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MASONRY WORKS
Council Of Ontario

BRICK
BLOCK
STONE

JULY 2022

MASONRY & SUSTAINABILITY

+
HIVE
3D-Printed Masonry Wall
inside

MASONRY & SUSTAINABILITY

How the Masonry Industry is Addressing the Climate Crisis

Earlier this spring the Federal Government released an ambitious emissions reduction plan which laid out Canada's pathway to net-zero. The report summarizes that Canada's average temperatures are rising at twice the global average in the provinces and three times the global average in the north. The country stands at a critical point wherein urgent action is needed to avoid a climate catastrophe. The government of Canada therefore has set targets to reduce national emissions to 40% below 2005 levels by 2030 and to net-zero by 2050. Municipal governments are also addressing the climate crisis through exploring a number of policy levers to reduce emissions. The Canadian Home Builders Association reports that 523 governments have declared a climate emergency. As our governments push forward with transitioning Canada to a zero-carbon future, it is critical that industries play a leading role in helping achieve these targets. The masonry industry in Canada has taken a number of steps to begin addressing the climate crisis. Although the industry has a long road ahead in achieving net-zero, the steps being taken today are actively reducing the emissions of Canada's built environment.

> *"As our governments push forward with transitioning Canada to a zero-carbon future it is critical that industries play a leading role in helping achieve these targets. The masonry industry in Canada has taken a number of steps to begin addressing the climate crisis."*

The Switch to Low Carbon Cement

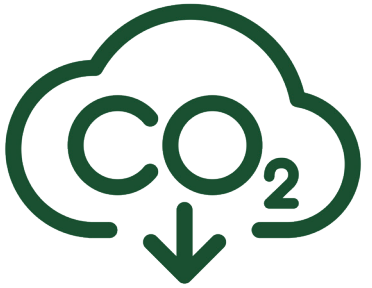
Cement with a higher limestone content produces less green house gas emissions through its manufacturing process. The industry has developed GU and GUL low carbon cement which, through its usage reduces the embodied emissions of cement by 10%. In Canada, the block industry has moved quickly to adopt this technology and 70% of all block now produced in Canada is using low carbon cement in the manufacturing process.

Accelerating Carbon Sequestration

Concrete masonry products actively sequester carbon over their service life cycle. Although helpful this process takes a number of years to become fully complete. A number of block producers in the masonry industry have been active in developing and implementing technology that accelerates the carbon sequestration process. These developed technologies, CarbonCure and Craboclave, inject carbon into concrete masonry units during the manufacturing process. This leads to a significant reduction in the net-emissions which occur in the manufacturing of block. In the Ontario market a number of major producers have adopted this technology and are actively bringing these blocks to market.

Building Climate Resilience

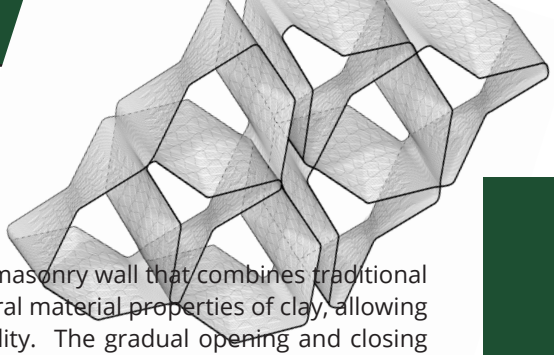
Unfortunately, we are beginning to see the effects of climate change through the increased frequency of extreme weather events. This means that the built environment in Canada will be under increased stress as these weather events continue to occur. Masonry materials, brick, block and stone, provide significant protection against extreme weather events. Masonry is inherently resilient and stands up well to major wind events, hail and rain. Moreover, masonry boasts strong thermal mass properties. This means that masonry buildings can better regulate the temperature of a building in the case of long-term power outages. The resiliency of the built environment will become evermore important over the coming decades and masonry materials will play a key role in ensuring that our communities are safe as we experience the effects of climate change.



EMISSIONS REDUCTION

HIVE

3D- Printed Masonry Wall



Composed of 175 unique 3D-printed clay bricks, the Hive is an interlocking masonry wall that combines traditional ceramics, smart geometry and robotic precision, which embraces the natural material properties of clay, allowing its malleability and fluidity to shape the clay units' form and surface quality. The gradual opening and closing of apertures in each clay unit creates undulating variations in privacy and light along the wall. Like a honeycomb, the aggregation of hexagonal units produces a strong and materially efficient structure. Designed and developed by Ye Sul E. Cho, Ji Shi, Meghan Taylor, James Clarke-Hicks, Isabel Ochoa and David Correa, the design of the masonry units, and the overall wall design, are the result of a highly iterative design and fabrication process. Conceived as digital craftsmanship, the development process involved working back and forth between digital and analogue models in order to respond to the dynamic material qualities of wet clay, requiring formulating clay mixes suitable for 3D-printing, new computational design and fabrication tools, extensive material testing, and multiple assembly mock-ups. This approach embraces the spirit of traditional ceramic craft with robotic precision, offering new avenues for material expression and geometric complexity within this field.

The capacity of these nascent technologies to quickly produce large prints offers an interesting and economically feasible intersection for 3D printing and architecture to operate. While the messy and unstable nature of wet clay presents technical challenges in practical applications, these same qualities create opportunities to explore the unique aesthetic and functional possibilities offered by this fabrication process.

The project was made possible through a research partnership between the University of Waterloo and Investment Management Corporation of Ontario (IMCO). The project was commissioned by SDI Interior Design. Technical and financial support for 3DP masonry research was provided by the Masonry Works Council of Ontario.

Image credits: *Correa_hive: David Correa, Hunsberger_hive: Fred Hunsberger, Khokhar_hive: Shabaan Khokhar*

WEDNESDAY **JULY 27** 2022

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