

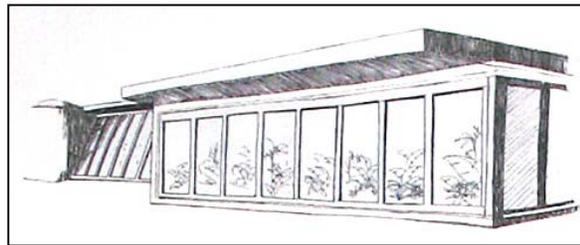
## The Application of the Earthship Building Type

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The walls that surround the dwelling of a human family do more than just support the roof that shelters them. The walls themselves speak of the relationship of the inhabitants with their environment. The family that dwells in the Earthship is aware of their environment as well as the problems that mankind creates. It is this awareness that calls to the family to do what they can to support their environment.

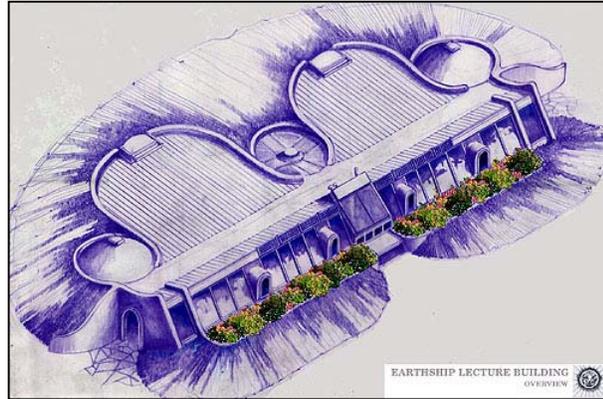
The EcoHouse of 2004 is required to be located in the community of the architect, in order to intuitively understand the relationship of the dwelling and its inhabitants with the



environment. Brampton, Ontario is a community that has grown by leaps and bounds in the last fifteen years. While its population is approximately 400,000, Brampton still has vast areas of farmland as well as forested areas and smaller waterways. It is in one of these areas of farmland bordering forest that this EcoHouse is placed, in order to benefit from the topography of the area.

The Earthship is the creation of Michael Reynolds of New Mexico. His idea has evolved the Earthship from a single dwelling into the vision of entire communities of Earthships. The essence of this building type is to be a self-contained vessel that does no harm to its environment. The Earthship is composed of recycled and reused materials that work as a unit with the systems that provide the amenities that sustain the inhabitants. This type has the capability of heating and cooling itself, energizing itself and dealing with its own waste.

The Earthship structure is usually tucked into a hillside or earth is packed around it to provide natural shelter and insulation. This also aids in the flow of air for natural cooling and ventilation. By using fill that is locally available, the costs and energy associated with the



transportation of the earth are decreased. This building type does not require a foundation to support its walls. The earth that it is built on does need to be well drained as well as strong enough to support the weight of the structure. The sheltering of the house with earth aids in insulating the dwelling against heat and cold, as well as shifting due to frost. Placing plastic against the back of the tire wall prevents water from seeping into the house. The plastic should also be integrated into a peripheral drainage system, as Earthship buildings require special drainage consideration. Foam insulation as well as a layer of pumice provides a thermal break between the tires and the ground. This aids in reducing heat loss from the structure.

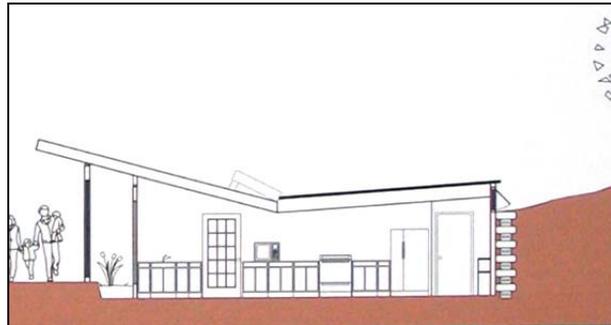


Earthships primarily use recycled and waste materials in their construction. Automobile tires, pop bottles, aluminum cans are just some of the components used in creating the structure of the Earthship. The finishing materials used in the house are made of recycled and reused materials. The carpet is made of

PET or recycled pop bottles. Walls facing the interior of the dwelling are typically covered with stucco or earthen plaster. The crevices between the tires may be filled with aluminum cans or mud as filler. Since municipal recycling programs make great use of the highly recyclable aluminum cans, other materials are encouraged as filler.<sup>1</sup>

Automobile tires form the basis of the structural component of the majority of the exterior walls of the Earthship building type. This abundant waste product of modern human society has not reached its recyclable potential and so the majority of them end up in landfills or illegally dumped.

The recycled tires used in the Earthship are filled with compacted earth and form a rammed earth brick encased in steel belted rubber. The packing of the tires may be done by hand or by pneumatic

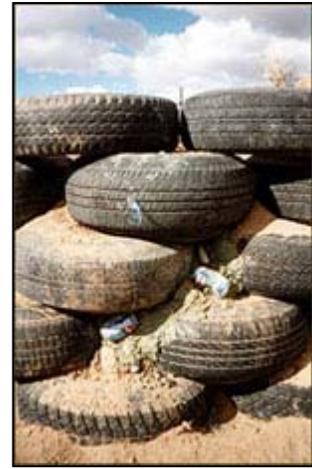


tamping. While pneumatic tamping does decrease some of the time involved in construction, it also requires a generator to run the pneumatic tamper. Both methods are labor intensive and time consuming. The U-shaped design of the house allows for walls that are structural stable and resistant to lateral loads. Driving rebar vertically through the centers of the tires provide additional strength to the walls. Horizontal rebar is inserted into the concrete for the floor slab to provide tensile strength.<sup>2</sup>

Illegal dumping and stockpiling of tires has caused at least six tire fires in Ontario in the last fifteen years.<sup>3</sup> Once ignited, tire fires are extremely hard to put out. Some fires have been known to burn for days while expelling large amounts of toxic fumes into the air. Illegal dumping starts when the average cost for tire disposal is lowered. The average cost to safely dispose of a passenger vehicle tire is \$4 per tire.<sup>4</sup> Illegal dumpers advertise disposal of tires at \$1 to \$2 per tire.

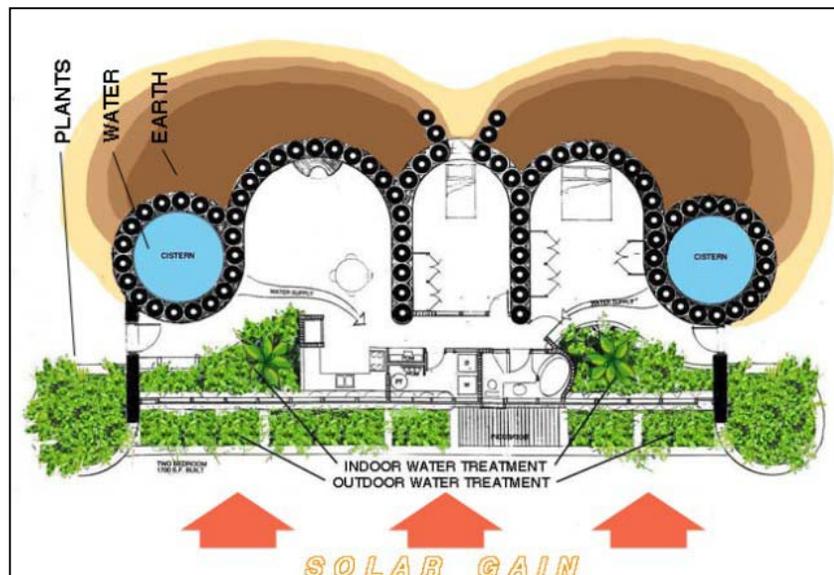
These tires are then dumped on rental properties and then abandoned when the site is full.

Stewardship of these tires is a problem at every stage of its lifecycle. From who pays the tire levy to who is responsible for proper disposal to which branch of government will accept responsibility to take legal action against the dumpers. In most cases, final stewardship of the dumped tires will fall on the owner of the dumpsite, who is usually unaware of the tires on their property. Brampton has recently concluded a successful court battle against the dumpers of millions of illegal tires on a



commercial property. Even though the tires in question were spilling over the property line towards the GO railway track, calls to GO Transit resulted in the comment that there was nothing they could do. It took a phone call to the Health Department of the Region of Peel regarding the hazard of West Nile mosquitoes breeding in the stagnant water collecting in the dumped tires for any of the various levels of government to take action.<sup>5</sup>

The Earthship building type consists of two major internal components: the U-shaped living spaces and the environmental interface corridor. The main walls of the U-shaped areas



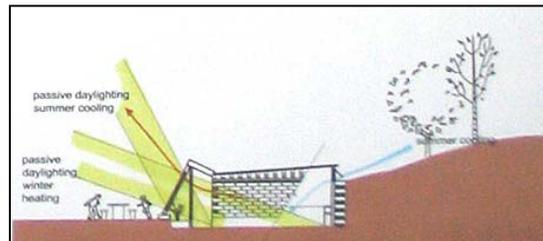
are constructed with automobile tires stacked like bricks. The environmental

interface corridor has walls that are primarily glazed to allow for passive heating and day lighting.

Large cisterns located on the ends of the U allow for the storage of water. This water is composed primarily of rainwater collected from the sloping roof. After filtration within the components of the environmental interface corridor, the water is then ready to supply the domestic needs of the inhabitants of the house. In order to anticipate the concerns of the Ontario Building Code as well as the municipality, the cistern water will function primarily as gray water for irrigation and domestic needs. The location of the house easily allows for hook up to the municipalities' water supply for drinking water, until such time as the environmental interface corridor is allowed as an accepted filtration device for purifying drinking water.



The environmental interface corridors house the water filtration systems, as well as the solar hot water systems and the batteries for storing the power collected from the photovoltaic panels on



The locations of these corridors allow for the easy flow of water to and from the appliances and fixtures, as well as ample sunlight for the growth of the plants of the system. The front wall of the Earthship is usually composed of glazing inserted in a wood frame that is clad with steel. This wall may be sloped, or vertical, depending on the location of the dwelling and the desires of the homeowners. The front wall rests on a foundation of packed tires.

While the Earthship is a relatively new concept in building design and construction, it has increasing potential. Complete sets of plans, sections and

details are available to order for a few thousand dollars.<sup>6</sup> The set includes details on the various techniques involved in the construction of the Earthship. The complete component systems of the Earthship are also available to order and even the packing crate is incorporated into the construction.<sup>7</sup> The average costs for Earthships range from \$30 to \$100 per square foot and depend largely on labor costs and materials used.<sup>8</sup> When considering life cycle costing the long-term benefits of this building type can be brought to the foreground.



The walls of this dwelling speak of the relationship of the inhabitants with their environment. Each individual that passed through the walls can take note of the construction and the intention behind them. It is an example of one taking responsibility for one's own habits and that of those around them. The Earthship building type can be seen as an understanding that the Earth's resources are limited and that its capacity for holding mankind's ever-increasing waste is decreasing.

## Endnotes

- <sup>1</sup> Daniel D. Chiras, "The Natural House: A Complete Guide to Healthy, Energy-Efficient, Environmental Homes." (Vermont: Chelsea Green Publishing, 2000) 107
- <sup>2</sup> Chiras 103
- <sup>3</sup> Ontario Tire Dealers Association: The Voice of the Independent Tire Dealer in Ontario  
<http://www.otda.com/public/pages/index.cfm?pageid=34>
- <sup>4</sup> PPS Review: Managing Waste Responsibly – An information service for municipal governments Vol 4, Issue 5, January 2004  
<http://www.productstewardship.org/ppsrev23.PDF>
- <sup>5</sup> George J. B. Magus, Resident of Brampton, In Person Interview, August 12, 2004
- <sup>6</sup> Earthship Bioteecture: Putting Housing back into the Hands of the People  
<http://www.earthship.org/staticpages/index.php?page=packaged-es>
- <sup>7</sup> Earthship Bioteecture: Putting Housing back into the Hands of the People  
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- <sup>8</sup> Chiras 117

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