RISAMasonry

Version 1.0 User's Guide

RISA TECHNOLOGIES

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Before You Begin

Hardware Requirements

Minimum

- Any Windows compatible computer with an 80586 or better processor.
- Windows95\98\2000\ME\XP\Vista or Windows NT
- 32MB of RAM
- 10MB of hard disk space
- Two or three button mouse

Recommended

- 64MB of RAM
- 20MB of hard disk space

Technical Support

Complete program support is available to registered owners of RISAMasonry and is included in the purchase price. This support is provided for the life of the program. The "life of the program" is defined as the time period for which that version of the program is the current version. In other words, whenever a new version of RISAMasonry is released, the life of the previous version is considered to be ended.

Your options to contact RISA Technologies, LLC:

E-mail: support@risatech.com

Website/FAQ: www.risatech.com

Phone: (949) 951-5815

Fax: (949) 951-5848

Installation

To install RISAMasonry please follow these instructions:

Put the RISAMasonry CD in your computer CD drive.

If the CD starts automatically go to step 4. If the CD does not start click the Windows Start button and select Run.

In the Run dialog box type "d:\risacd" (where "d" is the label of your CD drive) and then click the OK button.

Follow the on-screen instructions.

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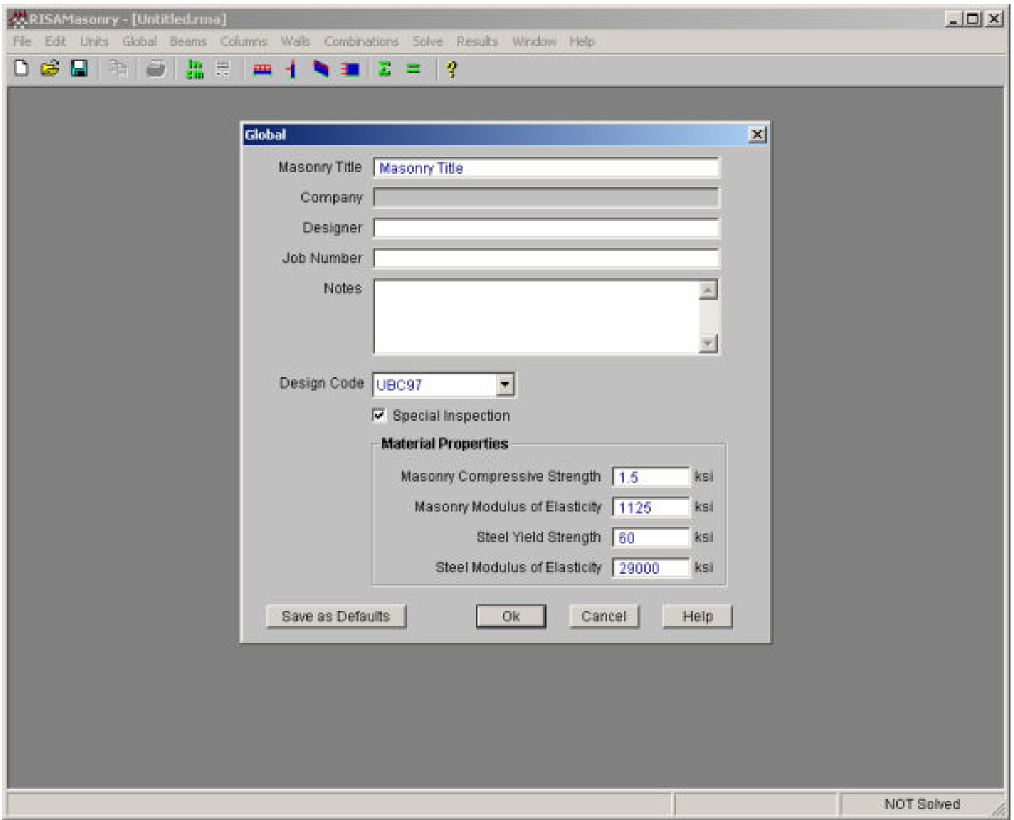
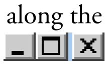
Interface

RISAMasonry presents the following interface when the program is initially opened:



The bar along the top of the screen is called the title bar, which displays the name of the file that is currently open. The three buttons  on the far right side of the title bar are used to control the main window. The left button will shrink the main application window to a button on the Windows taskbar. The middle button will shrink or maximize the window on your screen. The right button will close the file, prompting you to save changes if necessary.

Just beneath the title bar is the main menu beginning with File on the far left and ending with Help on the far right. These menus provide access to all of the program features. Clicking on some of these options will open windows to display sub-menus that contain more options that you may choose from. The toolbar mentioned in the next section provides easy access to most of these menu options.

The status bar spans across the bottom of the interface. On the left it displays a brief explanation of what data is expected in the current or active input field. On the right, it displays whether the elements are solved or not.

Main Menu

All of the features of the program may be accessed through the main menu. Clicking on individual menu items will either open a window or display sub-menus. The menu items can also be selected by pressing the ALT key with the underlined letter of that item.

File Menu

New will close the current file, prompting for saving if necessary, and will start a new file.

Open will close the current file, prompting for saving if necessary, and will open an existing file.

Save will save the current file, prompting for a name if necessary.

Print will access printing options.

Page Setup will access setup options such as page margins and orientation.

Preferences activates the Preferences submenu described below.

Toolbar toggles the display of the toolbar on and off.

Status bar toggles the display of the status bar on and off.

Reset Defaults resets all program defaults.

Exit will close RISAMasonry, prompting for saving if necessary.

Edit Menu

Copy will copy the selected item to the clipboard.

Units

Selecting **Units** will open the units dialog. You may adjust the units at any time with automatic conversions.

Global

The user can input a file title, designer's name, company, job number and design notes on the **Global Window**. The design code and the special inspection flag can also be selected along with specifying the strength and modulus of elasticity of both masonry and steel. These inputs are applicable to all elements in the current file.

Beams

Opens the beams/lintel window.

Column

Opens the column window.

Walls

Out-plane Walls opens the out-plane wall window.

In-plane Wall opens the in-plane wall window.

Combinations

Opens the Load Combinations window spreadsheet where default and new load cases can be defined.

Solve

Solves all elements in all categories and presents the result windows.

Results

This menu item is activated once the solution has been performed. The sub-menu items are beams, columns, out-plane walls, in-plane walls and slender walls. Selecting the relevant link will open a window containing all elements of that particular category.

Window

This menu helps in viewing the results. There is an option to cascade or tile results which helps in comparing similar elements. It allows the user to close all results windows.

Help Menu

Contents opens the help file where the topic can be searched using the Contents or Index.

About provides version and serial number or Hardware Key information.

Toolbars

Toolbar buttons provides quick access to common features in the program. Holding the mouse cursor over the button provides a ToolTip for that particular button.

Status Bar

The status bar is the light grey area broken into three boxes at the bottom of the interface. The large box on the left provides information on the active field. The right box toggles between "Solved" and "Unsolved" indicating if the project file has been solved.

Input Windows

RISAMasonry uses standard dialogs for input windows. Therefore, ***you may only have one input screen open at a time.*** Furthermore, all input windows allow the user to set default information. Each new project file created thereafter will automatically begin with this data.

Shortcut Keys

Shortcut keys allow the user to use the keyboard for quick access to common features. Because the program uses standard dialog windows for most of the input window, the shortcut keys will only work when there are no active input windows open.

Key Combination	**Function**
F1	Help on the active window
Ctrl-N	Start a new file
Ctrl-O	Open an existing file
Ctrl-S	Save the current file
Ctrl-P	Print

Overview

RISAMasonry is a comprehensive package that performs analysis and design for masonry construction. Version 1.0 addresses the design of beams, columns, in plane, and out of plane walls for working stress design. In addition, it performs slender wall design using the iterative strength design methods.

The many unique features of RISAMasonry include:

Design Flexibility

- The software performs analysis and design of all types of wall element whether it is in-plane or out-of-plane, reinforced or unreinforced, grouted, partially grouted, or ungrouted.
- The software performs automatic arching of loads in case of lintels. It also has the ability to dispersing concentrated loads applied at the diaphragm in accordance with NCMA.
- It has a tool for calculating automatic layout of reinforcement in case of columns. Both cracked and uncracked sectional analysis is performed for in-plane shear wall. The capacity of slender walls is calculated in accordance with the iterative analysis technique for strength design of walls. The software also has an ability to perform T-beam analysis for partially grouted transverse walls.
- RISAMasonry supports both the UBC 97 and MSJC 02 codes for working stress design and strength design of slender walls. MSJC 02 is being referenced by IBC 2003, and hence can be used in place of this code.
- Like all RISA products, RISAMasonry offers a powerful units conversion utility. The units can be changed anytime in between editing different elements. In addition, you can automatically perform a unit conversion on your existing project data.

Pre-built library of common masonry units

- RISAMasonry comes with a built in library of most commonly used masonry units. Therefore, all you have to do is select your masonry unit and all the calculations for effective sections, areas and dead weight will be performed automatically.

Multiple Elements

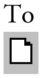
- This program has the ability to store and analyze an unlimited number of elements. Therefore, you may create a single file to store all the numerous beams, columns and walls that will be used on that project.

Results Presentation

- The element detail report has been specifically designed for ease of use. It provides detailed diagrams for enveloped axial loads, shear and moments along the length of the element. In addition, this detail report contains all input, intermediate and final output values for the element.

Quick Introduction

RISAMasonry consists of four categories of elements: 1. beams/lintels; 2. columns; 3. out-plane walls (non- slender and slender); and 4. in-plane walls. Your file may contain as many of these elements as you need for your project.

To start a new file in RISAMasonry, use either the menu by selecting File - New from the main menu, or by clicking the  button.

The element to be designed can be chosen from the toolbar or by selecting it from the appropriate menu. While you may input all elements in a single file, only one category window can be opened at a time. Therefore, if you are inputting a beam, you must close that input page before you may open an input page for one of the other elements.

Load combinations can be defined by selecting Load Combinations from the main menu or by clicking the Σ button. See Combinations for more information.

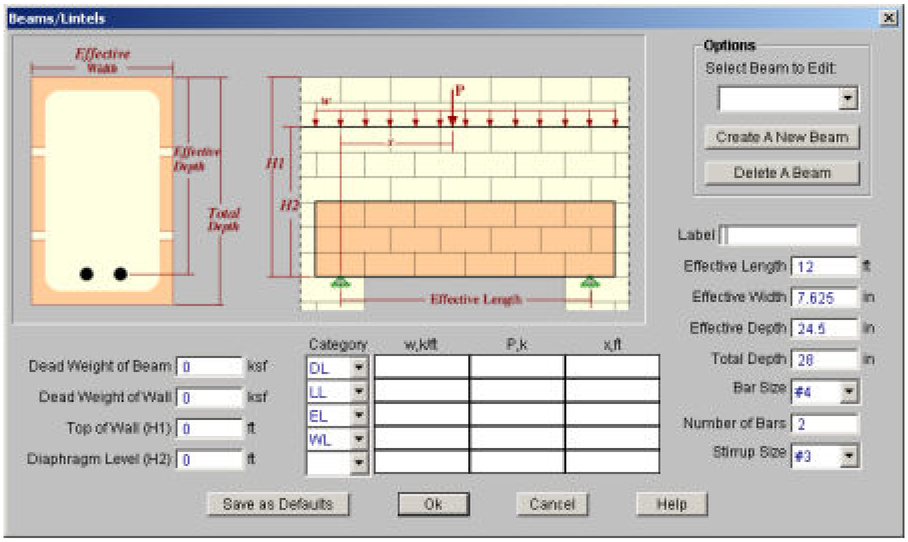
The units system can be changed at any time between entering elements. The Units window can be activated by selecting Units from the main menu, or by clicking the in/cm button.

Once the load combinations are defined, select Solve from the main menu or = button to perform analysis and design. RISAMasonry solves all elements at once and opens the results windows. If one of the results windows has been closed and you need to recall it, you can simply select them from the Results menu. More than one window can be opened for the same category of elements, and can be aligned using various options available in the
Window menu.

Miscellaneous Program Notes

- The grouted width is assumed to be 6 inches for shear width calculation in case of shear walls.
- Deflection of beams is not being currently supported in this version, but will be added into a future version of the program.
- As the program does not input the seismic zone, it does not provide a value for the minimum reinforcement in case of reinforced walls for different seismic zones. Consequently, special provisions for shear spacing in columns, for high seismic zones are not considered in this program. The user may refer section 2106.1.12 of the UBC and 1.13 of MSJC for seismic reinforcement.
- For the maximum and minimum limitations of the values of f'm, the user is advised to refer to UBC 2107.1.2

Beams/Lintels



The displayed diagram provides a visual explanation of relevant data entry fields. The **Options** on the top right lets the user create a new beam and edit or delete an existing beam.

At the bottom of this window, there is a button to save the current data as the default data for all new elements. The **OK** button exits the beam/lintel dialog with save, while the **Cancel** button exits the dialog without saving the current element. The **Help** button provides help on beam/ lintel topics.

Effective Length

The effective length is the center to center distance between beam supports. For Lintels, this will normally take as the sum of the opening width plus one half of the bearing length on each side of the opening.

Effective Width

The effective width for solidly grouted masonry beams/ lintels is as follows:

Nominal Block Width	Actual Effective Width
4 in.	3.625 in.
6 in.	5.625 in.
8 in.	7.625 in.
10 in.	9.625 in.
12 in.	11.625 in.

For partially grouted and multi-wythe walls, the user should calculate the value of the effective width.

Total and Effective Depth

The overall depth of the beam/lintel should be entered as the **Total Depth**.

The **Effective Depth** is distance from the extreme top fiber of the beam/lintel to the centroid of the flexural reinforcement.

Bar and Stirrup Sizes

The standard deformed bar sizes for flexural reinforcement shear stirrups can be selected from the drop down list. #11 is the maximum permitted reinforcement according to UBC 2107.2.2.1/ MSJC 1.12.2.1 for masonry.

Number of Flexural Bars

This entry is used to calculate the total area of tensile steel, as, which is assumed to be applied at the effective depth.

Density of Beam/Lintel

The density of the beam/lintel is used in self weight calculations and contributes to shear and moment for the element as dead load.

Density of Wall

For Lintels, the density of the wall is used in self weight calculations and contributes to the maximum shear and moment for the element as dead load.

For beams in general, there would be no wall on top; hence this value should be entered as zero.

Top of Wall

The top of the wall is used for the calculation of wall self weight on a Lintel. It may be located at the same level as the diaphragm, or (for the case of parapets) may be above the diaphragm.

Note:

- The program automatically switches between arching action and full load. For wall heights above the lintel equal to or less than half the effective span of lintel plus 8 inches, the arching action is considered ineffective and therefore is ignored. In such cases, the lintel is designed to carry the dead weight of the entire rectangular portion of the wall over the effective span.
- For beams, or where the user does not wish the program to automatically calculate wall self weight, this value may be entered as zero.

Diaphragm Level

The diaphragm is the same as the roof or floor level, where the user defined dead and live loads are assumed to be imposed.

For beams, where the load is applied directly at the beam level, this may be entered as zero.

Beam Loading

Load Category

Enter the Load Category (DL, LL, RLL, SL, WL, EL, or OL) for each applied load. These load categories will be combined and factored in the load combinations spreadsheet to develop the total loading on the beam/lintel. The self weight of both beam/lintel and wall are automatically assigned to the DL load category.

Line Load Magnitude (w)

The uniformly distributed load is effective only if the height of the diaphragm above the lintel is equal to or less than half the effective span of lintel plus 8 inches.

Point Load Magnitude (P) and Location (x)

For point loads, the program automatically disperses the concentrated load at 30 degree to the vertical on either side of the load point (NCMA 1997 TEK 17-1A).

The location refers to the distance of the point load from the left end of the beam.

Beam/Lintel Results

The detail report provides detailed information on the analysis and design of your beam or lintel. The beam detail report is arranged in the following basic sections: Input Data Echo, Force Diagrams, Code Check Summary, Applied Load Details, Design Details, and
Load Combinations.

Echo of the Input Data

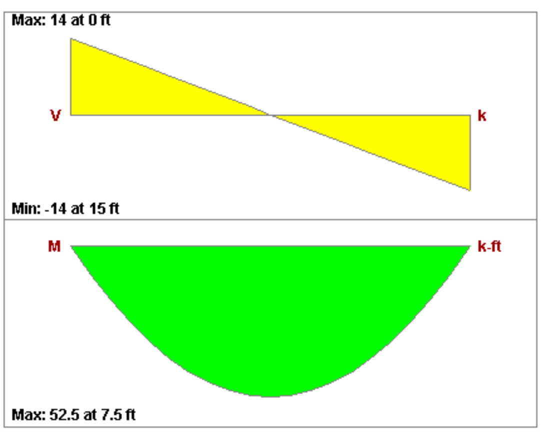
The first section of the detail report just echoes the Criteria, Materials and Geometry data entered by the user. An example is shown below:

CRITERIA		MATERIALS			GEOMETRY		
Code	: UBC97	Masonry f'm	: 2	ksi	Top of Wall	: 0	ft
Special Insp	: Yes	Masonry Em	: 1500	ksi	Dia Level	: 0	ft
		Steel fy	: 60	ksi	Eff Length	: 15	ft
		Steel E	: 29000	ksi	Eff Width	: 10	in
Stirrup Size	: #5	Beam dead wt	: .1	ksf	Eff depth	: 26	in
Flex Steel	: 2-#8	Wall dead wt	: 0	ksf	Total Depth	: 32	in

Envelope Force Diagrams

The next section of the detail report plots the Shear and Moment envelope diagrams for the solved Load combinations. The Maximum and Minimum values are reported along with the location along the length of the beam where they occur. The locations are always measured from the left face of the beam.

An example of this section is shown below:



Code Check Summary

The next section of the detail report gives a summary of the Shear check and Bending check. Examples of each section are shown below:

Shear Summary

The maximum shear stress on the beam is reported as (fv). The allowable shear stresses are then reported as (Fvm) and (Fvs), where Fvm is the allowable of the masonry alone and Fvs is the allowable considering the effects of the shear reinforcement.

The bond stress is reported as (u), and the allowable bond stress as (U). This Bond Check is always performed at the maximum shear check location.

SHEAR SUMMARY

Shear Chk fv/Fvs	: .46	
Bond Chk u/U	: .491	
fv	: .062	ksi
Fvm	: .045	ksi
Fvs	: .134	ksi
u	: .098	ksi
U	: .2	ksi

Bending Summary

The maximum bending stress in the in the reinforcement is reported as (fs), and the allowable steel bending stress as (Fs).

The maximum bending stress in the in the masonry is then reported as (fm), and the allowable masonry bending stress as (Fm).

BENDING SUMMARY

Bend Chk fs/Fs	: .736	
Bend Chk fm/Fm	: .842	
fm	: .561	ksi
Fm	: .667	ksi
fs	: 17.666	ksi
Fs	: 24	ksi

Applied Load Details

This section of the detail report shows all the load that were applied to this Beam/Lintel and Load Category they were assigned to.

APPLIED LOADS DETAILS

Load Category	Distibuted Load Magnitude (k/ft)	Point Load Magnitude (k)	Point Load Location (ft)
DL	1.6	0	0
LL	0	0	0
WL	0	0	0
EL	0	0	0

Design Details

This section of the detail report gives more detailed information used for the calculation of the Bending and Shear checks. This includes a reporting of the maximum forces, the locations where they occurred and the load combination in which they occurred. The locations are always measured from the left face of the beam.

DESIGN DETAILS

BENDING DETAILS						SHEAR DETAILS		
Max Moment	: 52.5	k-ft	Steel Area As	: 1.571	in2	Max Shear	: 14	k
Location	: 7.5	ft	Per of steel p	: .006		Location	: 0	ft
Load Comb	: 1					Load Comb	: 1	
Mm	: 62.379	k-ft	k	: .38		Shr Spacing c/c	: 13	in
Ms	: 71.323	k-ft	j	: .873		Peri of bars	: 6.283	in

Bending Details

The Steel Area (As) and reinforcement ration (p) are reported.

The allowable moment based on the masonry stress is reported as (Mm). The allowable moment based on the steel stress is reported as (Ms).

The ratio of the compressive depth to the overall member depth (k) is reported along with the ratio distance between the centroid of the compressive and tensile forces (j).

Shear Details

The center to center spacing of the shear reinforcement is reported along with the perimeter of the reinforcing bars used in the calculation allowable bond stress.

If the maximum imposed shear stress fv exceed the capacity Fvv then the shear spacing is shown as -1, which means not calculated.

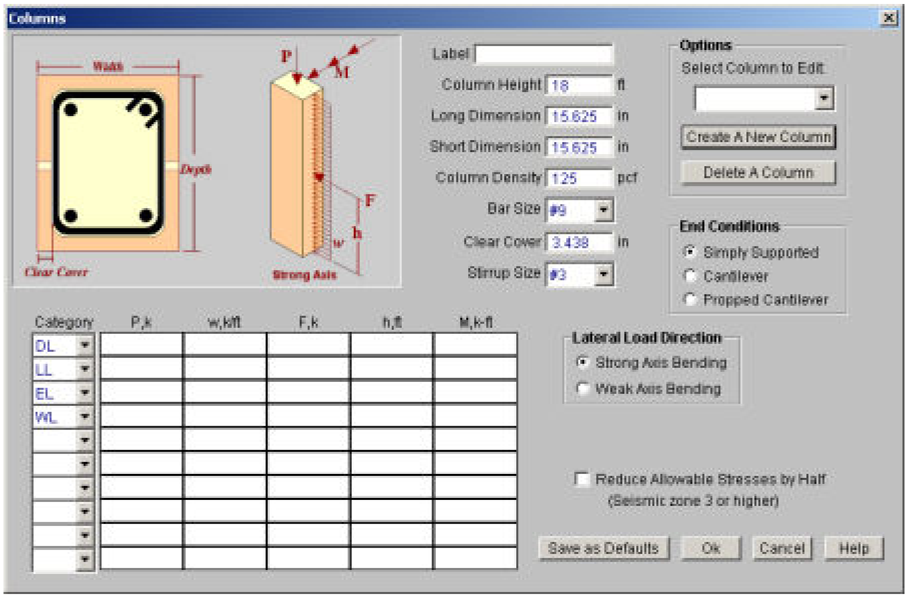
Load Combinations

This section of the detail report summarizes the load combinations that were solved for the Beam/Lintel Elements. An example of this section is shown below:

LOAD COMBINATIONS

LC	Label	ASIF	DL	LL	EL	WL	SL	RLL	OL
1	UBC 12-7	1	1	0	0	0	0	0	0
2	UBC 12-8 a	1	1	1	0	0	0	1	0

Columns



The displayed diagram provides a visual explanation of relevant data entry fields. The **Options** on the top right lets the user to Create a new column and edit or delete an
existing column.

At the bottom of this window, there is a button to save the current data as the default data for all new elements. The **OK** button exits the beam/lintel dialog with save, while the **Cancel** button exits the dialog without saving the current element. The **Help** button provides help on beam/ lintel topics.

Column Height

The **total height** of the column is entered here. The **effective height** of the column is calculated depending on the column end conditions.

Column Dimensions

The short and long dimensions of the column cross section are entered here. For square columns the short and long dimensions will be equal.

Note:

- The program does not automatically enforce the minimum dimensions as specified in UBC 2107.1.3.2 or MSJC 2.1.6.1.

Column Density

If the density of a column is specified, then the program will automatically compute the axial load due to self weight. This load is applied as Dead Load. If the user does not wish to add the self weight of the column, then a zero must be entered in this field.

Flexural Bar and Stirrup Sizes

The standard deformed bar size for reinforcement can be selected from the drop down list. Number 11 is the maximum permitted reinforcement according to UBC 2107.2.2.1 or MSJC 1.12.2.1 for masonry.

Clear Cover

The clear cover is the distance from the extreme column fiber to the outer face of the shear stirrup.

End Conditions

The user can choose to design a simply supported, cantilevered or propped cantilevered column. The end conditions also affect the effective height of the column in the following way:

End Condition	K Value
Simply Supported	1.0
Cantilevered	1.2
Pinned - Fixed	0.8

Column Loading

Lateral Load Direction

While the columns are analyzed and designed for uniaxial load, this load may be applied about the strong or weak axis of the column. Columns are NOT analyzed

Reduced Allowables for Seismic Zones

Typically the allowable stresses are reduced by half for columns with their smallest dimension lesser than 12 inches in seismic zones three and higher (UBC 2107.1.3.2). However, the user has to specifically request this for the program to take it into account.

Load Category

Enter the Load Category (DL, LL, RLL, SL, WL, EL, or OL) for each applied load. These load categories will be combined and factored in the load combinations spreadsheet to develop the total loading on the column.

Axial Load Magnitude (P)

Enter the axial load applied at the top of the column. Note: The self weight of the column is automatically included and assigned to the DL load category.

Lateral Line Load (w)

The magnitude of the lateral line load can be entered. This load is taken as a uniformly distributed load over the height of the column.

Lateral Point Load Magnitude (F) and Location (x)

The magnitude and locations of the Lateral Point Loads that are applied to the column can be entered here.

Imposed Column Moment (M)

The moment due to eccentric axial loads, and otherwise, can be entered here. The moment is applied at the top of the column.

Column Results

The detail report provides detailed information on the analysis and design of your column. The column detail report is arranged in the following basic sections: Input Data Echo, Force Diagrams, Code Check Summary, Applied Load Details, Design Details, and Load Combinations.

Echo of the Input Data

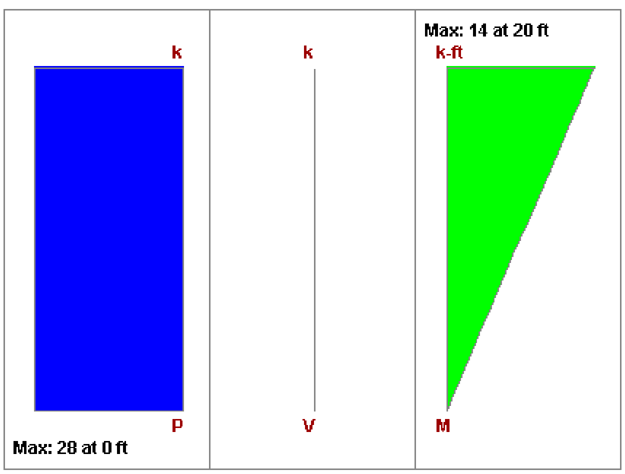
The first section of the detail report just echoes the Criteria, Materials and Geometry data entered by the user. An example is shown below:

CRITERIA			MATERIALS			GEOMETRY		
Code	: UBC97		Masonry f'm	: 1.5	ksi	Column Height	: 20	ft
Special Insp	: Yes		Masonry Em	: 1125	ksi	Long Dim	: 15.625	in
Zone 3+	: No		Density	: 0	pcf	Short Dim	: 15.625	in
Stirrup Size	: #3		Steel fy	: 60	ksi	Simply Supported		
Bar Size	: #8		Steel E	: 29000	ksi	Strong Axis Bending		
Cover	: 2.75	in						

Envelope Force Diagrams

The next section of the detail report plots the Axial, Shear, and Moment envelope diagrams for the solved Load combinations. The Maximum and Minimum values are reported along with the location along the length of the column where they occur. The locations are always measured from the bottom of the column.

An example of this section is shown below:



Code Check Summary

The next section of the detail report gives a summary of the code checks. Examples of each section are shown below:

Combined Force Summary

The maximum overall code checks considering the effects of both bending and axial stresses are summarized in this section.

COMBINED CHECKS

P/Pa + fb/Fb	: .979
fs/Fs	: .441

Axial Summary

P is the imposed axial load on the column at the section where the combined check (P/Pa + fb/Fb) is maximum. Pa is the maximum allowable axial capacity of the column.

AXIAL SUMMARY

P	: 28	k
Pa	: 120.258	k

Bending Summary

The maximum bending stress in the in the masonry is reported as (fb), and the allowable steel bending stress as (Fb).

The maximum bending stress in the in the steel is then reported as (fs), and the allowable steel bending stress as (Fs).

BENDING SUMMARY

fb	: .373	ksi
Fb	: .5	ksi
fs	: 10.593	ksi
Fs	: 24	ksi

Shear Summary

Shear spacing is the maximum distance between consecutive lateral ties for the column.

SHEAR SUMMARY

Shr Spacing c/c	: 15.625	in

Applied Load Details

This section of the detail report shows the entire load that were applied to this Column and the Load Categories they were assigned to.

APPLIED LOADS DETAILS

Load Category	Distibuted Load,w Magnitude (k/ft)	Axial Load,P Magnitude (k)	Moment,M Magnitude (k-ft)	Point Load,F Magnitude (k)	Location (ft)
DL	0	28	14	0	0
LL	0	0	0	0	0
WL	0	0	0	0	0
EL	0	0	0	0	0

Design Details

This section of the detail report gives more detailed information used for the calculation of the code checks. This includes a reporting of the maximum forces, the locations where they occurred and the load combination for which they occurred. The locations are always measured from the bottom of the column.

DESIGN DETAILS

AXIAL DETAILS			BENDING DETAILS			REBAR DETAILS	
Max Axial	: 28	k	Max Moment	: 14	k-ft	Total St Ratio	: .013
Location	: 20	ft	Location	: 20	ft	Tensile St Ratio	: .008
Load Comb	: 1		Load Comb	: 1			
Rad gyration r	: 4.511	in	k	: .476		Total bars N	: 4
h'/r	: 53.209		d	: 12	in	Tensile bars Nt	: 2
Red Factor R	: .856		j	: .841		Max in bottom row	3

Axial Details

The radius of gyration (r), the wall slenderness ratio (h'/r), and the reduction factor (R) are reported here. The effective height of the wall is based on the end conditions and on the column height entered by the user.

The reduction factor (R) is used to reduce the allowable stresses for walls where slenderness and P-Delta become a design consideration. If the wall exceeds a certain h/t ratio, then the wall MUST be designed as a slender wall.

Bending Details

The ratio of the compressive depth to the overall member depth (k) is reported along with the ratio distance between the centroid of the compressive and tensile forces (j).

The value (d) represents the distance from the extreme compression fiber to the centroid of tension steel.

Reinforcement Details

The calculation and layout of reinforcement is governed by the total allowable steel in the column. This percentage can have a maximum value of 4 %. Total Steel

Reinforcement is calculated as the ratio of the total steel and total area of the column (Long Dim * Short Dim). The Tensile St Reinforcement is calculated as the ratio of the Steel Area and the effective area (Dim perpendicular to load dir * effective depth of reinforcement).

The total number of bars calculated is arranged symmetrically throughout the cross-section in accordance with the specified clear cover.

The number of tensile bars is the total number of bars in tension in the column. The detailed report also gives the maximum number of bars that can be accommodated in the bottom and top rows of the column.

Load Combinations

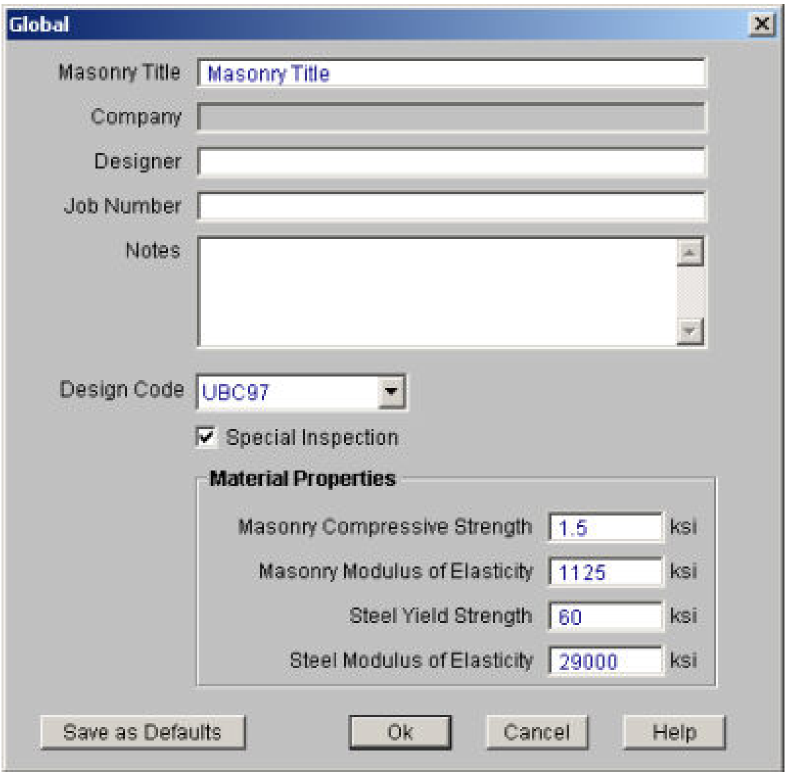
This section of the detail report summarizes the load combinations that were solved for the Column Elements. An example of this section is shown below:

LOAD COMBINATIONS

LC	Label	ASIF	DL	LL	EL	WL	SL	RLL	OL
1	UBC 12-7	1	1	0	0	0	0	0	0
2	UBC 12-8 a	1	1	1	0	0	0	1	0

Global Parameters

The **Global Parameters** are used to define information that influences the project and its solution in an overall (global) manner. You may save any of the information as the default setting so that when you start a new project that information is already there. To do this, simply enter the information that you want to save and click the **Save as Defaults** button.



The entries under the first section are used to enter descriptive information such as a title for the particular model being defined, the name of the designer and a job number. The title may then be printed at the top of each sheet of the output.

Design Code

You can currently choose between the 1997 UBC (Uniform Building Code) and the 2002 MSJC (Masonry Standards Joint Committee). The MSJC is also adopted by the American Concrete Institute (as ACI 530-02 and ACI 530.1-2), the American Society of Civil Engineers (as ASCE 5-02 and ASCE 6-02), and by The Masonry Society (as TMS 402-2 and TMS 602-2).

Special Inspection

Check this box to indicate whether or not there will be special inspection for these masonry elements. This will affect the calculation of allowable stress values.

Material Properties

Masonry Compressive Strength

Enter the value to be used for the f'm of the masonry.

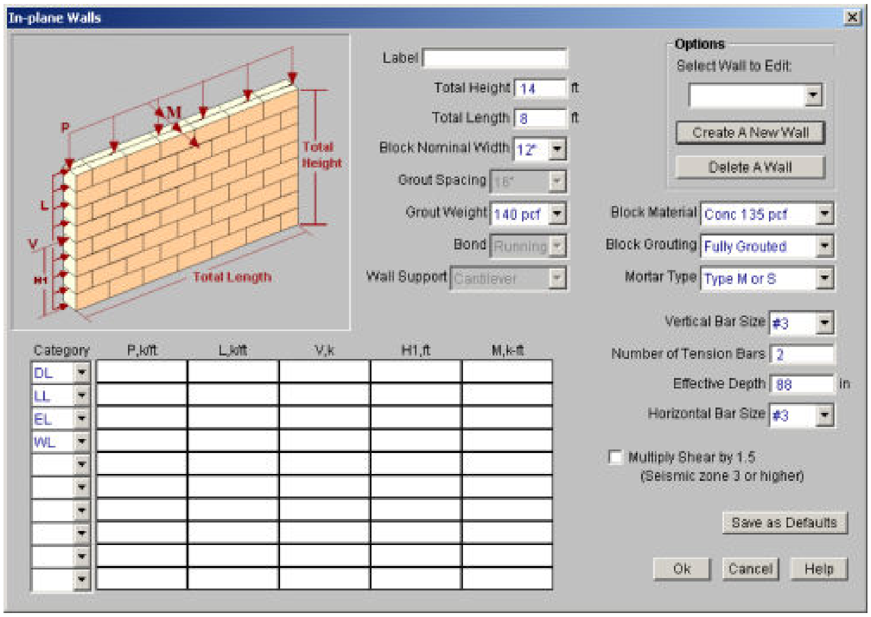
Modulus of Elasticity

The modulus of elasticity of the masonry and steel can be calculated in accordance with MSJC 1.8.2.2 or UBC 2106.2.12.

Steel Yield Strength

Enter the value to be used for the f`m of the masonry.

In Plane (Shear) Walls



The displayed diagram provides a visual explanation of relevant data entry fields. The **Options** on the top right lets the user create a new wall and edit or delete an existing wall.

At the bottom of this window, there is a button to save the current data as the default data for all new elements. The **OK** button exits the beam/lintel dialog with save, while the **Cancel** button exits the dialog without saving the current element. The **Help** button provides help on beam/ lintel topics.

Height and Length

The total height and length of the wall can be entered here.

Since shear walls are almost always attached to a horizontal diaphragm etc. in the out of plane direction, the *effective* height for axial capacity is always considered to be 1.0 * total height. In other words, the program assumes pinned-pinned end conditions when calculating the allowable axial stress due to out of plane buckling.

Block Nominal Width

The nominal width of the masonry block is selected here. The equivalent solid width is calculated as per the following table:

Block Nominal Width	Actual Effective Width
4 in.	3.625 in.
6 in.	5.625 in.
8 in.	7.625 in.
10 in.	9.625 in.
12 in.	11.625 in.

Grout Spacing and Weight

Grout spacing is used for the calculation of the wall's effective properties.

The grout weight is used in calculating the dead weight of the wall. There is an option to choose between 140 and 105 pcf.

Wall Support

At this time, RISAMasonry can only designed cantilevered shear walls.

Block Material and Grouting

The block material is used in calculating the dead weight of the wall.

Fully grouted, partially grouted or ungrouted shear walls can be designed in this version of RISAMasonry.

Masonry Type

This value is required for calculating the shear capacity in case of *unreinforced* shear walls for the UBC code. For all other cases, this information is ignored.

Vertical and Horizontal Bar Sizes

The standard deformed bar size can be selected from the drop down list. #11 is the maximum permitted reinforcement according to UBC 2107.2.2.1 or MSJC 1.12.2.1 for masonry.

Number of Tension Bars

The number of bars entered constitutes the number of vertical bars that are present for the tension zone reinforcement.

Effective Depth

It is the distance from the extreme fibre along the length of the shear wall to the centroid of the tension zone reinforcement.

Wall Loading

Load Category

Enter the Load Category (DL, LL, RLL, SL, WL, EL, or OL) for each applied load. These load categories will be combined and factored in the load combinations spreadsheet to develop the total loading on the wall.

Axial Load Magnitude (P)

Enter the uniformly distributed axial load applied to the top of the wall. Note: The self weight of the wall is automatically included and assigned to the DL load category.

Uniform Shear Load (L)

Enter the magnitudes of the shear loads at the top of the wall. These loads will be taken as uniformly distributed shear loads applied over the entire height of the wall.

Lateral Point Load Magnitude (V) and Location (H1)

Enter the magnitude and locations of the Lateral Point Loads that are applied to the wall. These loads will be taken as a point loads applied at a distance H1 from the base of the wall.

Applied Wall Moment (M)

Enter the magnitude of the moment that is applied at the top of the wall.

In Plane (Shear) Wall Results

The detail report provides detailed information on the analysis and design of your shear wall. The shear wall detail report is arranged in the following basic sections: Input Data Echo, Force Diagrams, Code Check Summary, Applied Load Details, Design Details, and Load Combinations.

Echo of the Input Data

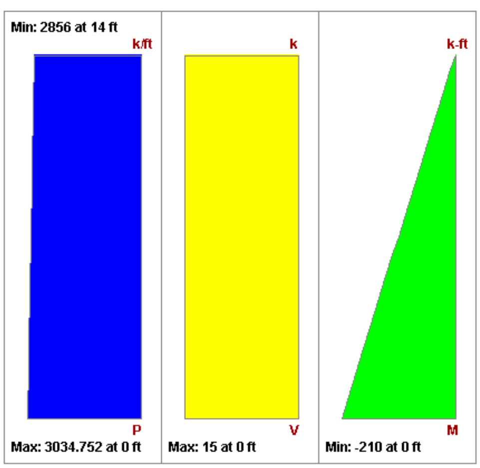
The first section of the detail report just echoes the Criteria, Materials and Geometry data entered by the user. An example is shown below:

CRITERIA			MATERIALS			GEOMETRY		
Code	: UBC97		Masonry f'm	: 1.5	ksi	Total Height	: 14	ft
Special Insp	: Yes		Masonry Em	: 1125	ksi	Total Length	: 8	ft
Hor Bar Size	: #5		Steel fy	: 60	ksi	Blk Grouting	: Fully Grouted	
Vert Bar Size	: #3		Steel E	: 29000	ksi	Grout Spacing	: 16"	
No of Ten Bars	: 2	in	Blk Material	: Conc 135 pcf		Blk Nom Width	: 12"	
Effective Depth	: 88	in	Grt Weight	: 140 pcf		1.5 Shear Factor	: No	

Envelope Force Diagrams

The next section of the detail report plots the Axial, Shear, and Moment envelope diagrams for the solved Load combinations. The Maximum and Minimum values are reported along with the location along the length of the shear wall where they occur. The locations are always measured from the bottom of the shear wall.

An example of this section is shown below:



Code Check Summary

The next section of the detail report gives a summary of the code checks. Examples of each section are shown below:

<u>Combined Force Summary</u>

The maximum overall code checks considering the effects of both bending and axial stresses are summarized in this section.

COMBINED CHECKS	
fa/Fa + fb/Fb	: .734
fs/Fs	: 0

Axial Summary

fa is the imposed axial stress on the wall at the section where the combined check (fa/Fa + fb/Fb) is maximum. Fa is the maximum allowable axial capacity of the wall.

AXIAL SUMMARY		
fa	: .227	k
Fa	: .434	k

Bending Summary

The maximum bending stress in the in the masonry is reported as (fb), and the allowable steel bending stress as (Fb). These values are given for the Load Combination and section that produce the maximum combined check (fa/Fa + fb/Fb).

The maximum bending stress in the in the flexural reinforcement is reported as (fs), and the allowable steel bending stress as (Fs). These values are given for the Load Combination and section that produce the maximum code check (fs/Fs).

BENDING SUMMARY		
fb	: .141	ksi
Fb	: .665	ksi
fs	: 0	ksi
Fs	: 31.92	ksi

Shear Summary

The maximum shear stress on the beam is reported as (fv). The allowable shear stresses are then reported as (Fvm) and (Fvs), where Fvm is the allowable of the masonry alone and Fvs is the allowable considering the effects of the shear reinforcement.

The bond stress is reported as (u), and the allowable bond stress as (U). This Bond Check is always performed at the maximum shear check location.

SHEAR CHECKS	
fv/Fvm	: .525
u/U	: .302

SHEAR SUMMARY		
fv	: .024	ksi
Fvm	: .047	ksi
Fvs	: .077	ksi
u	: .08	ksi
U	: .266	ksi

Applied Load Details

This section of the detail report shows the entire load that were applied to this Column and the Load Categories they were assigned to.

APPLIED LOADS DETAILS

Load Category	Axial Load, P Magnitude (k/ft)	Moment, M Magnitude (k-ft)	Lat Line, L Magnitude (k/ft)	Lat Point, V Magnitude (k)	Height, H1 (ft)
DL	29.75	0	0	0	0
LL	0	0	0	15	14
WL	0	0	0	0	0
EL	0	0	0	0	0

Design Details

This section of the detail report gives more detailed information used for the calculation of the code checks. This includes a reporting of the maximum forces, the locations where they occurred and the load combination for which they occurred. The locations are always measured from the bottom of the shear wall.

DESIGN DETAILS

AXIAL DETAILS			BENDING DETAILS			SHEAR DETAILS		
Max Axial	: 0	k	Max Moment	: 4907.88	k-ft	Max Shear	: 254.1	k
Location	: 0	ft	Location	: 0	ft	Location	: 0	ft
Load Comb	: 1		Load Comb	: 1		Load Comb	: 1	
			Sect Mod S	: 446400	in3	Corresponding M	4907.88	k-ft
			Tension St Asv	: 4.712	in2	M / (V*d)	: .495	
Rad gyration r	: 3.34	in	Per of steel p	: .000866168		Shear Area Av	: .601	in2
h'/r	: 111.377		k*d	: 77.153	in	Shear Spacing	: 23.568	in
Red Factor R	: .395		j	: .95		Peri of ten bars	: 18.85	in
			CRACKED SECT ANALYSIS					
			fm = fa + fb	: .297	ksi			
			C	: 133.16	k			
			T	: 133.16	k			

Axial Details

The radius of gyration (r), the wall slenderness ratio (h'/r), and the reduction factor (R) are reported here. The effective height of the wall is based on the end conditions and on the shear wall height entered by the user.

The reduction factor (R) is used to reduce the allowable stresses for walls where slenderness and P-Delta become a design consideration. If the wall exceeds a certain h/t ratio, then the wall MUST be designed as a slender wall.

Bending Details

The uncracked section modulus (S) is reported for the applied forces. This is based on the effective thickness and the length of the wall. The vertical steel area (Asv) and reinforcement ration (p) are also reported.

The length of the compression block (k*d) is reported along with the ratio distance between the centroid of the compressive and tensile forces (j). For the shear checks, the j value is always assumed to be equal to 0.9.

Cracked Section Details

If the axial compressive stress (fa) is greater than or equal to the bending stress (fb), then minimum jamb steel is required as vertical reinforcement. Since it is not needed to resist the forces, the stress in this steel is assumed to be zero.

If the bending stress exceeds the compressive stress, then the wall is assumed to crack and an iterative analysis is performed to determine the section properties of the cracked wall. The maximum masonry stress (fm) is obtained by solving the moment equilibrium equation as a quadratic equation of kd. Each iteration of the steel area is based on the amount of steel needed to create a 0.005 ksi difference in the calculated bending stress (fb). The iterative process is carried out until the calculated value of required reinforcement is less than the reinforcement provided. The final values of fm (fa+fb), C (0.5*fmtkd), T (C-P) are then displayed on the detailed report. A good reference for this iterative procedure is Design of Reinforced Masonry Structures by Narendra Taly and published by McGraw-Hill.

Shear Details

The moment corresponding to the maximum shear check is reported along with the
M/Vd ratio.

The required area of horizontal steel (Av) is reported along with its center to center spacing and the perimeter of the reinforcing bars used for the calculation of allowable bond stress.

For the shear checks, the j value is always assumed to be equal to 0.9.

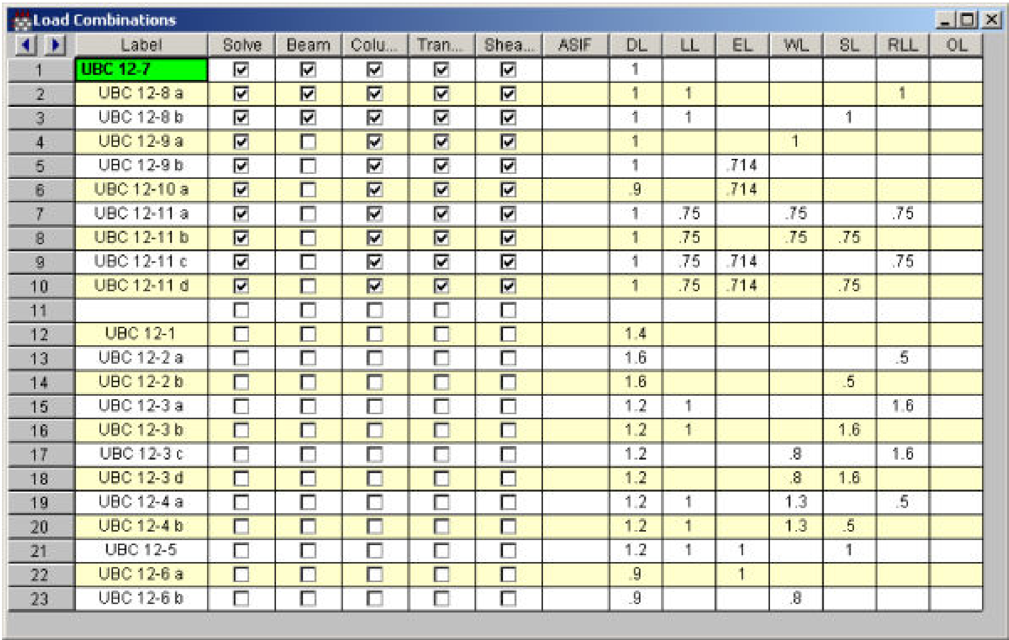
Load Combinations.

This section of the detail report summarizes the load combinations that were solved for the Column Elements. An example of this section is shown below:

LOAD COMBINATIONS

LC	Label	ASIF	DL	LL	EL	WL	SL	RLL	OL
1	UBC 12-7	1	1	0	0	0	0	0	0
2	UBC 12-8 a	1	1	1	0	0	0	1	0

Combinations



Load Combinations

	Label	Solve	Beam	Colu...	Tran...	Shea...	ASIF	DL	LL	EL	WL	SL	RLL	OL
1	UBC 12-7	☑	☑	☑	☑	☑		1						
2	UBC 12-8 a	☑	☑	☑	☑	☑		1	1				1	
3	UBC 12-8 b	☑	☑	☑	☑	☑		1	1			1		
4	UBC 12-9 a	☑	☐	☑	☑	☑		1			1			
5	UBC 12-9 b	☑	☐	☑	☑	☑		1		.714				
6	UBC 12-10 a	☑	☐	☑	☑	☑		.9		.714				
7	UBC 12-11 a	☑	☐	☑	☑	☑		1	.75		.75		.75	
8	UBC 12-11 b	☑	☐	☑	☑	☑		1	.75		.75	.75		
9	UBC 12-11 c	☑	☐	☑	☑	☑		1	.75	.714			.75	
10	UBC 12-11 d	☑	☐	☑	☑	☑		1	.75	.714		.75		
11		☐	☐	☐	☐	☐								
12	UBC 12-1	☐	☐	☐	☐	☐		1.4						
13	UBC 12-2 a	☐	☐	☐	☐	☐		1.6					.5	
14	UBC 12-2 b	☐	☐	☐	☐	☐		1.6				.5		
15	UBC 12-3 a	☐	☐	☐	☐	☐		1.2	1				1.6	
16	UBC 12-3 b	☐	☐	☐	☐	☐		1.2	1			1.6		
17	UBC 12-3 c	☐	☐	☐	☐	☐		1.2			.8		1.6	
18	UBC 12-3 d	☐	☐	☐	☐	☐		1.2			.8	1.6		
19	UBC 12-4 a	☐	☐	☐	☐	☐		1.2	1		1.3		.5	
20	UBC 12-4 b	☐	☐	☐	☐	☐		1.2	1		1.3	.5		
21	UBC 12-5	☐	☐	☐	☐	☐		1.2	1	1		1		
22	UBC 12-6 a	☐	☐	☐	☐	☐		.9		1				
23	UBC 12-6 b	☐	☐	☐	☐	☐		.9			.8			

You may modify the existing load combinations or create new one. Spreadsheet functions such as fill block, math on block are supported for this spreadsheet.

The data from other spreadsheets or applications can be copied onto the spreadsheet. Fill Block can be sued to fill large blocks of cells automatically and Math on Block can be used to perform math on selected columns.

Default Load Combinations

The load combination spreadsheet can be accessed using the Σ button or choosing Combinations from the main menu. The program by default provides all load cases from UBC for both working stress and strength design. (UBC 1612)

Once the user has created his preference of load combinations, he may use the **Save as Defaults** feature to give him a good starting point for new files. This feature is available in the right click menu.

Element and Solve Check Boxes

The spreadsheet allows the user to choose which elements should be analyzed for each load combinations. This allows the user to specify different load combinations for the design of each element.

A solve flag is also provided to designate exactly which load combinations should be included in the solution.

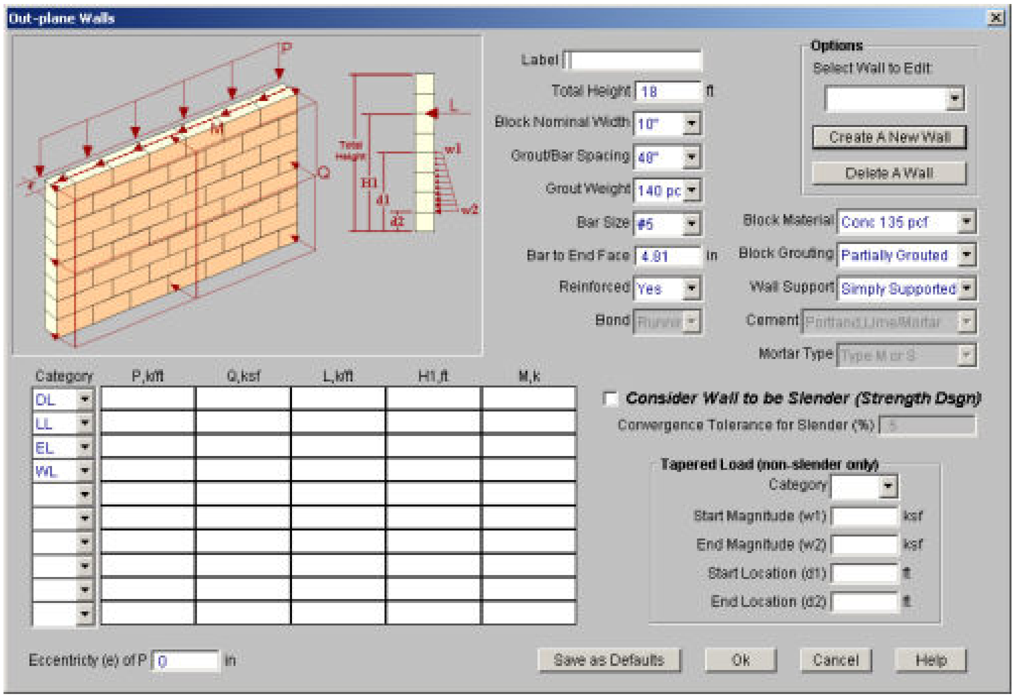
Allowable Stress Increase Factor

The user can also input an allowable stress increase factor under the ASIF column. The **ASIF** factor is for working stress design. This value is ignored for slender wall design.

Load Categories

There are seven categories of loads being supported in RISAMasonry: dead load (DL), live load (LL), wind load (WL), earthquake load (EL), roof live load (RLL), snow load (SL), and an additional “other load” (OL).

Out of Plane (Transverse) Walls



The displayed diagram provides a visual explanation of relevant data entry fields. The **Options** on the top right lets the user to Create a new wall and edit or delete an existing wall.

At the bottom of this window, there is a button to save the current data as the default data for all new elements. The **OK** button exits the beam/lintel dialog with save, while the **Cancel** button exits the dialog without saving the current element. The **Help** button provides help on beam/ lintel topics.

The design of **Slender Walls** can also be carried out in accordance with the *strength* design provisions of UBC and MSJC using this dialog.

Total Height

The total height of the wall is entered here. The effective height of the wall is calculated depending on the end restraint conditions.

Note

- Because the wall will be designed on a per foot basis, it is not necessary to enter in the width of the wall.

Block Nominal Width

The nominal width of the masonry block is selected here. The equivalent solid width is calculated as per the following table:

Nominal Block Width	Actual Effective Width
4 in.	3.625 in.
6 in.	5.625 in.
8 in.	7.625 in.
10 in.	9.625 in.
12 in.	11.625 in.

Grout/Bar Spacing

For Fully Grouted and Partially Grouted walls, select the center to center distance between vertical reinforcing. For partially grouted walls, only those cells with reinforcing will be assumed to have grout. This will be used for the calculation of the wall's effective properties.

For unreinforced walls, you may specify the center to center distance between grouted cells. This will be used for the calculation of the unreinforced wall's effective properties.

Grout Weight

The grout weight is used in calculating the dead weight of the wall. There is an option to choose between 140 and 105 pcf.

Bar Size

The standard deformed bar size can be selected from the drop down list. #11 is the maximum permitted reinforcement according to UBC 2107.2.2.1 or MSJC 1.12.2.1 for masonry.

Bar to End Face Distance

The distance from the centerline of the bar to the face of the wall can be entered here. This is an effective way to designate whether there will be one or two layers of reinforcement. When a single row of reinforcement is used, this value would simply be half of the masonry unit's effective width (assuming the bar is located at the center of the unit). If two rows of reinforcement are provided, this value would be the depth from the face of the wall to the center of the tensile reinforcement.

Reinforced

The program is capable of designing either reinforced or unreinforced masonry walls.

Note

- Slender Wall design is NOT available for unreinforced masonry.

Block Material

The block material is used in calculating the dead weight of the wall.

Block Grouting

Fully grouted, partially grouted or ungrouted walls can be designed in this version of RISAMasonry.

Wall Support

The wall can be designed as a simply supported, cantilevered or propped cantilevered element. The wall supports also affect the effective height of the wall:

End Condition	K Value
Simply Supported	1.0
Cantilevered	1.2
Pinned - Fixed	0.8

Cement

This drop box refers to the kind of mortar being used. Its redundant information for reinforced walls, but required for unreinforced construction (Table 2.2.3.2 MSJC; Table 21-I UBC 97).

Masonry Type

This drop box refers to the kind of mortar being used. Its redundant information for reinforced walls, but required for unreinforced construction (Table 2.2.3.2 MSJC; Table 21-I UBC 97).

Special Input for Slender Walls

Consider Wall to be Slender

The design of Slender Walls can also be carried out in accordance with the strength design provisions of UBC and MSJC using this dialog.

If this option is checked, then the convergence tolerance edit box is activated. This is tolerance for the iterative analysis.

The loads that can be entered for slender wall design are only lateral area loads and eccentric axial loads. This is to being done to be consistent with the provisions in the code (UBC 2108.2.4 and MSJC 3.2.5). Only exception being for the SHEAR strength calculation is done using the UBC 97 only.

Convergence Tolerance

This means that the displacements from one iteration to the next must vary by no more than this convergence tolerance for the solution to be considered converged. You may adjust this tolerance, but be careful! If you set this value too high, unstable models may falsely converge. It is not advisable to set this value above about 1 percent.

Wall Loading

Load Category

Select the Load Category (DL, LL, RLL, SL, WL, EL, or OL) for each applied load. These load categories will be combined and factored in the load combinations spreadsheet to develop the total loading on the wall.

Axial Load Magnitude (P)

Enter the distributed axial load applied at to top of the wall. Note: The self weight of the wall is automatically included and assigned to the DL load category.

Lateral Area Load (Q)

Enter the magnitude of the uniform lateral area load that is applied to the wall.

Lateral Line Load Magnitude (L) and Location (H1)

Enter the magnitude and locations of the uniform Lateral Line Loads that are applied to the wall.

Note

- This type of loading is not available for Slender walls.

Eccentricity of Axial Load (e)

The eccentricity can also be entered on a separate input field. This creates an applied moment at the top of the wall. If entered, this eccentricity will be applied to all axial loads. It is also used while calculating axial capacity of unreinforced walls for the MSJC 02 code (eqn 2-15).

Moment (M)

The moment caused by eccentric axial loads, and otherwise, can also be inputted under the M column. The units of moment are being shown as force units as it represents the applied moment per unit width of the wall.

Note

- This type of loading is not available for Slender walls.

Tapered Load (w1, w2) and Locations (H1, H2)

Tapered loads may be applied to non slender walls. This is especially effective for approximating the hydrostatic and soil pressure loads associated with retaining walls.

Out of Plane (Transverse) Wall Results

The detail report provides detailed information on the analysis and design of your transverse wall. The transverse wall detail report is arranged in the following basic sections: Input Data Echo, Force Diagrams, Code Check Summary, Applied Load Details, Design Details, and Load Combinations.

Echo of the Input Data

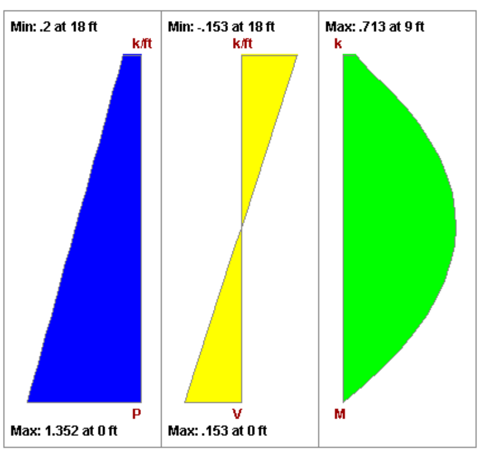
The first section of the detail report just echoes the Criteria, Materials and Geometry data entered by the user. An example is shown below:

CRITERIA		MATERIALS		GEOMETRY	
Code	: UBC97	Masonry f'm	: 1.5 ksi	Total Height	: 18 ft
Special Insp	: Yes	Masonry Em	: 1125 ksi	Blk Nom Width	: 10"
Reinforced	: Reinforced	Steel fy	: 60 ksi	Blk Grouting	: Partially Grouted
Slender	: No	Steel E	: 29000 ksi	Grt/Bar Spacing	: 48"
Bar Size	: #5	Blk Material	: Conc 115 pcf		
End Face Dist	: 4.81 in	Grt Weight	: 140 pcf		

Envelope Force Diagrams

The next section of the detail report plots the Axial, Shear, and Moment envelope diagrams for the solved Load combinations. The Maximum and Minimum values are reported along with the location along the length of the transverse wall where they occur. The locations are always measured from the bottom of the wall.

An example of this section is shown below:



Code Check Summary

The next section of the detail report gives a summary of the code checks. Examples of each section are shown below:

Combined Force Summary

The maximum overall code checks considering the effects of both bending and axial stresses are summarized in this section.

COMBINED CHECKS

fa/Fa + fb/Fb : .617

fs/Fs : 1.046

For unreinforced or ungrouted walls, the **Tensile Str Chk** is calculated in accordance with UBC 2107.3.5. p / (0.25*Pe) is calculated only for the MSJC code in accordance with
eqn 2-11.

COMBINED CHECKS	
fa/Fa + fb/Fb	: .174
Tensile Str Chk	: 2.493

Axial Summary

fa is the imposed axial stress on the wall at the section where the combined check (fa/Fa + fb/Fb) is maximum. Fa is the maximum allowable axial capacity of the wall.

AXIAL SUMMARY		
fa	: .011	ksi
Fa	: .295	ksi

Bending Summary

For reinforced walls, the maximum bending stress in the in the masonry is reported as (fb), and the allowable steel bending stress as (Fb). These values are given for the Load Combination and section that produce the maximum combined check (fa/Fa + fb/Fb).

The maximum bending stress in the in the flexural reinforcement is reported as (fs), and the allowable steel bending stress as (Fs). These values are given for the Load Combination and section that produce the maximum code check (fs/Fs).

BENDING SUMMARY		
fb	: .29	ksi
Fb	: .5	ksi
fs	: 25.101	ksi
Fs	: 24	ksi

For unreinforced walls, the allowable bending stress (Fb unreinforced) is the value of allowable tensile stress calculated in accordance with Table 21-I (UBC 97) and Table 2.2.3.2 (MSJC 02).

BENDING SUMMARY		
fb	: .072	ksi
Fb	: .5	ksi
Fb unreinforced	: .025	ksi

Shear Summary

The maximum shear stress on the beam is reported as (fv). The allowable shear stress is then reported as (Fv).

The bond stress is reported as (u), and the allowable bond stress as (U). This Bond Check is always performed at the maximum shear check location.

SHEAR CHECKS

fv/Fv	: .074	
u/U	: .351	

SHEAR SUMMARY

fv	: .003	ksi
Fv	: .039	ksi
u	: .07	ksi
U	: .2	ksi

Applied Load Details

This section of the detail report shows all the load that were applied to this Column and the Load Categories they were assigned to.

APPLIED LOADS DETAILS

Load Category	Pressure Load, Q Magnitude (ksf)	Axial Load,P Magnitude (k/ft)	Moment,M Magnitude (k)	Line Load,L Magnitude (k/ft)	Height, H1 (ft)
DL	0	0.12	0	0	0
LL	0	0.08	0	0	0
WL	0.017	0	0	0	0
EL	0	0	0	0	0
SL	0	0	0	0	0

Design Details

This section of the detail report gives more detailed information used for the calculation of the code checks. This includes a reporting of the maximum forces, the locations where they occurred and the load combination for which they occurred. The locations are always measured from the bottom of the transverse wall.

DESIGN DETAILS

AXIAL DETAILS			BENDING DETAILS			SHEAR DETAILS		
Max Axial	: .696	k/ft	Max Moment	: .713	k	Max Shear	: .153	k/ft
Location	: 9	ft	Location	: 9	ft	Location	: 0	ft
Load Comb	: 2		Load Comb	: 2		Load Comb	: 2	
Rad gyration r	: 3.33	in	k	: .23		Sh Wdth/c/c Reinf	48	in
h'/r	: 64.865		d	: 4.81	in			
Red Factor R	: .785		j	: .923				

Axial Details

The radius of gyration (r), the wall slenderness ratio (h'/r), and the reduction factor (R) are reported here. The effective height of the wall is based on the end conditions and on the wall height entered by the user.

The reduction factor (R) is used to reduce the allowable stresses for walls where slenderness and P-Delta become a design consideration. If the wall exceeds a certain h/t ratio, then the wall MUST be designed as a slender wall.

Bending Details

The ratio of the of the compressive depth to the overall member depth (k) is reported along with the ratio distance between the centroid of the compressive and tensile forces (j).

The value (d) represents the distance from the extreme compression fiber to the centroid of tension steel.

For partially grouted walls, the program performs a T-beam analysis when the depth of neutral axis exceeds the depth of the flange.

For unreinforced walls the net area (An) of the ungrouted block is reported along with its section modulus (Sx) and moment of inertia (Ix). These values are given on a per foot basis.

An/ft	: 33	in2
Ix/ft	: 567	in4
Sx/ft	: 117.8	in3

Shear Details

Shear width/c/c of reinf is the effective width per c/c of reinforcement that carries the shear in case of partially grouted walls.

Load Combinations.

This section of the detail report summarizes the load combinations that were solved for the Column Elements. An example of this section is shown below:

LOAD COMBINATIONS

LC	Label	ASIF	DL	LL	EL	WL	SL	RLL	OL
1	UBC 12-7	1	1	1	0	0	0	0	0
2	UBC 12-8 a	1	1	0	1	0	0	1	0

Out of Plane (Slender) Wall Results

The detailed reports for Slender out-plane walls are organized differently than all other elements. This is done to be more consistent with the iterative procedure given in the strength design codes. The slender wall detail report is arranged in the following basic sections: Input Data Echo, Applied Load Details, Design Details, Moment & Deflection Details, and Load Combinations.

Note

- All values shown under Sectional Properties, Results and Moment and Deflection Details are reported for a width equal to the center to center spacing of the reinforcement.

Echo of the Input Data

The first section of the detail report just echoes the Criteria, Materials and Geometry data entered by the user. An example is shown below:

CRITERIA		MATERIALS			GEOMETRY		
Code	: UBC97	Masonry f'm	: 1.5	ksi	Total Height	: 23.33	ft
Special Insp	: Yes	Masonry Em	: 1125	ksi	Blk Nom Width	: 8"	
Reinforced	: Reinforced	Steel fy	: 60	ksi	Blk Grouting	: Partially Grouted	
Slender	: Yes	Steel E	: 29000	ksi	Grt/Bar Spacing	: 40"	
Bar Size	: #6	Blk Material	: Conc 115 pcf		Conv Tol (%)	: .5	
End Face Dist	: 3.81 in	Grt Weight	: 140 pcf		Ecc(e) of P	: 7.3	in

Applied Load Details

This section of the detail report shows the entire load that were applied to this Column and the Load Categories they were assigned to. The other loads (Line Load, Applied Moment, and Tapered Load) are not considered for slender walls.

APPLIED LOADS DETAILS

Load Category	Axial Load,P Magnitude (k/ft)	Pressure Load,Q Magnitude (ksf)
DL	0.5	0
LL	0	0
WL	0	0.016
EL	0	0
SL	0	0

Section Properties

This portion of the detail report gives more detailed information on the section properties used in the iterative analysis procedure.

ALL RESULTS PER C/C OF REINFORCEMENT

SECTIONAL PROPERTIES							
Total Width	: 40	in	Agross	: 142.922in2	As	: .442	in2
Eff Width bw	: 8.375	in	Igross	: 1122.98in4	Ase	: .498	in2
Flange thick tf	: 1.25	in	Crack Moment Mcr	: 2.377 k-ft	Rho Gross(.0032)	: .001	
Effective Thick te	: 7.625	in	Icracked	: 129.338in4	Rho Struct (.0053)	: .003	

The center to center distance between reinforcing (Total width) and the effective width (which accounts for partially grouted walls) are both reported in this section. The flange thickness (tf) refers to the thickness at the face of the block whereas the effective thickness (te) refers to the overall depth of the block.

The gross area and moment of inertia are reported along with the cracking moment and the cracked moment of inertia.

The area of steel (As) and the effective area of steel (Ase) are reported, with the effective area based upon As + Pu/fy per the design procedure given in the code.

The gross steel ratio (rho gross) is calculated as the area of steel divided by the total area of the section.

The structural steel ratio (rho struct) is calculated as the area of steel divided by the total width times the effective depth (As/bd). This is limited to a maximum value of 0.5 * rho balanced.

Design Details

The program performs a service load analysis for determining the governing deflections. Simultaneously it also performs an ultimate load analysis (with factored loading) to determine the governing bending moments. A separate service load analysis is also run to determine the most critical value of axial loading. The load combination for each of these cases is displayed below the imposed and allowable capacity in the Design Details section of the report.

RESULTS

AXIAL DETAILS			BENDING DETAILS			DEFLECTION DETAILS		
fa/ Fa	: .435		Mu / phi*Mn	: .923		Delta_s Chk	: .875	
fa	: .026	k	Imposed Mom Mu	: 6.465	k-ft	Delta_s,Max	: 1.714	in
Fa	: .06	k	Mom Cap phi*Mn	: 7.003	k-ft	0.007*h Limit	: 1.96	in
Load Comb	: 1		Load Comb	: 2		Load Comb	: 2	

Axial Details

The radius of gyration (r), the wall slenderness ratio (h'/r), and the reduction factor (R) are reported here. The effective height of the wall is based on the end conditions and on the wall height entered by the user.

The reduction factor (R) is used to reduce the allowable stresses for walls where slenderness and P-Delta become a design consideration. If the wall exceeds a certain h/t ratio, then the wall MUST be designed as a slender wall.

Bending Details

The ratio of the compressive depth to the overall member depth (k) is reported along with the ratio distance between the centroid of the compressive and tensile forces (j).

The value (d) represents the distance from the extreme compression fiber to the centroid of tension steel.

Shear Details

The center to center spacing of the shear reinforcement is reported along with the perimeter of the reinforcing bars used in the calculation allowable bond stress.

Moment and Deflection Details

A summary of results for each load combination (both service and factored) is provided in the section on Moment and Deflections Details. It gives the calculated imposed moment and corresponding deflection, along with the number of iterations which the program took to obtain those results.

MOMENT AND DEFLECTION DETAILS

Load Comb	Service Mom Ms, k-ft	Service Deflection Delta_s, in	Service Iterations	Factored Mom Mu, k-ft	Factored Deflection Delta_u, in	Factored Iterations
1	.519	.04	3	.257	.02	3
2	4.667	1.714	5	6.465	2.937	5
3	.519	.04	3	.519	.04	3

Load Combinations.

This section of the detail report summarizes the load combinations that were solved for the Column Elements. An example of this section is shown below:

LOAD COMBINATIONS

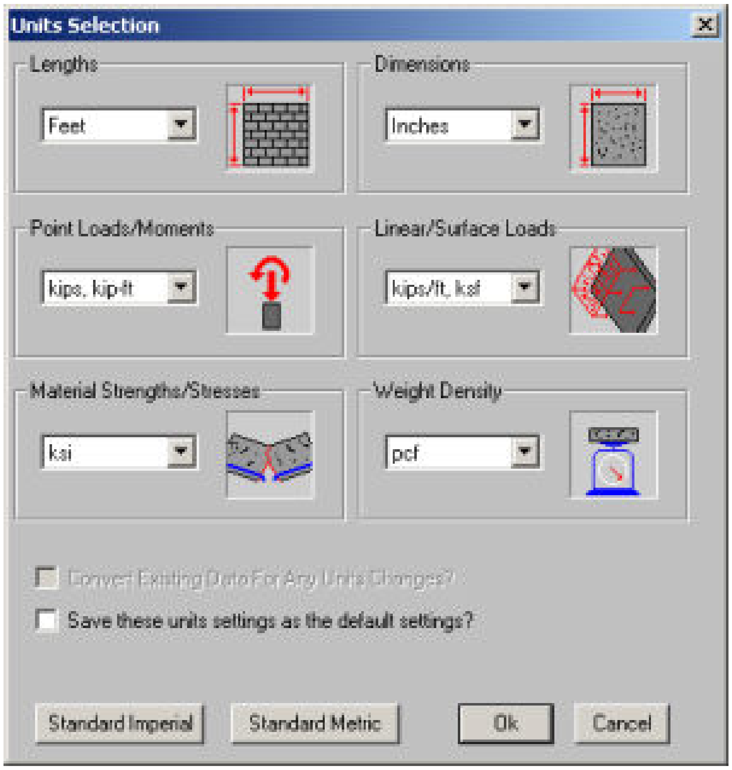
LC	Label	ASIF	DL	LL	EL	WL	SL	RLL	OL
1	UBC 12-7	1	0.5	0.5	0	0	0	0	0
2	UBC 12-8 a	1	0.9	0	1.43	0	0	0	0
3	UBC 12-8 b	1	1	0	0	0	0	0	0

Solution

After completing the input data on all relevant windows, the solution can be performed by selecting Solve from the main menu or pressing the Solve button.

Result windows would be displayed for all element categories which have been defined in the current file. The user can open more than one window for the same category by choosing the relevant element from the Results menu.

Units



RISAMasonry can work with Imperial (Kips, inches, etc.) or metric (KN, meters, etc.) units, or a combination of the two. To change the units system between entering elements in any category, click Units on the main menu, or click the "Units" button.

Converting Units

As a strong and important feature, all existent data can be converted to the new units using the Convert Existing Data For Any Units Changes check box.

Units Options

Standard imperial and metric units systems can be applied by a single click on the respective button on the bottom left of the Units window.

Save these units settings as the default settings allows the program to remember the specified system of units for any new project files that are created.

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