



# Masonry engineering software innovates the ease of masonry design

BY DAVID STUBBS, B. ENG, P. ENG

The new Masonry Analysis Structural Systems (MASS) software is changing the ease of masonry design. Up until now, designers were missing an important tool in expediting the process. A visual, user-friendly and dynamic structural software design package, MASS is poised to be the new driver for effective, structural masonry designs.

The Canada Masonry Design Centre (CMDC) and the Canadian Concrete Masonry Producers Association (CCMPA) formed a partnership to develop a new software program with significant improvements over its predecessors. To meet the complex demands of the marketplace and address the needs of users who require unique solutions, CMDC and CCMPA concluded that a completely new software solution needed to be developed. Throughout the development of this software, CMDC staff focused on creating a program capable of providing quick, effective structural solutions for masonry buildings. This software is a powerful tool to aid and encourage design of masonry for structural applications, with numerous layers of customization controls that allow versatility of configurations and design methodologies.

CMDC has been at the forefront of providing design aids to engineers since its inception in 2003. The development of the Engineered Masonry Design Course, a comprehensive course that teaches the fundamentals of engineered masonry design to practicing designers, was the first step. In 2006, CMDC published the First Canadian Edition of *Masonry Structures - Behaviour and Design*, authored by world-renowned masonry researcher, Dr. Robert Drysdale of McMaster University.

“It only seemed natural that CMDC would undertake the task of developing a structural design software program,” says David Stubbs, Director of the CMDC. “This program was developed using the same design methods and rationale

**“Generating a design is as simple as entering a few dimensions and applying a few loads.”**

taught in our courses and found in our textbook. It has been created using the feedback from our course participants. It provides quick, effective designs but also acts as a teaching aid for modern masonry design through the detailed intermediate data, dynamic equation display and cross-references with CSA Standards. It is unlike any other software we have seen.”

MASS analyzes and designs masonry beams, shear walls and out-of-plane walls in accordance with the Design of Masonry Structures Standard CSA S304.1-04. MASS comes with a default masonry unit database which includes common masonry units and their properties. This allows MASS to cover most design scenarios right out of the box. In addition, the MASS database can be readily customized allowing the user to modify and/or create units based on new suppliers, unit types and properties, to reflect unique units found throughout Canada and encompass future units currently in research and development.

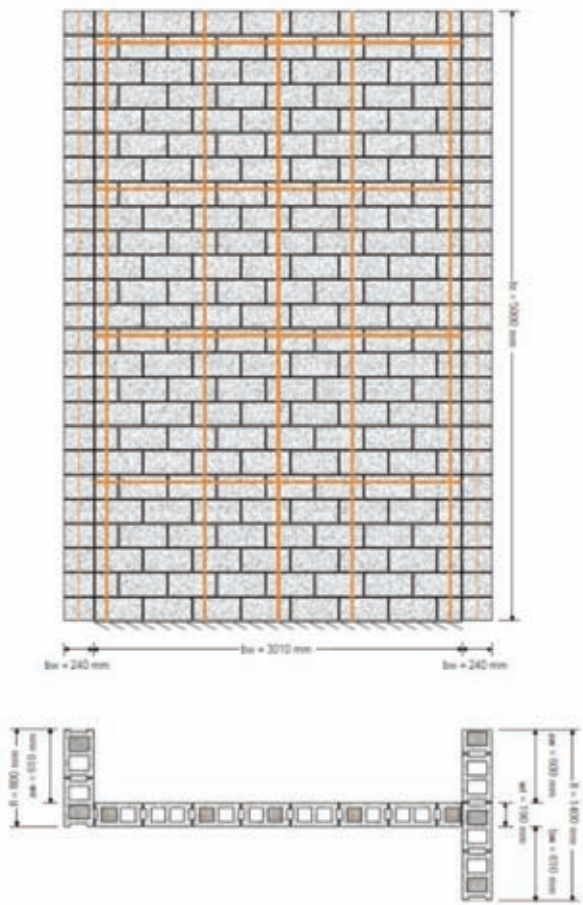
MASS is substantially more than a simple masonry capacity analysis tool. It is a complex design tool! MASS determines the critical load combinations for Moment, Shear and Deflection from the user inputted loads. It quickly cycles through thousands of possible assemblage configurations (block size, block strength, reinforcement size, reinforcement configuration and reinforcement spacing) to determine an optimum design solution. The user then has the ability to customize this solution with a few quick clicks of the mouse to remove or add unknown parameters to the design routines.

Generating a design is as simple as entering a few dimensions and applying a few loads. From there, a single click will start the design engine and, in seconds, the user has results. MASS not only provides an easy way to enter information, it turns those inputs into detailed and comprehensive outputs in various formats. There is a simplified format for users who just want a quick solution. MASS also provides scaled, graphic representations of the designed assemblage for visual inspection, as shown in Figure 1. Most unique to this program is the detailed report



that provides all of the intermediate design data, equations and cross-references with the design and construction CSA Masonry Standards shown in Figure 2. This allows the user to know how the program determines the design solution and makes it easy and transparent for the user to understand the inner workings of MASS.

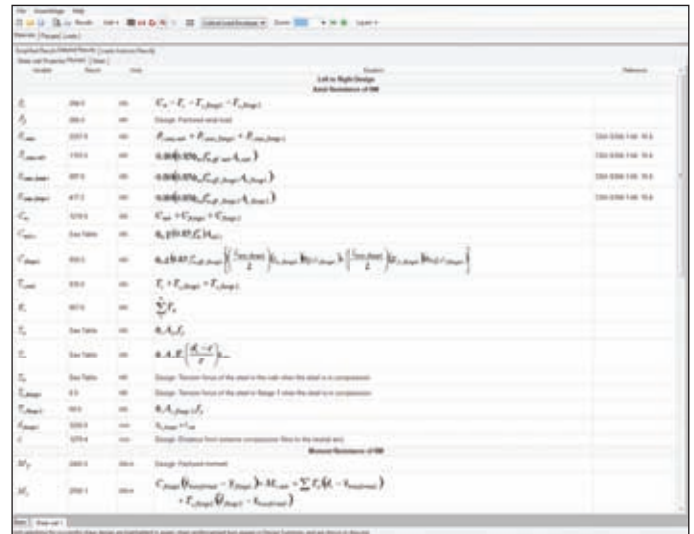
This transparency in the software allows designers to see and readily verify their work, and it provides a learning opportunity for those less experienced in masonry design. The user has the ability to see exactly what equations the program has used in the calculations. This is extremely beneficial to a designer because they can quickly understand how the program reached a current design, building their confidence in the design and in the program in general.



“One of the most challenging aspects during the development of this software was to create a program that was simple to use with minimum data entry by the designer. Simultaneously this program also needed to be highly customizable to allow unique and endless configurations with multiple design philosophies and layers of detailed outputs,” says Alicja Hanebach, Masonry Applications Coordinator at CMDC.

Analysis and design are easily interpreted visually through the use of graphs and drawings. Applied loads, bending moments and shear diagrams are easily accessible. Elevations and cross-sections are graphically displayed to scale and readily indicate dimensions, materials and placement of reinforcement. The P-M Interaction diagrams

are advanced and dynamic, allowing the user to view key values by selecting any point along the curves to display the axial resistance, moment resistance and associated compression zone width.



“From the beginning of this project, CCMPA and CMDC wanted to create a design software that was extremely versatile, to allow for significant growth in its scope and development. We are excited to launch MASS into the market this fall and look forward to future versions,” say Paul Hargest, President of CCMPA.

The future of MASS is focused on continuous improvement and expansion. Expanding the default material database, creating new design modules, adding additional constructability concerns, and increasing the design capabilities of existing modules are but a few of the many options to explore for future versions. In addition to the ongoing improvement of MASS, CMDC will be providing ongoing technical support free of charge on behalf of the Venture Partners to any designer using a registered copy of the software.

For more information about MASS and its release please contact Alicja Hanebach at the Canada Masonry Design Centre.

360 Superior Blvd.  
 Mississauga, ON L5T 2N7  
 Tel: (888) 338-3336 Tor: (905) 564-6622  
 Fax: (905) 564-5744

ahanebach@canadamasonrycentre.com  
 www.canadamasonrycentre.com

David Stubbs, P. Eng, is the Director of the Canada Masonry Design Centre. The Canada Masonry Design Centre (CMDC) was established in 2003. CMDC provides masonry contractors and the design community in Canada with tools and resources to facilitate the proper design and construction of masonry structures.