



What is Grid Beam?

Grid beam is a simple, reusable system for building things. It is so simple that almost anyone can use it. Even if the limit of your mechanical aptitude is using a screwdriver, you can construct amazing stuff.

Yet grid beam is a real building system, not a toy. With it, ordinary people can create strong, durable, real-world projects ranging from furniture and sheds to vehicles, full-size buildings, and industrial equipment.



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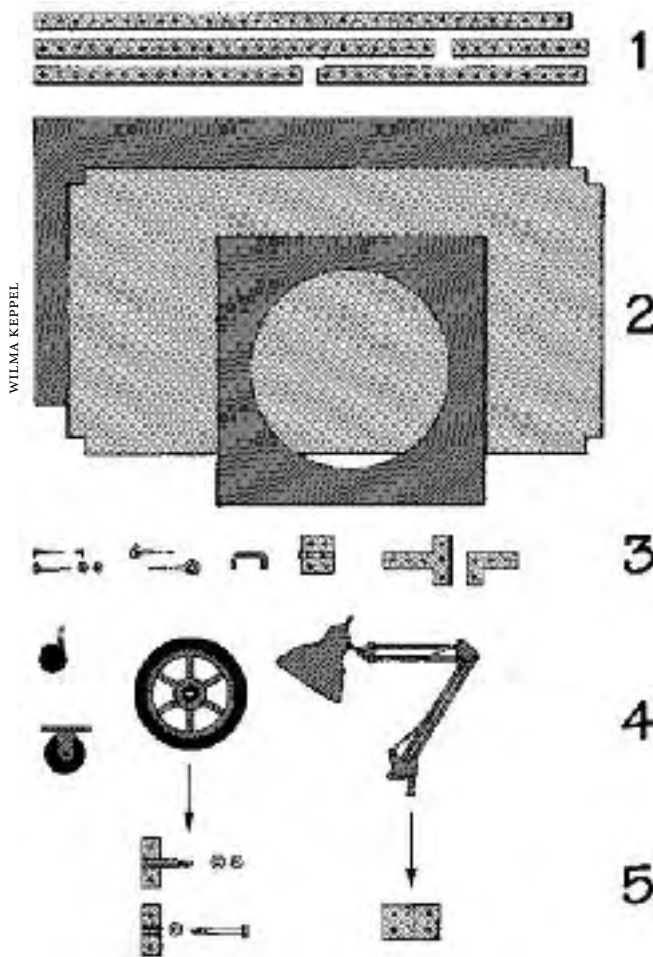
REINHOLD ZIEGLER

1.1: Bunk bed, trade show booth with Vanda electric micro-van parked in front, and windmill and tower — all built from grid beam.

1.2: Eighth-grader Jordan Bismuth racing a grid beam Moose car he designed and built in school. "It's a really good experience," he says. "Building a car isn't something I thought I could do before."



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The basics

The grid beam system includes five kinds of parts, and methods for putting them together. The parts (see picture) are

1. Sticks of wood, aluminum, or steel.
2. Skin such as plywood, sheet metal, or fabric.
3. Hardware, mostly nuts and bolts.
4. Accessories such as wheels, lights, sinks and drawers.
5. Adapters, which let you bolt odd-size accessories right into the system.

Depending on your skill level and budget, you can combine some or all of these pieces to build beds, shelves and workbenches, or more adventurous projects such as lofts, garden tractors, houses, and windmills. The University of Hawaii even built a remote-controlled grid beam submarine for deep-sea exploration. With grid beam, the possibilities are virtually unlimited!

How it works

Like Buckminster Fuller's geodesic domes, grid beam is a completely new way of assembling things. Unlike geodesics, grid beam looks a lot like older systems, so people don't notice the differences. A box is a box, right? Well, not quite.

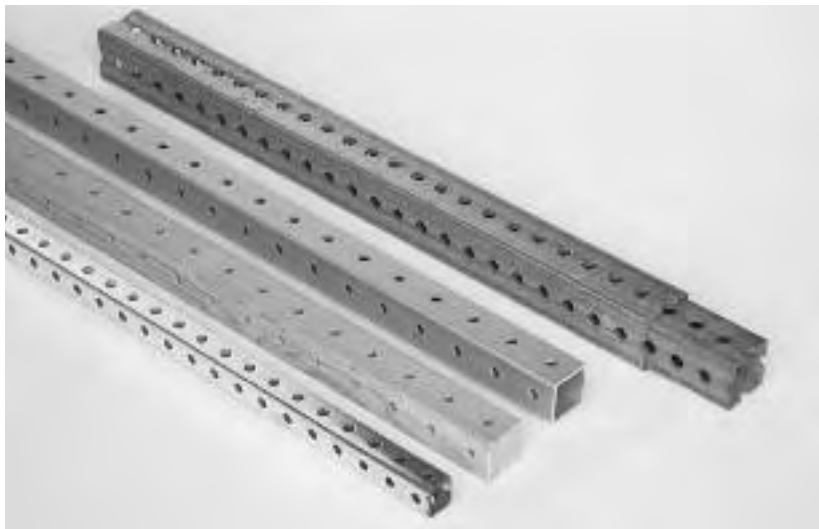
Grid beam seems obvious, even simplistic, but it is neither. Many of its advantages are invisible until you actually use it. After over 30 years of using and introducing people to this system, we feel that you will understand grid beam only after you have built projects with it. Bear this in mind as you read.

The best way to understand grid beam is to build with it. Ideally we'd include a project's worth of beam with every book, but that's not practical. Instead we'll use photographs to take you through the process of assembling a simple workbench.



REINHOLD ZIEGLER

1.4: Steel-framed HELIOS helical rotor. Designed by Reinhold Ziegler and built by students in 1985, it uses Filon fiberglass rotors to pump water.



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1.5: Four types of commercial grid beam. From bottom: 1-inch (25 mm) steel, 1½-inch (40 mm) wood, 1½-inch aluminum, 2-inch (50 mm) steel double-hole with a 1¾-inch (45 mm) insert. You can also drill your own.

The Twelve-Minute Workbench

The key to grid beam's fast assembly is the bolted tri-joint. Three bolts fasten three beams tightly together. Each beam is bolted twice, from two different sides. The bolts squeeze the flat sides of the beams together,

making a joint that is tremendously strong, rigid in every direction and automatically square. Speed-assemble a project, and when you tighten the bolts at the end of the process, the frame will square right up.

Now the materials: Those pictured here are already cut to size and ready to go.



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1.6: Tri-joint of aluminum sticks fastened with hex nuts and hex bolts. For a stronger joint, use washers on both sides of the sticks. Press-fit end caps are plastic.



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1.8: Basic tools and fasteners for metal-frame projects. The nut driver and gear wrench at the bottom of the picture really speed assembly.



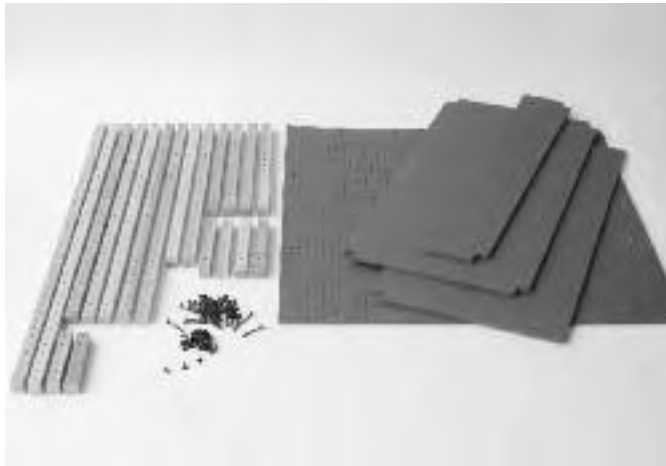
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1.7: Wooden tri-joint uses fasteners that lie flat on both sides of the joint.



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1.9: Tools and fasteners for wooden grid beam. The T-handled Allen wrench at left is easy to use; the L-shaped wrench at right is better for tight spaces.



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1.10: *Workbench materials.*



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1.11: *The Twelve-Minute Workbench. The small shelf can also go on top.*

Grid beam is a modular system: parts are interchangeable and come in standard sizes. With a modest collection of components you can build dozens of projects.

Sticks and panels of various sizes and materials match whatever job you need to do. Our workbench frame is 1½-inch (40-millimeter) wood. You could build a heavy-duty version of the same project using 2-inch (50-millimeter) steel.

Two wrenches, or a wrench and nut driver, are enough to assemble most metal-framed projects. For wood, you only need an Allen wrench. We're ready to get to work.

1. The easiest way to begin building a grid beam structure is to build a tri-joint into it. This instantly gives the project shape. Installing an upright post on an outside corner seems to work the best. Do not tighten the bolts yet. You should have a bit of flex in each joint.



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2. From this point on you only have to add a single piece at a time. This single-stick technique is invaluable in saving time and your back, especially with larger structures. Support uprights with your hand or shoulder until you have them fastened with two bolts. Uprights held by only one bolt can fall over and pinch or hit someone.
3. If you're designing a project as you build, establish your corner verticals and the main level, such as your work surface, as early as possible. Build up and down from there until your frame is complete.
4. Once the frame is assembled, tighten the bolts. As the joints get tight, your project's frame will straighten and square itself. Use between five and ten pounds of pressure on the wrench. Beginners often over-tighten bolts.
5. The rear panel attaches over the frame bolts. Tighten its bolts.



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6. Add the shelves and work surface.
Presto, you're done! Total assembly time: twelve minutes.

Yes, grid beam really is that simple. And with this simple system, you can build just about anything! Since 1976, we've used grid beam to build hundreds of projects, ranging from shelves, desks, and beds to vehicles, small buildings, and even complete industrial assembly lines.

Grid beam is faster than welding, carpentry or fabrication. It's also goof-proof: just unbolt the problem area and rebuild it the way you want. And because you can re-use the same components again and again, grid beam helps the environment while saving you money. Every way, you win!

Sources

Where do you get grid beam? You have three options:

1. Buy a kit. (See the Suppliers chapter for sources.)
2. Buy specialty components such as sticks from a vendor, and supply the rest of the pieces yourself. Grid beam is designed to work with standard, widely available sheet materials such as plywood and hardboard. Most grid beam components are available as off-the-shelf parts. This approach gets you exactly the right parts for your special project.
3. Drill your own sticks. While time-consuming, this can save you money, and is the only way to go if you need a



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1.17: Steel-framed stand for a chop saw that cuts bronze bar. Built in 1980 as part of an industrial assembly line, it is still in use.

kind of stick that no one manufactures. Basic shop skills are required.

The easiest way to get plans is to copy designs from photographs in this book — just count the holes. Standard-size parts make it easy to build features from one project into another.

We encourage you to experiment with designing your own projects. It's a lot of fun, and a great way to get exactly what you want.

Using this book

This handbook shows projects ranging from beginner level to advanced. It also includes hundreds of photos of real-world

grid beam projects as well as grid beam charts and tables of measurements.

Part 1 introduces you to the grid beam way of building: its history and advantages in Chapters 2 and 3; and its components and how they work together in Chapter 4.

Part 2 describes projects ranging from simple furniture to complex electric vehicles. **It is up to you to build projects that are within your skill level, and to build them safely.** When trying a new type of project, proceed cautiously. Get help from experienced people if you need it.

Some of the projects shown in this book require notching panels, or cutting sticks and panels to size. We assume you have basic shop skills. If not, get someone to show you. Using power tools is like driving a car: dangerous until you know how to do it, safe once you've had some practice.

Part 3 gets down to the basics of working with grid beam. This is where you'll learn about:

Sticks: how to buy them, cut them and drill them for your projects;

Skins: what materials work best for different projects, where to buy them, how to work with skin materials ranging from plywood to sheet metal to glass;

Panels: how to cut, drill and mount all the different kinds of panels you can use in grid beam; and

All the hardware, accessories and adapters that go with grid beam.

Part 4 describes the basics of grid beam project assembly and design. It takes you



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1.18: Richard relaxes in his cord-seat folding chair.

Common units of measure used in this book					
Unit	Measures	Abbreviation & Symbol	Equals	Metric (exact)	Metric approximates
inch	length	in. "	1/12 foot	25.4 millimeters	25 mm
foot	length	ft. '	12 inches	305 millimeters	300 mm
mile	length	mi.	5,280 feet	1.609 kilometers	
pound	weight	lb.	16 ounces	453.6 grams	
gallon	volume	gal.	4 quarts	3.785 liters	
horsepower	power	hp		745.7 watts	

1.19

from building and bracing simple frames to designing and building electric vehicles.

The book ends with two chapters that list additional resources to help you build, including suppliers of everything from wood and metal sticks to motors and suspensions for your vehicles.

A glossary defines special terms we use. To order kits, components and books, and to find out the latest news in the world of grid beam, visit our websites at grid-beamers.com and grid-beam.com.

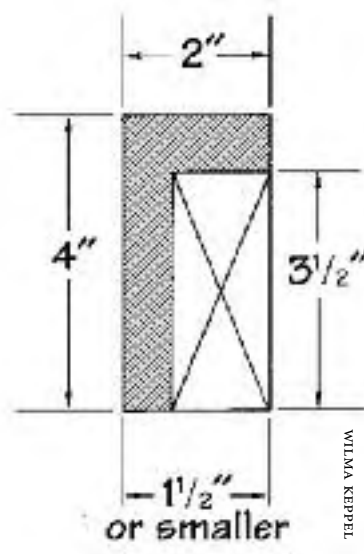
Measurements

We live and work in the US, where most construction materials are measured by the US system, not metric units. The grid beam we use is designed to work with the standard sizes of those materials. Since this book is based on our experience, we've used US measures throughout. We list metric conversions for common stick widths and bolt diameters in Figure 1.20. You'll find metric conversions for common panel sizes and stick lengths in Figure 4.1 (page 26).

The names of standard US lumber sizes usually *don't* match the actual sizes.

Common stick widths	
US sizes	Closest metric size
3/4 inch	20 mm
1 inch	25 mm
1 1/2 inch	40 mm
2 inches	50 mm
3 1/2 inches	90 mm
Bolt sizes	
1/4 inch	6 mm
5/16 inch	8 mm
3/8 inch	9.5 mm
7/16 inch	11 mm

1.20: Standard stick lengths and panel sizes are listed in Figure 4.1. Common US lumber sizes are listed in Figure 16.9



1.21: The incredible shrinking two-by-four. In 1955 it measures 2 x 4 inches. By 1990 it had shrunk to 1 1/2 x 3 1/2 inches. Tree farm lumber sometimes shrinks more — we have measured sticks as small as 1 3/8 x 3 1/4 inches. Measure lumber before you buy.

That's because most lumber is cut to its nominal (named) size while green, shrinks as it dries, and then smoothing it removes more wood. A modern "two-by-four" measures 2 x 4 inches when cut, but shrinks to 1½ x 3½ inches or less when dry. Lower-quality lumber shrinks more.

In this book, we **spell out the stated dimensions of lumber** (two-by-four, not

2 x 4 inches or 2 x 4½) and **write actual dimensions in numbers** (when we write 2 x 4 inches, we mean exactly 2 inches by 4 inches).



Ready to learn all about grid beam and what you can do with it? We'll start with a short history of the system.