



INSIGHTS

FOR MASONRY DESIGN

Software Review for Structural Masonry Design Programs

Numerous design programs support masonry analysis and design, for both component design and finite element analysis (FEA) and design. As engineers, it is important to not only know what programs are available and when to use them, but also the common issues with software and how to avoid them.

Below are examples for modifying FEA elements to properly model masonry:

- How to account for partial grouting in masonry
- Incorporating masonry control joints (CJ)
- How to account for cracking in masonry

All items are available on the FORSE website: <http://website.forsei.com/find/masonry/>

List of Finite Element Analysis/Design Software Reviewed by FORSE

We recommend using FEA programs for walls that are either complicated or have a reasonably high load demand, which includes: walls with relatively large openings, shear walls with openings, masonry wall groups used with stair and elevator shafts, exterior walls with high loads, multistory masonry walls, and storm shelter walls. FEA programs are required for understanding the true load on all masonry lintels.

1. **RAM Elements** - Masonry Wall module

Quick start guide: [IMI - RAM Elements V8i Manual for Masonry Analysis and Design \(pdf\)](#)

2. **RISA Floor/ RISA 3D**

Quick start guide: [IMI - RISA-3D Workflow Manual for Masonry Analysis and Design \(pdf\)](#)

3. **ETABS** - Masonry walls are all modeled as grouted solid. When the actual wall being modeled is solid, ETABS can be used without issue; if it is partially grouted, modification factors need to be used.

Quick start guide: *Not yet available.*

IMI quick start guides are found at: <http://imiweb.org/masonry-software/>

More about RAM Elements

RAM Elements V16 is a finite element analysis-based, structural analysis and design programs that provide tools for effective modeling and design of masonry structures.

This software can be used to create an entire building that includes masonry or simply model and design an individual masonry wall panel with the RAM Masonry Wall module. The module provides code checks for masonry load bearing walls, masonry shear walls, masonry wall lintels, and masonry columns at the end of wall panels. The code check options are as follows:

- TMS 402-16 SD, ASD; TMS 402-13 SD, ASD; TMS 402-11 SD, ASD; TMS 402-08 SD, ASD; ACI 530-05 ASD

It also can design hybrid masonry/frame structures and handles both reinforced and unreinforced masonry using concrete masonry units or clay brick units in a variety of compressive strengths and unit configurations.

About RAM Elements V16 (from Bentley Systems, Inc.)

<https://www.bentley.com/en/products/product-line/structural-analysis-software/ram-elements>

RAM Elements V16 provides quick, reliable tools for specific structural tasks. RAM Elements V16 is the only structural engineering software system that offers finite element analysis plus stand-alone or integrated design tools all in one package.

When you are designing masonry walls, or performing many other everyday design tasks, RAM Elements V16 delivers the industry's most productive and easy-to-use engineering analysis and design toolkit.

More About RISA 3D

RISA 3D is a finite element analysis based, structural analysis and design programs that provides tools for effective modeling and design of masonry structures.

This software can be used to create an entire building that includes masonry or simply model and design an individual masonry wall panel. It provides code checks for masonry load bearing walls, masonry shear walls, masonry wall lintels, and masonry columns at the end of wall panels. The code check options are as follows:

- TMS 402-16 SD, ASD; MSJC-13 SD, ASD; MSJC-11 SD, ASD; MSJC-08 SD, ASD; MSJC-05 SD, ASD, MSJC-02 SD, ASD, ACI 530-99 ASD, UBC 1997 SD, UBC 1997 ASD

About RISA 3D V19 (from RISA Technologies, LLC)

https://www.risa.com/p_risa3d.html

RISA 3D has the most current steel, concrete, cold-formed steel, masonry, aluminum and timber design codes, RISA-3D gives you the tools to tackle multi-material projects with confidence.

List of Component Design Software Reviewed by FORSE

We recommend using component design programs for walls that are less complicated and have common load demand, which includes: partition walls, single story building with many walls and low in-plane shear loads, walls with relatively small openings.

1. **IMI Partition Wall** - Provides designers with the opportunity to engineer masonry partitions with simple input, simple non-FEA analysis, and with code checks for analysis results. Code checks are based on 2009 -2015 IBC ASD; including appropriate references to TMS 402.
 - <http://imiweb.org/masonry-software/masonry-partition-wall-software/>
2. **DIRECT DESIGN 3.1** (NCMA) - Software that enables design of an entire masonry structure in one model. Simply enter design criteria, specify the plan layout and opening locations, and the software fragments the model into individual components for design checks. Every wall is detailed simultaneously. The software is based on the TMS Direct Design Handbook (TMS 403).
 - <https://ncma.org/software/direct-design/>
3. **EleMasonry** (NCMA) - Software for structural designs of masonry elements one component at a time. Design walls for in-plane (shear walls) and out-of-plane loads, columns, pilasters, and lintels including code-prescribed detailing requirements for seismic loading, second order analysis, lap splicing, shear reinforcement, and more. Code available for 2002-2016 ASCE 7 ASD or SD; including appropriate references to the masonry design provisions of TMS 402 and corresponding loading criteria from ASCE 7. This program is a sister software to QuickMasonry (through IES).
 - <https://ncma.org/software/elemasonry-design-software/>
4. **QuickMasonry** (Integrated Engineering Software, Inc.) - Software for structural designs of masonry elements one component at a time. Design walls for in-plane (shear walls) and out-of-plane loads, columns, pilasters, and lintels. Codes available for MSJC 2013, MSJC 2011, MSJC-08.
 - <https://www.iesweb.com/quick/#qm>
5. **TEDDS** (Tekla/Trimble) - Software for structural designs of masonry elements one component at a time. Design walls for in-plane (shear walls) and out-of-plane loads, columns, and lintels. Codes available for MSJC 2013, MSJC 2011, MSJC-08, MSJC-05.
 - <https://resources.tekla.com/youtube-structural-analysis-and-design-with-tekla-software/masonry-wall-panel>