which set the middle section of the ridge some 20 ft. out over the stream and about 18 ft. above the bridge deck, in minutes, a task that would have taken the three of us a day to accomplish without hydraulics and cables. A lift with a 32-ft. reach carried and set the remaining 40,000 lbs. or so of timber sections and trusses in place.

Once the posts, plates, roof ridges and common rafters were installed, we scribed in place the valleys and jacks. Knee braces were also scribed in place and set with structural wood screws, countersunk and plugged. The final fit was by a small pencil scribe, which helped the bracing conform to small discrepancies in the roughcut timbers. All other parts and pieces, including the overlapping ridge beams, had been laid out by calculation and precut. When checked to theoretical center of structure the actual center of structure varied by an eighth of an inch. We also checked the effect of the weight of the cover on the bridge deck and found the same one-eighth-in. deflection from our original baseline elevation at center span. Kudos to Summit Structures on that count.

Along the way and during the daily routine of work, we enjoyed the beauty and special moments of each day on the site: the mink who lived in the rocks around the piling foundation at the west end of the bridge, the osprey sailing overhead with a fresh-caught trout in its talons, the fighting pronghorns in the sagebrush flats just east of us, the deer who used the bridge nightly

after we left (fresh footprints found in the dust at each end of the bridge deck when we arrived each morning), the weasel chased out of the tool trailer with a mouse in its jaws, a flock of mergansers feeding under the bridge.

And most spectacular, perhaps, the moose. One day, about midmorning, we spotted a nice, mature bull moose wandering across the pasture just west of us. We watched as he headed south, upstream, then vanished into a thicket of willows. Just before noon as we were working on the bridge deck I glanced up and saw this same bull now standing about 20 yards from us on the east end of the bridge, right next to my parked truck. He seemed to be glaring at us as if angry that we were blocking his way over the bridge and he didn't want to get his feet wet. . . . I ran over to my truck to grab the camera but he wandered away before I could get a photo.

As we proceeded with assembly, each time we added a component it seemed to add to the beauty and stance of the structure. When it was assembled and covered we were all quite taken with how everything "fit" really well. And I'm not talking just tight joints. The client was right: it's all about scale and proportion. He did a wonderful job of helping us get it right.

One of the last tasks was to set the roof decking of 1x12 roughsawn local pine boards. About three-quarters of the way through this process, we took a break and sat down on the bridge deck for a cuppa. We noticed the light from the stream below us being reflected up onto the underside of the pine boards above, making a flickering pattern on the boards and framing. Together with the sight of this gentle movement of light, the soothing sound of the stream flowing under us made it seem almost as if the structure was alive and breathing.

—STEVE RUNDQUIST
Steve Rundquist (stevenr@aol.com) operates Brewster Timber Frame Company (timberframes.net) in Bellevue, Colorado.

Qualifying Client Inquiries

HOW many times have you worked an inquiry, bid a job or spent weeks with a potential client, only to get a phone call, “Thanks for all your hard work and ideas, we’ll think about it and get back to you”—then to be put on terminal ignore, like the engagement’s off and they want the ring back, only to find out later that the job went to a less experienced framer who does marginal work and never was involved in all the legwork, meetings and phone calls the client put you through?

As a timber supplier, I get framers who want me to launch into a project but have not even had initial meetings with their clients. If you’re like most timber framers (or designers, or architects), you quote way more often than you close. Pretty soon, you can become so discouraged you want to quit. Timber framers often struggle with cash flow and thus leap at the chance to quote anyone, anywhere, anytime, hoping to get some business, any business, to keep the cash coming. Old habits are hard to break. Holding back a quote until you have all the information makes anyone anxious, but in the long run it will make you more successful. Working inquiries that do not have a strong chance of success is the Quote-and-Hope (or Pitch-and-Pray) approach, and it’s a poor use of your time.

You don’t have unlimited time to waste on nonstarters. Most small timber framers or even companies don’t have a budget to hire a dedicated salesman. So the owner often wears many hats including the sales hat. But he needs to figure out how to quickly qualify contacts. He must methodically qualify sales inquiries, and use limited time and energy wisely.

The Internet and your own marketing information about your company allow possible clients to learn about timber framing, and you, before they call. That can be helpful so they can pre-qualify themselves (to a certain degree), or they can disengage if they decide you’re not a fit for them. But product information is much more out of your control than it used to be and you still need to qualify an inquiry quickly before you invest time.

The most successful timber framers follow a disciplined qualifying and sales process. You may not be comfortable questioning prospects, or perhaps you don’t know how to qualify an inquiry, but there’s no time like the present to get started. Qualifying clients will probably make you more money, and certainly let you get back to doing the timber framing that you love. One more reason to qualify: with a new customer or mill, it takes six or seven inquiries to get your first order. Most people give up after three inquiries. Depending on where you are in the supply chain, the sooner you qualify inquiries the sooner you can start working with new customers downstream or new suppliers upstream.

Your first step, before dealing with customers, is to get a clear idea about the size, complexity and locations of projects you want to work on. There may be some key things that you consider to be “must haves.” Make sure you spell out to yourself what’s important. Understand which clients are not a good match for you (too big, too small, too-short time frames, or perhaps who do not fit your communications style) so that you can refer them to other timber framers who may fit them better. You will find that other framers will reciprocate in the future. If they get too busy for a job or the client doesn’t fit with their way of doing things, they’ll

refer the client on to you. When you’ve got a clear understanding of which sorts of clients will be happiest and most successful in working with you, then qualifying sales inquiries becomes much easier to do.

What is qualifying? No pain, no gain. Qualifying an inquiry is evaluating whether it’s worthy of your time. It might also be described as the supplier diagnosing the prospect’s problem and finding the pain. Only when you find the pain should you propose remedies or solutions to the pain. Once you find that, then evaluate whether there is a good likelihood of getting an order. If the customer can get what he needs from his established supplier, an invited supplier, or multiple other suppliers, there is no prospect here. Just because someone has phoned you (filled out a form online, dropped a business card off at your booth, called to ask about your services, etc.), that doesn’t make a lead. It just makes a kinda, sorta interested person. It’s still too early to know whether it’s a genuine opportunity or not. You need to find if the prospect is worthy of your time and effort. That’s right—worthy of your time and effort. Because your time is valuable, and, incidentally, so is the time of your professional partners and service providers, suppliers, engineers, draftsmen, and designers.

It costs time and money to provide even a basic response, professional quote or proposal. If you give ten inquiries, with no orders, to your partners, soon they will put you on terminal ignore. You need good upstream partners and suppliers as much as you need clients downstream, so it’s to your benefit to use everyone’s time and resources wisely.

Qualifying is asking basic questions to see if there is good reason to ask your partners upstream to work on the project. Ask the prospect to provide basic information. The four subject areas you need to check are *Budget*, *Authority*, *Need* and *Timing*. How much do you want to spend? Do you have authority to sign the order confirmation? Are you ready to buy now? When do you want the job completed? Ask the questions and don’t assume anything. Most price checkers simply want the price quote so they can move on, and are not going to volunteer much beyond minimal information. At the most, two phone calls and four simple questions should be enough for you to decide if further work is warranted. At this point ask yourself, “Is there something else better I could be doing?”

The first thing you need to be prepared to do is to “Go for the No.” Assuming you’ve got several interested sales inquiries, your next step is to eliminate, as fast as possible, the inquiries that don’t fit you or are not going to become orders. If the budget is too low, the schedule too soon, the client not ready to buy, the engineering requirements unrealistic, then you should gracefully back away. The most successful timber framers eliminate the losers as fast as they can. Get the facts. Size them up, “Go for the No,” and if necessary move on.

The biggest mistake is to keep working leads that you will probably never convert. Good qualifiers don’t make money by deluding themselves, thinking they can change a prospect from a “No” to a “Yes.” Before the order is confirmed is not the time to be an expert and show off your product knowledge in hopes of gaining the client’s confidence. You will not ingratiate yourself and

you will not obligate most clients by doing so. They usually take all your free information and, with their newfound knowledge, go and shop the job for the cheapest price. Get the job first, educate later.

Sometimes good questions are a little uncomfortable to ask. Don't be shy, simply ask the prospect for permission: "I'm curious about a few points. Can I ask you a couple of questions about the job? This will help me spend time efficiently for you on this job." Mention work and job because (let's be clear) you earn your living by converting inquiries into orders. The information gained from questions is not all one-sided. The client benefits because good questions give pause for thought, to clarify requirements and cause him or her to think through challenges. Match your questions to where you are in the relationship. You don't want your questions to feel like an interrogation, so pace yourself. Start with those four areas of Budget, Authority, Need and Timing.

Twenty questions Here are some model qualifying questions. After 1, 2 and 3 (introduction), go to 4 (budget). Two or three more questions will tell you if you need to go further. If things are going well, you can then ask the more pointed ones like 11, 12 and 18.

1. Thanks for contacting us to work on this project for you. I'm curious about your job. Could you share your advice and ideas? This will help us to go to work for you. We can work faster and do a better job for you.

2. Most projects take months of planning. Where are you in this process?

3. What is your global budget number for the timber frame package?

4. Why did you call us only two weeks before you need the timber?

5. What makes today's inquiry, presented at the last minute, urgent or important?

6. Is this a price-checking exercise?

7. What species or timber grades are you considering? Kiln-dried? Local pine? Recycled?

8. You are asking for clear wood cut from the best part of the log, the most expensive grade. Would you consider a structurally strong lower grade with more features, such as knots and checks, at a less expensive price?

9. If we can come in at your budget number, will you be able to order this week?

10. What's keeping you from confirming and working with us, today?

11. Are you already working with a preferred supplier?

12. What would you need to change from them?

13. When will you be able to confirm this as an order? I know that you may have to check with (your boss, the architect, the homeowner) but, if the decision was yours, would you give us the order this week? Why not?

14. Do you have a signed contract now? (This question is for the architect or general contractor.)

15. Have you had good and bad experiences with other timber framers? What do you need to do differently this time around?

16. What's your most important priority? What's your most urgent priority?

17. When choosing a timber framer in the past, was your decision based strictly on lowest price?

18. If you like our quote, will you need to check with anyone else before you give us the job?

19. What problems do you see that could get in the way of our working together?

20. What makes you lose sleep at night? Where do you need help on this project?

If the client will not respond, seems defensive or will not engage in the conversation, you need to stop the process. If the client asks for a quote on Doug fir with three grades, four options and two drying possibilities, don't bother continuing. The scatter-gun approach arises because the client has *no idea* what's needed. Your quote will usually get thrown into the blender with several other scatter-gun quotes and not move you toward a job.

It's fair to state that it is premature for you to do work for the client at this point since the necessary information is missing, and to ask for (or offer) a callback when the information is gathered.

Spend your energy and time with the general contractors, owners, and architects who take the time and effort to qualify their inquiry before coming to you. They will soon learn what you expect from them. Your partners in the supply chain will respond with lower prices because the sales process will be more streamlined and productive. Qualifying is a learning process for everyone up and down the supply chain.

Poor inquiries can be useful as learning tools. You know you're not going to get an order anyway. It will take time to become fluent in qualifying. Practice on poorly prepared prospects with unqualified inquiries. Use questions from the basic topics Budget, Authority, Need and Timing.

Refinements Make up a form to fill out when you get an inquiry, with check-offs or spaces for all the questions. Just conduct the conversation as though this is routine and part of the procedure needed in order to get a quote from you—"Just let me fill in my inquiry sheet and we can move forward on this." This is a good inquiry-tracking tool. Keep it on paper or handy in your computer. Leave space for a phone log of follow-up calls and other notes.

When you give a quote, don't just email it. Make a personal phone call, go over important points and make an appointment to call them back to follow up. (But note that you are not going to be able to qualify larger companies, pricing clerks with no authority or sealed bids for government jobs. I haven't found a good approach here because it's simply a bidding war.) Your competitors are orbiting over this job, and your partners upstream need follow-up. This includes keeping in contact and letting them know the status of the quote. This courtesy is appreciated by people who have done unpaid work for you, and will insure a prompt response on subsequent inquiries.

—BRUCE LINDSAY

Bruce Lindsay (brucelindsay@shaw.ca) operates Evergreen Specialties Ltd., consultant and timber broker, in North Vancouver, B. C.



Allan Stern

1 Bolton Historical Museum addition, Bolton Landing, N.Y. Struts are through-bolted; mitered post-to-rafter joint will be strapped.

Dogleg Framing

WE describe here a scheme for using timbers to frame open, innately stable structures. Usually the connections can be reasonably made with traditional joinery. Indeed, in the past the scheme was often used by builders who had nothing but traditional joints in their quiver. *Two rigid, three-membered assemblies leaning against one another at the ridge* defines the most basic version of the scheme. Those two subassemblies would usually be made from a rafter, post and interconnecting brace or strut (Fig. 1). While there are many variations, and spans can range from minimal to more than 100 ft., we have come to call the general method *Dogleg Framing*, looking, at least to some eyes, like a canine rear appendage.

Rudy Christian's Parma Heights, Ohio, church pavilion, a fine example of the breed (see TF 117), was at first designed with kingpost trusses at 4:12 pitch set atop 14-ft. posts. That flat pitch made for brutally high axial forces in the trusses, whereas Rudy's hope was to use traditional joinery rather than the steel gusset plates the architect had specified and assumed necessary (Fig. 2).

As high as the forces are in such a long and shallow truss, we were at least as worried about the completed structure's lateral stability: this was to be an open pavilion, and the tall, tippy posts looked like they just wanted to let the truss roof land intact on the ground. Furthermore, those impressive tie beams, high as they were, still seemed as if they would feel a bit low and flat. (My concept of spiritual spaces includes feeling unfettered by even implied ceilings.)

Rather than tweak traditional joinery to handle high forces (while being so high up as to be nearly invisible to any but the most peg-obsessed), as consulting engineers we thought: Why not change the topic entirely? So we proposed using another framing scheme, the one we have come to call the dogleg. While the roof lines in this case remained almost identical, the doglegs really opened up the space while providing strong but unobtrusive lateral strength (Figs. 3 and 4).

By all accounts, the architects and parishioners are happy with their finished structure. Since much of the joinery is not only traditional, but also closer to occupants' eyes, we like to think that our craft is better represented by the structure than it would have been with the original high, flat trusses. The Parma pavilion is a dramatic example of dogleg framing, with its 40-ft. span between the aisle posts and the valley doglegs necessary to the cruciform plan.

Doglegs, though, can be used in very small and simple structures (Fig. 5). Some of the first that I played a role in building provided shelter to a single picnic table.

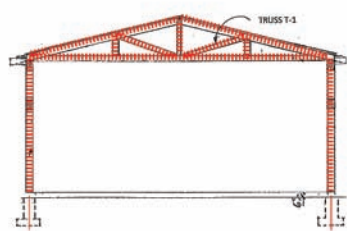
In subsequent years we designed and built quite a few dogleg variants. Far from becoming bored with them, we have continued to use them, especially for open (but roofed) structures and ones that need or deserve to maximize headroom. All the dogleg versions (Fig. 6) share these two crucial virtues:

1. Innate lateral stability, derived from the three-pinned arch (or A-frame) action.

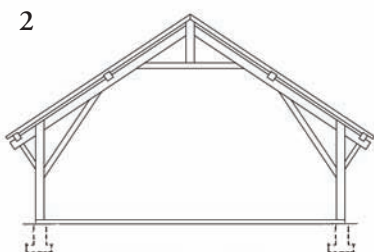
2. Maximized headroom: the only space sacrificed to structure at the ridge line is taken by principal rafters.

Doglegs can be seen as modeled on ancient cruck frames, which are really the simplest structural form, the A-frame, but use curved or crooked timbers to gain some headroom along the walls. The earliest cruck frames used curved timbers to support the structure and define the building envelope. More evolved versions used the curved timber (naturally curved or laminated) as the internal strut of the dogleg.

We have designed dogleg frames ranging in clearspan from 10 to 40 ft. and eaves-drip-to-drip spans up to 60 ft. Some examples seem to differ from one another only in the scale used when sending the drawings to the printer. As for the roof drip line, notice that when the posts can be well within the footprint, post-to-rafter struts can be added to the exterior post face, bracing the long eaves cantilever.



Pavillion Frame - as Originally Proposed



Pavillion Frame - as Built

Eugene W. Minnick



3



4

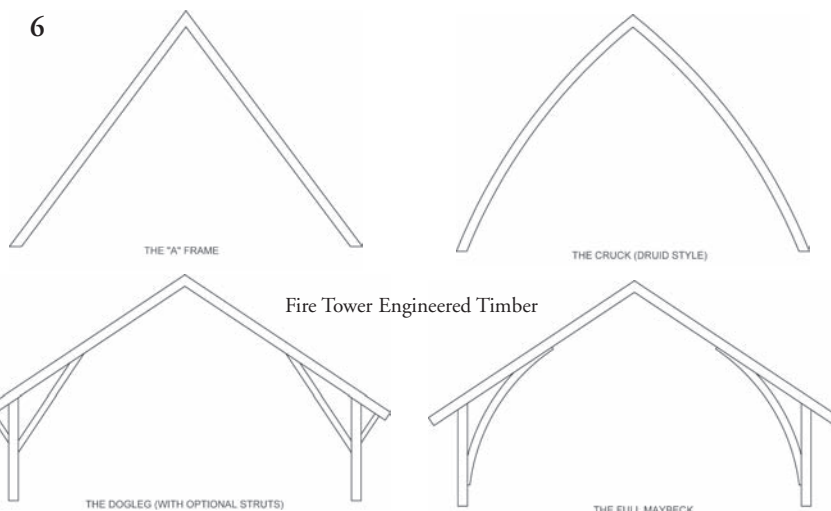
Rudy Christian



5

John McRae

6



7

College of Environmental Design Documents Collection, University of California

2 Original and as-built framing schemes, Parma Heights, Ohio, Baptist Church pavilion.

3, 4 Parma Heights pavilion, completed frame and detail of interior in use.

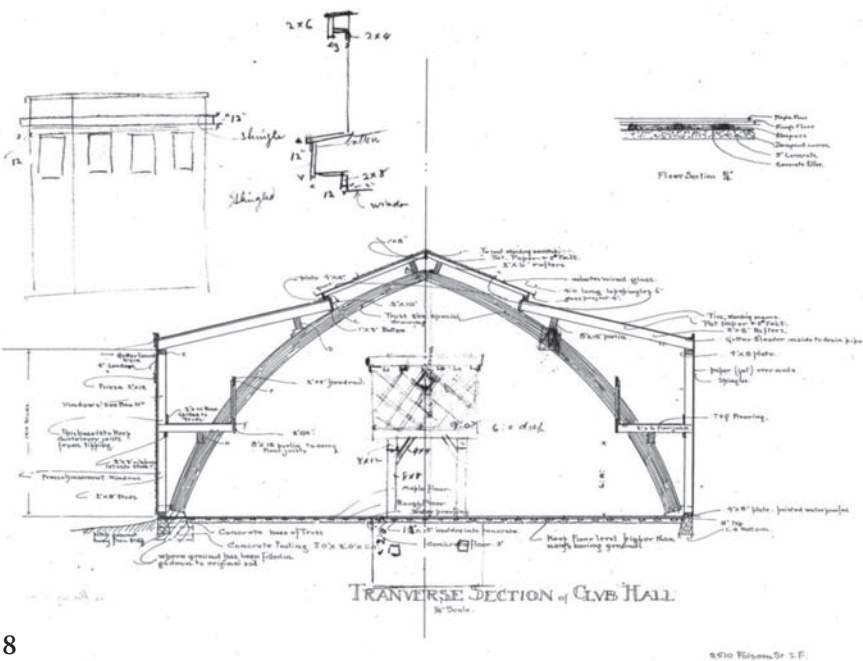
5 Mini-Talk pavilion, Squam Lakes Natural Science Center, Holderness, N.H.

6 A-frame and typical evolved dogleg sections.

7 Hearst Hall, Berkeley, Calif., 1899. Nailed-laminated arches rise 54 ft. Building was engineered to be disassembled and moved.

Typically, for timber framers, we have followed in the footsteps of many great builders, including Bernard Maybeck (1862–1957). He used curved timbers for the struts (he called them “crux pieces”) in Hearst Hall, Berkeley, California (Fig. 7). The hall was later moved to the Berkeley campus of the University of California

and the main reception room made into a gymnasium. He also built a dogleg frame with struts of nailed plank curves (he called the element a “truck spring cruck”) for the San Francisco Boys Club gymnasium, which came in at one dollar per sq. ft. total construction costs, including clearing the lot, in 1911 (Fig. 8).



8

College of Environmental Design Documents Collection, University of California



9

Allan Dickson



10

Will Beemer

Like so many structural forms, doglegs can be seen as integrated extensions rather than fringe elements, and they can flow from one to another. They are one specific version of a larger family of structural forms that have innate stability, including not only A-frames and crucks, but also “Tudor” glulam arches and steel rigid frames.

Modern European timber builders have been using various dogleg (or “rigid frame”) forms to span many structures for which Americans would use steel moment frames, such as ice-skating rinks, warehouses, industrial plants and field houses. For inspiring examples of modern European examples of dogleggy structures, see Goetz, et al.

One concern with dogleg framing is bending in the posts, induced by both gravity and lateral loads. The rafters are supported by the post struts, but only by applying outward bending forces to those posts. Even if the structures are open and catching relatively less wind, all the lateral force is transferred through post bending, with maximum stress at the lowest brace, where we want to cut that lovely traditional joinery (Fig. 9). Keeping the strut(s) as low as possible on the posts is a great way to minimize the bending stresses. We have used glulam timbers, with their relatively higher capacities, and modified the connections to reduce the damage done at that critical cross section. We have used multiple posts, as we did at the Parma Pavilion, to halve the bending stress. Finally, in some instances, the post can be completely removed. One of my favorite renditions was the pavilion the Guild built for the 1993 Guild Conference at Franklin Pierce College in Rindge, New Hampshire. The open frame, designed by the late Ed Levin, avoided the post bending induced by the struts by taking the latter directly to the foundation (Fig. 10). This fabulous frame was inaugurated by an epic dance party (the late Mark Witter on blues harmonica, see TF 29) but unfortunately was disassembled to make way for a dorm only ten years later. *Lacrimae rerum*.

My best advice to you designers, for the next pavilion (or enclosed basketball court) on your screens, is to consider some version of this classic dogleg framing scheme. —BEN BRUNGRABER
Ben Brungraber, PhD, PE (ben@fjet.com), is a civil engineer and principal at Fire Tower Engineered Timber in Providence, R.I. He previously spent two decades as Operations Manager and Chief Worrier at Benson Woodworking, Walpole, N.H.

Bibliography

Cardwell, Kenneth H. *Bernard Maybeck, Artisan, Architect, Artist*. Salt Lake City, 1983.
Goetz, Karl-Heinz, Dieter Hoor, Karl Moehler and Julius Natterer, with Peter F. Marticchini, translator. *Timber Design and Construction Sourcebook: A Comprehensive Guide to Methods and Practice*. New York, 1989. Originally published in German, 1978.

8 Maybeck’s drawing for Boys Club gymnasium, San Francisco, 1910. Arches nail-laminated like those in Hearst Hall.

9 Pavilion for Morton County, N.D., Water District, designed by Fire Tower Engineered Timber and built by Empire Timberworks in Mandan, N.D. Earlier pavilion in distance. Roof loads put posts into bending via struts.

10 Rindge Pavilion, 40x80 ft., Franklin Pierce College, Rindge, N.H., 1993. Designed by Ed Levin and built at a Guild workshop of 30 people. Roof loads carried to ground via struts.



Matt Hunter



Arvel Aldrich

At left, detail of Douglas fir shed roof entryway designed and built by Ashland Post and Beam, Ashland, Ore. Through-tenon of post to trim off. Above, Southern yellow pine wedding chapel frame, 2868 sq. ft., Houston, designed and built by Red Suspenders Timber Frames, Nacogdoches, Texas, itinerant framer Arvel Aldrich assisting.

Guild Conference Slide Show 2015 (II)

THE annual conference slide show last October at Coeur d'Alene, Idaho, featured images of recent work by Guild members and friends. A small selection appears here and on the following two pages. Additional images appeared in TF 118.



Robert Ward III

Above, mixed-species reclaimed framing bridges between domestic loft spaces, Rochester, N.Y., built by Robert Ward III and others at Grand Wood LLC in Naples, design by HB Cornerstone in Pittsford. Major post 11x15 reaches 24 ft. to ridge. At right, floor framing and circular stairway under way for mansion in Texas hill country, by Jim Holzkecht of Kerrville, in collaboration with Robert Tomlin, builder, and designer Ernesto Bustomanti.



Jim Holzkecht



Jeffrey Totaro

Above, recreational outbuilding with regulation size basketball half-court in suburban Philadelphia, timber frame of No. 1 export grade Southern yellow pine built by Methods & Materials Building Co., Gilbertsville, Penna. Architectural design by John Milner Architects, Chadds Ford, frame engineering by Ruff Engineering, Reading. Composite trusses span 48 ft. using scarfed chords with hidden pinned steel plates, and assembled with an inch of camber to allow for settling under load.



Mike Victor

At left and below, composite framing and interior view of public-access treehouse in city park in Sammamish, Wash., designed and built by Treehouse ARTZ in Chimacum of all reclaimed Douglas fir, Western red cedar and barnboard siding. Design by Terrapin Architects, Port Townsend, engineering by Greenwood Engineering, Takilma, Ore. Specialized metal work by Big Timberworks, Gallatin Gateway, Mont.



Dale West



Irene Brinkman

Central space in retirement house designed and under construction by specialty sawyer George Brinkman in Meadow Creek, B.C., 2200 sq. ft. on two stories. Center post is cedar harvested from property, walls outside studs are 7-in.-thick salvaged fir glulams from a Safeway store ("actually bulletproof"). All doors and windows to come from one yellow cedar log and stair treads to be made from 17 British Columbian species arranged in alphabetical order. Timber framing assistance from Andrew Bagshaw. "We did not go full timber-frame, only in locations where it was functional and beautiful at the same time," reports George. "Full-on timber frames are for rich people."



Ken Gutmaker

Entertainment space for existing house, Seattle, 350 sq. ft. plus deck, with Douglas fir roof system, steel and cedar trellis and ipé trim, by Cascade Joinery of Bellingham, Wash. Engineering by Ira L. Gross, design by Robert Edson Swain Architecture, general contractors Krekow-Jennings, all of Seattle. Compound roof, composite trellis and tight site made for difficulties.



Jörn Wingender



Cindy Mullen

Above, restored and rehabilitated former Canadian Pacific Railway Station (1899), 10,600 sq. ft., Nelson, B.C., by Jörn Wingender of the Traditional Timber Framing Company, Inc., Nelson. Design by Fairbank Architects and engineering by SNT Engineering, both of Nelson. Repairs included 200 linear ft. of 3x12 sills and 60 ft. of 20-ft.-high 2x6 balloon-framed exterior wall, and reconstructing missing 30-ft. timber bent with original 12x12 timbers. Principal obstruction caused by new plywood roof deck with wood shingles installed before framing was inspected or necessary structural repairs and corrections were made.

At left, half-scale frame cut by Grigg Mullen II (fatigues) and Bear Dance Joinery's Bob Smith (ponytail) for Virginia Military Institute as engineering-class teaching aid in how loads are applied to structures. "It seemed a good idea at the time," Col. Mullen observed, "until the realization set in that there were the same number of joints as if cut full size in 8x8s."



Reciprocal roof framing at the St. James Episcopal Church in Cannonball, ND
by Empire Timberworks.

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