SBC RESEARCH INSTITUTE™

One Step Closer to World Class

by Kirk Grundahl, Keith Hershey & *SBC* Staff

We are happy to report that construction is progressing at a steady pace on our 5,730 square-foot industry testing facility. By the time you read this, the Structural Building Components Research Institute (SBCRI) facility will be very near completion. SBCRI will be home to critical testing projects that examine the structural integrity and cost efficiency of buildings. The new data obtained will advance the industry by developing a fresh body of knowledge to lead the next generation of industry growth.

Part 1: Q&A

As you can imagine we have been asked a wide variety of questions concerning SBCRI. What follows are the most frequently asked questions that we have received over the last several months.

Why is WTCA investing in a testing facility?

As building codes, engineering and design programs, and construction materials become more sophisticated, the prescriptive methods that have been used successfully over the years are being questioned, and in some cases replaced. It is clear from the meetings held and the information exchanged among industry professionals that there is still much to understand. With better knowledge of actual performance of the entire integrated structure, many fundamental improvements can be made.

Our research facility will have the capability to test complete structural framed systems. Here are some examples of our testing scope (see Figures 1 and 2):

- Our standard widths can range from 4’ to 18’. Our standard heights can range from a 10-inch floor system to a 20-foot high series of floors, walls and a roof. Our standard length can range from 4’ to 90’ long.
- Our initial calibration test structure will be a 16-foot wide x 30-foot long 8-foot wall and roof truss assembly.
- Our 40’ x 90’ strong floor will provide us a great deal of testing flexibility:
  - We can build a two-story structure inside our facility and test it.
  - We can place undulations on our floor system and simulate the actual lateral and vertical displacements that take place during an earthquake.
  - The maximum area available for testing is 30 feet wide x 32 feet high x 90 feet long. However the actual size we will be able to test will depend on the type of product and the testing procedure that is required.

at a glance

- The SBCRI will have the capacity to hold a 30 foot x 40 foot two-story structure for testing purposes.
- The maximum size structure we can test is 30 feet wide x 32 feet high x 90 feet long.
- A survey on testing topics yielded 464 member responses that provided very important feedback.
- The Truss Plate Institute entered a joint venture with WTCA that will yield TPI/WTCA test plans, data and a testing budget of $500,000 for 2007.

Figure 1.

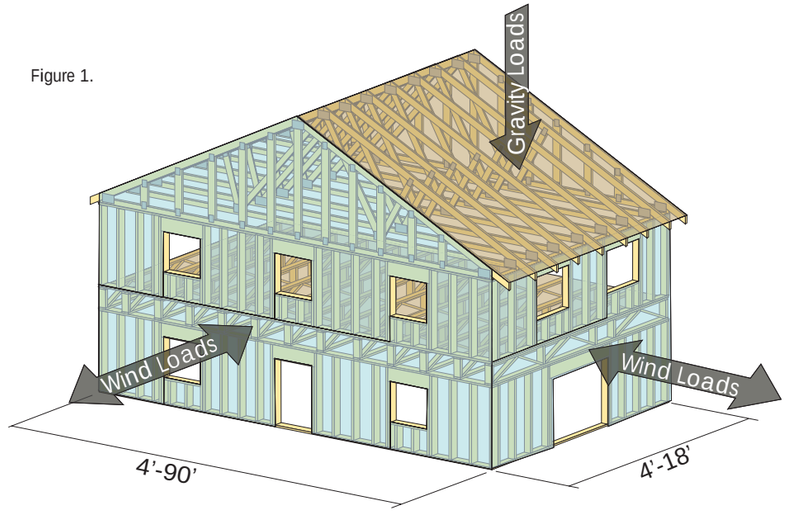
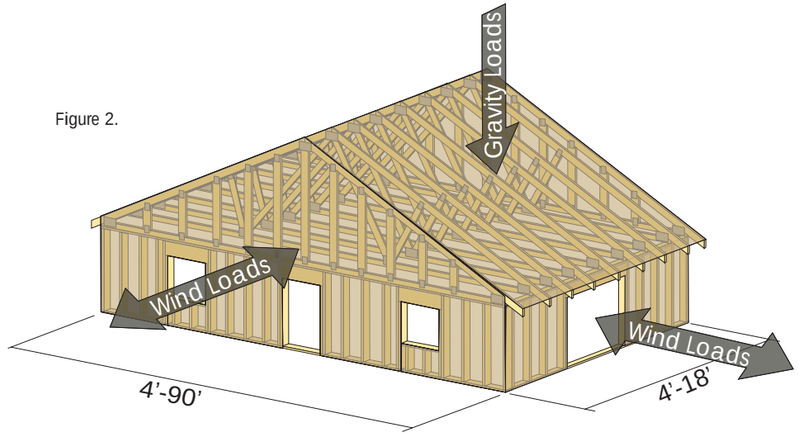


Figure 2.



In all the testing combinations we will be able to apply loads simultaneously in vertical (gravity and uplift and cyclical) and horizontal planes (parallel and perpendicular to roof framing and cyclical).

We have also designed the controls of the loading actuators to be as universal as possible and haven’t limited ourselves by focusing on a single testing method. The facility will have the ability to test most types of construction materials and will allow us the flexibility to change with technology as new products come into our market.

By taking the initiative to build a testing facility, the WTCA Board of Directors has chosen to lead our industry forward through testing and technological improvements. We are certain that we’ll find a variety of new ways to optimize component usage in the construction process. There is also a possibility that we will isolate a few cases in which the structural analysis or performance was inaccurate the first time we looked at it.

As a member of WTCA, how can I participate in the testing done by SBCRI?

As a member of WTCA you will have a voice in the types of testing this facility undertakes. All testing plans that we take on will be available for any member to review and provide perspective. In additional, any member can suggest a test plan that they would like to see us undertake. You may have already participated in a survey we earlier this year to gain a sense for what testing is important to our membership, which garnered 464 responses.

How will testing bring new business to the industry?

Through the continual testing of structural components, we will be able to build more confidence with those who specify and inspect our products, which can lead to more business for our industry. Having a world class facility that can test these products either as individual components or as part of very complex structural systems and being able to provide a detailed analysis of performance will quickly help build confidence. This is particularly important in today’s regulatory environment where proving performance in real terms carries a great deal of weight.

Will testing reduce my material costs?

Having the capability of analyzing structural components as systems will give us a better understanding of the flow of loads through all the interconnected parts of a building. In turn, this will allow us to optimize the resistance of those loads while providing safe structural performance. There are a great many complexities that will affect optimization, with the most important being the factor of safety. This will lead us to find some situations that are ripe for cost savings and some that will require added costs.

How will testing help our design software?

As software development continues to progress toward “whole house design,” the testing capabilities of the SBCRI will provide sound empirical data that can be used to provide new resistance data and calibration information to improve the accuracy of these current design programs.

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Summary of Results from SBCRI Testing Poll

	Component Manufacturers	CFSC Members	TPI Companies	Suppliers -- Engineers	Suppliers -- Lumber
1	Bearing -- Determine how far an interior bearing can miss a vertical web and still be considered as a bearing point without any structural performance issues.	Ultimate truss capacity tested as compared to ultimate design capacity.	Bearing -- Top chord bearing capacities with the addition of truss plates added strategically at bearing locations.	Gable end details, lateral resistance, bracing, optimization.	Flow of loads -- Lateral capacity of trusses (esp. CFS) to transfer shear forces from the roof and ceiling diaphragm to the bearing plate.
2	Bearing -- Top chord bearing capacities with the addition of truss plates added strategically at bearing locations.	Attic truss performance and analysis	Flow of loads -- Test a variety of heel analogs and how the moment is being transferred through different heel conditions.	Girder -- A multi-ply floor truss girder - determine load sharing capacity and recommendations for attaching plies together	Finger jointed lumber testing and how finger joints perform when used in tension and compression members in trusses.
3	Girder -- A multi-ply floor truss girder - determine load sharing capacity and recommendations for attaching plies together	Tail bearing capacities for roof trusses	Girder -- A multi-ply floor truss girder - determine load sharing capacity and recommendations for attaching plies together	Flow of loads -- Lateral capacity of trusses (esp. CFS) to transfer shear forces from the roof and ceiling diaphragm to the bearing plate.	Initial testing -- An initial set of experiments on a run of trusses, preferably from several different component manufacturers who will supply multiple copies of the same truss, built to the same specifications. Then test the individual trusses and the trusses together as a system to see if there were performance differences based on the manufacturer.
4	Repair -- Test various types of repairs to broken webs and chords	Bearing -- Determine how far an interior bearing can miss a vertical web and still be considered as a bearing point without any structural performance issues.	Bearing -- Top chord bearing capacities for floor trusses.	Floor vibration and deflection for various floor systems.	Fire -- Comparative fire performance of various structural building component systems
5	Girder -- determine the max. number of plies that girders can reasonably use and the flow of loads to each girder ply and flow of loads to the connections.	System testing -- Roof system reaction to wind loads.	Bearing -- Top chord bearing truss chord/web member joint load limits.	Flow of loads -- Permanent bracing and how the loads flow from truss to truss through lateral restraint members and into diagonal braces. Evaluate BCSI permanent bracing and optimal bracing needed.	Fire -- Fire performance of unprotected trusses.
6	Bearing -- Top chord bearing capacities for floor trusses.	Bearing -- Evaluate bearing capacity and top plate/chord crushing at the bearing.	Flow of loads -- Joint Stiffness -- amount of resistance provided by a metal plate connected joint that is forced to displace a unit amount. Rotational joint stiffness will strongly influence truss performance. Evaluate pinned, semi-rigid and rigid and the effect on flow of loads.	Bearing -- Determine how far an interior bearing can miss a vertical web and still be considered as a bearing point without any structural performance issues.	Ultimate truss capacity tested as compared to ultimate design capacity.
7	Bearing -- Top chord bearing truss chord/web member joint load limits.	Wind loading conditions -- uplift and variable wind pressure loading on the performance of trusses. Determine the limits on uplift failure. What can we learn when we test the system versus testing single trusses?	Flow of Loads -- Obtain data from all trusses tested for use as truss calibration data. Collect the following data at selected locations for a given loading -- Chord forces (including moments). Web forces (including moments). Deflections. Reactions.	Lumber -- Trusses with finger jointed lumber, if it passed we could save huge amounts of material.	Fire -- Truss performance protected.

Summary of Results from SBCRI Testing Poll, continued

	Component Manufacturers	CFSC Members	TPI Companies	Suppliers -- Engineers	Suppliers -- Lumber
8	Wind loading conditions -- uplift and variable wind pressure loading on the performance of trusses. Determine the limits on uplift failure. What can we learn when we test the system versus testing single trusses?	Uplift resistance of overhangs. What is the capacity of overhangs and how does it influence the performance of other members of the truss?	Heel joints -- Performance of raised heel trusses w/ wedges.	System testing -- Shear at the roof truss to wall plate line	Quality -- Evaluate various quality characteristics and their affect on the truss performance.
9	Quality -- Test trusses with a missing a plate at a joint on one side.	Girder -- A multi-ply floor truss girder - determine load sharing capacity and recommendations for attaching plies together	Girder -- Connections shall be designed to transmit load from ply to ply in accordance with the ply-to-ply load distribution assumed in the design of the girder. Connections shall be adequate to carry the cumulative load of the remaining plies. Evaluate the flow of loads from ply to ply, through the connections and at concentrated loads.	System testing -- Roof system reaction to wind loads.	Fire -- Hanger connection performance under fire conditions.
10	Tail bearing capacities for roof trusses	Repair -- Test various types of repairs to damaged webs and chords.	Performance of various types of girder heel conditions.	Girder -- Connections shall be designed to transmit load from ply to ply in accordance with the ply-to-ply load distribution assumed in the design of the girder. Connections shall be adequate to carry the cumulative load of the remaining plies. Evaluate the flow of loads from ply to ply, through the connections and at concentrated loads.	System testing -- Roof system reaction to wind loads.

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Will it help us manufacture a better quality product?

Information obtained from sound and accurate testing will lead to a more efficient design, installation and use of all structural building components. Whether we are talking about a toe nail verses a hold down anchor, a simple single truss/joist/header capacity, top chord temporary bracing, the flow of loads within a multi-ply girder, capacities of various wall sheathing types, or capacities of roof and wall diaphragms, we will be able define the capabilities of our products and the methods in which they are installed.

Will it help challenge today's codes?

Due to the nature of the building code development and approval process, private and industry interests can and do have a major influence in how all codes are written and applied. By testing building components in a system environment, we will be able to provide proven information and analysis to the code development community that will help us advance the building code process in a very rational and effective way.

The advantage to our industry having its own facility is that our testing will be geared toward improving the design, application and use of all structural building components in the context of the overall construction process.

Will SBCRI be available to undertake proprietary testing for a member if I have a great idea that I would like to try out?

Absolutely. SBCRI has a structure in place that will allow anyone to use the testing facility with complete confidentially to independently evaluate any type of innovative product, system or construction method.

Part 2: Summary of Results from SBCRI Testing Poll

On January 4, 2007, we sent out to our entire membership a very important survey in advance of the joint TPI/WTCA staff 2007 planning meeting to use in developing our industry testing plan for the year. We asked you to rate 95 testing topic on a scale from 1 to 10. The response was tremendous—464 members commented—providing us with the important feed

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For additional photos, visit the SBCRI photo gallery at www.sbcindustry.com/testingphotogallery.php.

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back necessary to ensure we undertake the testing that will address the technical issues that our members face every day. The table on pages 46-47 outlines the top ten test topics based on the survey results, broken down by member type.

Our goal with the initial testing equipment assembly and series of testing plans is to perform as many tests as possible. We should be able to undertake flow of loads through bracing, a series of tests on girder trusses, a variety of bearing conditions and the effect of truss quality in the early stages of the testing program.

To that end, we are very pleased that TPI has agreed to participate with us in the creation of a joint activity that will yield TPI/WTCA test plans and data. Together we are committed to providing a 2007 testing budget of up to $500,000. Through 2011 we have commitments to undertake at least up to $300,000 of industry testing annually. This provides us with a solid foundation to build our test facility and industry knowledge.

Furthermore, TPI and WTCA will be 50/50 joint venture partners in all the industry testing that we undertake. We are going to develop this into a formal association business activity based on the following concepts:

- Exact funding will be determined annually for the following calendar year based on projected testing projects and related costs.
- Industry testing results will always be shared between WTCA and TPI and are the property of both TPI and WTCA.
- A TPI/WTCA industry testing report will be made at each TPI Board/WTCA meeting.
- Industry test reporting and updates will also take place at the WTCA Open Quarterly Committee Meetings.
- TPI/WTCA testing that is undertaken at the SBCRI facility will include:
  - TPI proposed industry tests.
  - WTCA proposed industry tests.
  - Joint WTCA & TPI proposed industry tests.
- Industry testing proposed by any member of either association for inclusion in our testing work may be individual member funded, jointly funded or funded from our industry testing budget depending on the nature of the testing proposal .
- Each testing project will have:
  - A proposed testing budget.
  - Detailed project plan including:
    - Description of Testing Objectives/Problem Statement
    - Description of Testing Outcome Desired
    - Description of Testing Approach
    - Description of Test Assembly
    - Description of Materials Needed
    - Defined Testing Costs
    - Description of Testing Project Timeline
    - Defined Funding
    - Any other Testing Project Issues/Needs
- An oversight Board or industry testing Steering Committee is in the process of being implemented consisting of:
  - 1 member of TPI TAC
  - 1 member of the TPI Board
  - 1 member of WTCA E&T Committee
  - 1 member of the WTCA Executive Committee
  - A TPI staff member
  - A WTCA staff member

  This group will review all individual test plans, budgets, and timelines to ensure that no details are missed prior to undertaking the testing program.
- Final draft test plan(s) will also be sent out to TPI TAC and WTCA E&T for comment and perspective and will be reviewed by the TPI and WTCA Board of Directors as they are created and at each joint TPI/WTCA meeting.
- Industry testing will be performed at SBCRI's direct cost of operations to ensure that our industry gets the greatest possible value from each dollar invested in testing.

This is an extremely positive industry outcome. We all are looking forward to focusing on testing and gaining the benefit of testing data that will provide our industry with incredible value in now and well into the future. SBC

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Truss Publications, Inc.

6300 Enterprise Lane • Suite 200 • Madison, WI 53719
608/310-6706 phone • 608/271-7006 fax
www.sbcmag.info • admgr@sbcmag.info