

## Riverdale NetZero Deep Wall System

Riverdale NetZero is a new semi-detached duplex on a prime inner-city site in Edmonton, Alberta. Each two-storey home is approximately 234 m<sup>2</sup> (2,519 sq. ft.), including the basement. As a winning project in the CMHC EQuilibrium™ Sustainable Housing Demonstration Initiative, the builder-developer, Habitat Studio & Workshop Ltd., has designed and constructed these homes with the intent that they are healthy and comfortable to live in, reduce energy use to a minimum, produce as much energy as they require in a year, conserve resources, have low environmental impact, and be marketable. One of the key features that is helping conserve energy is the Deep Wall System (DWS), highlighted in this EQuilibrium™ Housing InSight.

### Technical Specifications

The Riverdale NetZero DWS is a double-stud wall system forming a 406 mm (16 in.) cavity that is filled with blown-in cellulose insulation to achieve an impressive insulation value of RSI-9.9 (R-56). The wall has the following composition, as detailed in Figure 1:

- Exterior cladding;
- Spun bonded, non-woven, building sheathing wrap;
- 10 mm (3/8 in.) oriented strand board (OSB) sheathing;
- two 38x89 mm (2x4 in.) stud walls 610 mm (24 in.) O.C. with 406 mm (16 in.) outside to outside spacing;
- 406 mm (16 in.) of cellulose fibre insulation;
- fabric mesh to contain the insulation fill;
- 150 µm (.006 in.) poly ethyl vapour barrier; and
- 12 mm (1/2 in.) painted drywall finish.

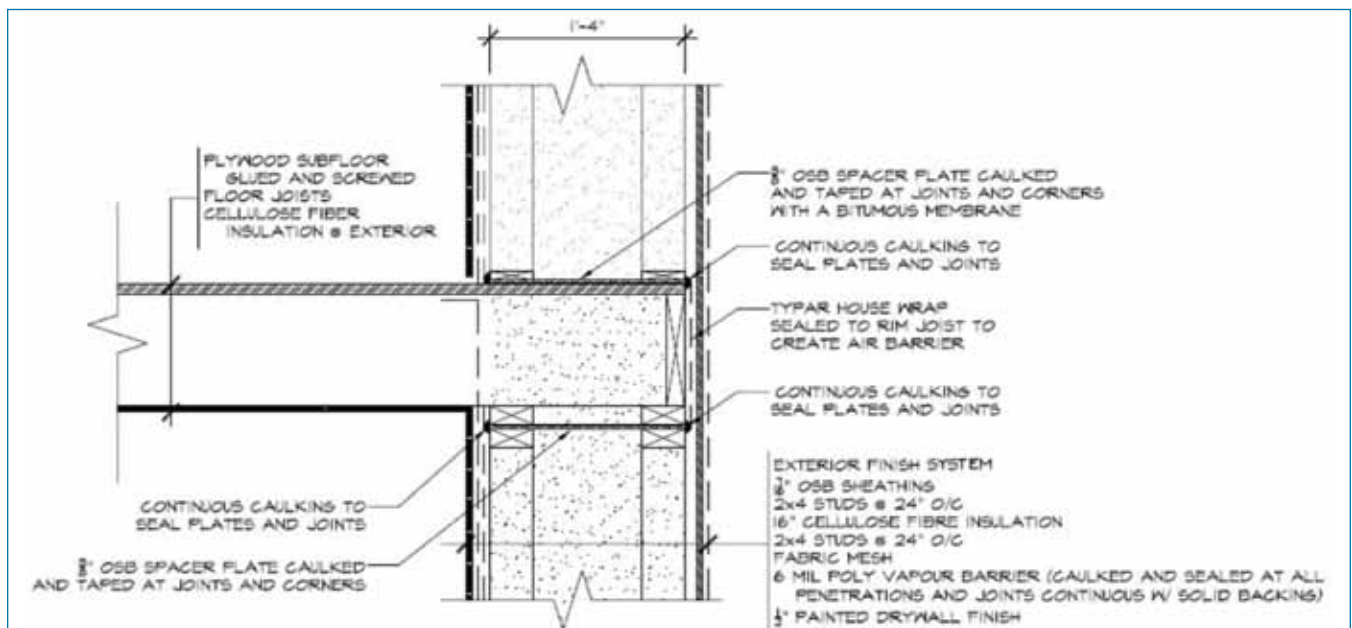


Figure 1 Cross-Section of Riverdale NetZero Deep Wall System at the 2<sup>nd</sup> Floor

The blown-in insulation is composed of cellulose organic fibres impregnated with borate additives to resist mold, wood decay, insects, corrosion and combustion. Its thermal resistance in a wall is rated at RSI-0.0263/mm (R-3.79/inch).

### Implementation Considerations

The Riverdale NetZero DWS requires no deviation from the typical construction sequence. The builder reports a number of labour management benefits for this super-insulated wall:

- Maintains traditional trades work sequence;
- Additional labour costs only for framer and the insulator; and
- Plumbing and electrical services easier to run through the wall cavity with fewer holes needing to be drilled.

In addition, it was reported that visitors enjoyed the deep windowsills that could to be used as window seats or shelves.

### Cost Implications

The amount of dimensional lumber used is very similar to a typical 38x140 mm (2x6 in.) wall with studs spaced at 406 mm (16 in.) O.C. In addition, on a per volume basis, 38x89 mm (2x4 in.) studs costs less. Additional costs for the DWS include:

- Increased framing labour costs of about 40% over a standard wall, or 10% of the overall framing budget;
- \$260 worth of OSB to separate the 2 – 38x89 mm (2x4 in.) outside walls;
- Bigger building footprint for same floor area; and
- Other minor expenses include lining the window wells with drywall and finishing the deep sills.

For more complex houses with many corners or rake walls, the additional costs would likely increase.



**Figure 2** Corner of Riverdale NetZero DWS

### Technology Benefits

#### Energy Savings

The DWS has very high insulation values and eliminates most of the thermal bridging through the exterior envelope. Table 1 compares the annual heating energy required for the Riverdale NetZero house with a typical 38x140 mm (2x6 in.) wall with an effective insulation value of RSI-2.9 (R-16.5), and three different thicknesses of the DWS with corresponding effective insulation values based on HOT2000 simulation results.

<sup>1</sup> Photo from: [www.riverdalenetzero.ca/PHOTOS/WALL\\_DETAILS/](http://www.riverdalenetzero.ca/PHOTOS/WALL_DETAILS/)

Wall Type	R-Value	Annual Heating Energy (kWh)
Standard	RSI-2.9 (R-17)	6610 kWh
305 mm (12") DWS	RSI-7.2 (R-41)	3280 kWh
406 mm (16") DWS	RSI-9.9 (R-56)	2730 kWh
508 mm (20") DWS	RSI-12.5 (R-71)	2430 kWh

**Table 1** Varying Heating Energy Consumption for Different Wall Systems

The Riverdale NetZero DWS is very airtight. Blower door tests done showed an air leakage rate of only 0.51 ACH and 0.50 ACH for the west and east units at 50 Pa, respectively. A subsequent net-zero energy house<sup>2</sup> built by the same builder achieved a preliminary airtightness value of 0.36 ACH at 50 Pa with the same wall system. Note that with any wall system, specific attention to details is required to minimise air infiltration. All possible air leakage locations need to be identified and sealed before the wall is completely finished.

Efforts were also devoted to reducing the embodied energy of the wall. Approximately 139 m<sup>3</sup> of cellulose fibre was used in the walls and ceilings to insulate each unit, which has a lower level of embodied energy compared to insulating foam products and other types of insulation providing an equivalent insulating value.

### Occupant Comfort

The combination of the high insulation value of the DWS with super efficient triple- and quadruple-glazed windows was specified by the NetZero team to improve occupant comfort by providing a higher indoor mean radiant temperature for equivalent room air temperature resulting in improved thermal comfort. In addition, the DWS is expected to reduce exterior noise transmission.

### Resource Conservation

As mentioned, the construction team reports that a similar amount of lumber is used in the DWS then in typical 38x140 mm (2x6 in.) walls with studs spaced at 406 mm (16 in.) O.C. The only increase in sheathing materials is the additional 19 mm ( $\frac{3}{8}$  in.) OSB required for the top and bottom plates and lining the window and door openings. The small increase is partly due to the simplified backing details and the inclusion of some Optimum Value Engineering (OVE) measures such as installing the door and window headers in the floor system.

### Summary

The Riverdale NetZero EQUilibrium™ team designed and constructed an innovative deep wall system to provide sufficient insulation to help the house achieve net-zero annual energy consumption. The team reports many other benefits offered by the system including deep window sills enjoyed by many visitors during the public demonstration of the home. The Riverdale team had such a positive experience with the DWS that they have used modified versions of it in two subsequent net-zero energy houses projects.

<sup>2</sup> <http://greenedmonton.ca/MillCreekNetZeroHome>

## Project Team

Primary contact: Gordon Howell

Howell-Mayhew Engineering

ghowell@hme.ca

Builder-developer: Habitat Studio & Workshop Ltd.

Builder contact: Peter Amerongen

pamerongen@habitat-studio.com

For more information about this project and other EQUilibrium™ housing projects, visit CMHC's website at [www.cmhc.ca](http://www.cmhc.ca)

## EQUilibrium™

### What is EQUilibrium™ Housing?

The national EQUilibrium™ Sustainable Housing Demonstration Initiative, led by Canada Mortgage and Housing Corporation (CMHC) brings the private and public sectors together to develop homes that address occupant health and comfort, energy efficiency, renewable energy production, resource conservation, reduced environmental impact and affordability.

CMHC's EQUilibrium™ housing initiative offers builders and developers across the country a powerful new approach to establish a reputation for building affordable, premium quality healthy homes that will meet the needs of Canadians now and well into the future.

EQUilibrium™ housing combines a wide range of technologies, strategies, products and techniques designed to reduce a home's environmental impact to an absolute minimum. At the same time, EQUilibrium™ housing also features commercially available, on-site renewable energy systems to provide clean energy to help reduce annual energy consumption and costs.

### EQUilibrium™ Housing InSight

EQUilibrium™ Housing InSight present specific housing design strategies and technologies implemented in EQUilibrium™ housing demonstration projects.

### CMHC

CMHC has been Canada's national housing agency for more than 60 years. CMHC is committed to helping Canadians access a wide choice of quality, affordable homes and making vibrant and sustainable communities and cities a reality across the country. To find out more about how the Government of Canada and CMHC are working to build stronger homes and communities for all Canadians, call CMHC at 1-800-668-2642 or visit [www.cmhc.ca](http://www.cmhc.ca)

©2009, Canada Mortgage and Housing Corporation  
Printed in Canada  
Produced by CMHC 12-08-10

This publication is intended to highlight housing technologies and practices the builder teams utilized to construct their projects under CMHC's EQUilibrium™ Sustainable Housing Demonstration Initiative. It is provided for general information purposes only and does not constitute an assessment, recommendation or an endorsement of any system, strategy, technique, technology, or product. The predictions for building performance contained in the publication have been provided by the individual builder teams based on computer modeling and current understandings of best construction practices. Actual building performance may vary. Reliance on the information in this publication for the purpose of planning, design or construction activities would not be appropriate. If readers intend to engage in activities of that nature, they are advised to consult appropriate professional resources to determine what is safe and suitable in their particular case. Any reliance or action taken contrary to this advice is the full responsibility of the user. Canada Mortgage and Housing Corporation assumes no responsibility for any consequence, expense, claim, damage or loss arising from the use of the information contained in this publication.