Building with bottles
- the basics
building trust international

Komitu Architects

Text and images:
Building Trust International
Inari Virkkala

More information on building with bottles:

www.aliteroflight.org
www.southofnorth.info
www.husk cambodia.org
www.nyit.edu/architecture/home2o/
Building with Bottles:

Why bottles?
Community engagement
Vertical bottle walls
Horizontal bottle walls
Glass bottles
Bottle buildings
Bottles for light
Building a bottle of light
Roofing with bottles
Why bottles?

Packaging and plastic bottles are ubiquitous today, making up a large portion of waste and greenhouse gases around the world. Reuse is better than recycling, and bottles are easy to reuse in building projects. Providing a secondary function for bottles keeps them out of landfill while offering a readily available and economical building material.

Benefits of building with bottles

- Reduces waste
- Locally sourced
- Preserves natural resources
- Lowers carbon footprint
- Inexpensive
- Low tech, easy to use

Plastic or Glass?

There are different uses for different types of bottles based on their material characteristics. Plastic is usually used for wall infill and plastered on the exterior, while glass bottles can provide some structure and bring in light. All recycled bottles used in buildings help to reduce the need for new materials and lower the costs.
Community engagement

Using recycled materials such as bottles to create building projects is a great way to reduce costs on a build, educate the local community about recycling and also benefits the environment.

By connecting the project with the local community and working with them to collect plastic bottles and waste plastic material from the project site, we can work together to create a sustainable building from recycled materials.

If the end users are involved in the material sourcing or building process, they have much greater sense of ownership for the project and will more likely help maintain the structure and its purpose.

The above image shows a poster asking locals to collect recycled bottles for workshop in Cambodia.

Husk Cambodia makes use of local volunteers and promoting waste management in Siem Reap. What they call the Eco Block is plastic bottles, taking the place of a brick.

Husk started a community collection program where stuffed plastic bottles were exchanged for food, school uniforms or bikes, allowing everyone to get involved.
Vertical bottle walls

When a house is designed with a bearing frame, the walls can be filled with almost anything (waste, sand, etc.) and then plastered overtop.

By collecting plastic bottles and plastic waste to be used as a wall infill improves the surrounding environment and provides inexpensive building materials.

Placing bottles right side up within a frame is known as a vertical bottle wall, while lying the bottles on their side is considered a horizontal bottle wall.

1. Build structural frame
2. Collect and fill bottles
3. Align bottles in wall cavity
4. Overlay frame with steel wires or mesh to hold bottles together for better structural integrity
5. Stuff loose plastic around bottle gaps
6. Plaster wall for clean finish
Kouk Khleang Youth Center

In Phnom Penh Cambodia, the Kouk Khleang Youth Center is a good example of a horizontal bottle wall.

To engage the community members, they were paid 200 riel per bottle, which is roughly the price of a red brick.

Overlaying the building frame with steel wires or mesh helps to tie the wall together and make the construction more solid. After filling and assembling all the bottles, gaps and voids in the wall are stuffed with loose plastic in order to use less plaster.

The finished wall is plastered like normal for a clean and common look.

An opening is left in the plaster to show what the wall is made of, hoping that it will inspire further projects. To protect the chicken wire from rust, a framed glass panel should be added.
Horizontal Bottle walls

Following the idea of vertical bottle walls, bottles can also be laid horizontally in courses between the structure.

After building a frame of concrete, wood or steel, bottles are laid down and held together with a mortar with the option of finished plaster.

For attaching chicken wire, pieces of rebar should be casted to the frame. Nails or screws can also be used to attach the net and to tie the steel wires.

Similarly, bottles can be used as infill for solid concrete forms, and reducing the amount of concrete needed.
Glass bottle walls

Glass has much more structural qualities than plastic bottles, therefore not needing to be used as an infill material. Glass bottles can offer various aesthetics due to its opacity and colour selection without the need for plastering overtop.

Most often in construction, glass bottles are cut, joined and laid horizontally within the wall structure (usually earth or concrete) to be used as an artistic element bringing in light. However they can also be used as building blocks with a greater density for more recycled content.

Build a glass bottle wall:

1. Collect bottles and cut off necks
2. Tape bottle ends together
3. Align grafted bottles in wall during construction

Other Recycled materials, such as metal parts, car hubcaps and barrels can also be used as ventilation or lighting elements that provide some security.
Bottle buildings

Glass bottles can be more than just aesthetic, based on the amount of bottles used within a solid wall, they can make up a large percent of the structure.

There have been initiatives to create bottle building blocks that are meant to serve as a recycled alternative to bricks.

Heineken was the first to introduce glass blocks in 1960 as a low cost housing solution but unfortunately it did not continue. Since then there have been other similar whole building bottle ideas.

With a combination of glass bottle panels and two liter plastic bottle walls, Illac Diaz and MyShelter Foundation built an entire structure in the Philippines using bottles.

The plastic bottles are filled with adobe and layered horizontally in courses between mortar.
Bottles for light

Lighting is easy with bottles, most are translucent and can be recycled or reused as lamps or interior decorating features. Larger glass bottles are popular in rustic and crafty settings.

In addition to lighting spaces with glass bottles in construction and interiors, plastics can also be used in more high tech and innovative ways as seen by Illiac Diaz and Alfredo Moser.

“Liter of light“ - Solar bottle bulb

The solar bottle bulb targets impoverished populations living without electricity in dense settlements, where even during the day, their dwellings are extremely dark.

Water inside the bottle refracts sunlight during the daytime and creates the same intensity as a 55 watt light bulb, making daylight affordable and easy.

This saves electricity and provides a way of lighting for those who cannot afford it while keeping homes secure.
Building a bottle of light:

Materials needed:
- PET soda bottle
- Galvanized Iron (GI) sheet
- Rubber sealant
- 10ml Bleach
- 1000ml Filtered Water

Steps to build a bottle of light

1. Draw two circles on a 9”x10” galvanized iron sheet, one circle 1” around the other

2. Cut out the smaller circle and make slices into the larger circle so that the pieces can bend upwards.

3. Rub sandpaper on the bottle so it has a better grip

4. Insert the bottle to the sheet until the top third and put sealant around the top

5. Once the sealant is dry, fill the bottle with water and 10ml of bleach and close

6. Place the bottle in a hole cut through the roof and drill holes in each corner to attach rivets

7. Cover rivets, all edges of bottle sheet and bottle cap with sealant

Source: www.isanglitrongliwanag.org
Roofing with bottles

Plastic bottles along with other recycled materials are often used for roofing, usually as crushed plastic for waterproofing. They can be very simple and artistic or have more uses with high tech properties.

More research is going into providing recycled material solutions in post disaster and low income contexts, where tons of water bottles and plastics are imported to areas in need of immediate shelter.

Design faculty and students from the New York Institute of Technology have created the Home20 project, a patented model for roofing made from a crate of water bottles.
building trust international

www.buildingtrustinternational.org