



Version 1.0

Masonry Analysis Structural Systems

BEAMS

WALLS

SHEAR
WALLS

Simplify and accelerate the masonry engineering process

Masonry Analysis Structural Systems (MASS™) software is a powerful software package that analyzes and designs masonry Beams, Out-of-Plane Walls and Shear Walls in accordance with the CSA Masonry Standards. This program dramatically simplifies and accelerates the masonry design process for Canadian Engineers.

Up until now, those who designed in masonry were missing an important tool which would expedite the design process. Masonry Analysis Structural Systems (MASS™) is about to change all that. 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 (CMDCC) and the Canadian Concrete Masonry Producers Association (CCMPA) formed a partnership to develop a new software program with significant advancements to its predecessors. 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. It provides quick, effective designs but also acts as an educational 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 in the current marketplace.

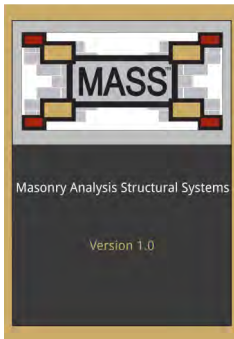
MASS™ is substantially more than a simple masonry capacity analysis tool; it is a complex design tool! Generating a design is as simple as entering a few dimensions and applying loads. From there, a single click will start the design engine, and allows the designer to obtain results in seconds.

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 and strength, reinforcement size, configuration and 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 parameters to the design routines.

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.

Complimentary copies of MASS™ Version 1.0 are being provided to designers within the regions of CMDCC and CCMPA (ON, AB, MB, SK and BC). The cost of these complimentary copies of MASS™ Version 1.0 distributed within Saskatchewan is covered by your local contractor and block producer members of the Saskatchewan Masonry Institute.



The designs are easily interpreted visually through the use of graphs and drawings. MASS™ provides scaled graphic representations of the designed assemblage for quick validation through visual inspection (shown in Figure 1). 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.

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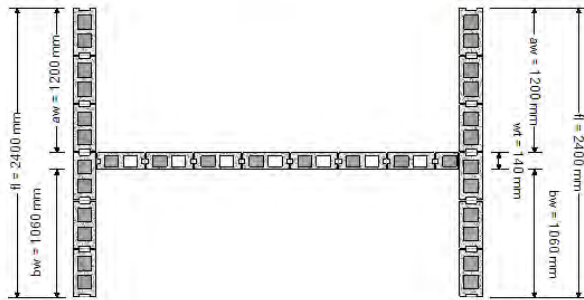
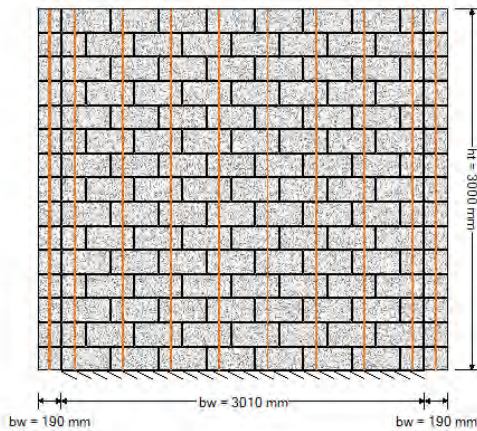


Figure 1: Assemblage drawing of a Shear Wall with Flanges

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 that just want a quick

solution. Most unique to this program is the detailed report (shown in Figure 2) that provides all of the intermediate design data, equations and cross-references with the design and construction CSA Masonry Standards. 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

Variable	Result	Units	Equation
	6.5	kN m	Design: Moment resistance (Mr1 < Mr2)
Axial resistance for URM walls (Excluding Grout)			
$P_{f,max}$	591.2	kN	$0.80(0.85\phi_c f'_{m,hollow} A_{m,hollow})$
$f'_{m,hollow}$	17.5	MPa	Design: Compressive strength of hollow masonry normal to bed joint at 28 days
P_{f2}	0.0	kN	C_{m1}
C_{m1}	0.0	kN	$0.85\phi_c f'_{m,hollow} A_{comp}$
A_{comp}	0.0	mm ²	$\beta_1 c b_{eff}$
c	0.0	mm	Design: Distance from extreme compression fibre to neutral axis
b_{eff}	1000.0	mm	Design: Effective face shell compression zone design length
$b_{c,eff}$	1000.0	mm	b_{eff}
Axial resistance for URM walls (Including Grout)			
$P_{f,max}$	1597.3	kN	$0.80(0.85\phi_c f'_{m,grouted} A_{m,grouted})$
$f'_{m,grouted}$	13.5	MPa	Design: Compressive strength of grouted masonry normal to bed joint at 28 days
$A_{m,grouted}$	290000.0	mm ²	Design: Grouted cross-sectional area in a fully grouted wall
P_{f2}	0.0	kN	C_{m1}
C_{m1}	0.0	kN	$0.85\phi_c f'_{m,grouted} A_{comp}$
A_{comp}	0.0	mm ²	$\beta_1 b_{eff} (\beta_1 c + b_{eff})$
c	0.0	mm	Design: Distance from extreme compression fibre to neutral axis
b_{eff}	1000.0	mm	Design: Effective face shell compression zone design length
$b_{c,eff}$	1000.0	mm	b_{eff}
Moment Design for URM Walls (Including Grout)			
M_{r1}	6.5	kN m	$MIN(M_{r1}, M_{r2})$
Axial and Moment Resistance			
P_f	22.1	kN	Input: Factored axial load
P_r	22.1	kN	Design: Factored axial load resistance
$P_{r,max}$	1597.3	kN	Design: Maximum factored axial load resistance
$M_{f,load}$	4.6	kN m	Design: Total factored moment (including slenderness effects)
M_f	4.6	kN m	Input: Factored moment
M_r	6.5	kN m	Design: Moment resistance (Mr1 => Mr2)
M_c			

Figure 2: Detailed Moment Results for an Out-of-Plane Wall

inner workings of MASS™. The program is also structured to alert designers to possible 'constructability concerns'; that is, to warn that certain solutions that work well on-screen may be difficult to implement on-site.

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.

To order MASS™ please contact NMDP's authorized service provider, the Canada Masonry Design Centre (CMDC) at:

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NMDP would like to thank the following organizations for their significant contributions to the development of MASS™:

