LoadHelper 2.0

User's Guide

Updated: 8/27/2024

LoadHelper 2 User's Guide

Table of Contents

1 Help Topics

1.1 Welcome to LoadHelper 2

LoadHelper is used to define project loading requirements from dead, live, wind, and seismic sources as required by ASCE/SEI 7-16, Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

In addition to being run as a standalone application, some features of LoadHelper are integrated within VisualAnalysis. See the Integration with IES Programs page for details.

Getting Started

- Feature List
- Program Layout
- Upgrade Guide (what's new)
- FAQ Answers at iesweb.com for business, licensing, installation issues.

Help Notation

Menu items appear like this: **File | New**.

Keystrokes or mouse commands appear like this: ***Shift+Click***.

Disclaimer

LoadHelper is a proprietary computer program of Integrated Engineering Software (IES, Inc.) of Bozeman, MT. This product is intended for use by licensed, practicing engineers who are educated in structural engineering, students in this field, and related professionals (e.g. Architects, Building Inspectors, Mechanical Engineers, etc.). Although every effort has been made to ensure the accuracy of this program and its documentation, IES, Inc. does not accept responsibility for any mistake, error, or misrepresentation in, or as a result of, the usage of this program and its documentation. (Though we will make every effort to ensure that problems that we can correct are dealt with promptly.) The results obtained from the use of this program should not be substituted for sound engineering judgment.

License and Copy Restrictions

The LoadHelper program is the copyrighted property of IES, Inc. and is provided for the exclusive use of each user. By installing LoadHelper on your computer, you become a registered user of the software. LoadHelper is currently offered as a free application; however, we reserve the right to change the licensing model at any time. All other applicable license and copy restrictions of IES, Inc. apply.

IES, Inc.

Integrated Engineering Software, Inc.
3740 Equestrian Ln Unit 1
Bozeman, MT 59718
Sales or Licensing: 406-586-8988, sales@iesweb.com
Technical Support: support@iesweb.com

1.2 Key Features

Dead and Live Loads

- Use predefined ASCE 7 material weights to assemble a group of components with a combined weight.
- Loads are saved to a user database to be used across several project files or applied directly to your VisualAnalysis model.

Wind Loads

- Perform ASCE 7 Wind Calculations using Chapter 27, Wind Loads on Buildings: Main Wind Force Resisting System (Directional Procedure – All Heights).
- Calculations performed for each cardinal direction.

Seismic Loads

- Perform ASCE 7 Seismic Calculations using Chapter 11, Seismic Design Criteria, and Chapter 12, Seismic Design Requirements for Building Structures.
- Lookup site specific parameters (Ss, S1, TL) using latitude and longitude coordinates.

Reporting

- Customize reports to include only the necessary tables and information
- Print Preview mode while working with reports
- Print to any printer including PDF
- Export reports to .doc or .xlsx

General

- Standard Windows interface for easy navigation
- Work in any unit system, perform math on input, and use custom unit 'styles'
- Program is self-documenting with tooltips on commands and input parameters
- Free Training Videos provided for learning efficiency
- Free technical support email with quick responses

Be a Squeaky Wheel

If you need a new feature, please let us know. We are always looking for ways to improve products in ways that you desire. See Support Resources.

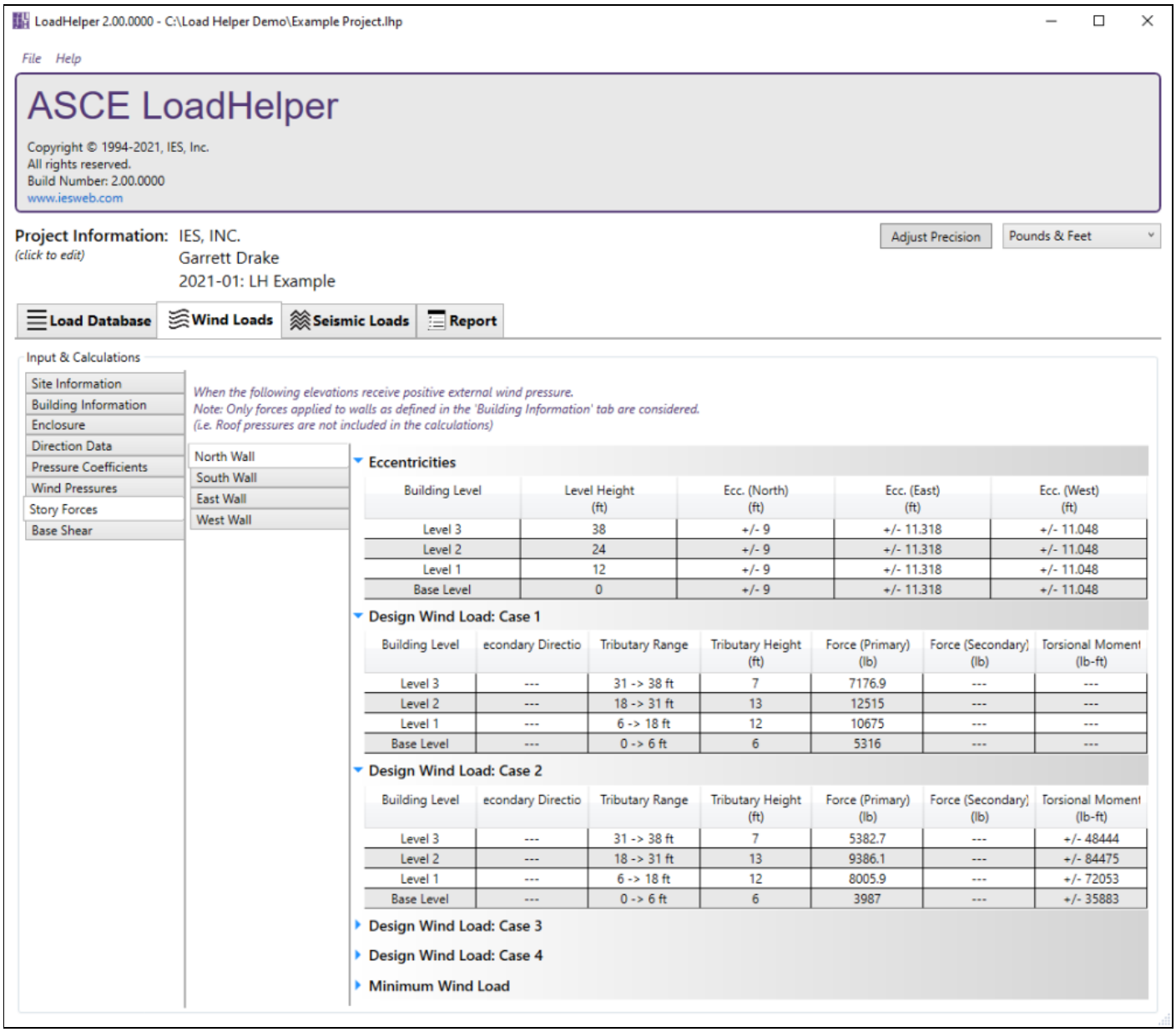
1.3 Program Layout

Explore

The best way to learn LoadHelper is to explore the program and try things yourself. Get to know what is available under each button or menu. Also, check out the tutorial videos.

Screen Layout

The image below introduces the program terminology used in this help file and the training videos. Hold your mouse over the screen image below for information about each area of the program.



Title Bar and Menu

File commands such as New, Open, Save, and Exit can be found here. Recent project files as well as the Help documentation can also be found here.

Project Information

Set project specific information, such as the Company, Engineer, Project Name, and Project Number. Note that the Company and Engineer value are stored and used in future instances of LoadHelper.

Load Tabs

These views are where you can work on the load specific information for the project. Data defined on each tab does not affect any other Load Tab within the program. In other words, each Load Tab is independent of every other Load Tab in the project.

Units & Precision

LoadHelper can display physical quantities in a variety of unit-systems. Select the unit system to use for all the displayed values and adjust the precision (number of decimal places) using the controls in the upper right corner.

Data Entry: Physical Quantities

Values may be input in any unit: enter any number or math expression followed by a known unit abbreviation. Length units may be entered in the "ft-in-16ths" notation. Entered values are converted and then redisplayed in the current 'display' units.

1.4 Release History

- Version 2.0 released July 2021
- Version 1.0 released April 2017 as a built-in utility in VisualAnalysis 17.0

Version 2.0 Features

- Added Wind and Seismic load modules
- Converted to a stand-alone application
    - Note, select features remain available within VisualAnalysis as a built-in utility.

Version 1.0 Features

- Dead and Live load modules
- Integration into VisualAnalysis 17 as a built-in utility

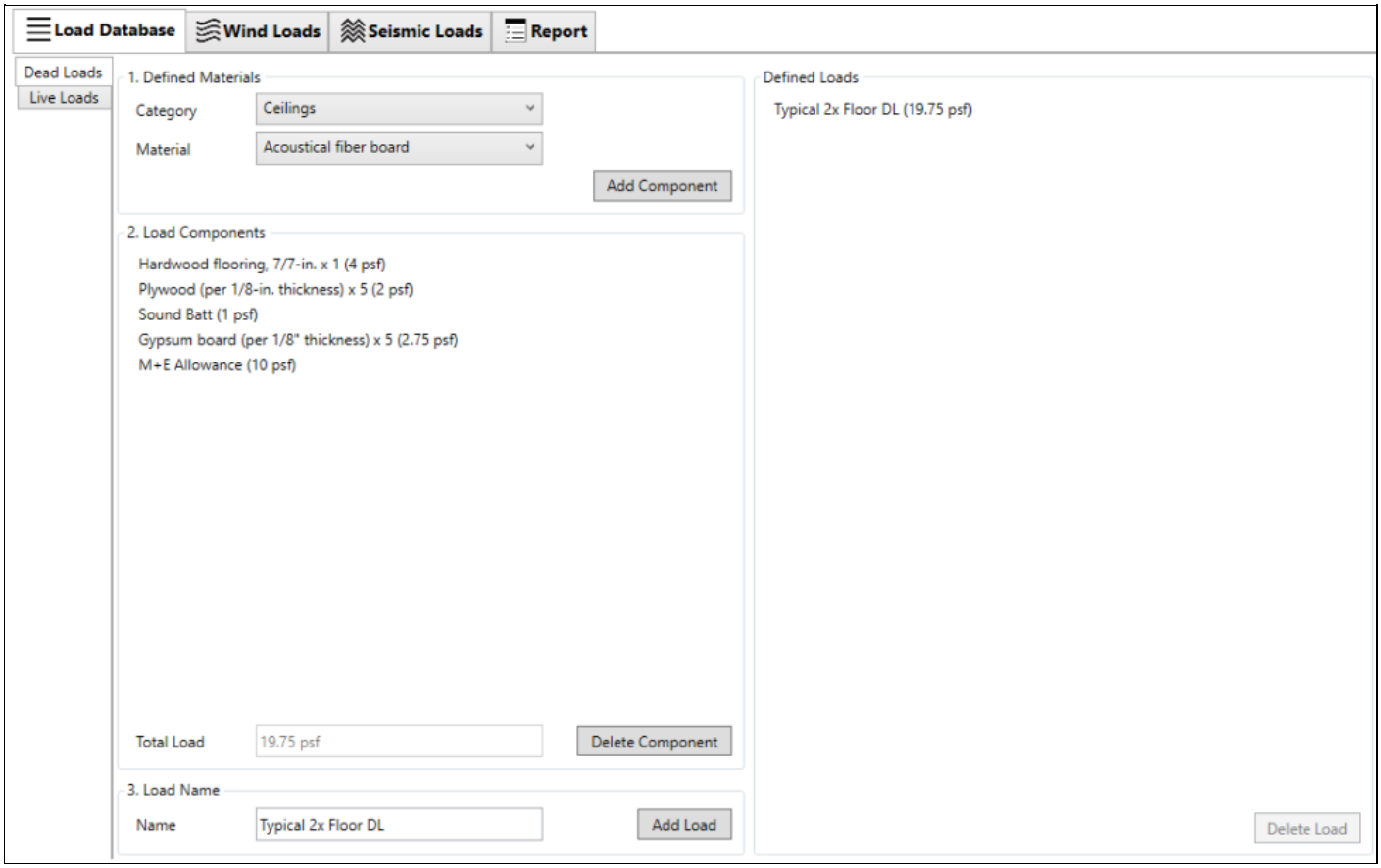
1.5 Dead Loads

The Dead Load module is designed to assist in creating custom Dead Loads that are common throughout your project. To define Dead Load assemblies, follow the steps below.

1. Select a predefined *Category* and *Material* from the 'Defined Materials' section.
2. Add the material component to the 'Components' list. Continue adding materials to the Components List until the load assembly is complete.
3. Provide a descriptive name for the load, then add it to the list of defined loads.

You may select any of the Defined Loads to see their individual load components should you need to remove or add to their definition.

The defined dead loads will be saved in a UserLoads.xml file located in the IES Customer data folder, allowing you to reuse the loads from project to project, as well as apply them to model objects in VisualAnalysis.

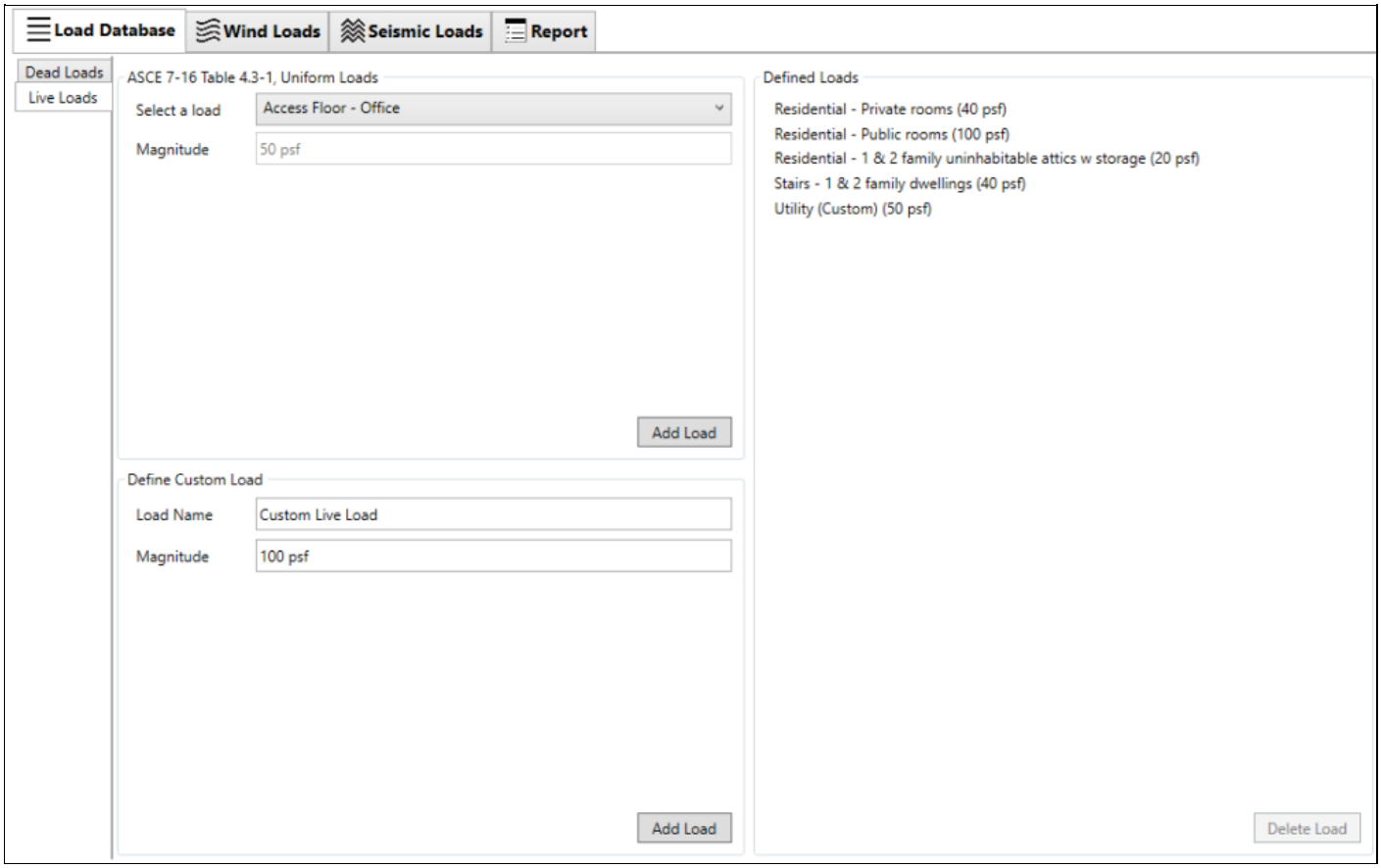


1.6 Live Loads

The Live Load module is designed to assist in creating Live Load definitions that are common throughout your project. To define Live Load assemblies, follow the steps below.

1. Select a predefined ASCE 7-16 Live Load or create a Custom Live Load.
2. Add the load to the list of defined loads.

The defined live loads will be saved in a UserLoads.xml file located in the IES Customer data folder, allowing you to reuse the loads from project to project, as well as apply them to model objects in VisualAnalysis.



1.7 Wind Loads

The Wind Load module performs wind calculations per ASCE 7-16, using Chapters 26 and 27 (Directional Procedure – All Heights). Below is summary of the user inputs, as well as a discussion of the calculations that are performed.

> The wind load data is saved with the project file (.lhp) and does not persist from project to project as with the dead and live loads.
>
> Data defined on the wind load tab does not affect any other load tabs within the program.

User Input

Site Information

Site Information

Specification - The ASCE 7 specification used for the wind calculations.

Basic Wind Speed - The basic wind speed in miles per hour, as defined in ASCE 7 for the project location.

Directionality Factor, Kd - The wind directionality factor, per Section 26.6.

Site Elevation - The ground elevation above sea level.

Ground Elevation Factor, Ke - Select how to use the ground elevation factor, per Section 26.9. When set to 'Ignore', Ke = 1.0

Building Information

Building Dimensions

Plan North-South Dimension - The building plan dimension in the North/South direction.

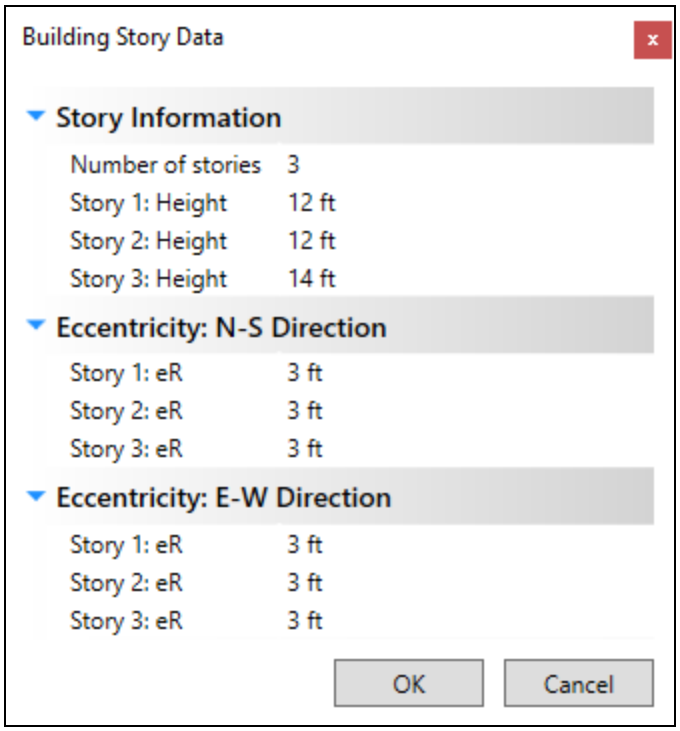
Plan East-West Dimension - The building plan dimension in the East/West direction.

Mean Roof Height - The value to use for the mean roof height in the wind calculations.

Story Information

Define Story Levels - Add, Edit, or Remove building stories from the calculation.

Include force at ground? - Should the forces tributary to the ground be included when determining the Wind Base Shear?



Enclosure

Enclosure Mode

Mode - The method used to determine the building enclosure. When set to 'Calculate', the enclosure for each direction is calculated per the definitions provided in Section 26.2.

Enclosure (Calculate)

North/South/East/West Wall - Enter the gross area, Ag, and total area of openings, Ao, for the walls in each cardinal direction.

Roof - Enter the gross area, Ag, and total area of openings, Ao, for the roof.

Building, Aog - The total area of openings in the building envelope as entered.

Enclosure (Override)

North/South/East/West - Enter the enclosure classification of the building for each direction. Note that the direction identified is when the corresponding building elevation receives positive external pressure.

Large Volume Information	**Large Volume Factor, Ri -** Select how to use the large volume factor, Ri. When set to 'Ignore', Ri = 1.0 **Aog -** The total area of openings in the building envelope. **Vi -** The unpartitioned internal volume.

Direction Data

Exposure	**Upwind Exposure -** The upwind exposure for the wind direction under consideration.
Building Flexibility	**Building Flexibility -** The building flexibility for the wind direction under consideration.
Gust Factor (Rigid Building)	**User G = 0.85? -** Should the gust factor be set to 0.85? Otherwise, the gust factor for rigid buildings will be calculated per Section 26.11.4.
Gust Factor (Flexible Building)	**Fundamental natural frequency, $\eta 1$ -** The fundamental natural frequency of the building in the wind direction under consideration. **Damping ratio, β -** The damping ratio, percent critical for the building in the wind direction under consideration (e.g. for 2% damping, enter 0.02).
Topographic Factor	**Topographic Factor, Kzt -** Select how to use the topographic factor, Kzt. When set to 'Ignore', Kzt = 1.0 **Hill Type -** The hill, ridge, or escarpment type to use when calculating Kzt. **H -** The height of the hill or escarpment relative to the upwind terrain. **Lh -** The distance upwind from the crest to where the difference in ground elevation is half the height of the hill or escarpment. **x -** The distance, upwind or downwind, from the crest to the building site. Positive values = Downwind of crest. Negative values = Upwind of crest.
Roof Pressure Coefficients	**Number of regions -** The number of regions to calculate roof pressure values in the wind direction under consideration. **Region 1: Cp -** The Cp values for the roof region in the wind direction under consideration. **Region 2: Cp -** The Cp values for the roof region in the wind direction under consideration. **... etc.**

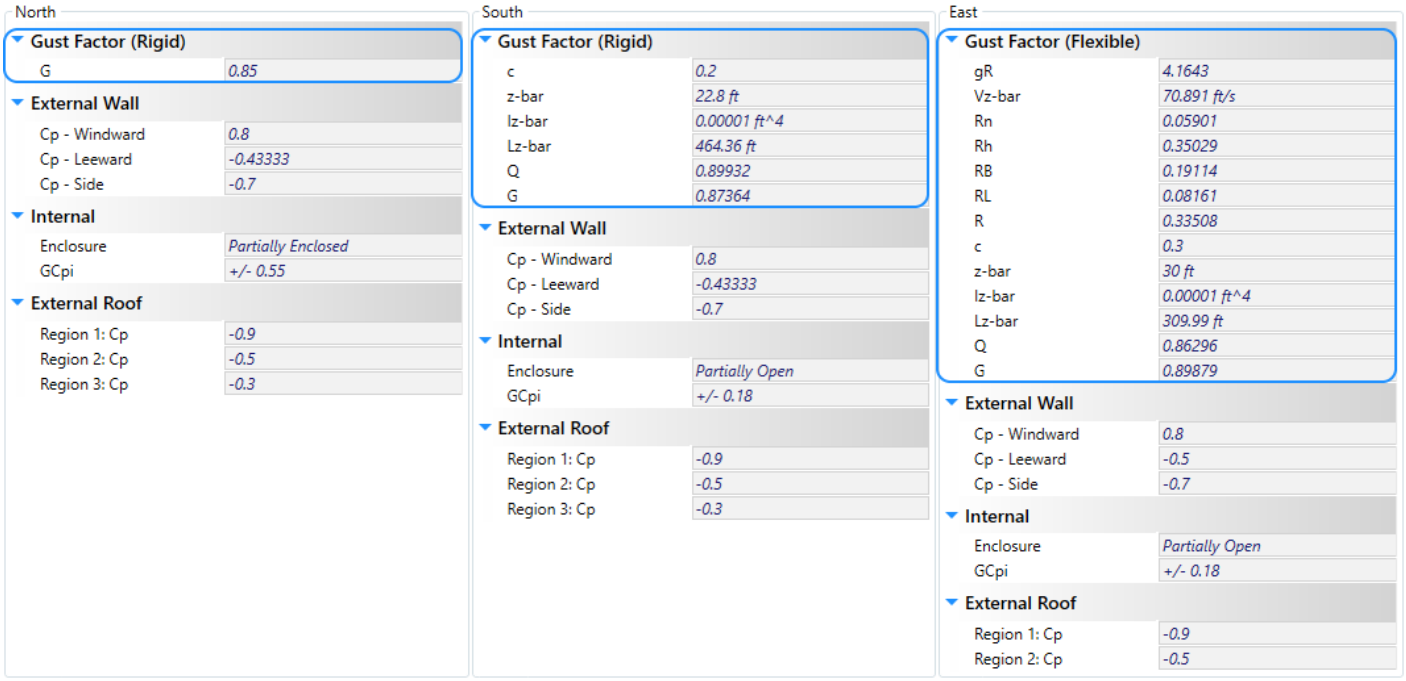
Calculated Values

Pressure Coefficients

The Pressure Coefficients tab shows the results of the calculations for the Gust Factor, per Section 26.11, the External Wall Pressure Coefficients, Cp, per Figure 27.3-1, and the results of the Enclosure Classification and the resulting GCpi value per Table 26.13-1. The External Roof Pressure Coefficients, which are user entered values as described above, are repeated here for convenience.

Three options are available to determine the Gust Factor, as shown in the table and image below. Note that intermediate values that are required to calculate G are also provided.

Building Flexibility	Use G = 0.85 ?	Reference
Rigid	Yes	26.11.1
Rigid	No	26.11.4
Flexible	---	26.11.5



Wind Pressures

The Wind Pressures tab shows the resulting wind pressures on the windward, leeward, side, and roof surfaces for each direction. The pressures on the windward wall vary with height and are shown at 5-ft increments, along with values at each level height of the structure. Additionally, the pressure values are calculated using both a positive and negative internal pressure (+/- GCpi).

When the following elevations receive positive external wind pressure.

North Wall
South Wall
East Wall
West Wall

K Factors

Directionality factor, Kd	*0.85*
Ground elevation factor, Ke	*0.83953*
Topographic factor, Kzt	*1*

Windward Wall Pressures

Height above base (ft)	Kz	qz (psf)	p (+internal pressure) (psf)	p (-internal pressure) (psf)
38	0.74954	16.568	2.1539	20.379
35	0.73214	16.183	1.8922	20.117
30	0.70059	15.486	1.4181	19.643
25	0.66503	14.7	0.88355	19.109
24	0.65732	14.53	0.76764	18.993
20	0.62395	13.792	0.26614	18.491
15	0.57472	12.704	-0.47391	17.751
12	0.57472	12.704	-0.47391	17.751
10	0.57472	12.704	-0.47391	17.751
5	0.57472	12.704	-0.47391	17.751
0	0.57472	12.704	-0.47391	17.751

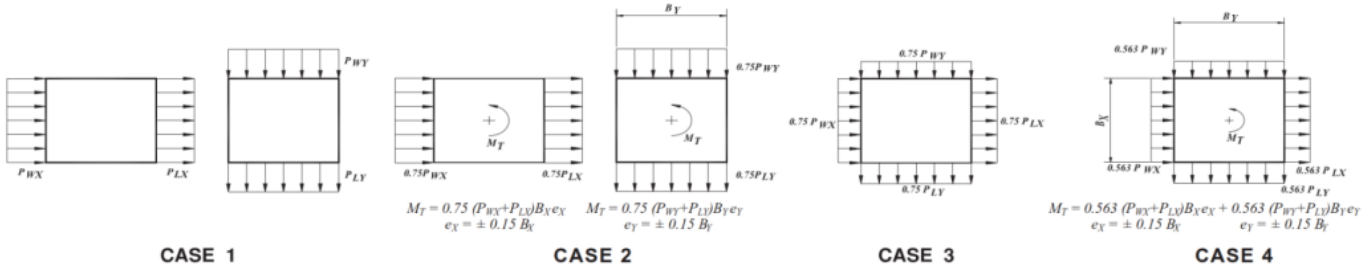
Leeward, Side, & Roof Pressures

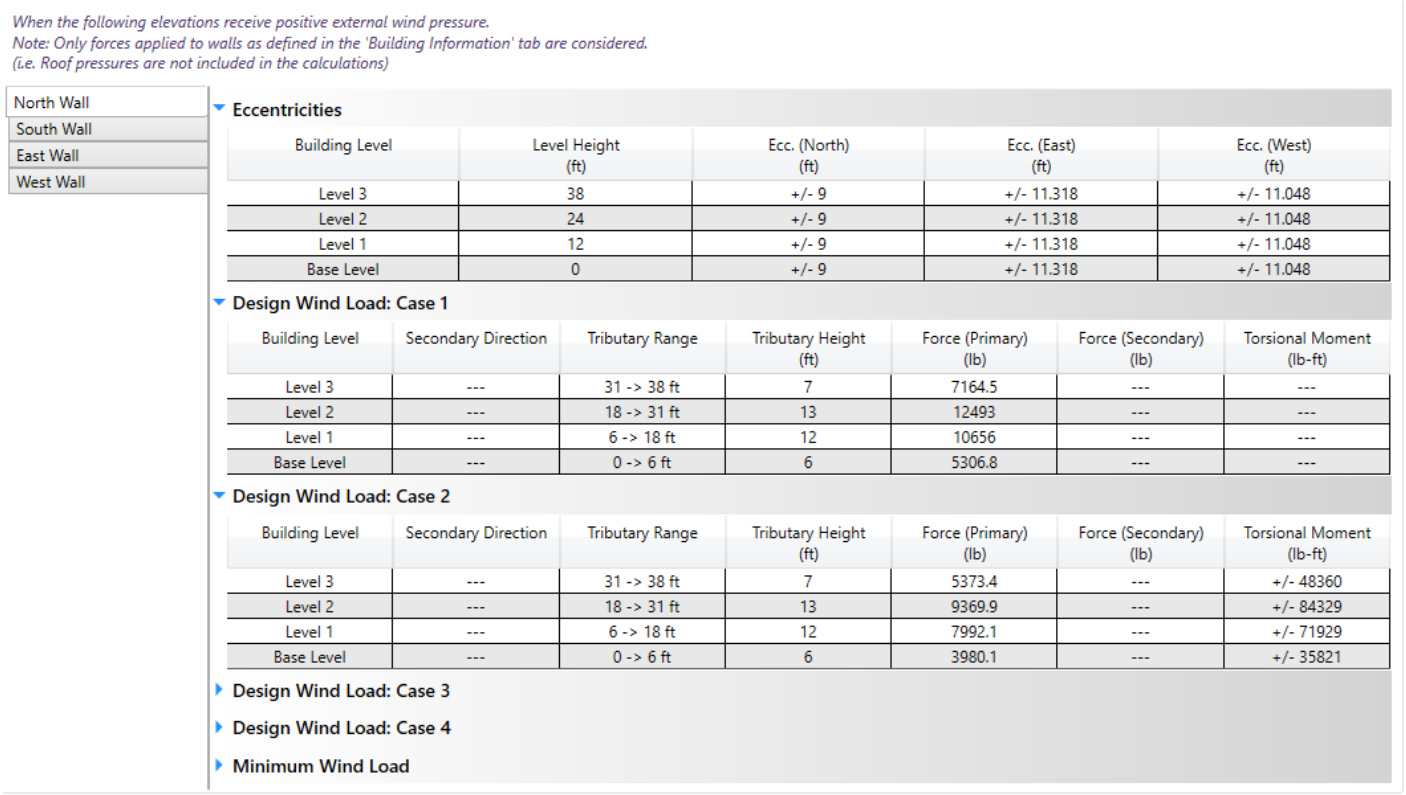
Surface	p (+internal pressure) (psf)	p (-internal pressure) (psf)
Leeward Wall	-15.215	3.0099
Side Wall	-18.971	-0.74557
Roof: Region 1	-21.787	-3.5622
Roof: Region 2	-16.154	2.071
Roof: Region 3	-13.337	4.8876

Story Forces

The Story Forces tab shows the resulting wind force attributed to each level of the building according to Design Wind Load Cases defined in Figure 27.3-8. In addition to the design wind load cases, the Minimum Design Wind Load per Section 27.1.5 is also calculated.

The story forces are calculated by summing the design wind load pressures acting on the respective surfaces multiplied by the perpendicular structure width and height tributary to each level.





When the following elevations receive positive external wind pressure.
Note: Only forces applied to walls as defined in the 'Building Information' tab are considered.
(i.e. Roof pressures are not included in the calculations)

North Wall
South Wall
East Wall
West Wall

Eccentricities

Building Level	Level Height (ft)	Ecc. (North) (ft)	Ecc. (East) (ft)	Ecc. (West) (ft)
Level 3	38	+/- 9	+/- 11.318	+/- 11.048
Level 2	24	+/- 9	+/- 11.318	+/- 11.048
Level 1	12	+/- 9	+/- 11.318	+/- 11.048
Base Level	0	+/- 9	+/- 11.318	+/- 11.048

Design Wind Load: Case 1

Building Level	Secondary Direction	Tributary Range	Tributary Height (ft)	Force (Primary) (lb)	Force (Secondary) (lb)	Torsional Moment (lb-ft)
Level 3	---	31 -> 38 ft	7	7164.5	---	---
Level 2	---	18 -> 31 ft	13	12493	---	---
Level 1	---	6 -> 18 ft	12	10656	---	---
Base Level	---	0 -> 6 ft	6	5306.8	---	---

Design Wind Load: Case 2

Building Level	Secondary Direction	Tributary Range	Tributary Height (ft)	Force (Primary) (lb)	Force (Secondary) (lb)	Torsional Moment (lb-ft)
Level 3	---	31 -> 38 ft	7	5373.4	---	+/- 48360
Level 2	---	18 -> 31 ft	13	9369.9	---	+/- 84329
Level 1	---	6 -> 18 ft	12	7992.1	---	+/- 71929
Base Level	---	0 -> 6 ft	6	3980.1	---	+/- 35821

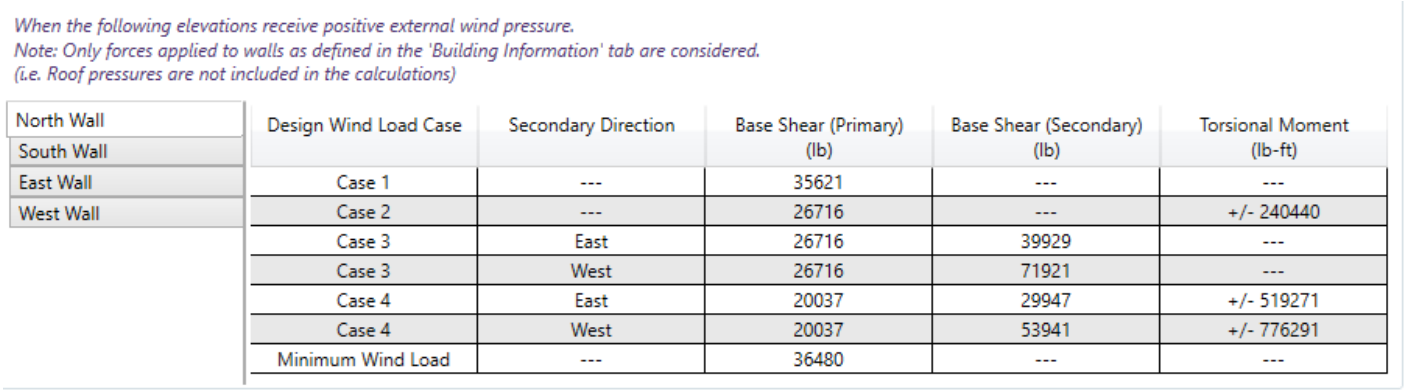
Design Wind Load: Case 3

Design Wind Load: Case 4

Minimum Wind Load

Base Shear

The Base Shear tab shows the result of the summation of story forces down to the base of the structure for each Design Wind Load Case.



When the following elevations receive positive external wind pressure.
Note: Only forces applied to walls as defined in the 'Building Information' tab are considered.
(i.e. Roof pressures are not included in the calculations)

North Wall
South Wall
East Wall
West Wall

Design Wind Load Case	Secondary Direction	Base Shear (Primary) (lb)	Base Shear (Secondary) (lb)	Torsional Moment (lb-ft)
Case 1	---	35621	---	---
Case 2	---	26716	---	+/- 240440
Case 3	East	26716	39929	---
Case 3	West	26716	71921	---
Case 4	East	20037	29947	+/- 519271
Case 4	West	20037	53941	+/- 776291
Minimum Wind Load	---	36480	---	---

1.8 Seismic Loads

The Seismic Load module is designed to perform seismic calculations per ASCE 7-16, using Chapters 11 and 12. Below is summary of the user inputs, as well as a discussion of the calculations that are performed.

> The seismic load data is saved with the project file (.lhp) and does not persist from project to project as with the dead and live loads.
>
> Data defined on the seismic load tab does not affect any other load tabs within the program.

User Input

Site Information

Risk Category

Risk - The structure's risk category as determined from Table 1.5-1

Site Information

Specification - The ASCE 7 specification used for the seismic calculations.

Site Class - The classification assigned to the site based on the types of soils present, as defined in Chapter 20.

Lat/Long Search - Search for Ss, S1, and TL values using latitude and longitude coordinates. This feature uses the USGS Seismic Design Maps Web Services and the 2016 ASCE 7 Standard End Point. More information on the USGS Web Services can be found at https://earthquake.usgs.gov/ws/

Ss, g - The mapped MCE_R spectral response acceleration parameter at short periods.

S1, g - The mapped MCE_R spectral response acceleration parameter at a period of 1-second.

Long Period Transition, TL - The mapped long-period transition period.

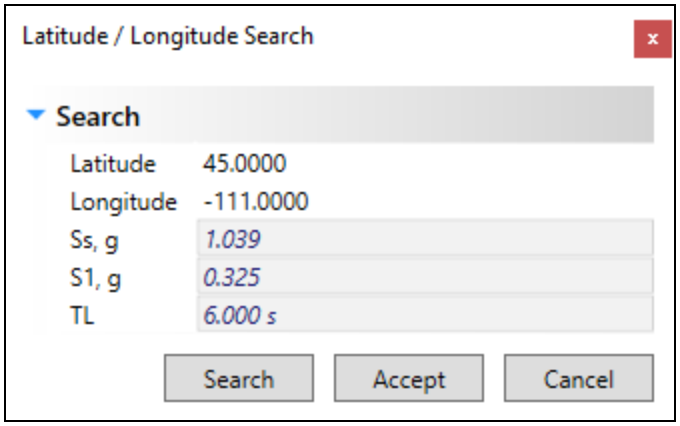
Determine SDC from SDs only? - Should the Seismic Design Category be chosen from the SDs value only? The user must verify that the criteria of Section 11.6 is met prior to changing this setting.

Override Fa - Should the short-period site coefficient be overridden?

Fa Override - The value to use for short-period site coefficient if overridden.

Override Fv - Should the long-period site coefficient be overridden?

Fv Override - The value to use for long-period site coefficient if overridden.



Seismic Force System

Seismic

Has Structural Irregularity - Does the structure have an irregularity as defined in Section 12.3.2?

Force Resisting System	**Response Coefficient, R -** The response modification coefficient for the seismic force resisting system.
	Deflection Amplification, Cd - The deflection amplification factor for the seismic force resisting system.
	X, Y, Z Overstrength - The overstrength factor for the seismic force resisting system in the X, Y, and Z-directions.
	X, Y, Z Redundancy - The redundancy factor for the seismic force resisting system in the X, Y, and Z-directions.

Building Information

Building Information	**Number of stories -** The total number of stories in the structure.
	Building Height - The total height of the structure. (read only)
	Seismic Weight - The total effective seismic weight of the structure. (read only)
Building Heights	**Story 1: Height -** The height of the first level within the structure.
	Story 2: Height - The height of the second level within the structure.
	etc...
Building Weights	**Story 1: Weight -** The portion of the total effective seismic weight attributed to the first level.
	Story 2: Weight - The portion of the total effective seismic weight attributed to the second level.
	etc...

Building Period - Approximate Method (Equation 12.8-7)

Approximate Method	**CT -** The building period coefficient.
	x - The building period exponent value.

Building Period - Concrete/Steel Moment Frame Method (Equation 12.8-8)

For structures not exceeding 12 stories above the base as defined in Section 11.2 where the seismic force-resisting system consists entirely of concrete or steel moment-resisting frames and the average story height is at least 10-ft, equation 12.8-8 may be used to determine the approximate fundamental period.

Building Period - Masonry/Concrete Shear Wall Structures Method (Equation 12.8-9)

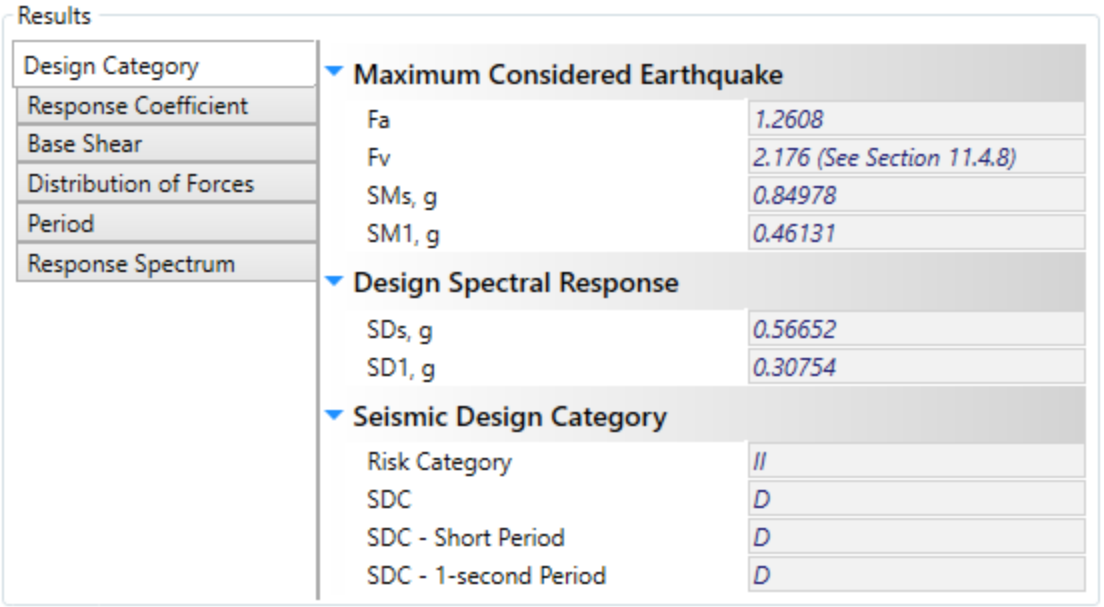
Masonry/Concrete Shear Wall Structures	**Base Area -** The area of the base of the structure.
	Wall sets - The number of shear wall sets within the structure. Each shear wall set should contain one or more walls with the same web area and length.
	Total shear walls - The total number of shear walls to consider as part of the Cw factor. (read only)
	Total web area of shear walls - The sum of web areas of all shear walls. (read only)
	Total length of shear walls - The sum of wall lengths of all shear walls. (read only)
Number of walls	**Set 1: Number of walls -** The number of individual shear walls associated in Set 1.

PER SET	**etc...**
Shear wall web area PER WALL	**Set 1: Web area per wall -** The shear wall web area of each wall in Set 1. For walls with varying web areas, add more Wall Sets. **etc...**
Shear wall length PER WALL	**Set 1: Length per wall -** The shear wall length of each wall in Set 1. For walls with varying length, add more Wall Sets. **etc...**

Calculated Values

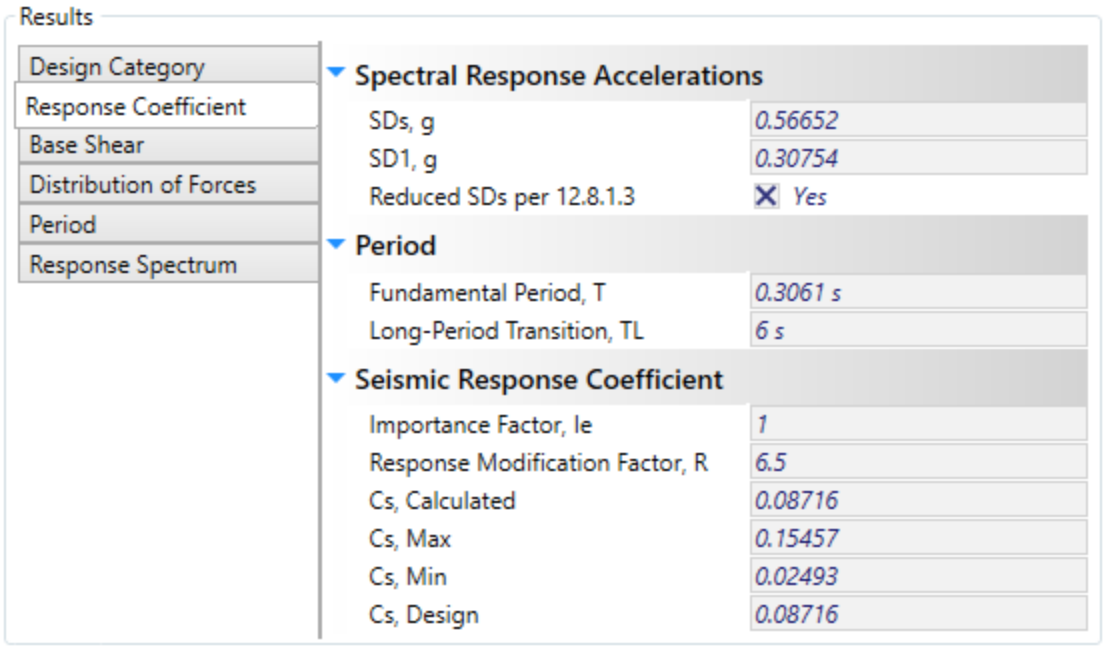
Design Category

The Design Category tab shows the results of the calculations required to determine the seismic design category of the structure per Section 11.6.



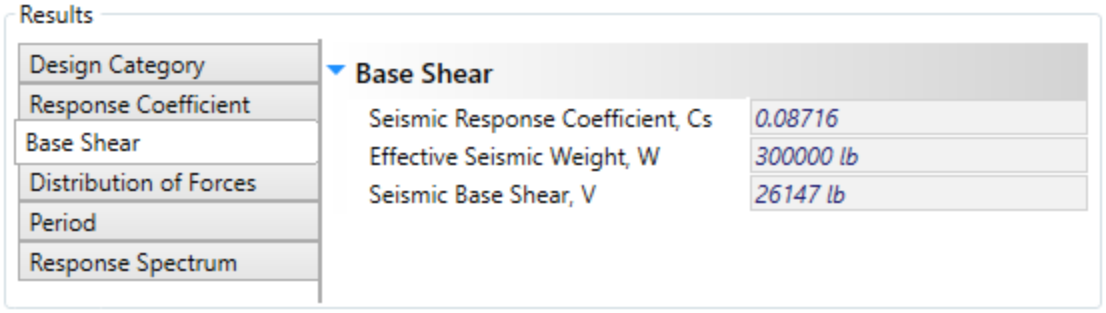
Response Coefficient

The Response Coefficient tab shows the results of the calculations required to determine the seismic response coefficient, Cs, per Section 12.8.1.1.



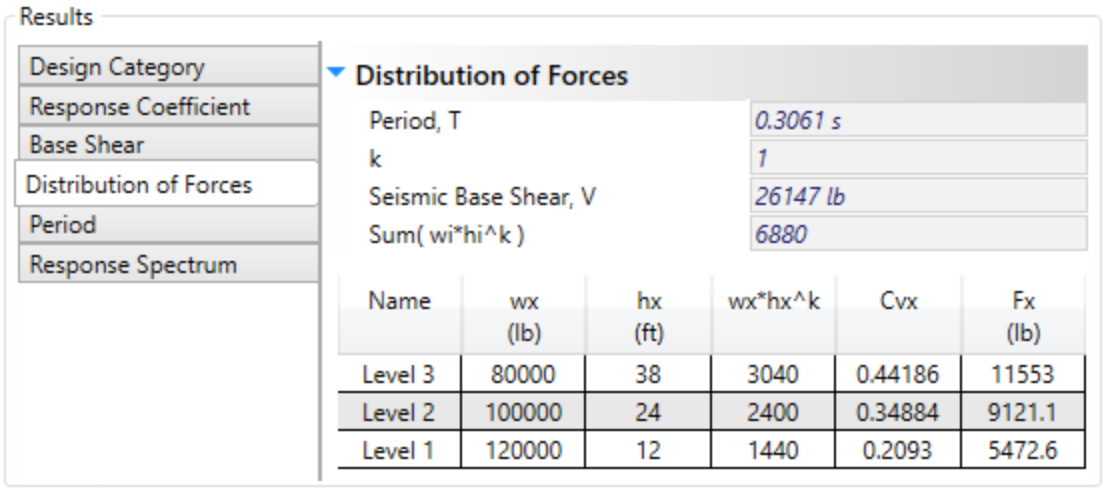
Base Shear

The Base Shear tab shows the results of the calculations required to determine the seismic base shear, V, per Section 12.8.1.



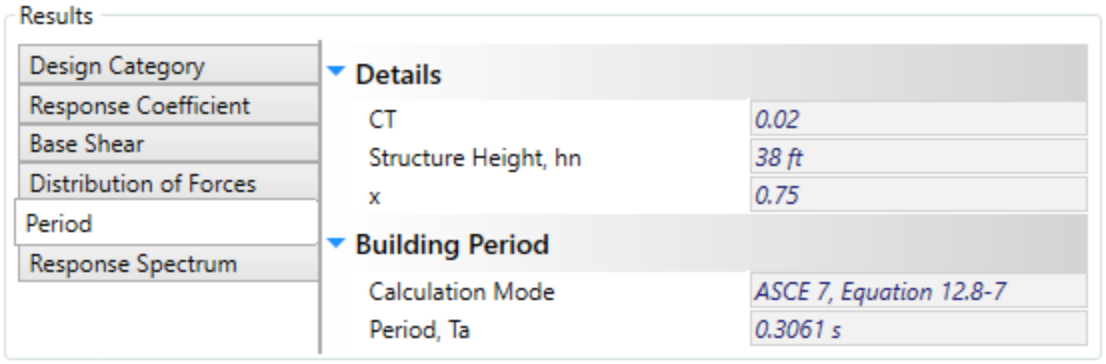
Distribution of Forces

The Distribution of Forces tab shows the results of the calculations required to determine the vertical distribution of seismic forces per Section 12.8.3.



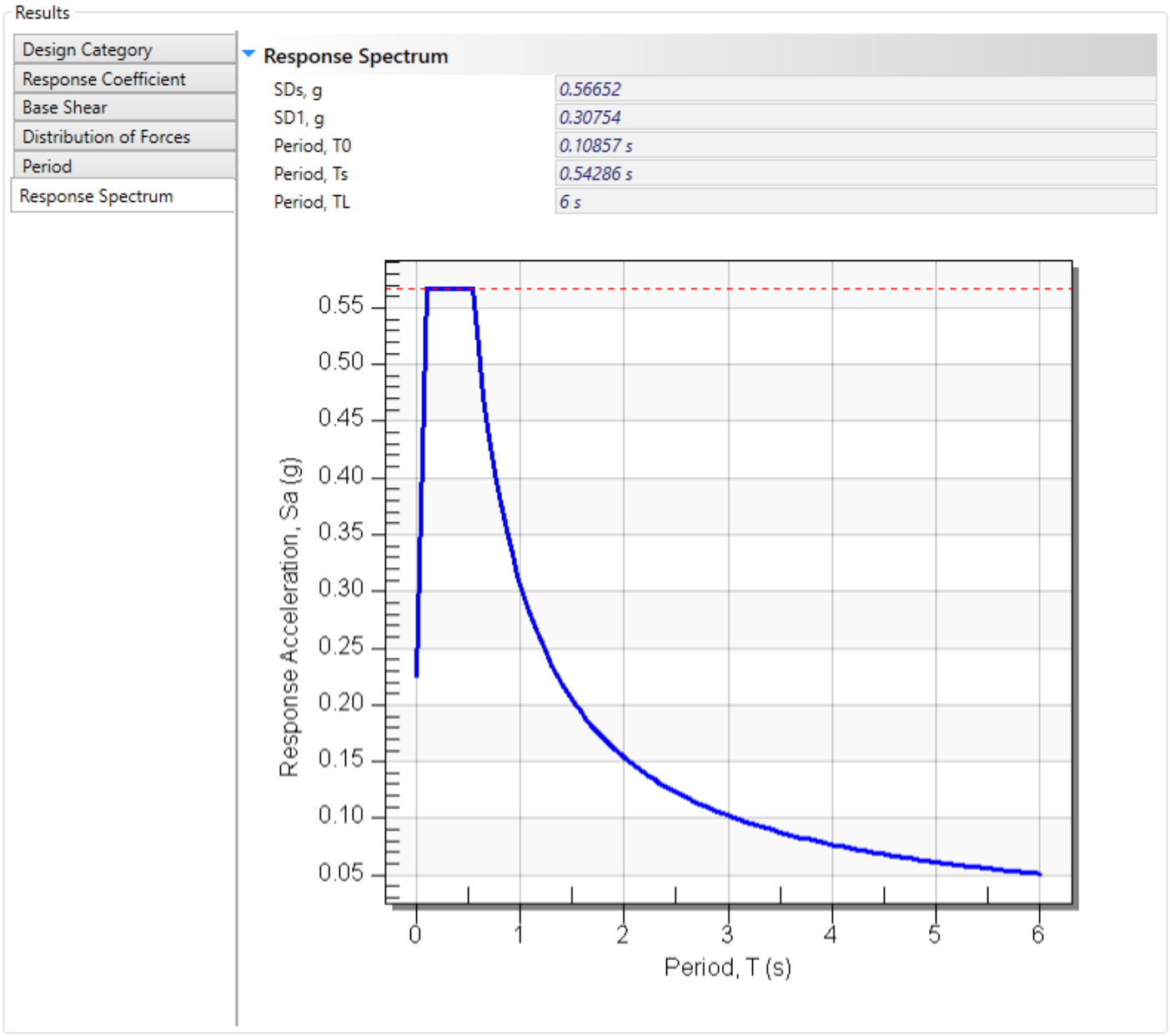
Period

The Period tab shows the results of the calculations required to determine the approximate fundamental period of the structure, per Section 12.8.2.1. If the Period calculation method was set to 'User Entered', the entered value will be shown here for convenience.



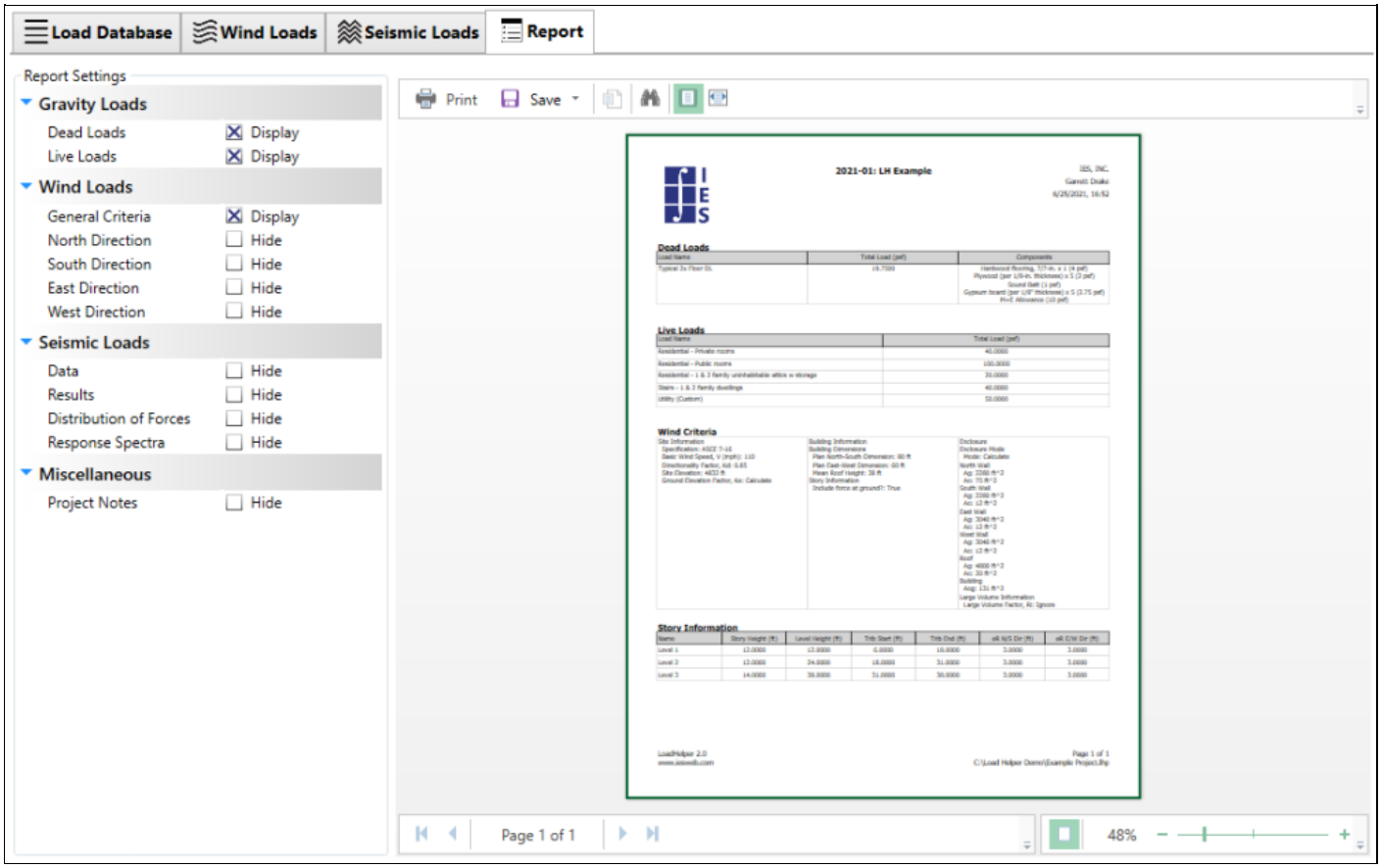
Response Spectrum

The Response Spectrum tab shows the results of the calculations required to generate the design response spectrum, per Section 11.4.6.



1.9 Reporting

In LoadHelper, reports are easily created to document your project information and calculation results. Switch to the **Report** tab and select from the available report tables to include them in the report. Reports can be saved in a variety of formats for use outside the program, such as PDF, Microsoft Word .docx, Microsoft Excel .xlsx, and others.

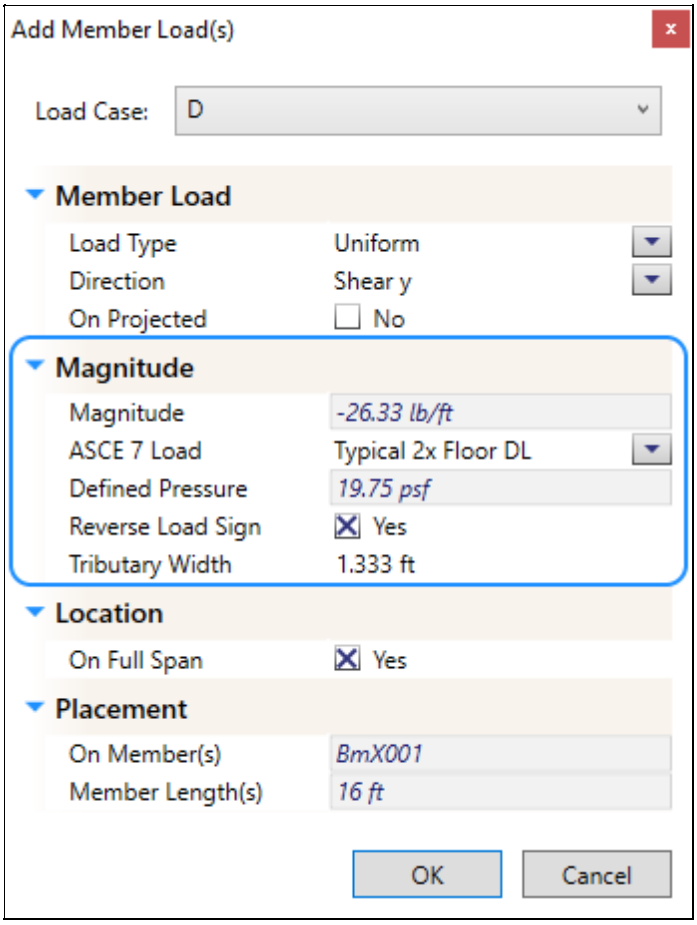


1.10 Integration with VisualAnalysis

Below is an overview of select features of LoadHelper available within VisualAnalysis. Additional information and a training video can be found on the Training Videos page.

Dead and Live Loads

Loads that have been defined on the Dead and Live Loads tab can be used throughout your VisualAnalysis model as a way to easily apply loads to nodes, members, plates, and areas. Depending on the type of model object and load you are applying, you may also need to define the tributary width or area to the model object. This will allow the defined ASCE Load, which is a pressure, to be converted to a linear force or concentrated force value. Below is an example of the member load dialog from VisualAnalysis utilizing a defined ASCE Load to apply a linear force to the member.



Custom Data File

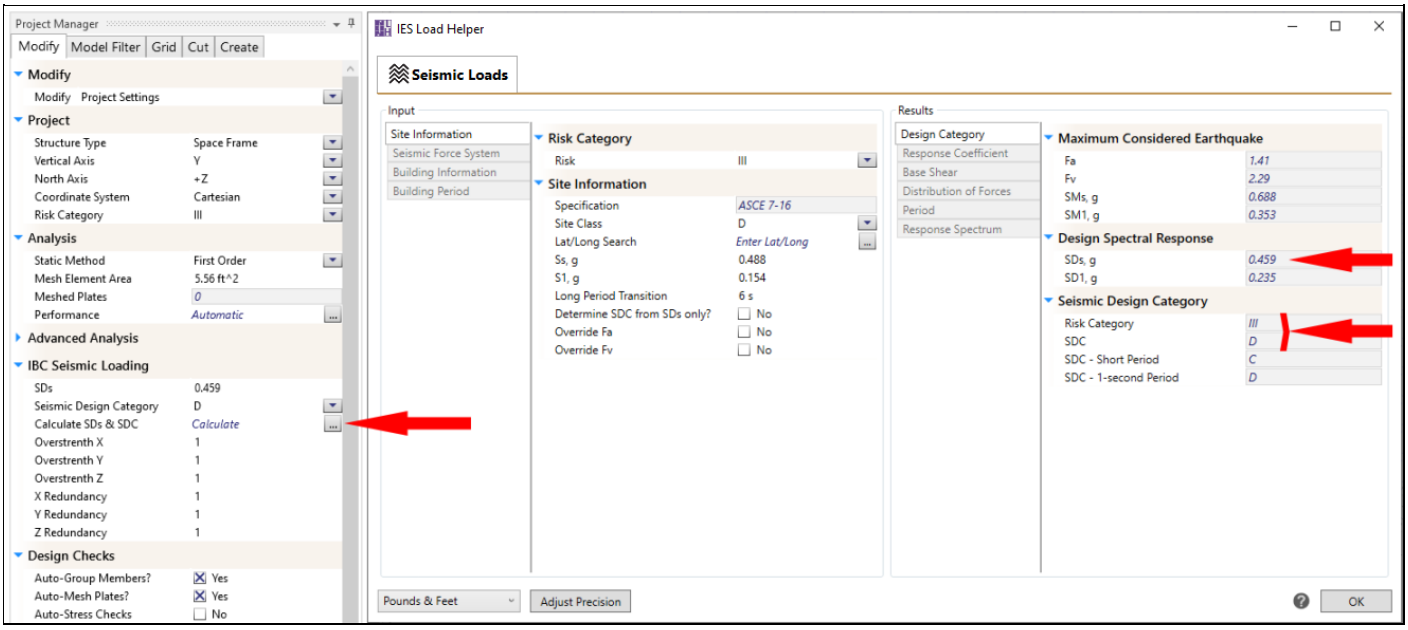
The Dead & Live loads created in the LoadHelper are saved in a XML file stored on a per-machine basis. The **Help | Open Custom Data** command will open the custom data folder in Windows Explorer and the XML file can be found at C:\Users\<*your.login*>\AppData\Local\IES\Customer\User Loads. The data file can be can be shared with other engineers, users, or put on a different computer by copying the file(s) to the same folder on the other machine.

Wind Loads

Currently, there are no features of the Wind Loads tab available within VisualAnalysis.

Seismic Loads

You may use the LoadHelper to assist you in performing Seismic Design Criteria calculations per ASCE 7-16 Chapters 11 and 12. Required input criteria is found on the Site Information tab. If you are satisfied with the results of the calculations, the Seismic Design Criteria and SDs values will be saved to the VisualAnalysis project criteria and used when auto-generating building code load combinations.



1.11 Support Resources

Did you Search this Help File?

Be sure you make use of the help and support built into the software, as described in the Program Layout section of the User's Guide. This document may be searched, and you should try various search terms, sometimes less is more when searching -- use just the unique word or words. There is also a logical Table of Contents available.

Do Not Contact Support For

- Licensing or Sales: use www.iesweb.com or sales@iesweb.com.
- Questions about how to model a particular structure. Such questions are your responsibility as an engineer.
- IES cannot validate your model or your results. If they "seem" incorrect, please figure out WHY they are incorrect. If you can document a defect, we will be happy to investigate deeper and fix things as necessary.
- Questions about engineering theory. IES is not in the business of educating engineers. There are design guides referenced in this help file and we can provide more guidance as to where to look if you cannot find one.

Technical Support

- Email Support: support@iesweb.com (Replies are usually within 2 business hours, if you don't hear anything within a day, assume it got spam filtered or lost and follow-up. For best results, be sure to ask a question, indicate exactly which IES product & version you are using, include as much detail as is practical or relevant, including attaching a project file.
- Telephone Support: No, sorry. We have found this to be too inefficient for everybody. With email you can attach a screen shot, a project file, and we can better direct your question to the IES expert for that product or area. Phone 'tag' takes longer than you think.
- Business Questions: For any licensing or sales-related questions or issues: sales@iesweb.com.
- Free Training Videos: Training videos can be accessed here.

1.12 References

1. American Society of Civil Engineers. **Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE/SEI 7-16)**. American Society of Civil Engineers, 2017. Print.