



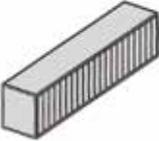
Container green house

Description

The container greenhouse is one of the quickest and cheapest ways per square meter to create wind and rain protection while producing food. Depending on the climate conditions and heating and insulation requirements and availability, it can be used for a growing space, a restaurant, or even a year-round living space.

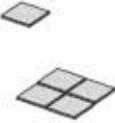
This design is optimal in terms of time and financial investment for temporary land-use, for anywhere from 2 up to 15 years. The building materials can be shipped inside the container, and once at the destination, the container can immediately act as a basecamp (water and energy utilities are inside), and as the most important structural element for the new building.

Fig 3.2 Green house construction
Kaskantine in its last location
in the Delflandpleinbuurt, 2019,
Photo by KasKantine

	<p style="text-align: center;">Container</p>	<p>Height: High cube (2.90m) Normal (2.60m) Length: 20 ft 40 ft. Quality: A (everything fine), B (could have a bump, or bad paint, but are water tight and closeable) C (could have holes, but structurally sound).</p>
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	<p style="text-align: center;">Trusses</p>	<p>You might find your metal trusses on the second hand market. But transport is difficult</p> <p>Not recommended to use a mix of types of trusses. Structural calculation is difficult and expensive.</p> <p>Make your own laminated trusses. The cheapest wood on the market is 4x6 inch beams, which go up to a length of 4.20 m.</p>
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	<p style="text-align: center;">Roof cover</p>	<p>glass. For a transparent roof, the cheapest option per m2 material investment. However, logistically and operationally for DIY it is a nightmare.</p> <p>plastic. fast to build and easy to find No sustainable and durability limited to not more than 2 years</p> <p>polycarbonate and plexiglass. long lasting, UV resistant, and have a relatively small environmental impact.</p>
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	<p style="text-align: center;">Floor</p>	<p>Projects < 2 years, the easiest solution is to put pallets on the ground Projects from 2 to 10 years, concrete slabs could be considered. Steenschotten (thick flat pallets for stones). very durable, can be recycled after the project, and can be transported by hand. But making a straight platform with poles requires time and dedication</p>
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	<p style="text-align: center;">Walls</p>	<p>Anything goes really: plastic wood waste glass ...</p>
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Materials and construction

Choice of container

Containers are big rectangular steel boxes. The floor panels are the strongest element, and the corner beams have the thickest profiles. The typical ondular shape of the side panels contributes to the overall structural strength. Cutting out windows from the side needs to be compensated by extra beams to make up for loss of structural strength.

There are different types of shipping containers: different heights and lengths and three quality classes. We describe here some of the pros and cons of each type.

Height:

High cube (2.90m) or normal (2.60m).

There is definitely a great advantage to using the High cube if you want a nice user space inside. This extra 30 cm makes all the difference in terms of practicality and feeling! However, the price is also much higher. If you stumble on a good deal, jump on it!

Length:

20 ft or 40 ft.

Per m², the 40 ft container is much cheaper. However, moving it around is really much more difficult! 40 ft containers require special transport trucks, while a 20 ft container is still possible to move by hand (well, lots of hands, but still).

Quality:

A, B or C

There are three quality classes to containers: A (everything fine), B (could have a bump, or bad paint, but are water tight and closeable) and C (could have holes, but structurally sound).

There is quite a big price difference between the quality classes. At the same time, in reality, a second hand class A container is often really a B, and a B is in fact often more a C, so be careful.

Transport and placement of the container

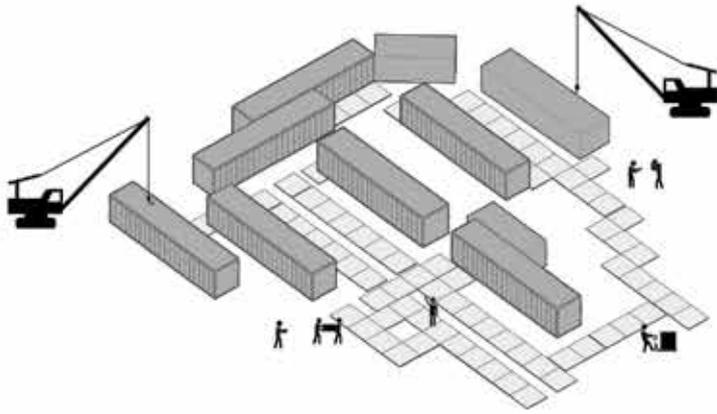
Transport of containers can be done by crane trucks. For 40-footers, the cheapest option is the "sideloader", a crane that can only load from a small distance, parallel to the truck.

A container has only 4 feet, thus considerable support is needed when the ground is not hard. Recommended are concrete slabs ("Stelcon") under each of the feet. Smaller slabs are possible, but 2 or 3 layers are necessary, in the shape of a pyramid; with the dimensions consisting of a first layer of 9 stones, a second layer of 4 stones, and a third layer of one stone (9-4-1).

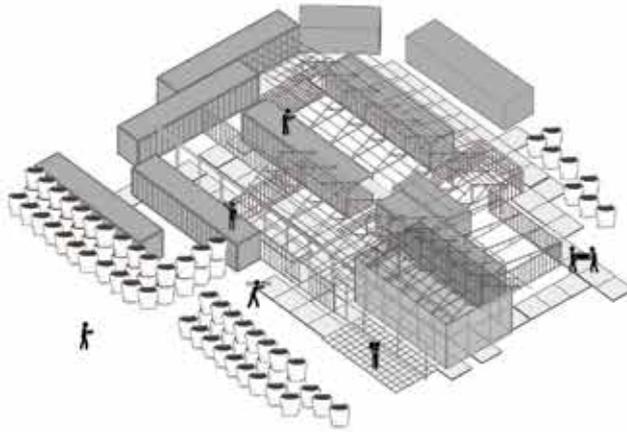


Next page Fig 3.3, land preparation.
Photo by Julie Ann Riemersma
Fig 3.4 and Fig 3.5 Transport and
placement of the container 2019,
Photos by Kaskantine

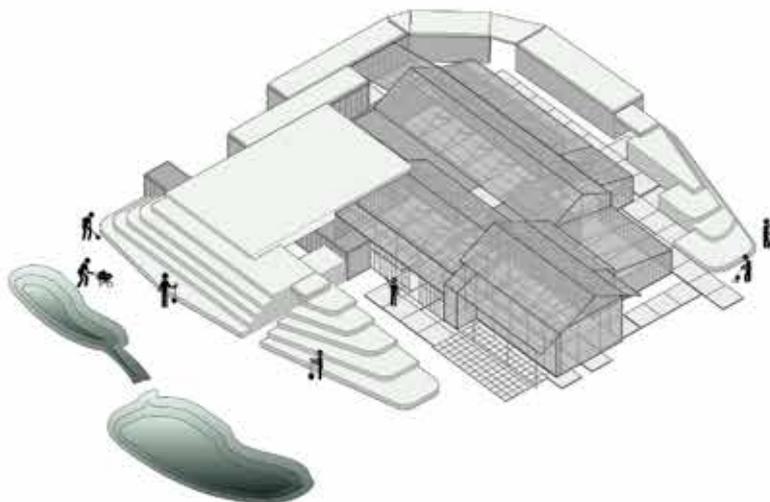




Phase 1
The first step is to prepare the land. Make it flat, position the concrete slabs Stelcon under each container feet. Transport then the containers on site. It can be done by a crane truck.



Phase 2
Once the foundations and the container are in place, it is possible to go on with the construction of the greenhouse structure, walls, and roof. Prepare as well the base structure for the dikes and start to work on installations such as electricity and grey water piping.



Phase 3
Roofing and covering. Once you have a roof above you, you can start to work on the rainwater collection system and finalize the filters. Then go on with interiors and details. Therefore with green roofs and landscape.

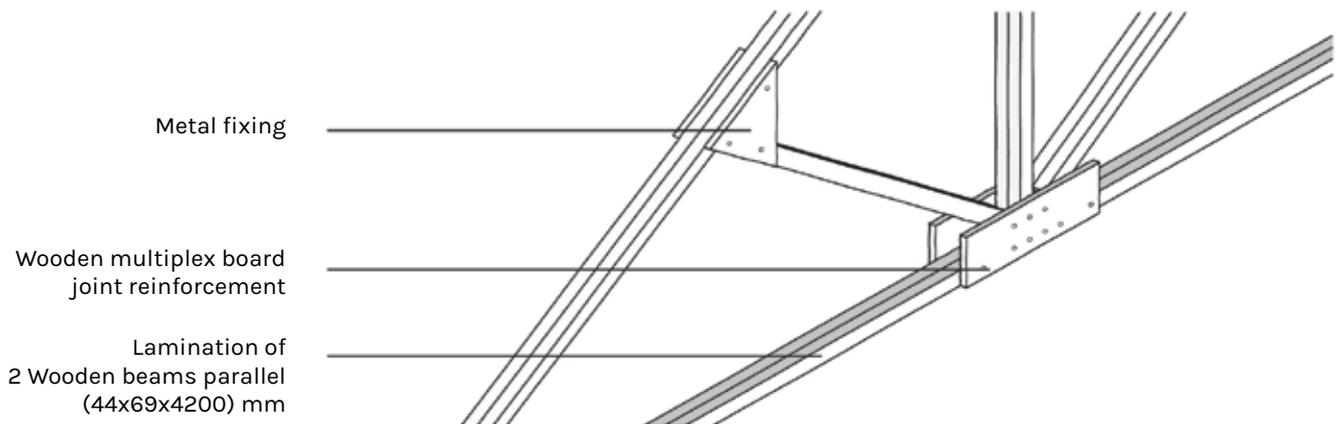
Next page Fig 3.6 construction phasing,
Below Fig 3.7 Trusses joints and Fig 3.8 Roof angle.
Illustrations by Alessandro Rosa

Choice of trusses

In order to receive a building permit, trusses need to be calculated by a professional for the required structural strength on the basis of material, thickness and strength of the connections.

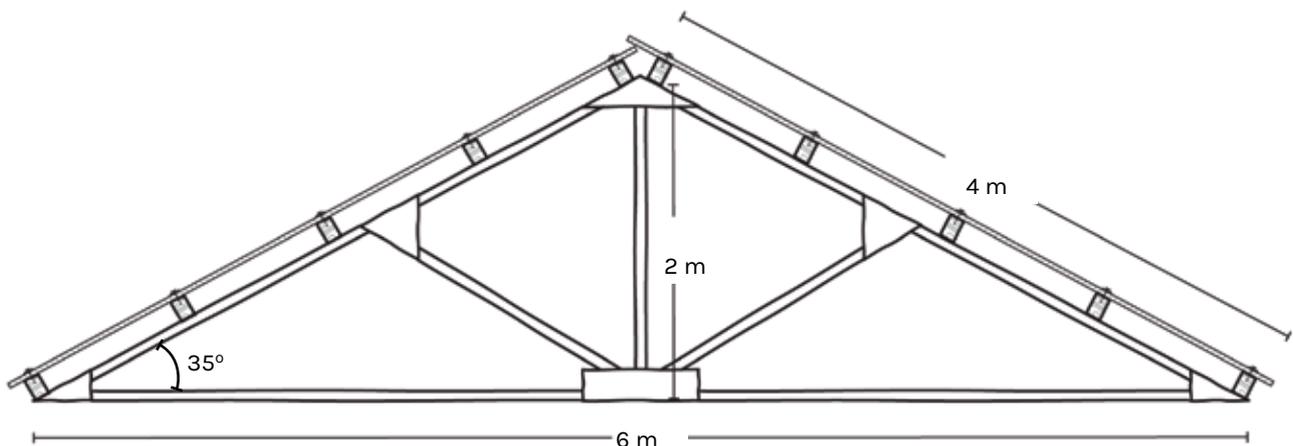
You might be lucky to find your trusses on the second hand market. However, transport is difficult, and if you need many, it is not recommended to use a mix of types of trusses. This makes the structural calculation difficult and expensive.

There is a cheap way to make your own laminated trusses. The cheapest wood on the market is 4x6 inch beams, which go up to a length of 4.20 m. Make three lengths of beams to make a triangle, the central post and the reinforcements. Make one as a master, and copy the rest of the beams according to this example. The "lamination" will in fact extend the beams to the desired length. Lamination can be done with wood glue, reinforced by nails or screws. Important is to reinforce each angle using a sandwich plating with a piece of 1 to 2 cm multiplex board.



Choice of roof angle

In order to minimise the use of materials and also to limit the wind load, we tried to find the minimum angle where snow accumulation risks are acceptable, and the angle for solar panels are also acceptable. We found that this is around 35 degrees.



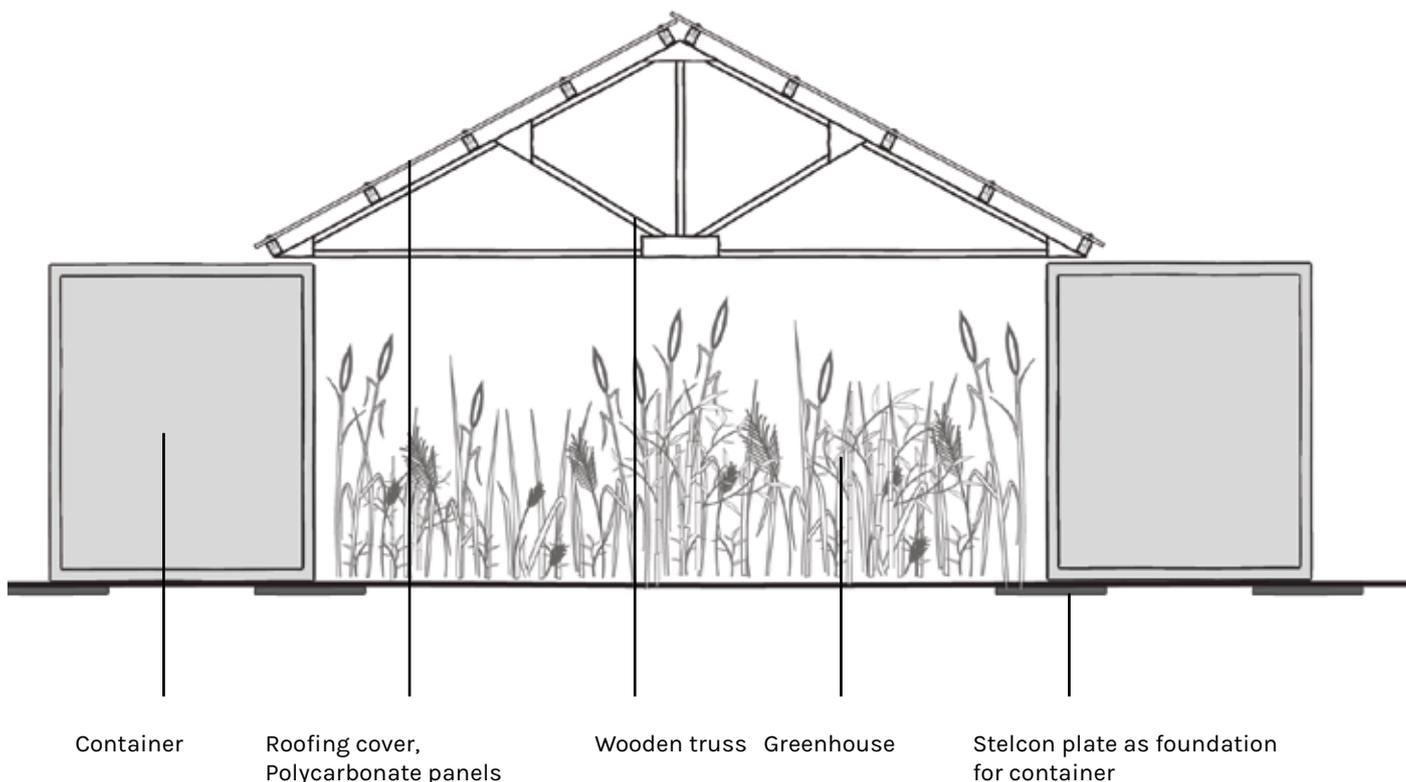
Because the cover material is plastic, the trusses can be fairly light. Within the triangle only three extra support beams are necessary in order to give the structure its rigidity.

Choice of roof cover

For a transparent roof, glass is the cheapest option per m2 material investment. However, logistically and operationally for DIY it is a nightmare. In order to use this material you need to be a specialist professional. What a difference with plastic sheeting! You can buy a plastic tarp at your local hardware store, put it on a wooden frame, and in no time you have a roof.

However, if you wish to prioritize sustainability and protection of the environment, you have to be careful with what plastic you engage in. A plastic tarp might give you emergency protection, but it will not hold for more than two years, because constant movement by wind and exposure to UV will make all kinds of plastic foil brittle, and it will eventually tear.

The most sustainable materials, but also most expensive, are polycarbonate and plexiglass. They are long lasting, UV resistant, and have a relatively small environmental impact. Therefore, it is possible to get these materials quite easily on the second hand market, making them affordable for projects that require little financial investment.



Next page Fig 3.9 construction greenhouse and roof covering, Illustration by Alessandro Rosa On the right Fig 3.10 and below Fig 3.11 photos of the construction site, particulars of roof and cover, Photos by Naiara Alava Aguirre



Choice of floor

We need hard flooring in areas that need to be cleaned from food debris or for food preparation, and for transport with pallet jacks and food trolleys. For projects projected to last less than 2 years, the easiest solution is to put pallets on the ground, cover them with underlayment boards, and put a sheet of linoleum overtop. For insulation, rockwool can be put underneath. Unfortunately, this creates a heaven for rodents. Much better, but rather expensive, is to put a layer of shells first, also under the containers. This regulates humidity, and rodents cannot live in it because it has a dehydrating effect.

For mobile projects projected to last from 2 to 10 years, concrete slabs could be considered. They are value proof, so if investment money is available, you can reuse or resell them easily with little loss. What makes it expensive is the transport and placement, mounting up to 20 to 40 euro per slab (4m²). They also require drainage and solid underground, so an extra layer of 10 cm of sand on top of the ground is often needed, also in order to place them neatly and levelled.

Finally, a platform can be built of wooden poles, with beams and underlayment or other wooden slabs, like "steenschotten" (thick flat pallets for stones). Steenschotten are very durable and can be recycled/reused after the project, and can be transported by hand. However, making a straight platform with poles requires time and dedication!

Fig 3.12 construction greenhouse joint wooden walls and container,
Illustration by Alessandro Rosa

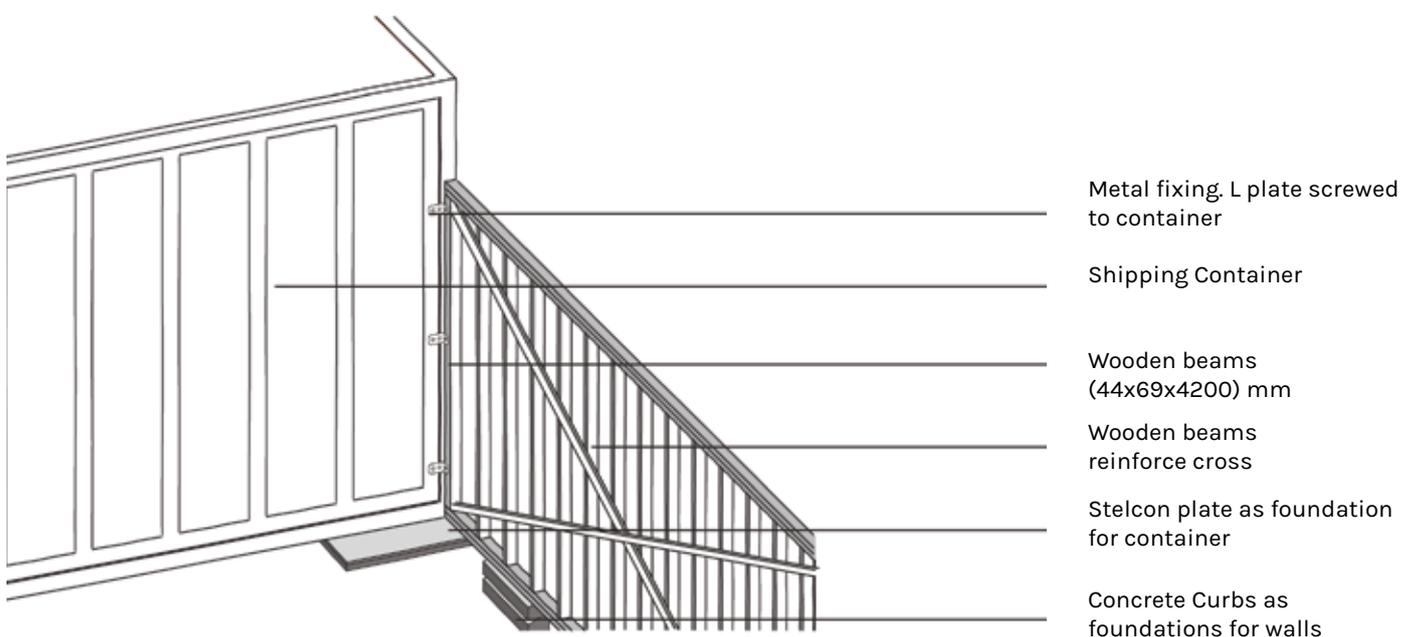


Fig 3.13 construction greenhouse detail walls,
Illustration by Alessandro Rosa

Choice of walls

Walls are mainly barriers against temperature changes and unwanted guests. Valuable materials can be stored in containers that can be locked like a money safe!

Everything in the greenhouse should be of such low value, or too big to carry, that it isn't worth it for the thief to run the risk of getting a bite from the watchdog in their behind.

Insulation of a greenhouse also doesn't make a lot of sense, as the roof is not insulated at all. This makes the choice of walling not very difficult. Anything goes really: from plastic to wood waste. Keep an eye on second hand doors, and gliding garage doors. If you place locks in doors, keep in mind that there are identical lock sets available in hardware stores, so you can lock all doors of the complex with the same key.

