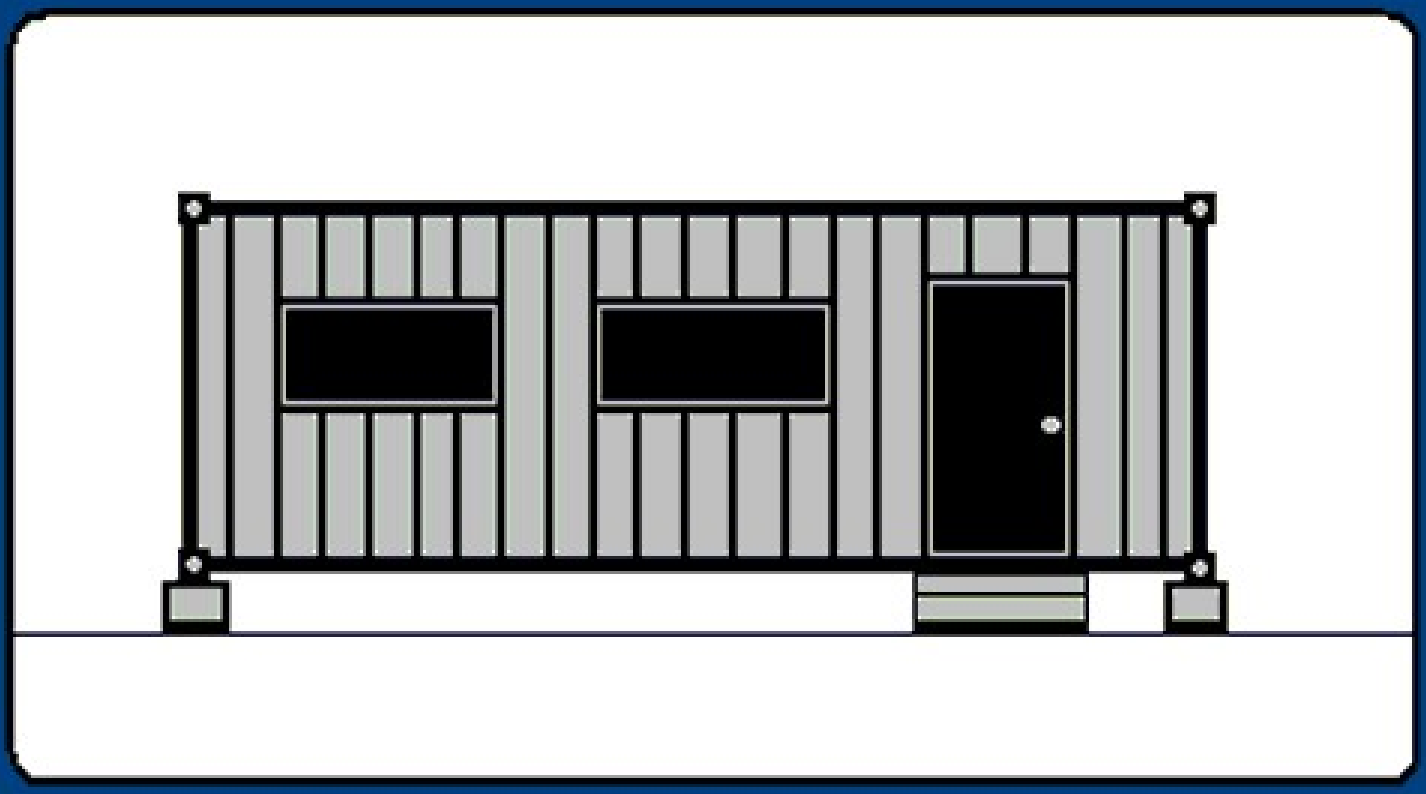
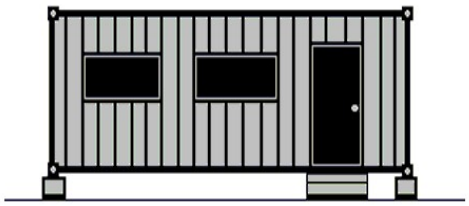
INTERMODAL SHIPPING CONTAINERS FOR USE AS STEEL BUILDINGS

By Paul Sawyers





Basic 20 ft structure on wood footings

Library of Congress, U.S. Copyright Office, Ref # _____

Published by the author. Original production copy # _____

About The Format of this Book

When I decided to write this book, the original plan was to have it published in paperback form by a vanity press. About halfway through I realized it would be much cheaper to make copies and assemble the books myself at home. The desktop publishing method single-handedly eliminates most expenses, and allows me to price the book far lower. This explains the lack of glossy cover etc. You could call it printing on a shoestring budget.

Feel free to contact me via email if you have any questions about this book, need design assistance, or just want to say hello. My address is paulsaw03@yahoo.com

INTERMODAL SHIPPING CONTAINERS FOR USE AS STEEL BUILDINGS

By Paul Sawyers

Table of Contents

Preface. Why Container Buildings?

I noticed a rather unique small building several years ago while driving cross country. It was one of those ocean cargo units that had been turned into a workshop. I've seen these units before, but never used as a small building. What a great idea! After that I began noticing more and more of these cargo container buildings. Mostly in rural locations. Funny how you notice things that you are actually looking for isn't it?

Well, since that first sighting of a cargo container small building, I have seen many others. It has been great to observe the many uses and structural variations people come up with. I truly believe that these type of structures will provide a low cost building solution to more and more people worldwide as we press forward into the next century.

This book covers some of the building designs I've seen, and some I've come up with myself. To my knowledge it is the worlds first book on the subject. The designs and techniques presented in this book, while fundamentally theoretical, are believed by me to be sound & easily accomplished with average skill.

Thank you and enjoy!

Part 1 About Containers

Chapter One. Introduction to ISO Container Buildings.

As a person now living in the pacific northwest of the United States, I guess I am in a position to observe the timber industry at closer range than most. Harvestable wood seems to be endless around here, and building with wood is always a pleasure. Never the less, I cannot accept the ridiculously high cost these days . Just try rolling a cart full of 2x4's and plywood out the automatic doors of a home improvement superstore without feeling five hundred dollars lighter. It's probably not going to happen.

If planning a small do-it-yourself building project, I propose the reader consider using a heavy duty welded steel box with 1.5 inch marine grade hardwood flooring. A pre-made, and ready to go small building that is very strong, able to support ten times its weight. An ISO Intermodal Shipping Container!

Ocean going cargo is shipped in steel boxes called intermodal containers. These are built to strict international quality standards, to survive harsh treatment and a violent life in the marine environment. These steel boxes are also known as cargo containers, shipping containers, sea boxes, or for the professional; ISO containers (international organization on standardization). This book will provide an assortment of various building designs made from these containers. Also, all the necessary knowlege to obtain your container, customize it, and wrangle it around your little chunk of the globe.

Note: As this book progresses, I will refer to the units simply as IC's (intermodal containers).

The term intermodal refers to the units ability to be loaded on ships, trains, or tractor trailers with it's integrated stackable chassis. Container cranes (usually, a rail-mounted gantry crane located on a wharf for the purpose of loading and unloading containers on vessels) easily pluck IC's from train cars, or trucks, and stack them on freighters. Thousands of dock workers, once a major work force, have been replaced by the lone crane operator. Interestingly enough, crane operators in major ports can earn six figures per year. Money well deserved as this is a precision job on the level of airline pilot, brain surgeon, or how-to book writer.

(a) high cost of lumber discussion

Joe Q Public can buy a good used 40' IC and have it delivered for about $1450 (at the time of this writing in 2004). 20 ft units come in for even less ($800 for a good used 20 ft). The cost to build a 400 sq ft cabin from lumber purchased new averages out to be at least $2450.

***Here's how lumber prices, and availability hypothetically effected construction plans for a 1000 sq ft cabin in the autumn of 2003:*

The price of sheathing material (plywood and the wood-composite product oriented strand board or OSB) went up. OSB sheathing prices reached $445-$535 per 1000 sq ft on 9/12/2003, depending on grade and thickness. The price per 1000 sq ft of OSB sheathing on 8/22/2003 was only $374. That's a big increase in less than 30 days.

A typical 1000 sq ft cabin consumes 3000 square feet of structural paneling.

In 2002 the structural-paneling composite price was at $240 per 1000 sq ft, while OSB was $139 per 1000 sq ft. Just going with the composite price, the 3000 sq ft that cost $1440 in September 2002 was at $3210 in September 2003, about 2-1/4 times more expensive.

Every 1000 sq ft cabin needs 8000 board-feet of framing lumber such as 2-by-4s and 2-by-6s. In September 2002, 8000 board-feet, at $288 per thousand, cost $2304. In September 2003, it was $382 per thousand board-feet, or $3056. So, the total cost of all lumber required for a 1000 sq ft cabin rose from $3024 to $4660 in just one year.

Plus, wood products account for only about one-half of the total cost of materials used to build a cabin.

***source: Random Lengths of Eugene, Oregon, randomlengths.com*

One thing for sure, lumber will not be dropping in price anytime soon. Time is money, and trees take time to grow. With populations multiplying rapidly, (& children growing faster than trees and weeds), the consumer must choose to either pay the cost for lumber, or find other suitable building materials.

I firmly believe a 20' or 40' water tight, air tight, 14 gauge steel IC offers much more bang for the buck than a similar sized lumber-built structure. Not to mention the fact that it is pre-built and construction labor is minimal. Its easy to order your IC, and have it plopped down right on your land. All that is required after drop-off, is to finish your unit as you see fit by adding interior elements, wiring, doors and windows, and the like.

These units are versatile. Maybe you would like to have a special structure that has two levels, or located several feet under the ground? It is not my place to question what your special needs may be as the author of this book, but to simply provide solutions. As you read on you will notice a heavy emphasis on rural placement of IC's, and not much time devoted to IC's for use within established city limits. This is due to the obvious problem of zoning. If you have picked up or purchased this book and read this far, escaping the restrictions of municipal zoning laws is assumably foremost in your mind anyways. Lets just take it for granted that your IC domicile will be located on private land away from the eyes of code enforcement or zoning officials if any. Zoning laws are a lot like the insurance industry in my opinion; organized crime. Who needs it!!?? In general, containers are considered portable structures, and might not fall within many permanent building city codes. Your IC is really no different than the 39 ft RV your neighbor has parked out back.

A formal source list or directory is not included in this book in an attempt to avoid regionalizing, but basic guidelines for finding sources in the United States are included. I can only assume these guidelines are similar abroad. Most U.S. liquidators of IC's are merely transport companies whose main business is shipping. When they have excess stocks of IC's for sale to the public they will place ads in local and regional classified newspapers. Used IC sales are essentially just an annoying sideline for these guys. When valuable yard space needs to be freed up, it equals big savings for you the private buyer.

There are also several companies that specialize in internet based sales & delivery of IC's nationwide (more on that later), but local print ads remain your best bet for good used deals.

(b) How big are IC units?

The IC's covered in this book are 8’ wide externally, 8’6” tall external (or 9’6” for the Hi-Cube type), and available in standard lengths of 20’ and 40’. After taking into account the thickness a basic 2x2 framework and minimum of insulation material, here are the remaining rough interior dimensions the IC builder has to work with: width of 7.5', and height of 7.5' (or 8.5' for the Hi-Cube models).

Containers / Dimensions

	Exterior			Internal			Door Openings	
	Length	Width	Height	Length	Width	Height	Length	Width
20ft	19'10-1/2"	8'	8'6"	19'3"	7'8"	7'9-7/8"	7'8"	7'5"
40ft	40'	8'	8'6"	39'5"	7'8"	7'9-7/8"	7'8"	7'5"
40ft HC	40'	8'	9'6"	39'5"	7'8"	8'10"	7'8"	8'5"-1/2"

Weight / Capacity

	Capacity	Empty WT	MAX Gross	MAX Payload
20ft	1,165	5,050	67,200	62,150
40ft	2,350	8,000	67,200	59,200
40ft HC	2,694	8,775	67,200	58,425

There are many other types and sizes of IC's on the market, but I wanted to stick with the three main sizes of dry cargo units for sake of simplicity. The 20' standard unit, the 40' standard unit, and the 40' high cube unit, aptly titled for it's extra tall design of 9' 6".

(c) Dry Cargo IC Construction Specs

Tops and sides are made from welded 14 gauge (.075") corrugated steel, on a 7 gauge (.18") tubular steel frame. Corner fittings are made from solid blocks of milled or cast steel and welded directly to the frame on each of the eight corners. One and a half inch thick marine grade plywood floors adds rigid-ness and a smooth surface for the units inner deck. All weather paint is standard on the exterior and interior.

Chapter Two. Purchase and Delivery of IC's.

IC's are by their very nature, mobile, but designed mainly for sea travel. Yet, thanks to the increasing number of transport companies, units are now available just about anywhere in North America. Many of these companies will even deliver your IC with a roll-bed truck. Delivery usually requires decent road access (gravel or dirt is ok), and a 75' cleared area. This is sort of the industry standard.

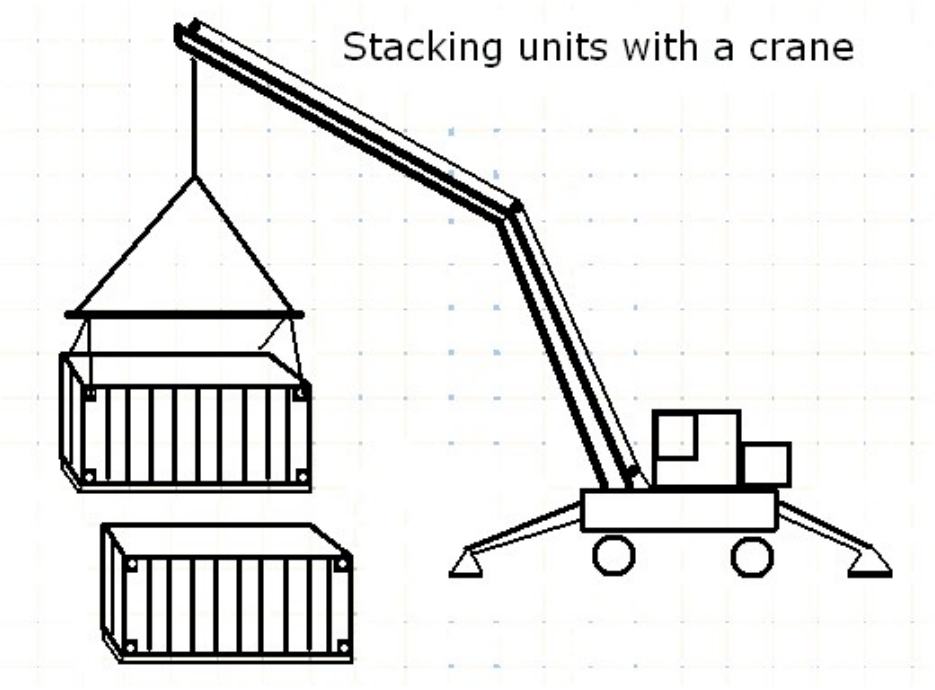
For the IC purchaser who only requires the unit delivered to a firm surface, at the end of a easily accessible road (for a delivery truck), you can sit back and relax. The process will be easy. On the other hand, if your destination is more off-the-beaten-track, logistical problems can arise. Your IC salesman will ask about this when you buy your unit. Most are open to dropping the unit as close as possible to the area required, and letting the buyer wrangle it from there. Some will offer advice on this, some will not. Remember, these folks back at the office usually do not deal with the hands-on end of the business. They let the drivers do that.

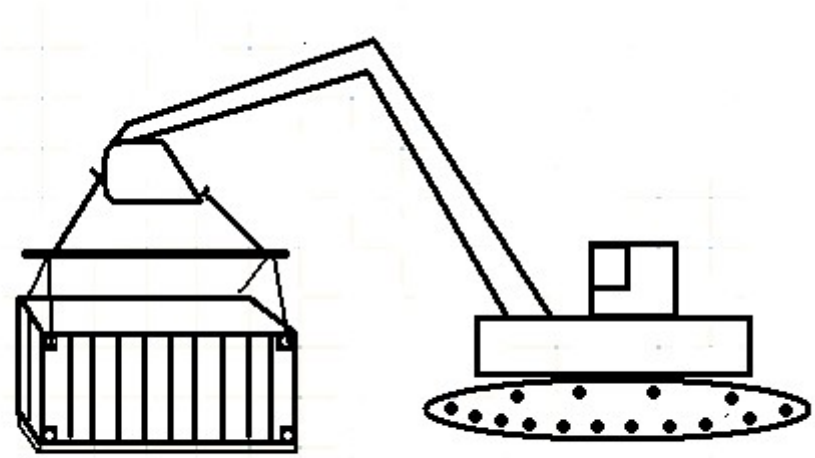
Often times drivers are more flexible, and will even go off-road (don't be afraid to "motivate them" with a few $50's), to drop your unit in the isolated spot you desire. Of course there are limits to this. Expecting a semi truck to cross muddy fields or navigate your atv trails is wishful thinking. Many companies use specialized delivery trucks just for 20' IC's. These are called side-loaders and drop the IC on the passenger side of the truck with miniature crane arms. These vehicles are usually able to reach more back-woods locations than the semi towing a flat bed trailer.

In general, a 20' unit will get into more spots than the 40', but dealing with the driver, and perhaps coaxing him, is always a possibility when taking delivery. These guys do the best they can to get the container as close as possible to the location you want, without having to call for a tow. The rest is up to you - but don't worry, I've included techniques for moving IC's short distances (for no-truck-access areas) later in this chapter.

One more thing to note: if you are required to move the IC yourself after delivery, make sure it is initially placed on railroad ties, pipes, or other material to keep it "afloat". If the delivery driver just plops it flat on the ground, you may not be able to get a jack under the bottom edge to lift it for moving. Old discarded tires also work good as a drop-buffer and temporary footing.

If you are planning a two story IC structure or underground design, a crane or excavator should be hired. Local equipment contractors/operators can offer you a fairly reasonable rate for half-a-days work. I recommend that you avoid attempting to rent heavy equipment and operate it yourself (unless you are qualified). For less ambitious single story buildings, my IC movement techniques will work just fine.





(a) North American Ports

U.S. port cities with the highest concentration of IC traffic.

Regions that surround port cities offer the highest concentration of available IC's for sale as shown below. Because delivery is charged on a per mile basis, consideration for logistics to your drop location must be studied.

Look within 500 miles of these cities for the best deal on used IC's.						
2001 Data in TEUs (one 20 ft IC = 1 TEU, one 40 ft IC = 2 TEUs etc).						
Ports	**Market Share**	**2001**	**Market Share**	**2000**	**Market Share**	**1999**
Los Angeles	19.4%	3,408,172	17.9%	3,164,778	15.5%	2,497,656
Long Beach	18.2%	3,212,759	18.4%	3,243,593	18.7%	3,006,528
New York-New Jersey	13.2%	2,322,952	12.4%	2,181,812	12.3%	1,976,283
Charleston, S.C.	6.5%	1,150,612	7.0%	1,230,430	7.1%	1,141,681
Oakland	5.5%	959,713	5.3%	936,995	5.4%	864,182
Hampton Roads	5.3%	928,563	5.2%	926,342	5.4%	877,891
Seattle	4.7%	823,529	5.4%	952,146	5.9%	950,448
Savannah	4.6%	811,472	4.0%	714,088	3.8%	619,111
Houston	4.3%	762,842	4.1%	727,448	4.2%	671,485
Miami	4.0%	710,785	3.8%	670,886	3.7%	601,141
Tacoma	3.5%	609,175	3.7%	651,142	3.5%	571,558
Port Everglades	2.4%	420,675	2.4%	422,382	2.8%	455,495
Baltimore	1.6%	274,230	1.5%	268,231	1.5%	248,147
New Orleans	1.2%	214,428	1.4%	239,202	1.4%	230,271
Portland, Ore.	1.2	205,975	1.2%	210,268	1.3%	208,719
Deleware River	0.9%	162,286	0.8%	140,048	0.9%	146,316
Gulfport	0.8%	132,160	0.9%	152,497	0.8%	122,868
Wilmington, Del.	0.7%	127,108	0.7%	128,070	0.8%	123,499
West Palm Beach	0.7%	118,738	0.6%	102,383	0.6%	100,348
Jacksonville	0.6%	103,539	0.6%	103,463	0.9%	137,550
Top 20 U.S. Ports—Total	99.1%	17,459,712	97.2%	17,166,654	96.5%	15,551,177
All U.S. Ports—Total	100.0%	17,609,408	100.0%	17,661,305	100%	16,108,608

(b) International ports with the highest IC traffic in 2002

ISO container volumes shown in TEUs.

One 20 ft IC = 1 TEU, one 40 ft IC = 2 TEUs, etc.

(1) Hong Kong, China 17.80 million,

(2) Singapore 15.57 million,

(3) Pusan, South Korea 7.91 million,

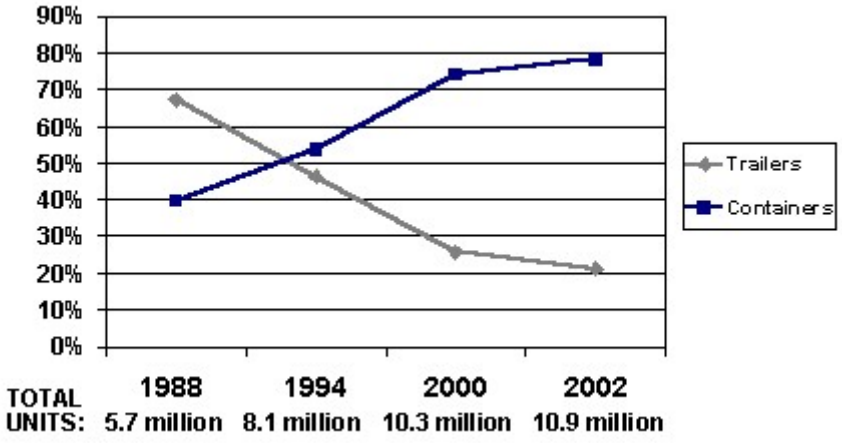
(4) Kaoshiung, Taiwan 7.54 million,

(5) Shanghai, China 6.33 million,

(6) Rotterdam, Netherlands 6.10 million,

(7) Los Angeles, USA 5.18 million

The number of IC's worldwide is increasing rapidly (as seen below).



(c) Print ad's for IC shoppers.

Regional classified papers such as trader publications, and little nickel press are great sources for IC resellers. Titles of these newspapers vary from state to state, but most of you know about the types of publications to which I am referring. The classified papers with no news in them (just stuff for sale).

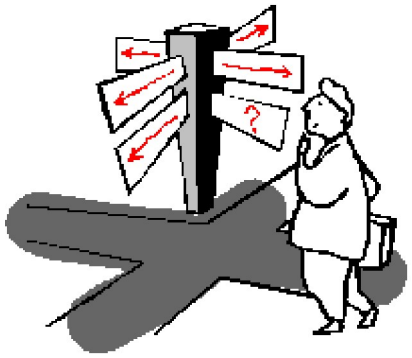
You can also look through the phone book under "shipping", "containerized freight", or "freight shipping" for local sales outlets. The yellow pages are usually the worst place to find anything, but I though at least mentioning it as one option couldn't hurt. I prefer to buy cheap from sources with low over-head, and you know if they have a big ad in the yellow pages, the over-head is not low.

(d) How to find IC's for sale on the Internet

I had originally considered listing the many websites that advertise containers and related products, but more often than not, a website possesses a 'here today - gone tomorrow' quality. Although, I have noticed an increasing number of IC's being offered for sale on ebay.com. Besides Ebay, what good are a bunch of links that lead to non-existent sites? Better would be to infuse you with the ability to find current websites fast and efficiently.

More IC companies are advertising on the web than ever, and this trend will likely continue as IC's become the world's top mode for movement of goods (see 'IC trends' chart above). I found several 20 ft units in nice shape offered for $800 while surfing the web. Some fresh paint, and those babies would be like new. For those of you that already know about these search tricks, this is not new information. For the rest of you, this info might change your entire view of internet searches. Since google.com is the only search engine I personally use, I can only verify that this will work on that website. I do not know if it will work on others.

The art of searching and finding what you are looking for on the web is a fine one indeed. With a little practice, you will become proficient quickly, saving yourself hours of wasted time scrolling through unrelated sites. Periods are used to connect keywords as shown. This prevents the search engine from returning a shotgun pattern of unrelated websites.



For example, say I want to find a shipping container in Florida and begin searching the internet for one. The keywords ' shipping container Florida ' might return what I need, but will also return two thousand other sites that have those 3 words anywhere in the first page. Adding a period between words likely to be together reduces this annoyance. ' Shipping.container Florida '. You can go even further by adding ' in. Florida ', or try changing ' container ' to ' containers ', etc, etc.

Some search word examples for IC's and related items:

intermodal.containers ... iso.containers ... shipping.containers ... 20'.containers ... 40'.containers ... used.iso.containers ... used.shipping.containers ... new.iso.containers ... new.shipping.containers ... iso.container securing.equipment (the best keyword phrase for IC clamps and connecting hardware)

Regional search examples (note: do not add a period before cities):

iso.containers Seattle ... intermodal.containers long. beach ... shipping.containers new.jersey ... cargo.containers Detroit ... intermodal.containers sales Chicago ... etc ... etc

The number of word combinations you can come up with are amazing. Don't be afraid to get creative. Just remember that if you connect any two words with the period, those two words become a phrase in that order. You can go over- board with specialized search phrases, these will usually turn up no results, but occasionally you hit gold. Try connecting only two words with a third "loose" word at first. Then (by process of elimination) gradually refine your phrase.

One more thing here before I move on. Yes, I know I said I was not going to list any websites, but this is a valuable source you may not be aware of. Government Liquidation LLC (at the time of this writing) is the officially contracted liquidator of the U.S. military's surplus gear. Since the military uses more 20 ft IC's than some small countries, and the deals are great, I feel it is ok to list the website (govliquidation.com).

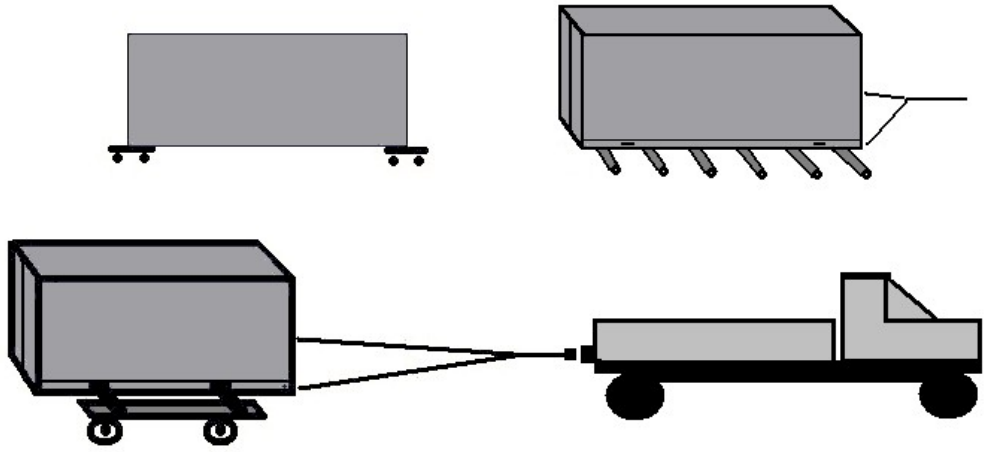
This company operates a never ending auction of surplus goods that the general public can bid on. I have witnessed some mind blowing deals on IC's from them. Most never receive bids, (because buyers must pick-up the IC directly from the military base) and the auction ends at $100. In my opinion, this is the best source if you live near a major military base, and can arrange for pick-up of the IC. Can't hurt to look into it...you could score a 20 ft unit in good condition for $100. Then just call a local trucking company to pick up the unit. After pick-up and delivery costs, you could possibly have a IC on your land for under $500. Food for thought my friends!

(e) Moving IC's short distances in no-truck-access areas

Man vs Intermodal Container! Firstly let me say *do not be intimidated by these big steel boxes. This is a job that can be done*. The ancient Egyptians moved giant blocks of stone great distances using only ropes and man-power. It won't be so hard to move your IC...we're not building a pyramid, after all. Here are two words to remember: physics & leverage. If you must move your IC yourself, and/or are not willing to hire a crane or excavator, this task will be the most difficult part of your project. With that said, the use of basic physics and leverage will be your best friend. Common everyday tools will also be of great assistance. For example, you can buy a bottle jack at Wal-Mart that will lift six tons for $12. Do not be afraid to purchase the necessary tools for the job. A certain outlay of cash will be required, but ultimately, the self-moved IC will save you at least 85% over hiring heavy equipment.

Sometimes moving the IC yourself will not be possible. What I mean by this is, pick your fights carefully. Do not expect to move a 40 ft unit down the side of a mountain yourself. Placing a 20 ft unit on the "back forty" of your semi level land is more realistic.

Techniques and Tools: *large tree's, winches, block and tackle set-ups, cables, hand-cranes, come-alongs, pickup trucks, large diameter steel pipes (to tow IC's over), large casters, home-built buggies (inserted through high-low holes), jack stands, hydraulic ram lifters, tractor jacks, old axles with tires, etc, etc.* See diagrams.



Techniques for moving IC's short distances without a crane

The simplest and most straightforward technique is probably towing your IC with a full sized pickup truck. I realize not everyone owns a pickup truck, but most people at least know someone who does. This works best on fairly level terrain, and a half dozen or more 6-8" diameter steel pipes. Logs can also be used.

Enlisting the help of one or two assistants to replace pipes as your IC moves forward is essential. This is a slow process, but Rome wasn't built in a day. Use a thick slab of plywood or 1/4" steel as a base to rest the required floor jack on (the leading edge of the IC usually needs to be lifted a few inches each time a pipe is replaced). Take care not to attempt this is very muddy or loose soils, as the pipes may sink into the ground.

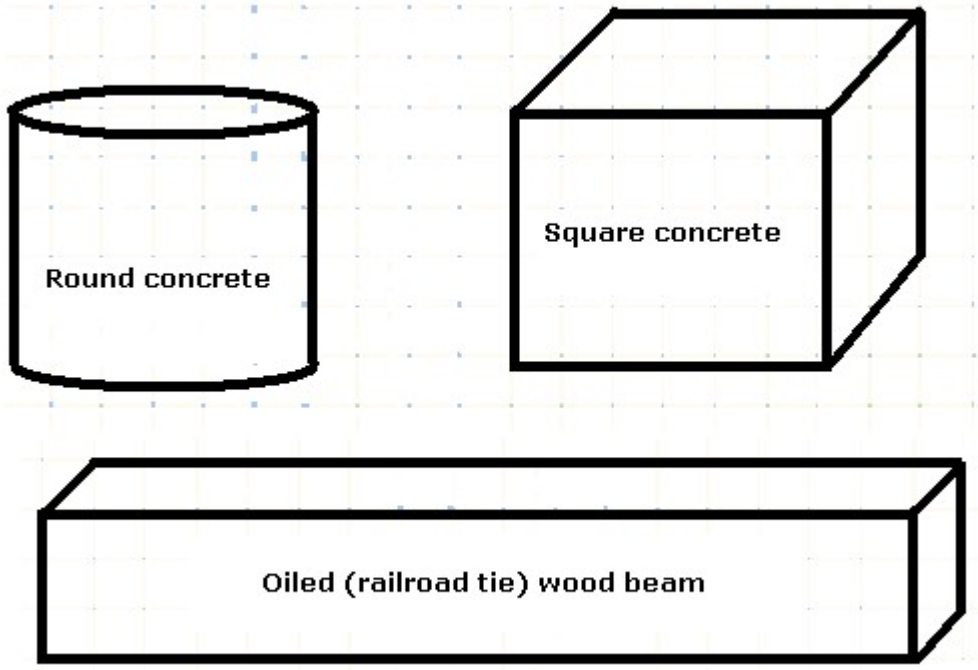
Self movers can also build a "container buggy" from small I-beams that will insert through the high-low slots located on the bottom edge of the IC. This will require a bit of engineering and labor, but if you plan to relocate your IC often, a "buggy" is a valuable tool to have available. You can purchase 12" casters and bolt, or weld them to the structural beams. Make sure to leave at least one side of the buggy assembly fastened with only bolts (so it can be removed from the high-low slots) if welding.

There are companies that manufacture "container buggies" for the military, but these are expensive and designed mainly for rolling units around on airstrip tarmac surfaces. The homemade buggy will function better on unpaved surfaces, towed with a full sized pickup truck or tractor. Use a minimum chain length of 35' if hooking-up to only the bottom two corners, and 25' if utilizing a centered four-corner tow approach.

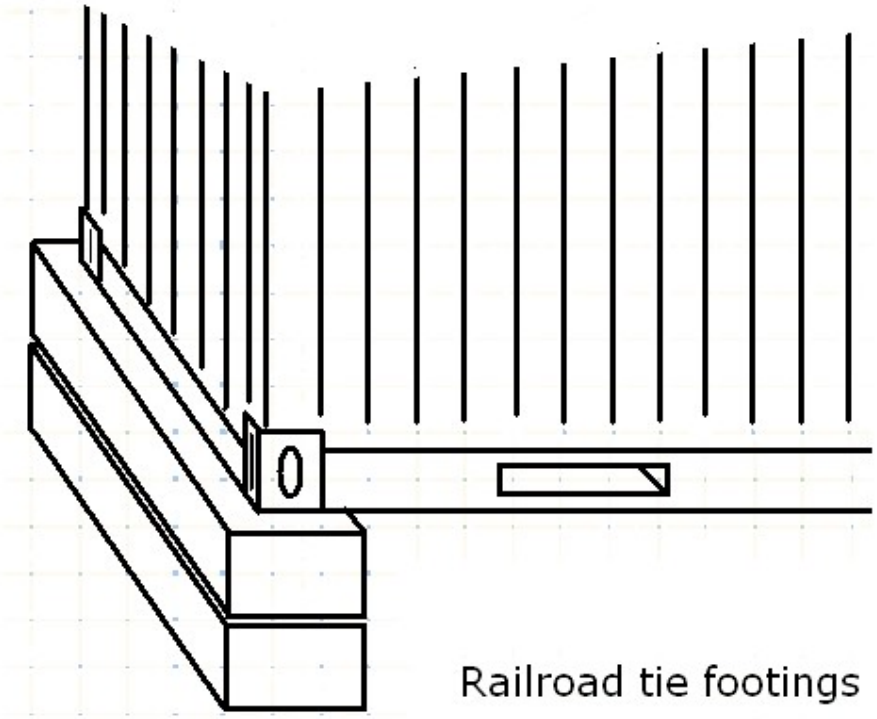
Part 2 Building with Containers

Chapter Three. Footings and Foundations

The sturdy design of your IC structure will be meaningless without a solid foundation for it to rest upon. Another factor to consider is the corrosive effects of moisture over time. In this chapter I will discuss setting up simple foundation footings that will provide a lasting base and prevent moisture vapor by holding your IC unit at a minimum of 12" above ground. Even if placing the IC on pavement or asphalt, I still recommend setting-up above ground level.



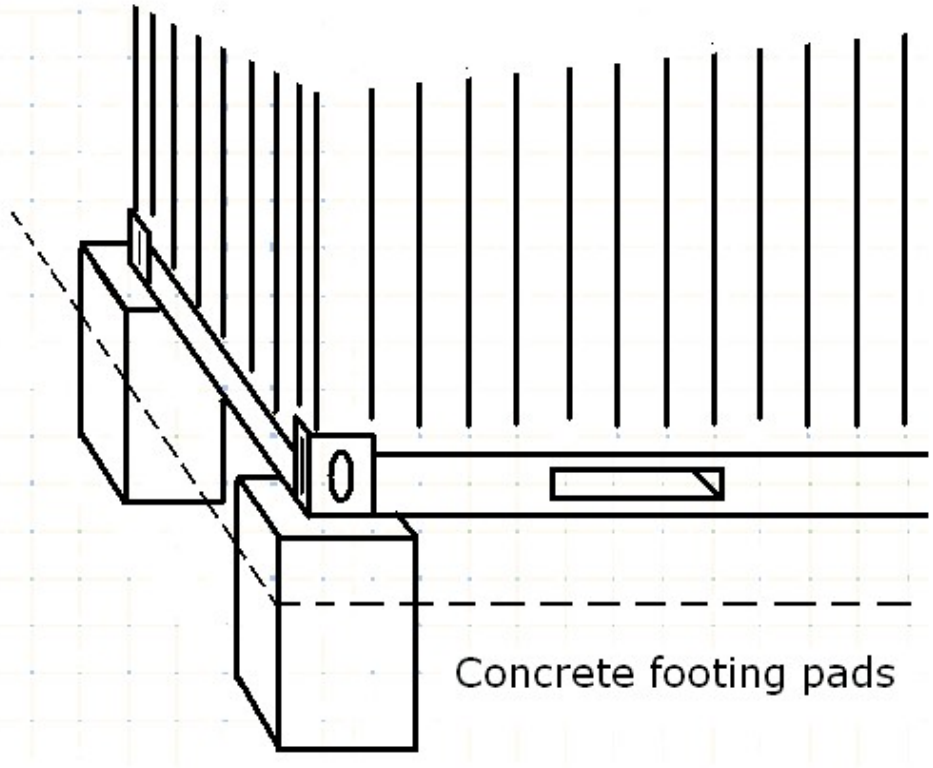
Oiled railroad ties are the standard workhorse of IC foundations. They are cheap and readily available at most lumber yards. I recommend a stacked level of two under each end. Since IC's only require support at each of the four corners, *OR* the full span of each of the long ends, our work is easy. Make sure to use a 4-6" bed of gravel under any wood based footings to assist in water drainage and discourage rotting of beams. Avoid attempting to add extra support under the mid-section of any IC. Although your motives may be genuine, this could cause a warping of your structure. The heavy 7 gauge (.18") tubular steel designed for support, is only located on the ends.



Railroad tie footings

Bricks, and cinder blocks should be avoided for use as IC foundation material. These can crack and crumble.

Poured concrete footings are probably the strongest foundation the IC builder can utilize. You can make cylindrical or square forms up to 4' under ground and 1-2' exposed above ground. A minimum 2' diameter (square or round) should be observed. Use of rebar or other material to secure your IC to the footing is optional.



Six ton heavy welded steel jack stands can be purchased for about fifty dollars per set of two, and make wonderful permanent footings for use on a concrete pad or in a parking lot.

Hot summer sun can soften asphalt (black-top), so choose a footing material that offers a large 'footprint' (like railroad ties) if building or setting up your IC on a this surface.

Chapter Four. Cutting Steel and Basic Framing

Cutting the 14 gauge (.075") corrugated steel sides of your IC for installation of doors and windows is easily accomplished with the use of a reciprocating saw or sawzall by Milwaukee. After careful measurement, mark your cuts with a grease pencil, then drill several 1/4" starter holes in each of the four corners.

Do not damage the water-tight roofs of these units by cutting holes for vents or stovepipes. Route all pipes of this type through the side of your unit with angled tubes. Why damage a perfectly good water tight roof when you can run that stovepipe out the side wall? Bomb shelters and other underground designs do require roof vents so they are exempt from this rule.

(a) Framing Interior

To save money and valuable interior space, I recommend using the affordable and easy to work with 2x2 entirely for your interior framework. Since the IC already possesses all of its load-bearing qualities built-in, strength of the framing material is not an issue. All you need is something to hold insulation, paneling, windows and doors.

Avoid the temptation to fasten 2x2 studs to the corrugated metal of the IC with drilled holes, bolts, or other fasteners. Why fill your water-tight walls with holes when this is not necessary? The best method is precise cut studs that will fit tightly in place (they should have to be lightly tapped into place with a hammer), and a bead of Liquid Nails brand construction adhesive. Liquid Nails is effective on steel and wood. This method will produce more than satisfactory results, while saving time, effort, and money. Studs should be placed every 4' to allow for easy attachment of standard 4x8 paneling or other interior sheathing material. Thin layers of fiberglass insulation placed under the paneling will help retain precious heat in the winter time, and should be considered.

A 2" platform is more than adequate to support and mount a standard vinyl pre-made window. For windows requiring more than a 2" stud, build additional mounting area using 2x4's or 2x6's inside the window opening.

If welding is something you know about, you can use this approach for tacking on steel strips as frames. This will save you a few inches of interior space, but provide less room for insulation behind paneling. In general, welding is more of a specialized skill, but for those of you that want more steel, and less wood in your structure, I say go for it. I've seen some IC buildings fit-out with hatches, doors and even portholes from surplus navy ships. Bolts and self-tapping screws are another route to take for the all-steel IC builder.

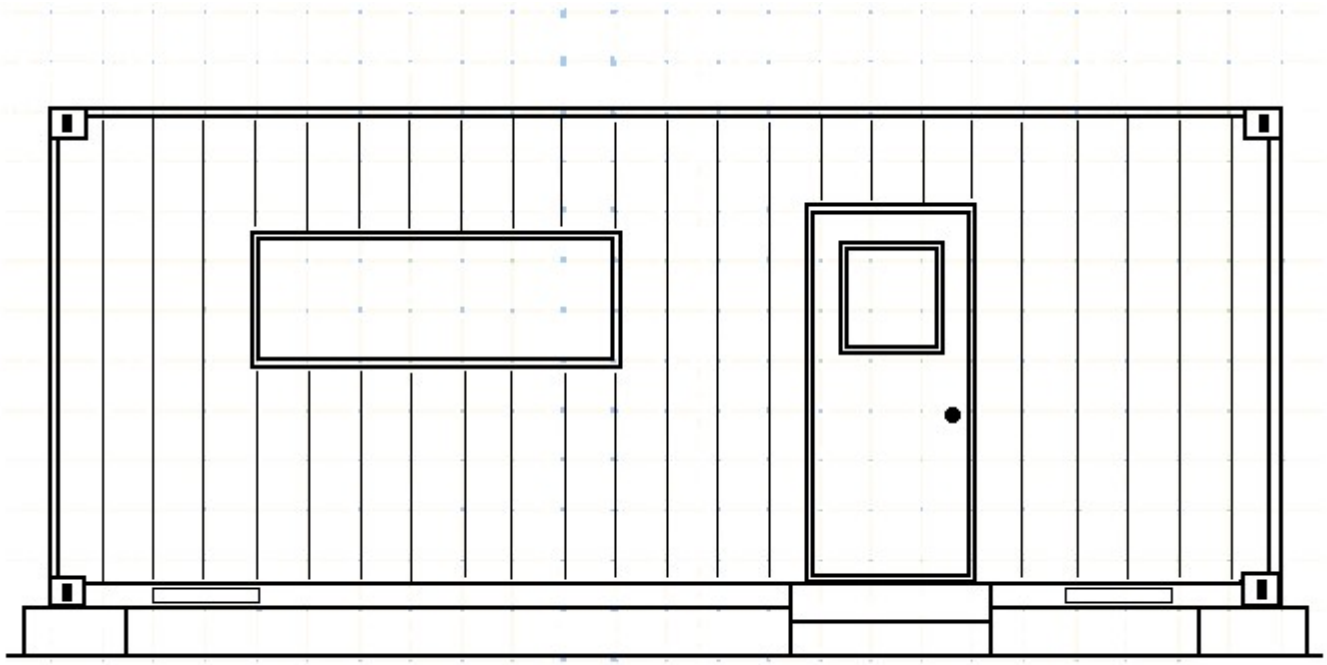
(b) Exterior Decks, Supports, and Roof Framing

I prefer to use standard readily available pressure treated decking lumber and connecting hardware for these jobs. This is the ideal material for the task, with the exception of mid-level support beams for 20 ft unit over 40 ft (split- level designs). Use steel I-beam framework for these applications.

4x4 beams work great for support of roof trusses, and 2nd story decks with stairs. You can drill holes through the 7 gauge (.18") tubular steel end frames, and secure studs using self-anchoring bolts. One the main studs are in place, you can build your peaked roof, or deck system just like you would with normal wood construction.

Part 3 - IC designs and Building Projects

Chapter Five - One Dozen IC Designs and Building Projects



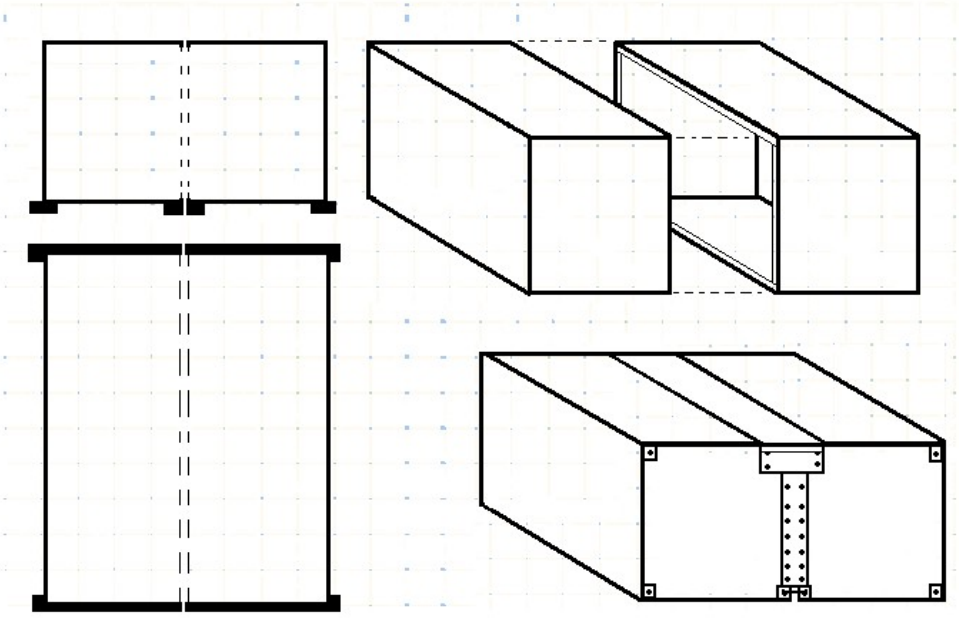
Special Safety Note

Air ventilation is a primary concern for anyone utilizing a shipping container for shelter. When entering any un-modified IC, you need to employ a safegaurd against accidentally becoming locked inside (possible suffocation may result). The locking steel doors can be a great deterent to would-be thiefs, vandals, and also mother nature, but they must be temporarily secured to the sides (in their open position) to prevent accidents. This safety measure can be discontinued after the first cuts (for doors, windows, etc) are made.

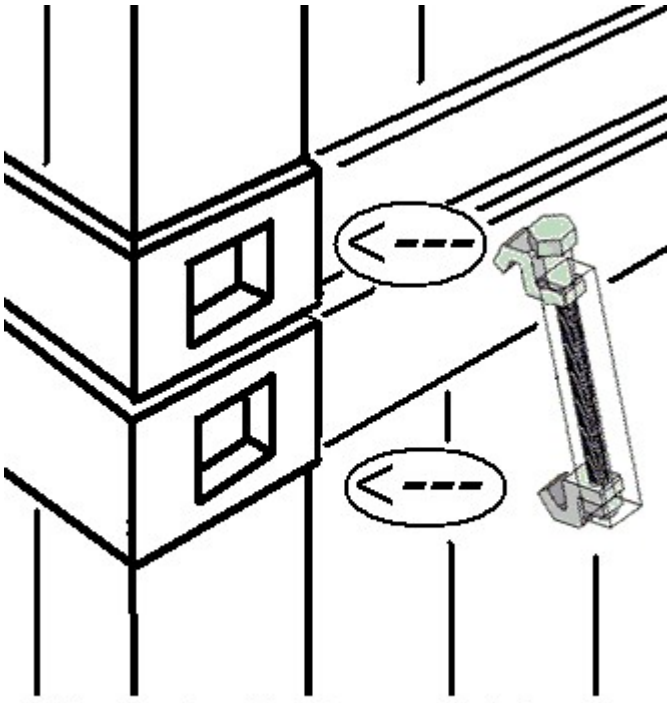
(a) Standard single design. This is a single 20 ft IC with wood railroad tie foundation footings, two windows, and a entry door. The steel cargo doors remain intact on this design, but can be opened to accommodate oversized materials if using as a workshop. The cargo doors can also be removed and replaced with a 6' patio slider glass door. Interior is fit-out with 2x2 framework, insulation, and decorative wood facade paneling.

Basic 20 ft structure on wood footings

(b) Dual 20 ft units placed side-by-side provides a roomier 16'x20' building. IC's are set in place on footings, then clamped together using IC clamps (see diagrams). Coil spring compressors can be substituted for IC clamps in a pinch. 1/4" steel plates can also be used (instead of IC clamps), welded and bridged across corners. Trim out desired wall material using a sawzall after units are secured together in place. Seams are covered with galvanized steel roofing material, and sealed with hot tar.

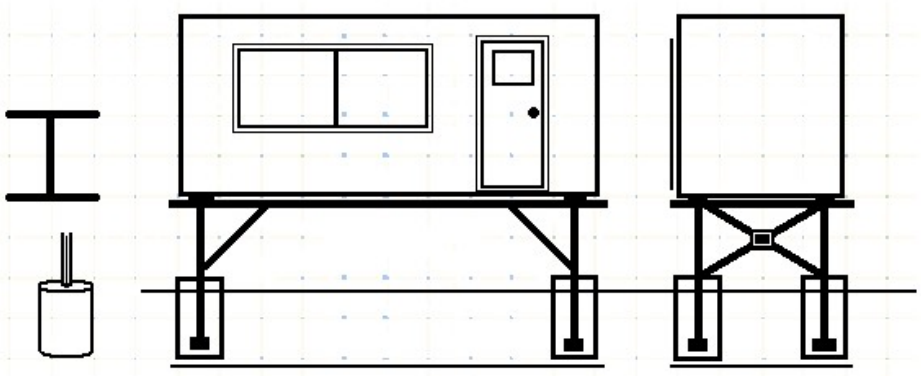


Dual 20 ft side-by-side arrangement

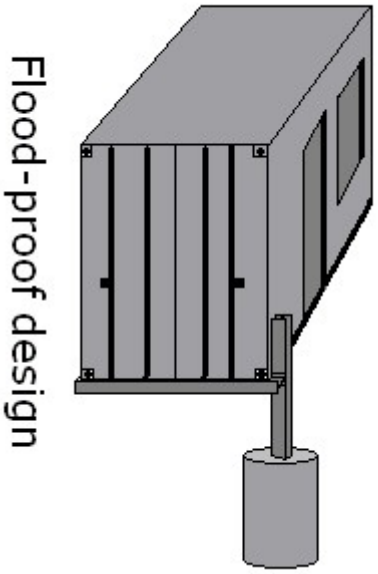


Clamp for joining containers

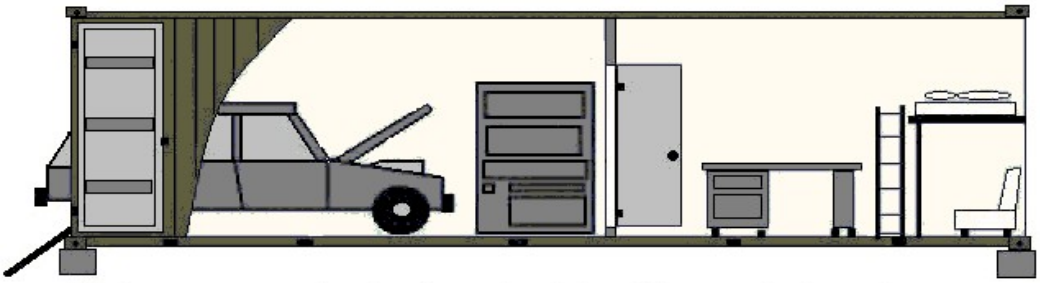
(c) Flood-proof design offers a reassuring structure for areas prone to high waters. Build the I-beam framework 4'-5' above the ground, and use 2'x4' wood molds or 55 gallon drums to pour the concrete footings in. Lift your 20 ft IC into place with a crane after concrete sets, and secure with bolts.



Flood-proof designed 20 ft unit w/I-beam footings



(d) 40 ft High-Cube IC modified to serve for auto repair. Back section of unit has office and sleeping area. Bulkhead dividing wall is built using standard construction methods, and secured in place with Liquid Nails. This design can serve many purposes from a basic workshop, to small car or motorcycle repair facility. Also worth mentioning, is the secure-locking nature of all IC units. These units provide a high level of security for expensive vehicles and tools. For the cost, the unit may prove a justified expenditure.

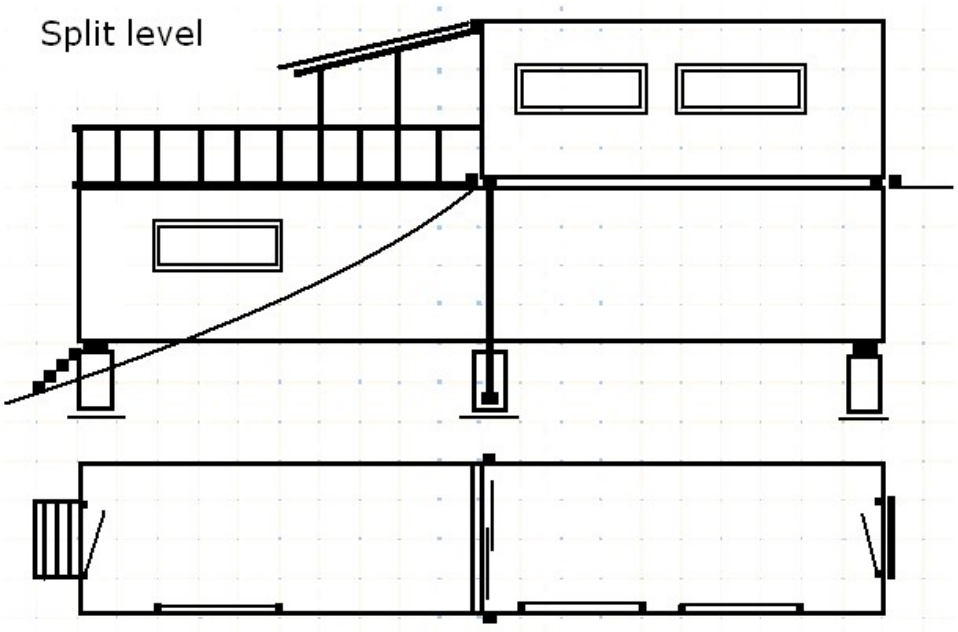


40 ft auto repair designed with office and sleeping area

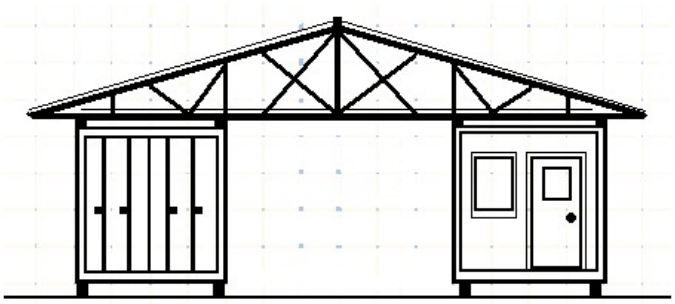
(e) 20 ft "desert rat" design has a peaked truss roof lined with solar panels. Set-up shades IC from the blistering hot desert sun, while simultaneously generating all required electrical power for the occupant. Use 12 volt deep cycle batteries connected to a DC-to-AC power inverter. Unit has steel shipping doors intact, but these can be opened to provide a breeze and a "outside patio" feel in the insect-free desert environment. Another option is to replace cargo doors with a 6' glass patio slider. Note: you can use removed IC cargo doors to make other doors (use one-half door as a entry on IC side etc). This will require a bit of metal-smith work (to make the mounting hinges and frame), but you will have a solid steel entry door for free when finished.

Solar cover for warm climates

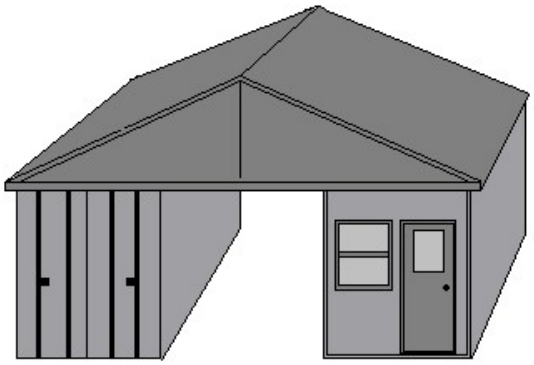
(f) Here is a great split level design for the serious builder. Building consists of a 40 ft IC half buried in the side of a modest slope, with a 20 ft unit serving as the second floor. Pressure treated decking is used on the open side creating a patio area complete with 6' glass slider doors, and corrugated tin overhang. Sections of the IC that will be covered with soil are painted using anti-fouling boat paint.



(g) Here is a design that maximizes the effective space of 20 ft units. The Super Carport has a peaked truss roof covered with corrugated tin roofing panels, space for your car, motorcycles, and a workshop.

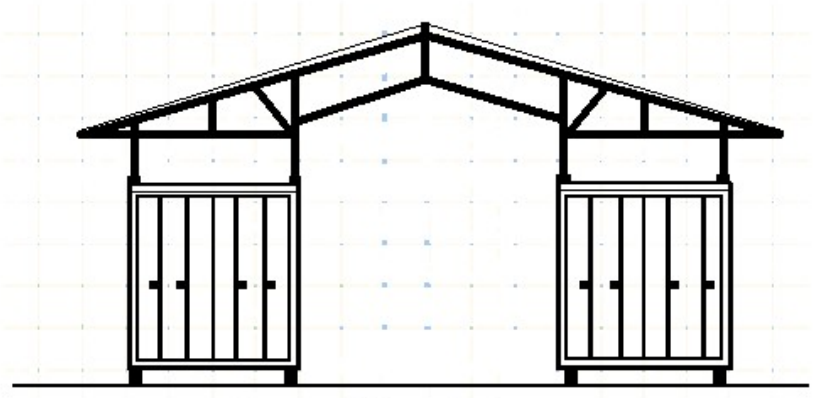


Super carport



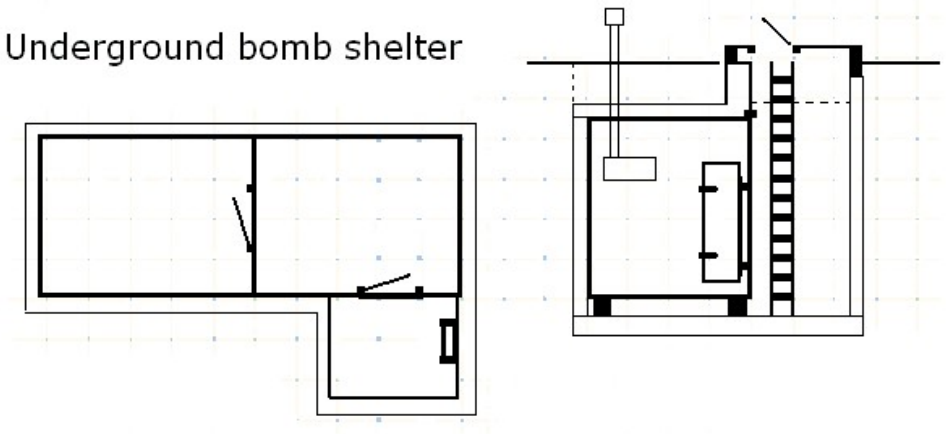
Super carport

(h) Super RV Cover is similar to the Super Carport, with extended main truss beams to accommodate tall RV's and boats for storage. Use 40 ft High-Cube IC's to create a massive utility structure. This design also works great for permanent RV living. Parked RV or 5th wheel is kept out of the damaging UV rays, while the IC units on each side offer several options. Owner may choose to build: large bathroom(s), whirlpool and sauna room, billiards room, bar, workshop, home theater, or bunkhouse in one or both units. Using such a design would allow you to easily expand the living and/or storage area of your parked RV or 5th wheel.

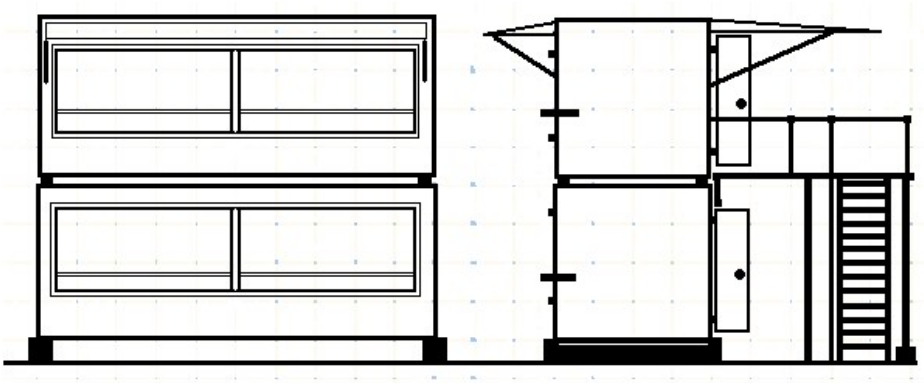


Super RV or boat cover

(i) Here is an underground bomb shelter that can be built on a budget using a 20 ft IC painted with anti-fouling boat paint (to prevent corrosion), a truckload of gravel, and some I-beams. This design requires a excavator with shovel to dig the hole, lower the IC in, and then fill the remaining gaps with gravel creating a thick stone wall around unit. Steel beam framework and 1/4" plate is used to create the entry space under ladder and hatch. Note vent tube in IC roof. It is doubtful this shelter would protect you from radioactive fallout, but, it would probably work for conventional munitions and small arms fire ... (also zoning officials, your ex-spouse, and other people you may wish to avoid). Loss of oxygen is a risk with this design if not properly constructed. Roof vents are required. Use at your own risk.

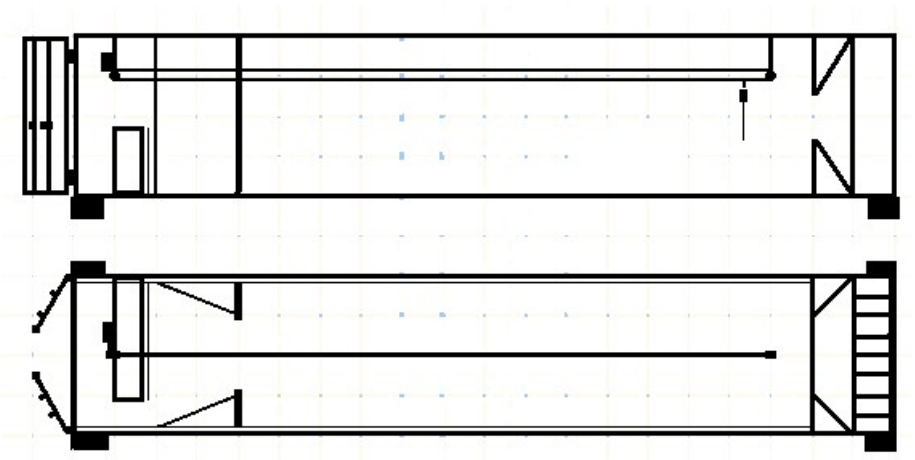


(j) Dual 20 ft stacked units for skeet or trap shooting. Design includes a pressure treated wood deck and staircase located on backside. This set-up could also be used for sporting events, providing a second story booth for announcers, and first floor unit for concessions or equipment storage. Possible applications: skeet & trap clubs on a budget, dirt-bike racing, new extreme sports facilities, horse races, and high schools.



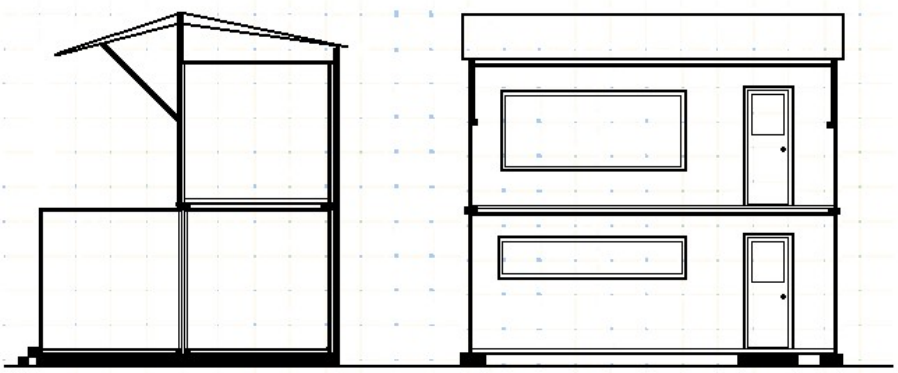
Skeet range, or snack bar and broadcaster booth for sports

(k) This 40 ft handgun range could prove useful for police departments or other agencies. Could be used as a temporary solution for lack of range space, or as a low cost range for departments on a budget. Other possible configurations include a two lane bowling alley, or small archery shop with target range.



40 ft mobile or stationary handgun range

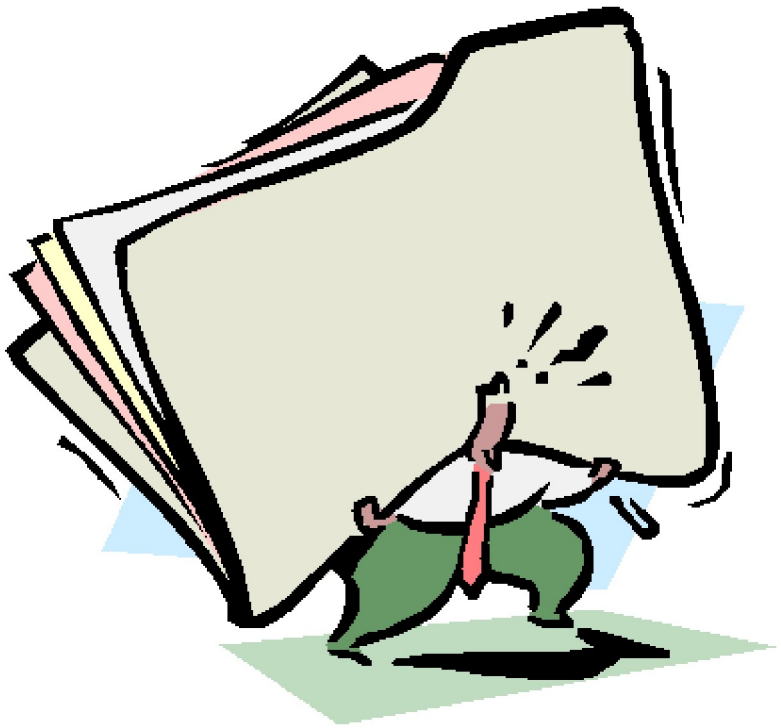
(I) Triple design 3- 20 ft IC's form a great little multi-level cabin, cottage, or guest house on your land. Connected walls can be trimmed out providing a large open space. Trim-out half of the connected roof-floor (of stacked units) to create a loft. Add wood stairs, a ladder, or a spiral staircase for second floor access. Open terrace can be designed as a screen porch or weather resistant, lumber-built dormer.



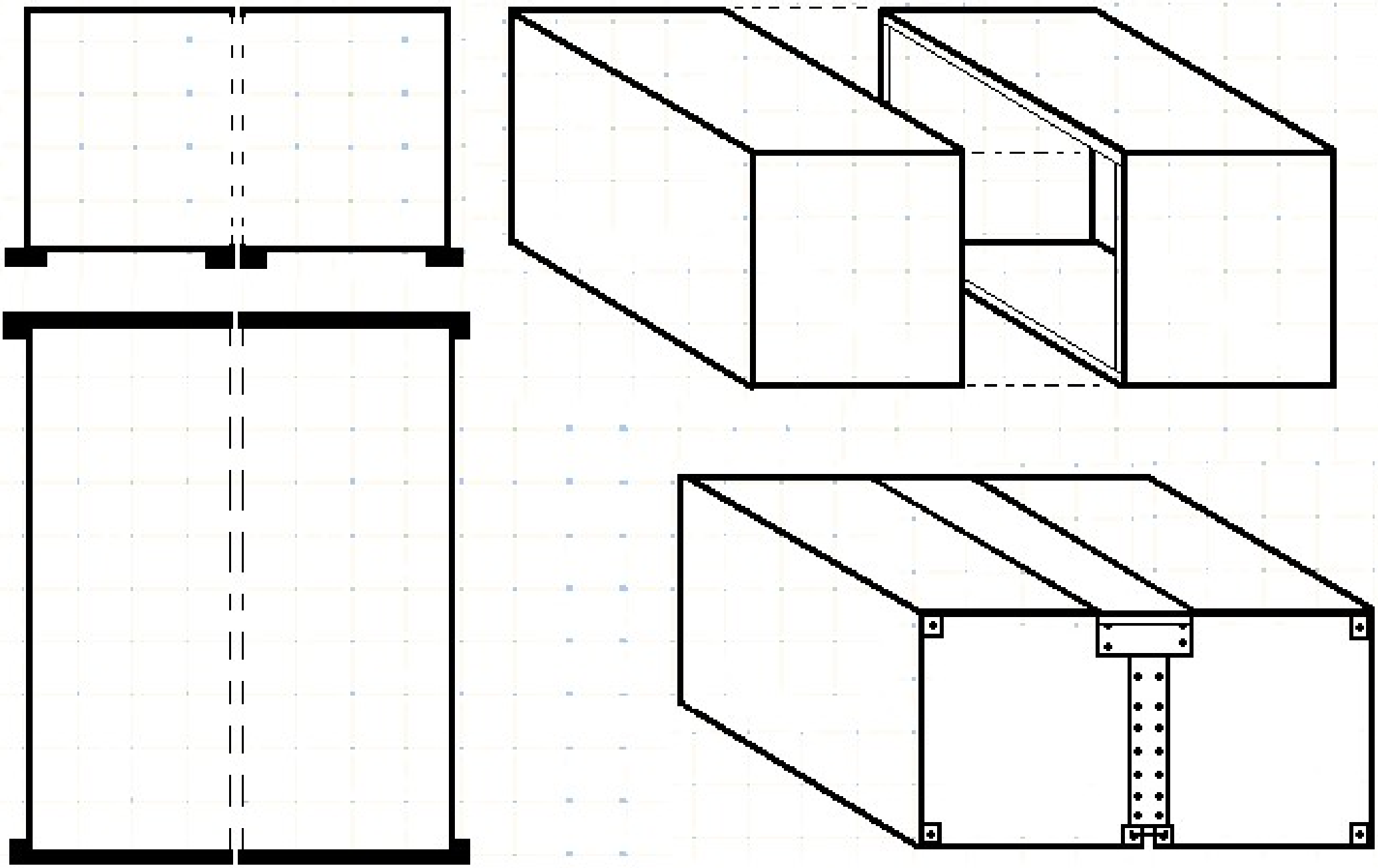
Triple 20 ft design

Part 4 - Illustrations & Diagrams

(a) full page 8.5"x11" illustrations and diagrams - pages 35 - 60

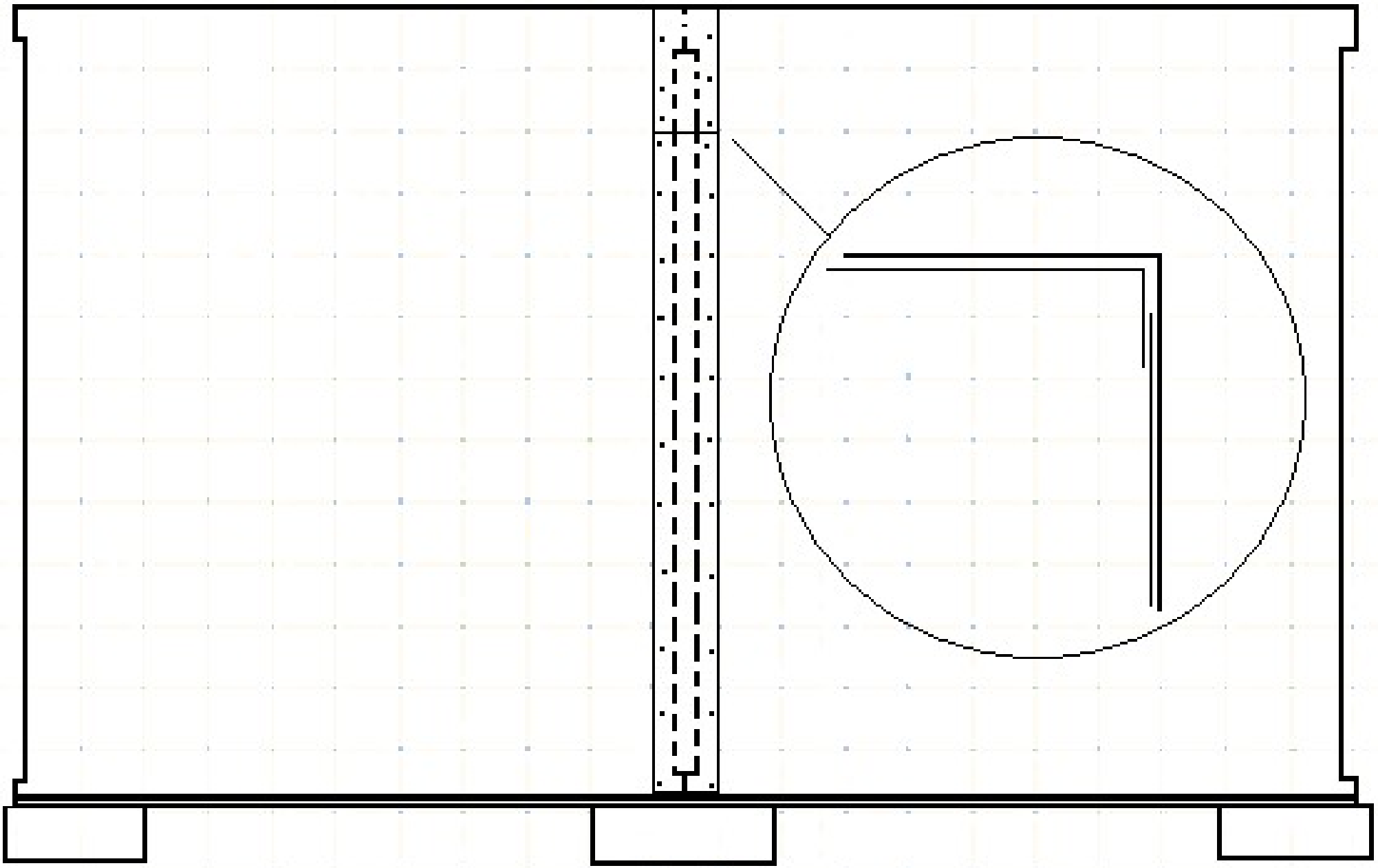


Basic 20 ft structure on wood footings



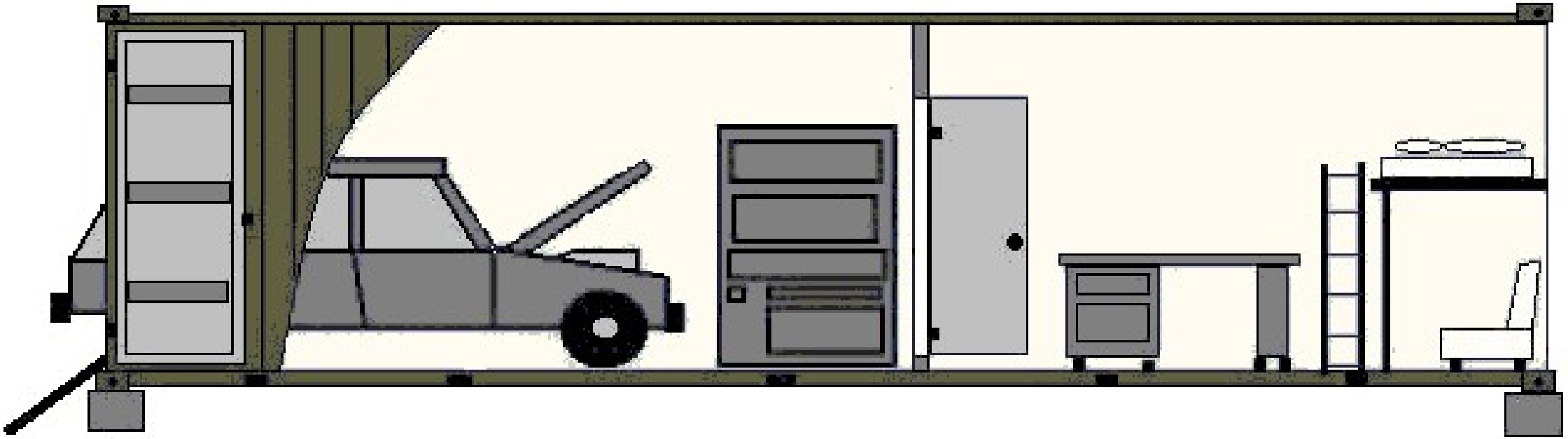
Dual 20 ft side-by-side arrangement

Seams can be waterproofed from inside when joining units side-by-side.
This alternative technique utilizes galvanized sheet metal and silicone or foam.



Flood-proof designed 20 ft unit w/I-beam footings

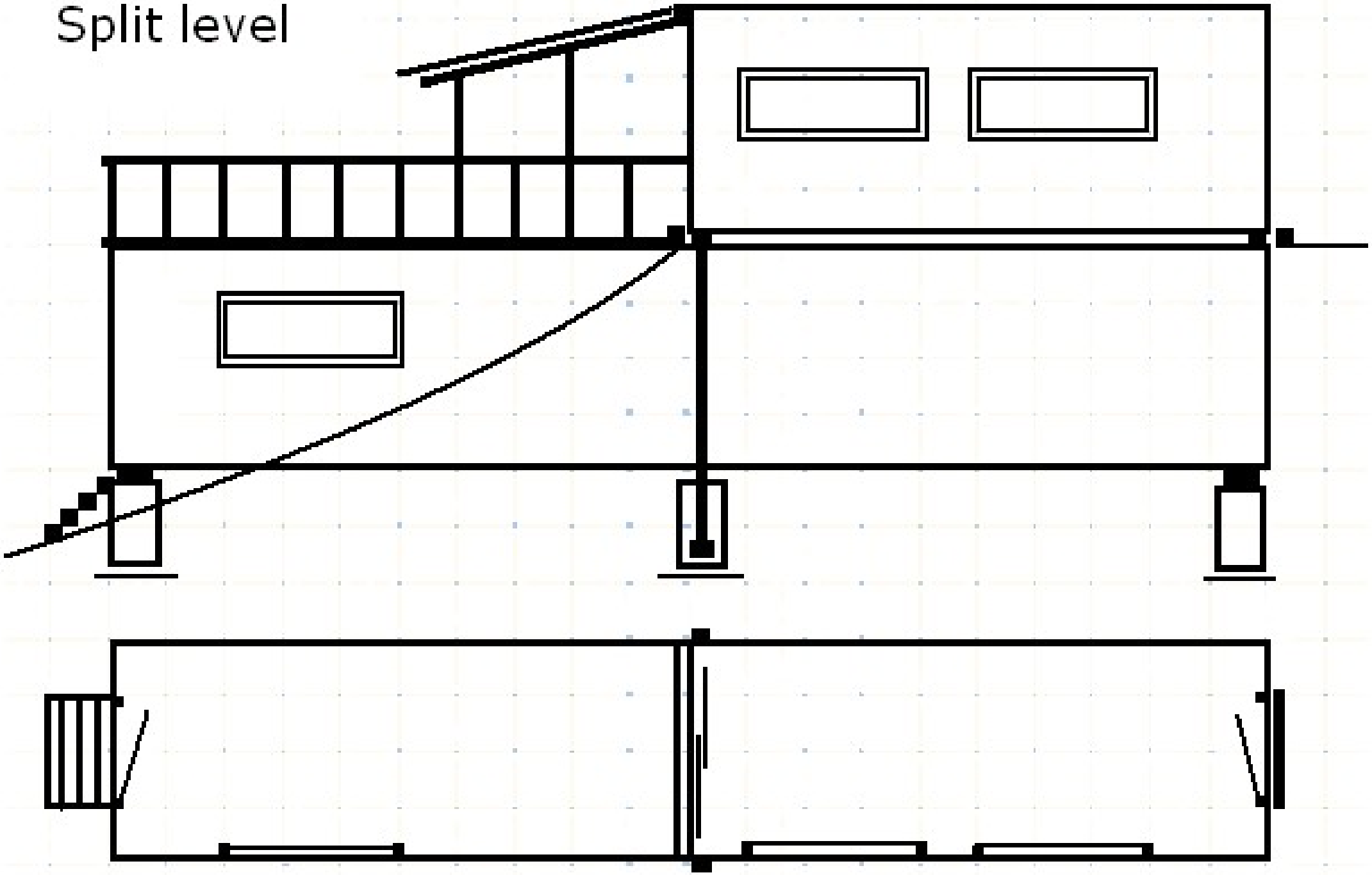
Flood-proof design



40 ft auto repair designed with office and sleeping area

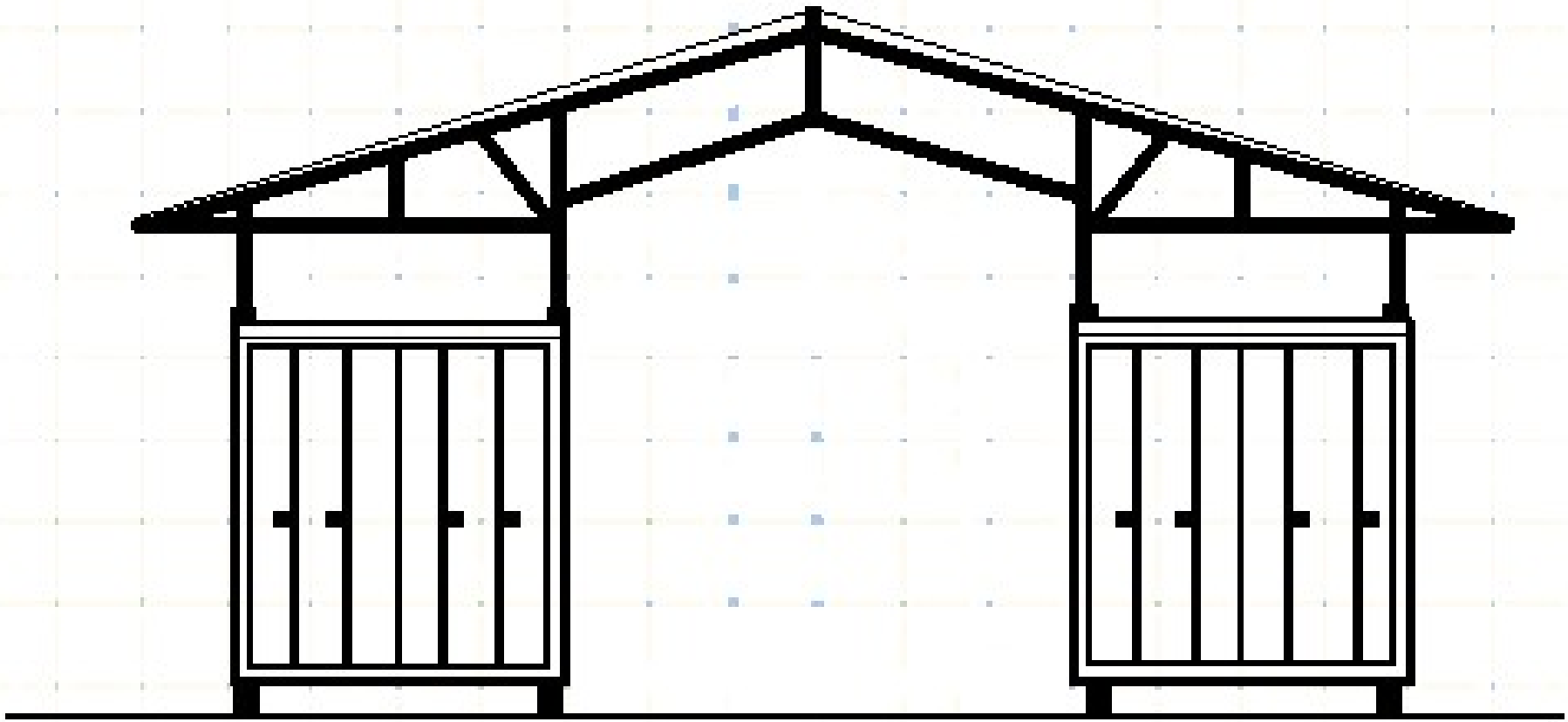
Solar cover for warm climates

Split level



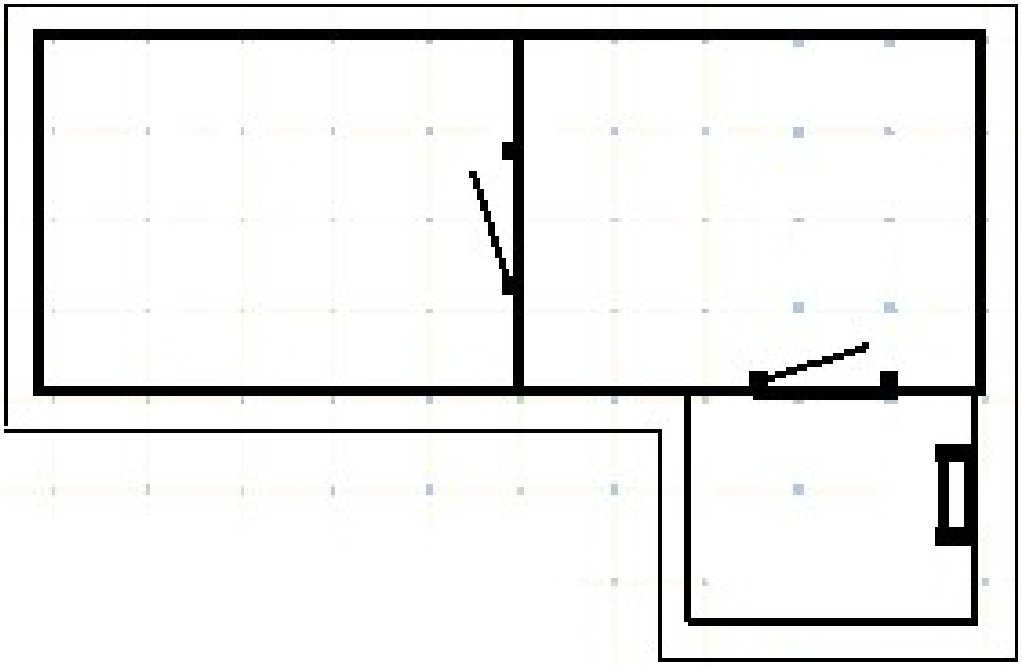
Super carport

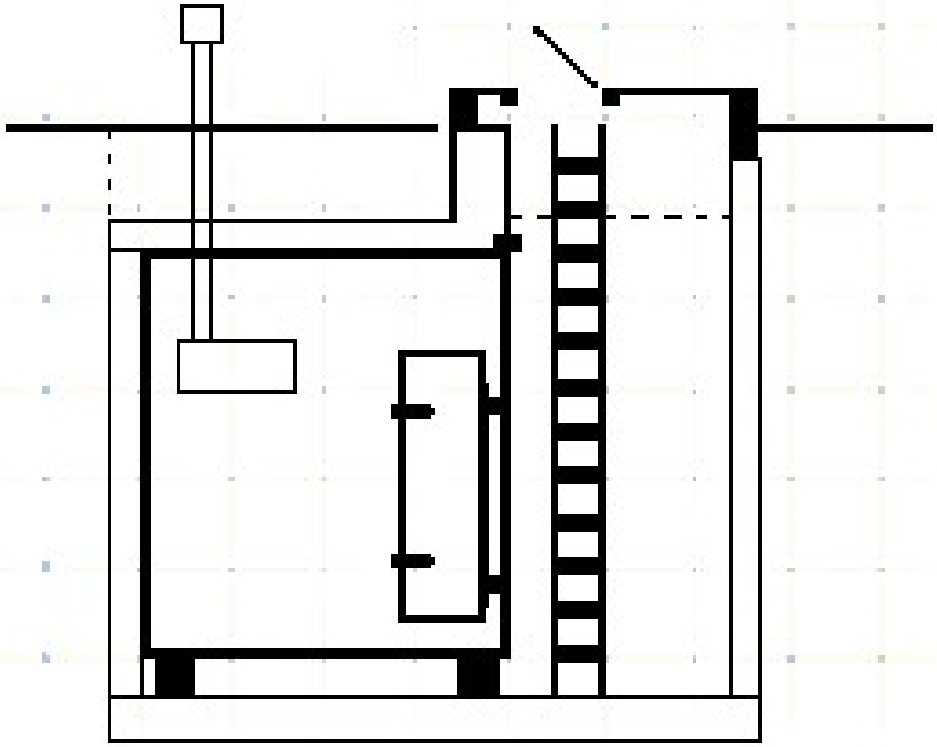
Super carport



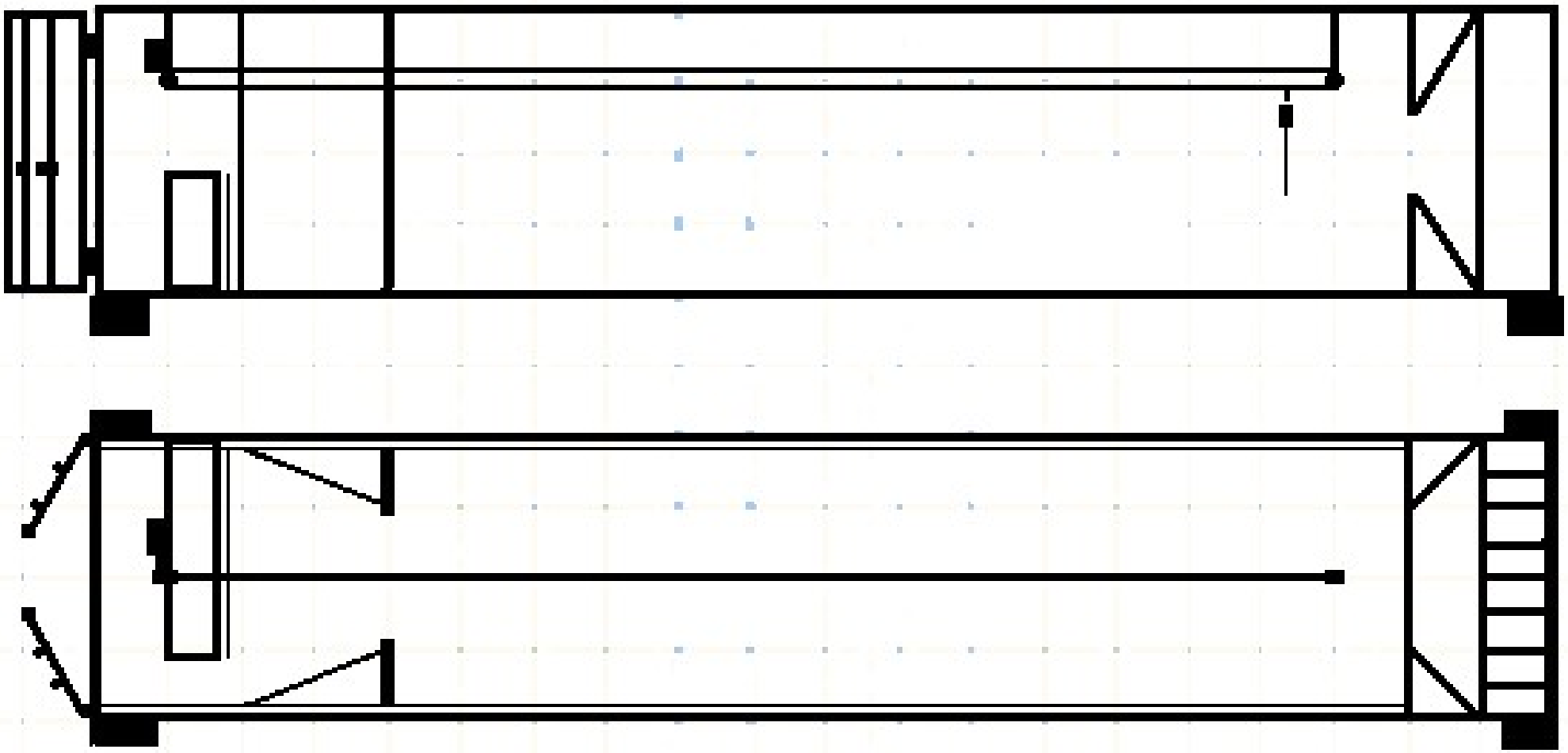
Super RV or boat cover

Underground bomb shelter





Skeet range, or snack bar and broadcaster booth for sports

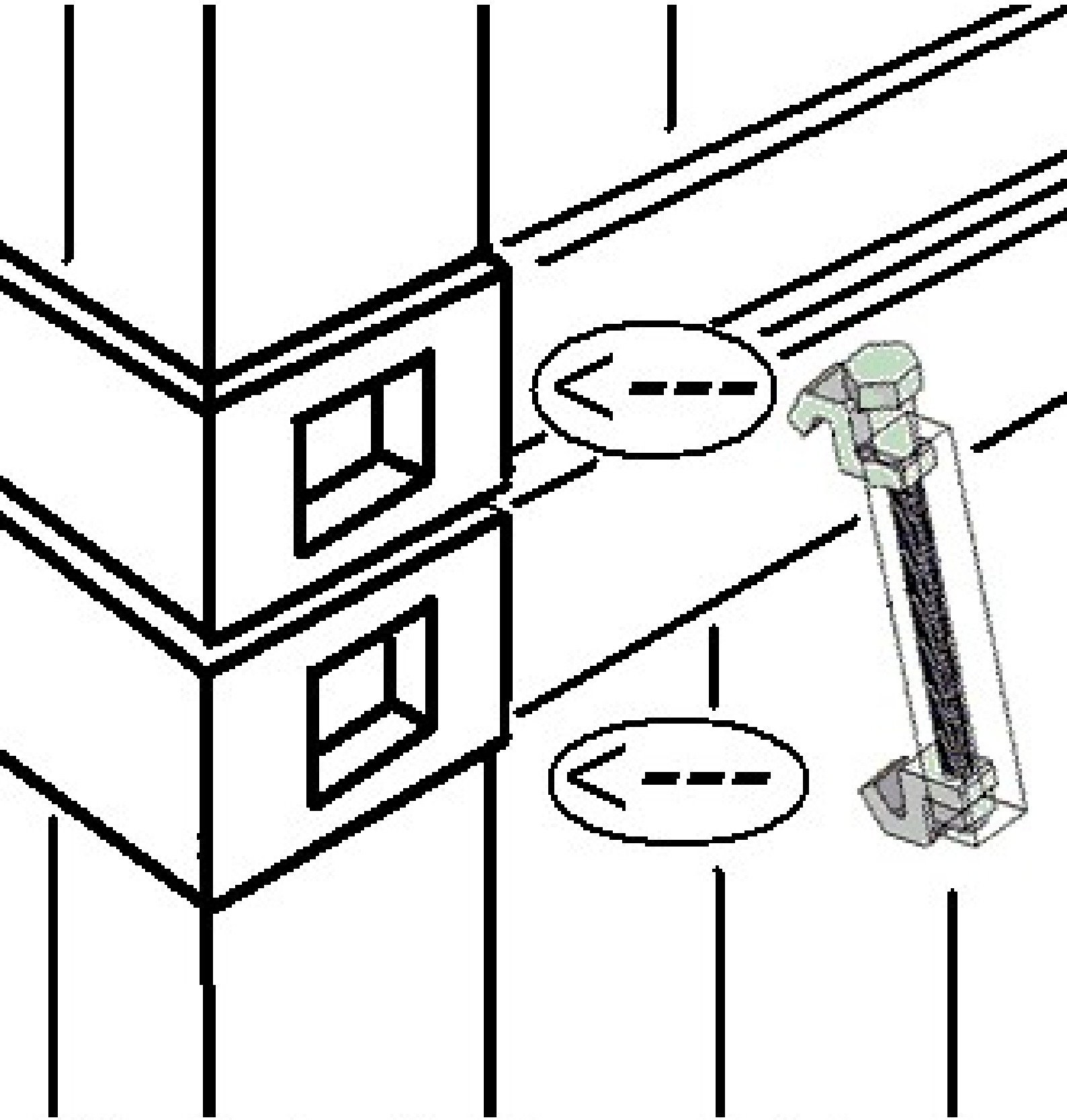


40 ft mobile or stationary handgun range

Triple 20 ft design

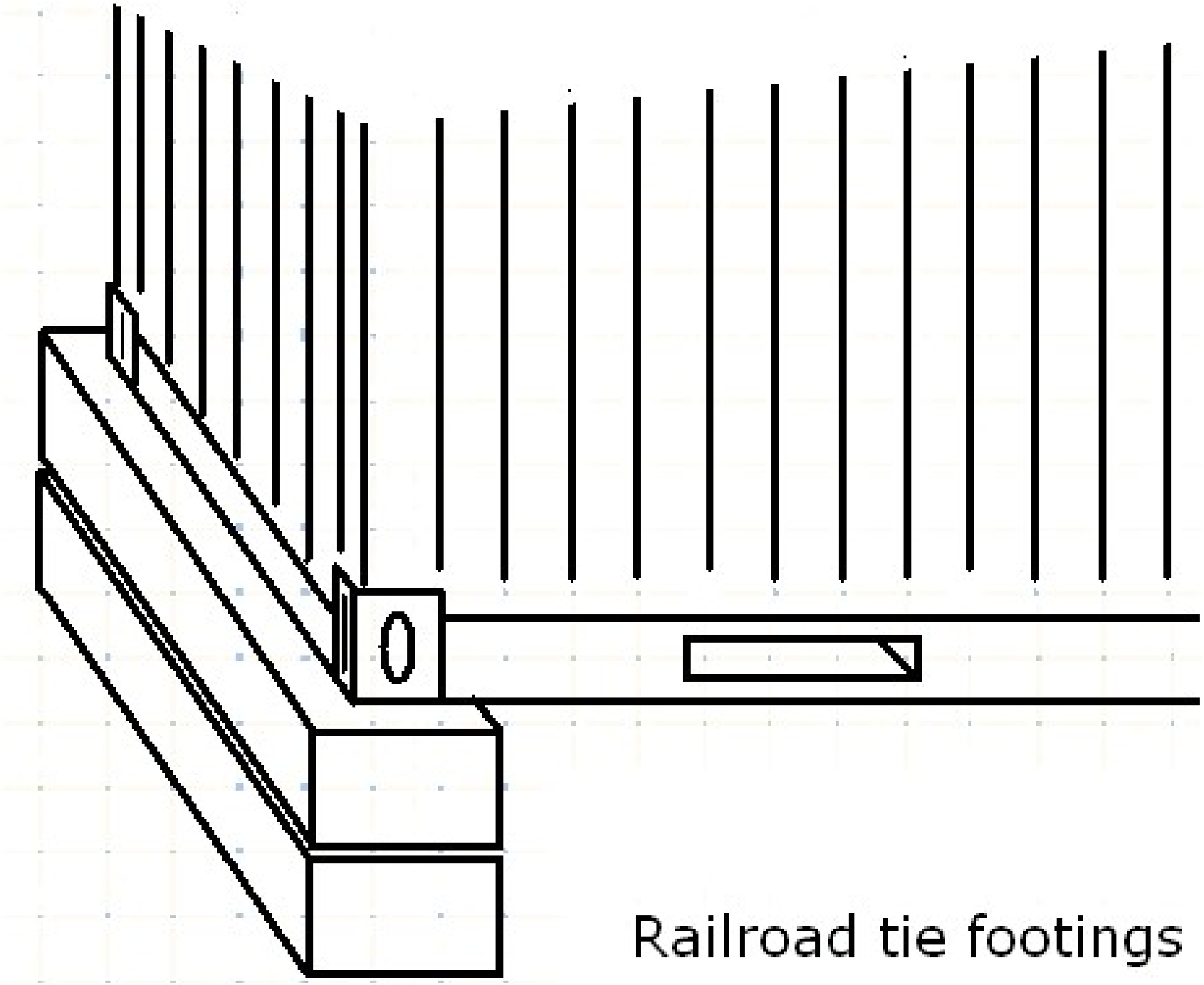
20 ft IC "90% underground" shelter with three levels

Clamp for joining containers

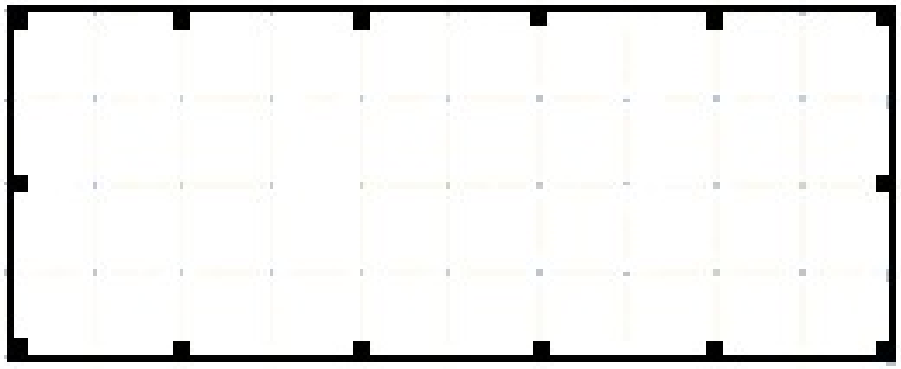


Clamp for joining containers

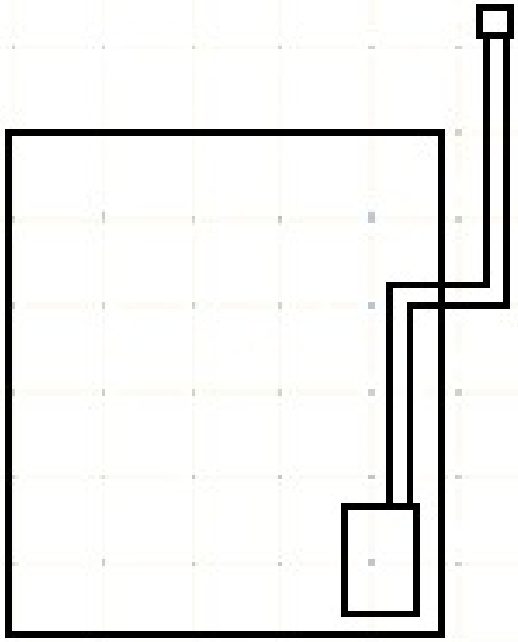
Concrete footing pads



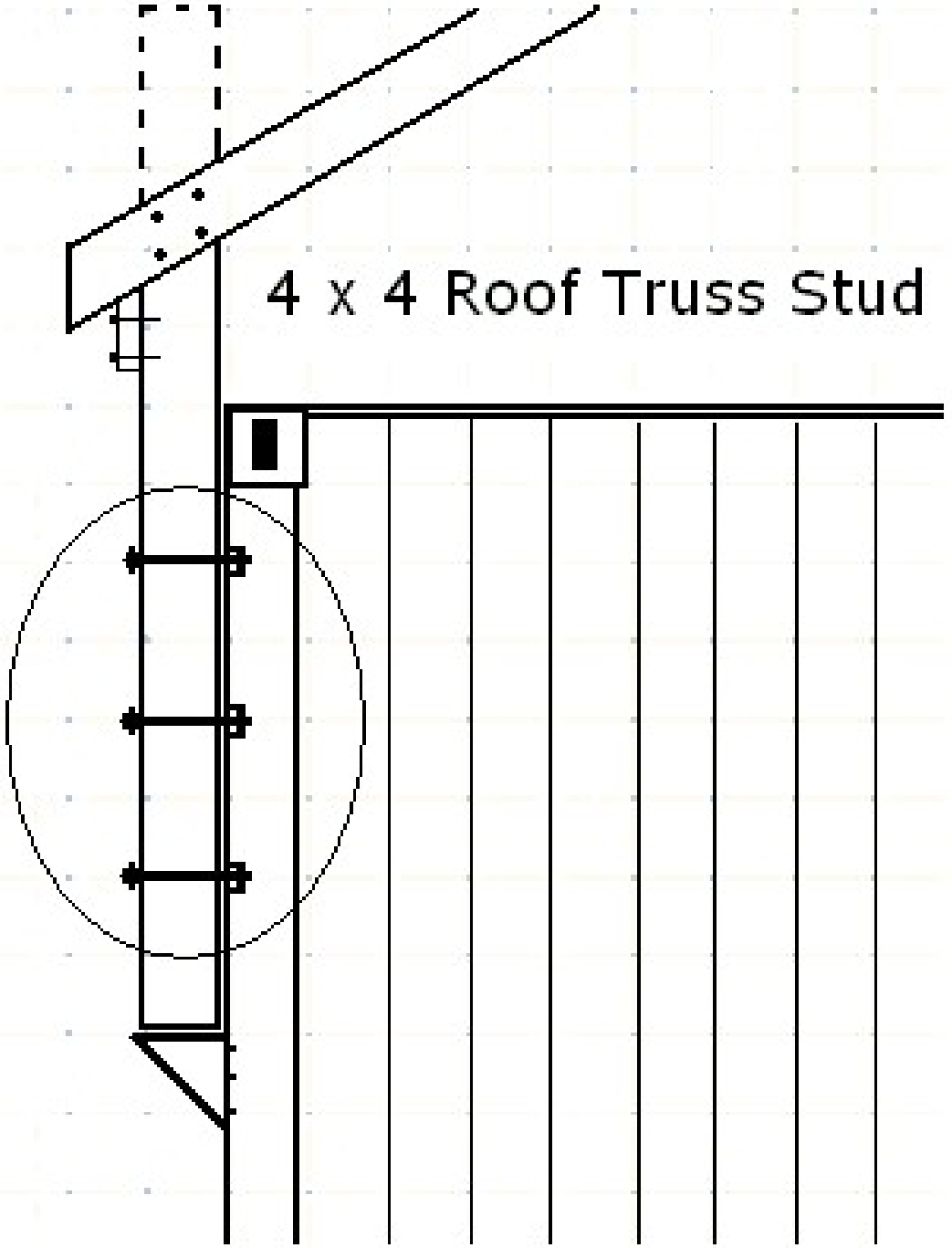
Railroad tie footings



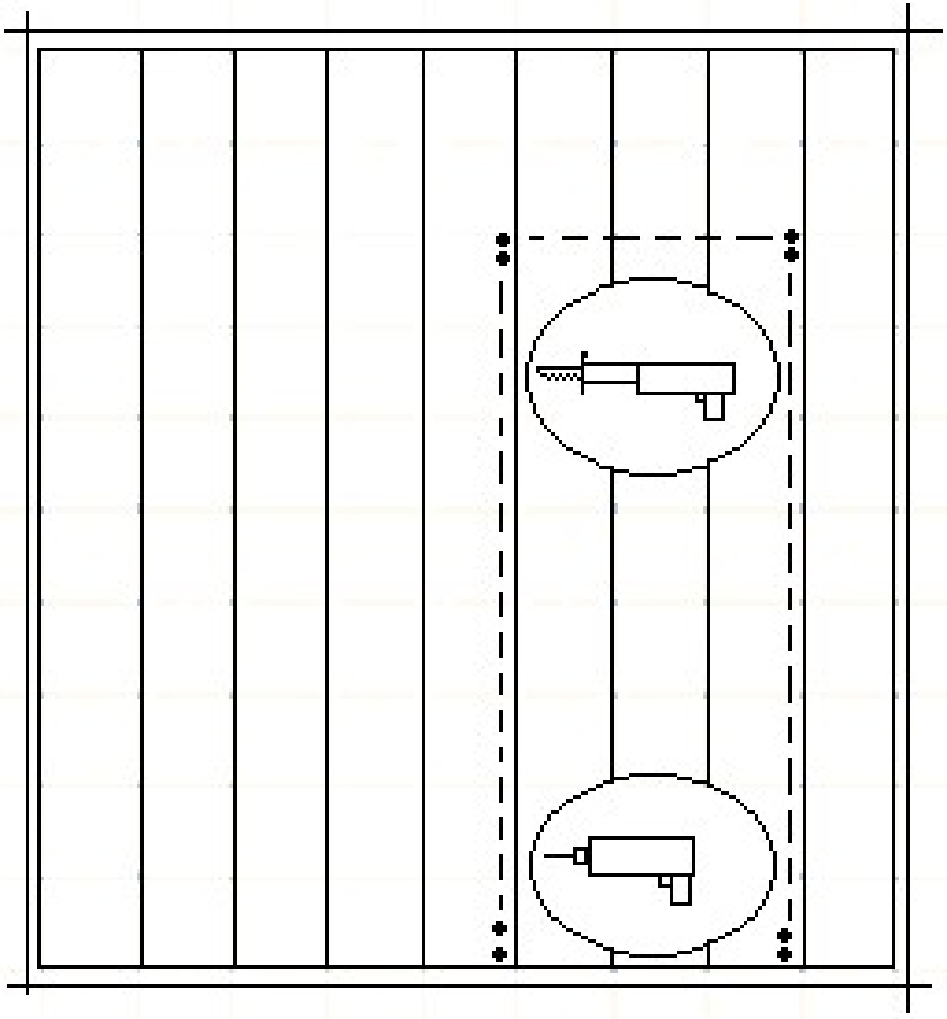
2 x 2 Framework in 20 ft



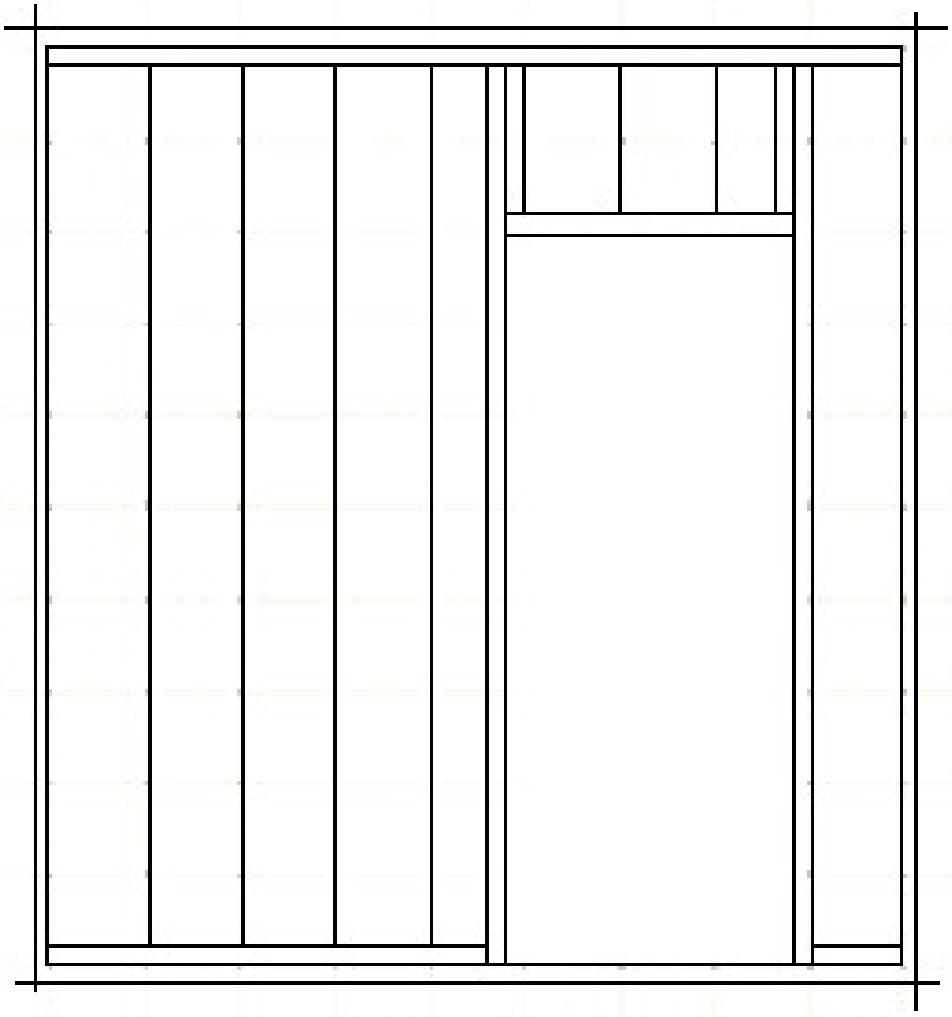
Flu pipe exhaust example

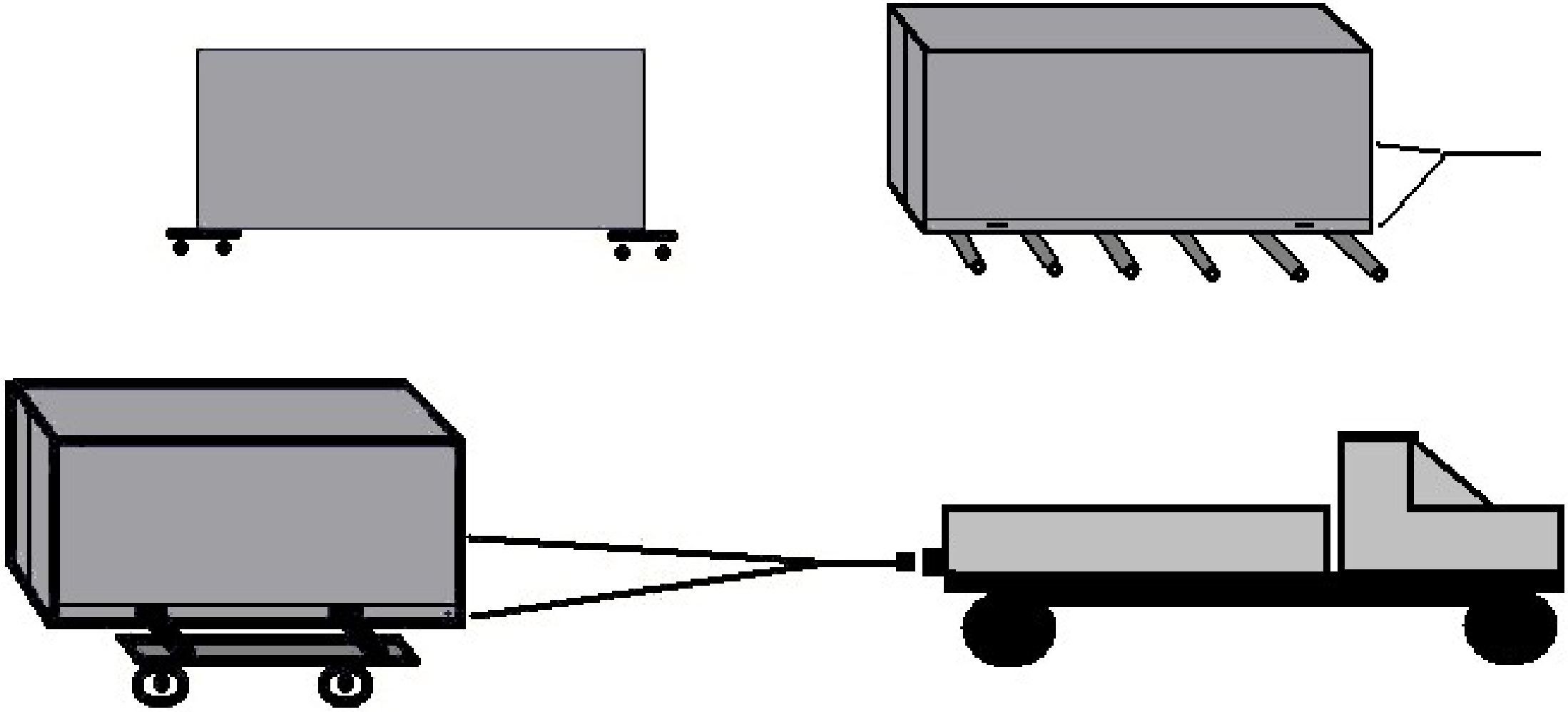


Steel is drilled then cut.



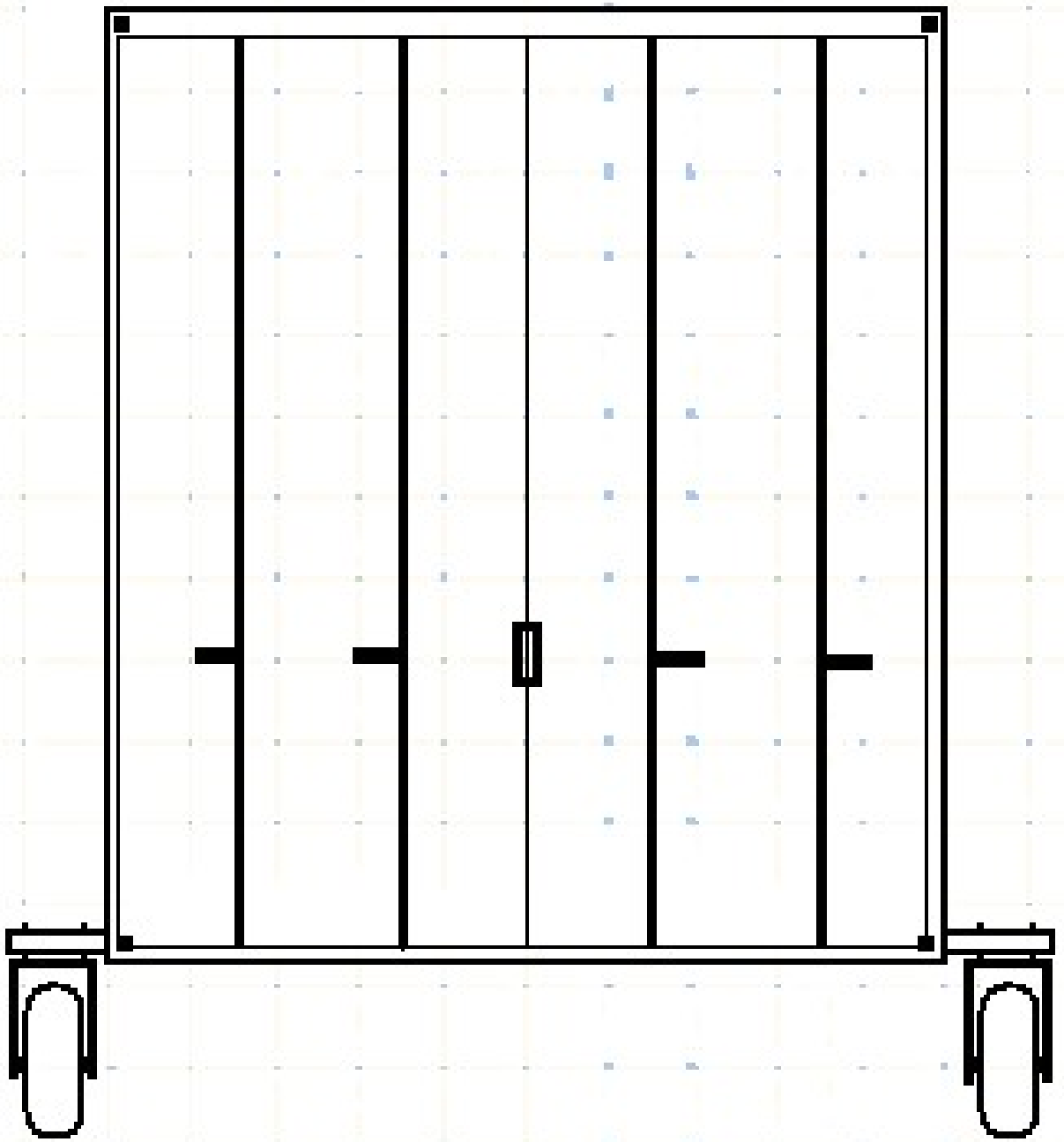
Inside view of door frame.



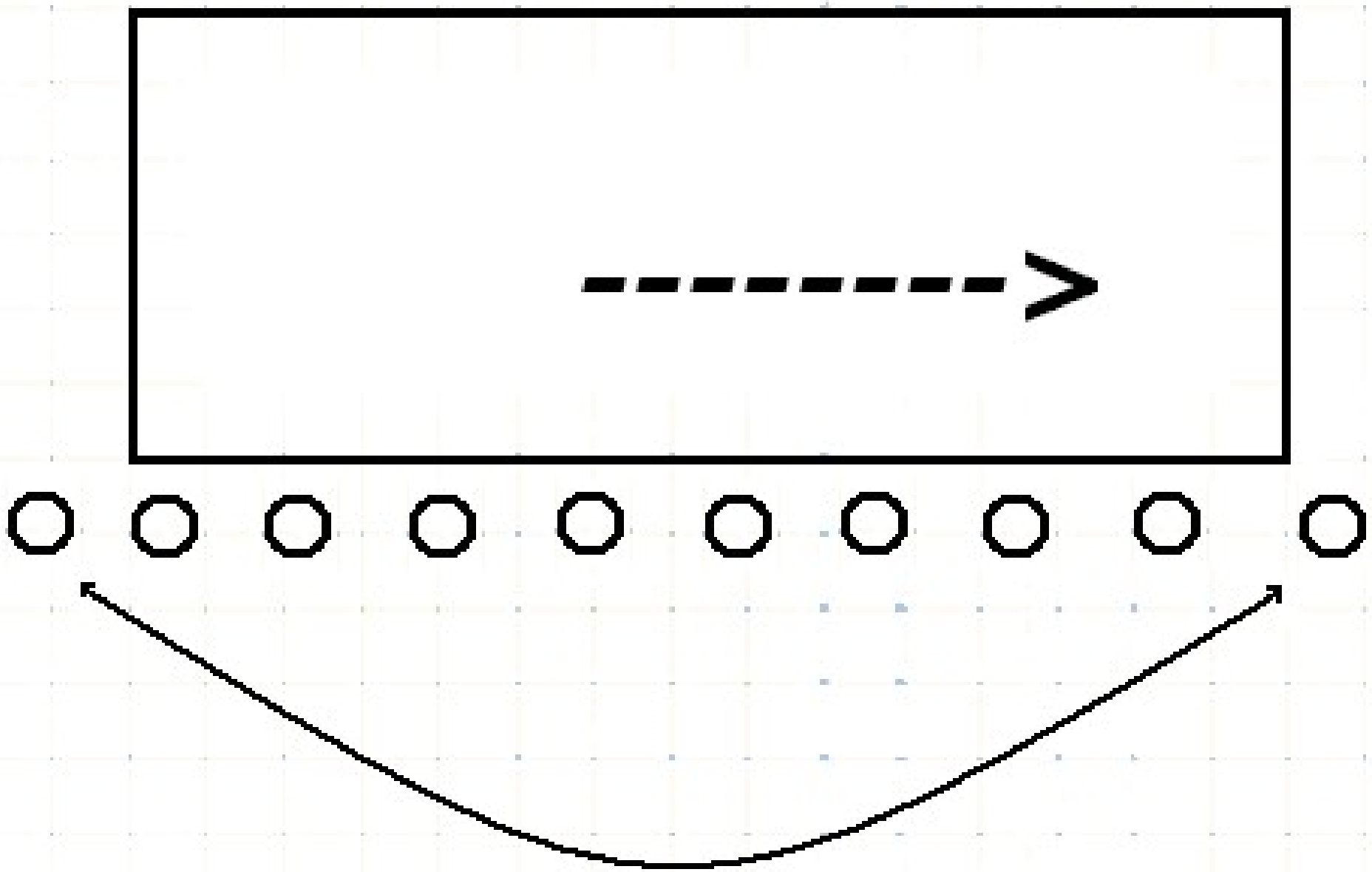


Techniques for moving IC's short distances without a crane

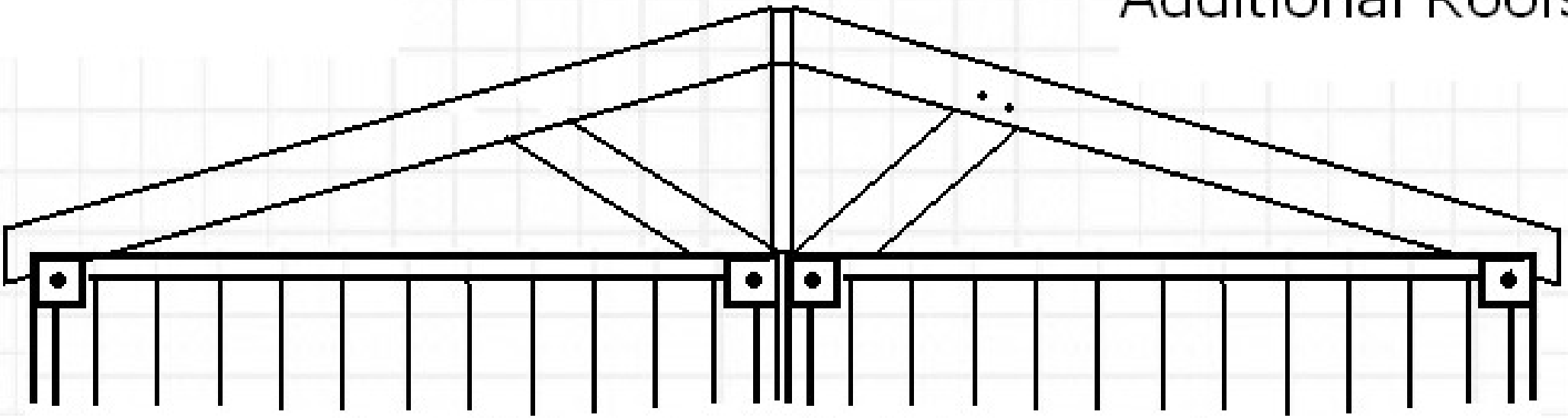
Homemade container buggy front view.



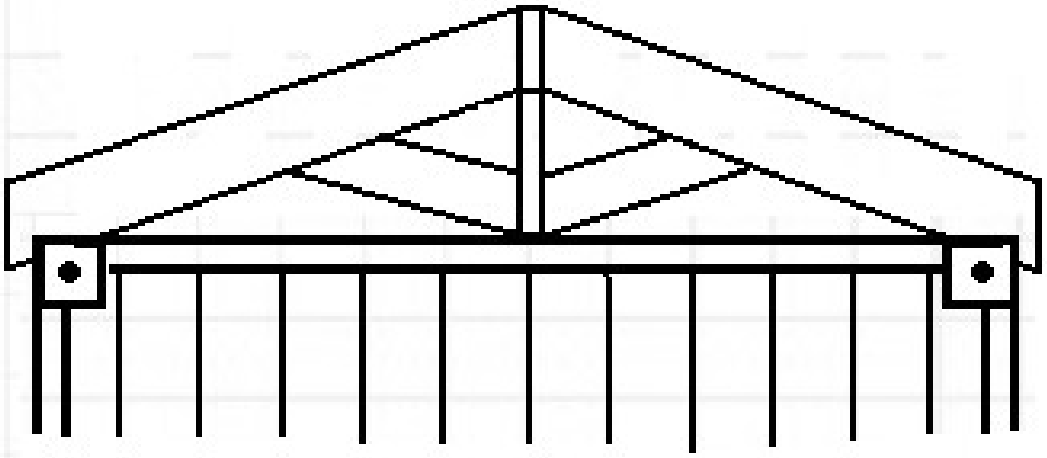
Rolling / towing unit on pipes



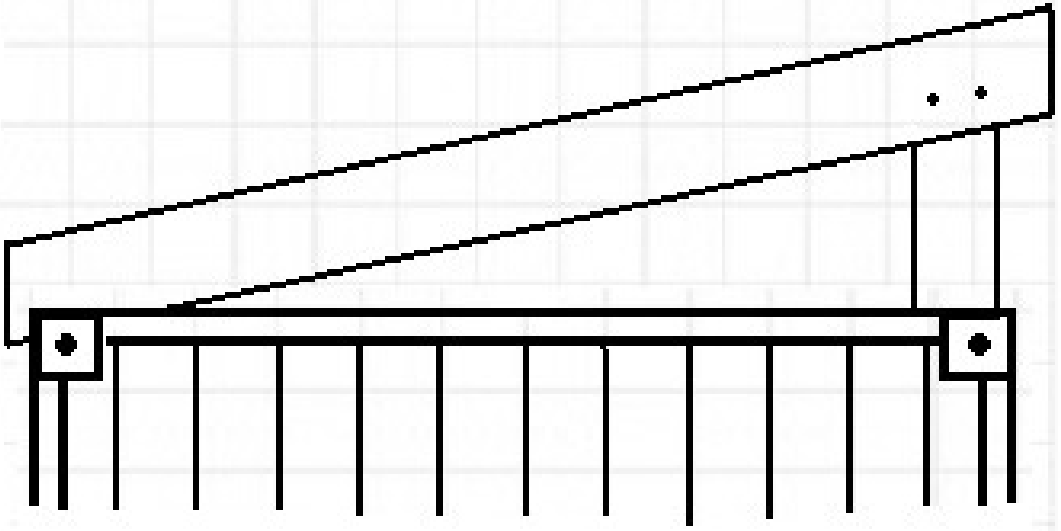
Additional Roofs



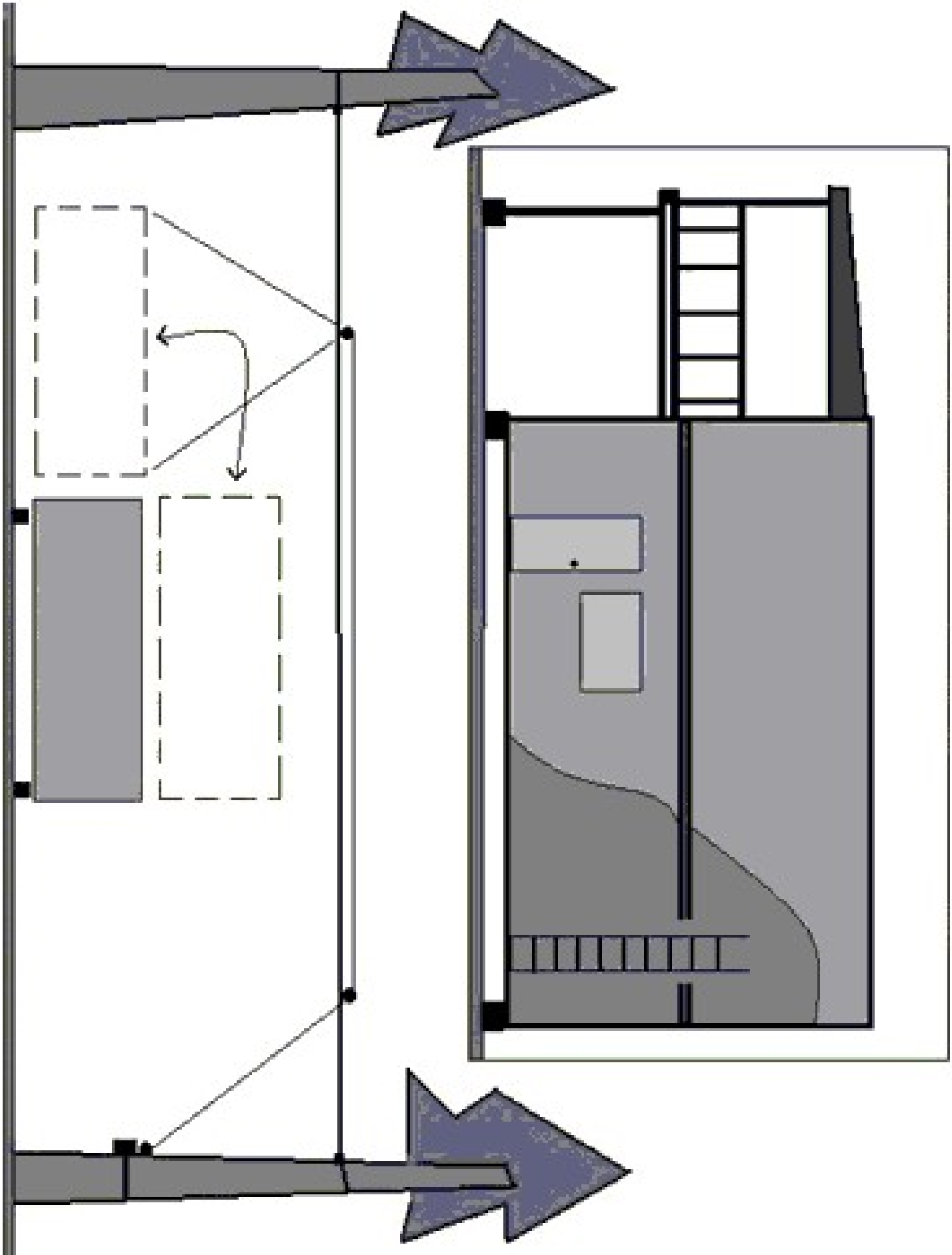
Dual 40 ft design with 2x6 truss system



20 ft single 2x6 truss

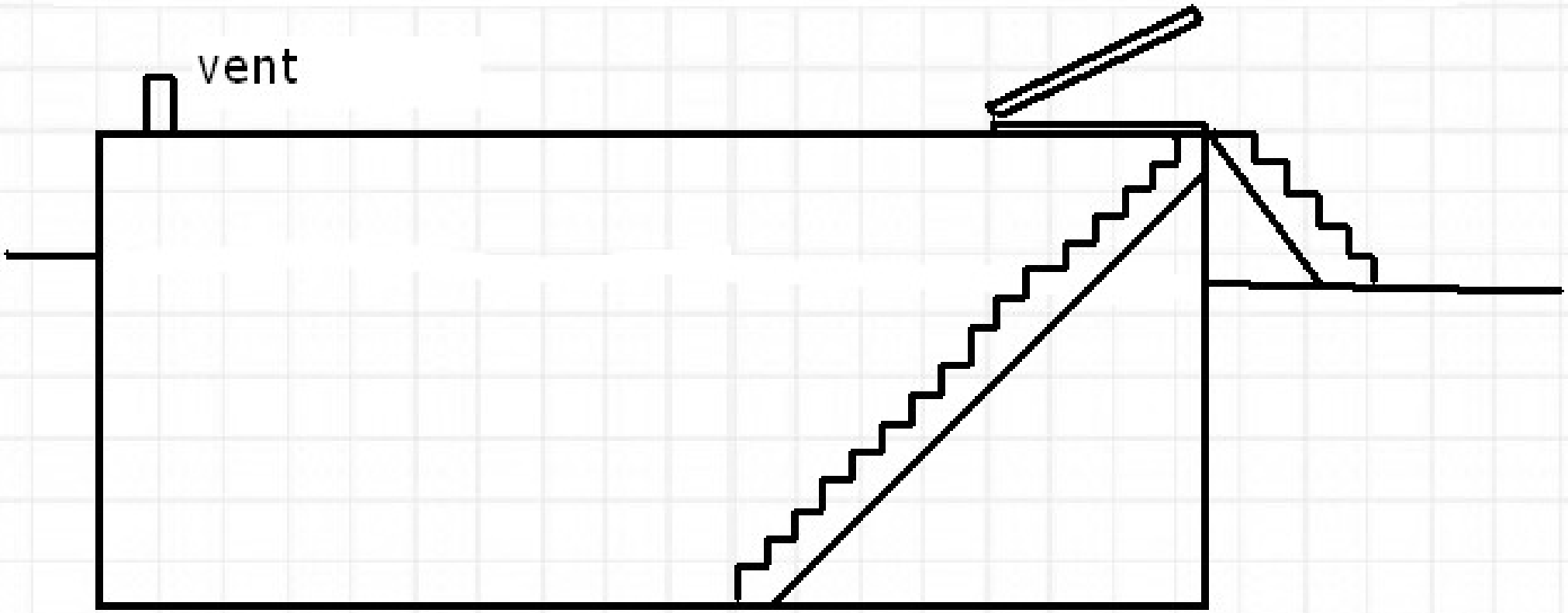


20 ft single slanted roof

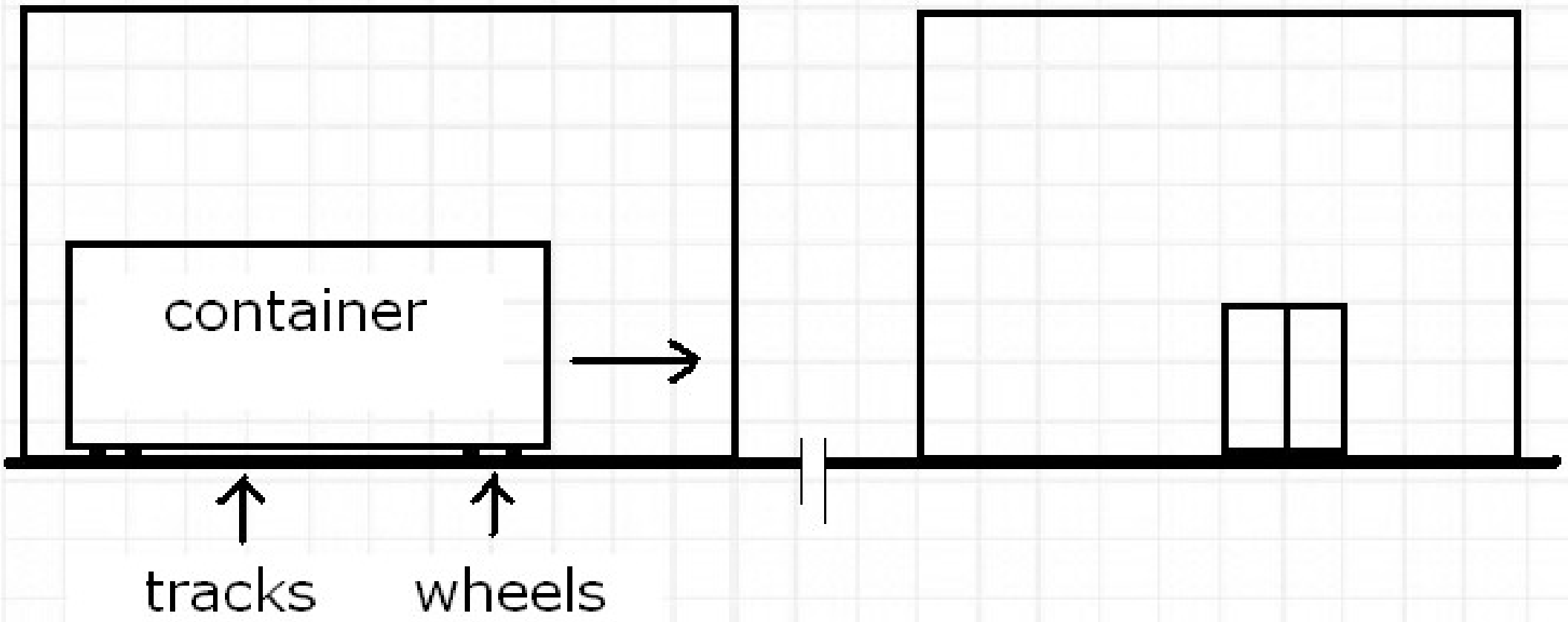


Stacking IC's with winch and tree's

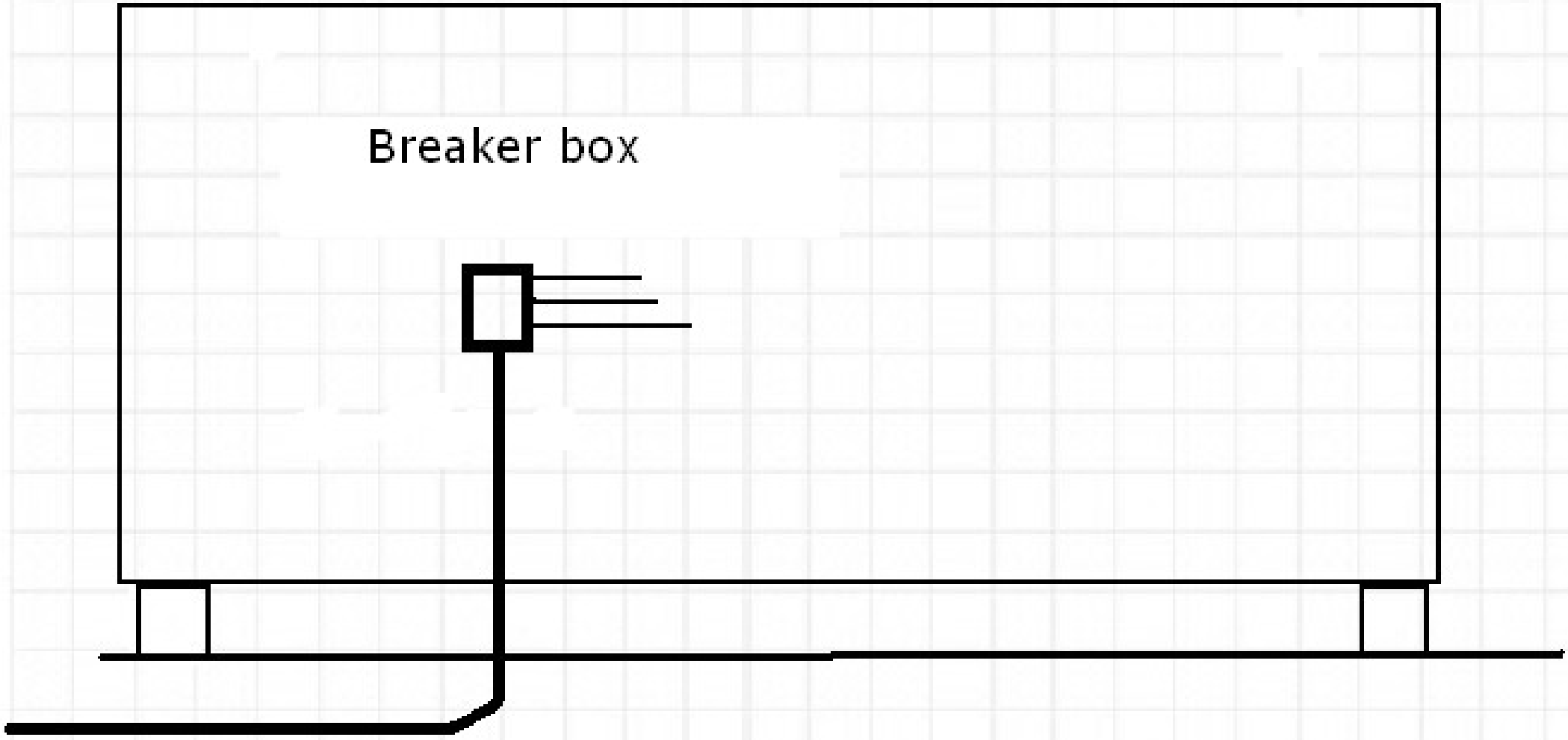
Tornado shelter - 20 ft unit 3/4 underground



20 ft mobile container building on train style tracks.

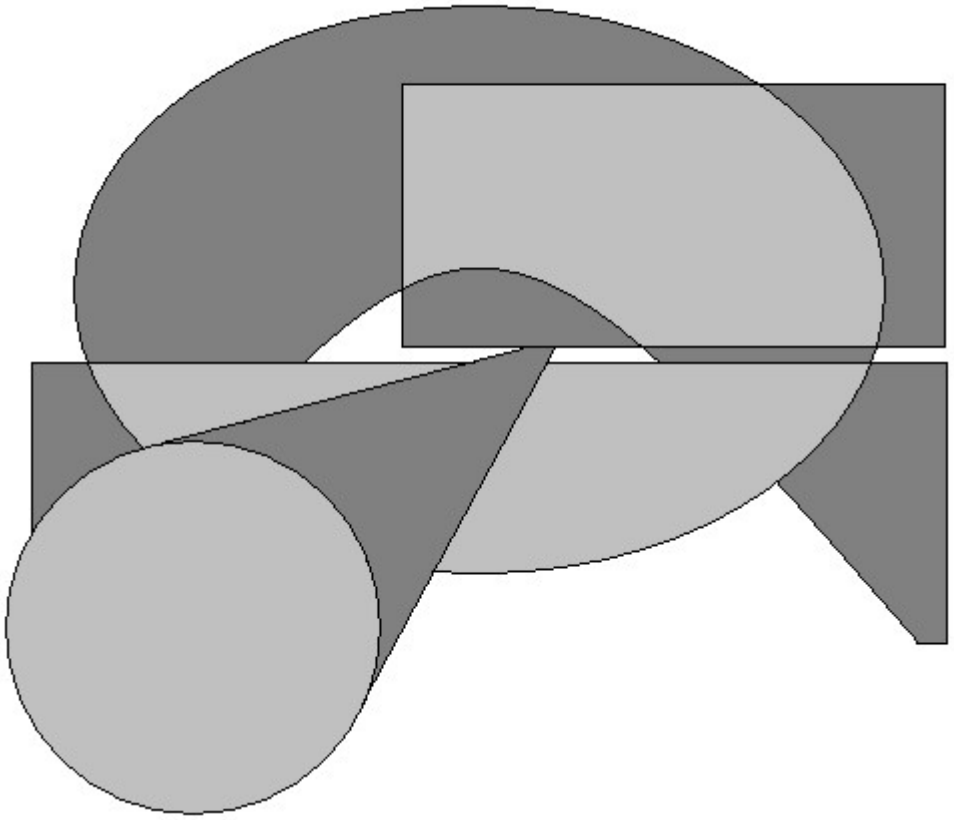


Underground conduit pipe for electricity



Electrical (romex) wire inside conduit pipe (6" under-ground)

This book is dedicated to 'outside the box' thinkers.



twenty foot container, forty foot container, and fulcrum