QUICKSTART PROCESS OF ENTERING PROJECT DATA

Welcome to LatPro, the professional lateral engineering calculation program!

GETTING STARTED:

Most users start **LatPro** by entering a project name, the date and their name or initials. Then the user must gather the necessary site and project information required by code and structural engineering practice to enter the General, Wind and Seismic Information into the tabbed pages. In order to save space in this document it will refer to the **International Building Code 2003** as the "IBC" and the Minimum Design Loads for Buildings and Other Structures, ASCE Standard, **ASCE 7-02** as the "ASCE". The Building information section is where the user starts working in the program and you can get back to it at any time in the upper menu bar by choosing Design, then "Building Information."

One of the great things about LatPro is that it works for all seismic horizontal and vertical structural irregularities as specified in the ASCE 7-02 Table 9.5.2.5.1. Since LatPro is based on the Equivalent Lateral Force Analysis Section 9.5.5, table 9.5.2.5.1 clearly shows it is an allowed analytical procedure to use and it meets all of the reference sections as long as the procedures are followed in LatPro and additional engineering that may be necessary in addition to LatPro.

An example of additional engineering that may be necessary would be the need to use the overstrength factor on a beam supporting a shear wall, in addition to the LatPro analysis, if this was the case in a particular structure.

BUILDING INFORMATION:

GENERAL INFORMATION

Start this section by entering information in the **General Information page**; the number of stories, the type of lumber (green or kiln dry), the sill plate size desired (2x or 3x), the anchor bolt size desired (1/2" or 5/8" diameter), the distance from the average height of the base of the structure to the average hight of the hightest level of the structure in feet. Note that if a 3x sill plate is chosen LatPro will chose a 14" long anchor bolt to compensate for the extra depth of the sill plate and allow the right depth for the anchor bolt.

The base of the structure could be the average slab height or the average foundation height. Enter the type of sheathing. LatPro gives the user the choice of 3/8" plywood, 3/8" OSB but footnote d. of Table 2306.4.1 for allowable sheathing values in the IBC says the user can use these same values for ½" (15/32") plywood or for ½" (15/32") OSB sheathing, so feel free to specify any one one of these four.

The user next enters the clear span between floors if it is a multi-story building, so that LatPro can calculate the holdown strap values between floors. This is adding the distance up of the floor joist depth, the floor sheathing, and the top and bottom plates. When this distance is subtracted, the remaining distance is the nailable area of straps that can be counted for holdowns to be used at the ends of shear walls. Then the user is given the choice of three lumber species which LatPro uses in its calculations Douglas Fir/Southern Pine (DF/SP), Spruce-Pine-Fir (SPF), or Hem Fir (HF).

Finallly the user must fill in the Upper, Middle and Lower Level names and information depending on how many stories the structure has. The names are just to give them a unique level name such as Main Floor for a one story building. On each floor, the user enters the length of interior wall, the average interior wall height, the average interior wall dead load.

Then the user enters **the very largest overall** east-west and north-south dimension for each floor for the ASCE wind calculations. It is very important to enter the maximum number here or you will be limited later on in the program, so be sure to enter any diaphragms including decks, overhangs, etc. that make up part of the loading and need to be calculated. Make sure to hit the"**insert"** button at the bottom of the window, before moving on. This is a good habit to get into with this program and you will see your data appear in the spreadsheet below the input box window (sometimes in a different format).

WIND INFORMATION

Then enter the **Wind Information page;** the Site Information starting with the wind exposure category as characterized in section 6.5.6.3 of the ASCE; the Wind Speed based on the 3-second gusts in miles per hour as shown on Figure 6-1 of the ACSE; enter if it is in a Hurrican Prone Region (as shown in LatPro help menu box), and enter if building is enclosed or only partially enclosed (such as a building with a partially open garage below the upper floor).

Then the user needs to know about the site to answer questions about Topographic effects on how wind will affect the structure. If any answer is no, there will be no additional questions, whereas if an answer is yes, an additional question will appear until the program is satisfied the user has met the code requirements. Enter if the building is located near the crest of a hill; if yes, enter a question about the height of the hill; if yes, enter if the hill is unobstructed for a 2 mile radius; if yes, enter if the hill is twice as tall as any other feature within 2 miles; if yes, enter more information about any feature and about the hill and building site. Then hit the "Insert" button to load the data into the program.

SEISMIC INFORMATION

Then enter the **Seismic Information page;** starting with the Site Class or site soil classification from section 1615.1.1 of the 2003 IBC or Table 9.4.1.2.1 of ASCE (note that the IBC allows the user to use site soil class D unless the building official determines E or F soil to be present at the site). The user can next enter the Zip Code of the site, but this is only good in areas where the zip code is for a small area, otherwise the user will need to look up the 0.2 Second and 1 Second Spectral Response Acceleration from the USGS web page earthquake.usgs.gov and go to the seismic hazard maps. Make sure this entry is put in the program as 100% of the USGS percentage value, for example 1.50 should be entered as 150% or "**150"** see help menu input text.

Next enter the R value (response modification coefficient) from table 9.5.2.2 of the ASCE (typically 6.5 for bearing wall system with light-framed walls), the Shear Wall Deflection Amplification Factor (Cd) where you can also refer to the ASCE table 9.5.2.2 for values, and the System Overstrength Factor where you can also refer to the same table in the ASCE table 9.5.2.2 for values. Then hit the "Insert" button to load the data into the program.

BUILDING DESIGN:

Go to the upper menu bar and choose Design, then click on "Building Design." This is where the user will "build" the floor plan of each floor by using only the numbers necessary to define the gridlines, diaphragms, tributary widths, and shear walls. These graphic floor plans will allow the user to visually check his work against a set of drawings and will be printed out in a report with all the required information for building department.

The LatPro process is to work your way down the side menu bar for each floor, starting with the highest floor and working your way down to the foundation. If you make a mistake or need to modify, add or delete something, there is always a way to do this. LatPro is designed for flexibility and the ability to do "**what-if"** types of engineering modifications with the least amount of extra work.

GRID LINES

Start by establishing the very farthest out grid lines for the project to the north and east, **on any floor,** as the base grid lines "1" and "A" respectively. This could be any corner of your structure, we just name them N-S and E-W to keep them clearly defined, for there is no code requirement that suggests a specific direction is necessary in the design (just be sure to clearly note any change so no confusion arises later). As the user adds grid lines the grid lines will appear in the table in the lower spreadsheet showing the offset distance from the base grid lines "1" and "A".

Enter all the grid lines you will need for defining both the diaphragms, including overhangs, cantalevers, and decks, and all the bearing or shear wall lines that may be necessary for transferring shear forces down through the structure. You don't have to worry about the diaphragm arrangement just yet but it is worth thinking about how the diaphragms will layout to transfer the loads or details or drag struts will need to be designed, especially in cases where there are roof or floor level changes. The point of the grid lines is to simply get as many of the possible diaphragm and shear wall lines defined in both the vertical and horizontal directions.

The user will also note that there is an up and down box, the user can select on the right side of that lower box. When the user selects the down box it highlights both the gridline in the graphics box and the gridline and offset in the lower table. It also activates two new buttons at the bottom of the side menu bar, to the left of your gridlines, called Edit and Delete Component. If the user selects Edit Component, the user can edit the grid line information that was already entered. If the user selects Delete Component, the user can delete the grid line that was already entered. This is true for many of the building design entry tabs, so the user can see that it is easily possible to enter (Add a component) a new feature, Edit a component, or Delete a component.

The user should follow the input directions working their way down the left side menu finishing each section before moving on to the next. The only section which does not have the use of the edit and delete buttons is the Specify Connectors input boxes. With these boxes, the user just needs to choose the drop-down wall and edit or delete from the menu using this window.

DIAPHRAGMS

The user will next enter the add diaphragms button and select the diaphragm type from the drop-down menu. The user will have the choice of gable or hip roof or other roof for the upper diaphragm and these or floor for lower floor diaphragms. Once the type is chosen, a large input box pops up to define the diaphragm divided into four input boxes on each four side of the box and one center input box.

The user enters the grid line defining the diaphragm into the outer four North, West, South and East input boxes along with the length of **exterior** wall in feet, the distance from the base of the structure to the average top plate height in feet (of that diaphragm), the distance from the base of the structure to the mean (or average) height of walls below the diaphragm in feet (distance from the base to the middle of the wall below the diaphragm), and the projected area of the roof in square feet.

The projected area of the roof is not the roof area but the area of the roof the wind would blow on parallel to level ground, similar to what you would see in an architectural elevation drawing of the roof line. If there is no roof, such as a gable end wall, this number would be zero and later entered into the height of the shear walls in that gable end.

In the Center Input Box, the user enters the diaphragm weight in dead load in pounds per square foot, the exterior wall weight in dead load in pounds per square foot, any special loads area in square feet, any special loads dead load in pounds per square foot. These special loads, such as snow load, need to calculated using the ASCE before being entered with their increases or decreases based on the design and location of the structure, including the ASD load combination reduction. Finally, the user hits the insert button and the diaphragm information is displayed in the lower information window as a component of the project, not to be confused with Components and Cladding, but just noted as such for use by the Edit or Delete Component buttons.

After any insert of information, it will be displayed along with additional information specific to this project. In the case of diaphragms the user will see the applied wind and seismic shear per linear foot in each direction on the diaphragm, whether wind or seismic is governing in each direction, the diaphragm, wall weight and added weight in pounds and the height from base in feet.

In addition, as with some other lower windows, there is another check box to more information. The diaphragm has a box called "Building Exterior" that the user can check to find more information in which to check their project. For the Upper Story this information box has the diaphragm name, exterior walls length and height and roof area and mean height for all four sides of each diaphragm. It also has the roof type, roof slope and direction of roof slope. These information boxes are a good place to check for errors in entering project data.

ERROR CHECK

A good habit to get into, especially when starting to use the LatPro program, is to use the Error Check button often during the inputs of a project. To do this, go to the top Menu and hit the "Design" tab, then hit the "Error Check" tab as often as you need to keep checking your work. At first it is good to hit the error check after entering each and every section of input in the "Building Design" information.

Sometimes a project could have so many errors showing up, that this is will lead to the program shuting down on the user. If this happens, we recommend that you start at the top of the error check window and work your way through all the errors before adding any additional information. The error check is a powerful tool to help keep the user on the right track while using the program.

TRIBUTARY WIDTHS

The user must assign a percentage of force so that 100% of each diaphragm has been assigned its tributary force to the correct grid lines. If a diaphragm only has, the outside walls as shear walls then the typical force allotment would be 50% to each outside wall in each direction, N-S and E-W. If a diaphragm has an interior shear wall on a grid line then 50% of the tributary are between 1 and 2 might go to grid line 1, 50% might go to grid line 2, 50% of the tributary area between 2 and 3 might go to grid line 2, 50% might go to grid line 3. That way 100% of the tributary area is accounted for with three shear walls. The same modeling can be done for four, five or more shear walls under one diaphragm in one or both directions.

Start in the Add Tributary Width window by entering the assigned percentage (ussually the 50(%)) which popups in the first window under assign 50(%) between Grid Lines, and it will show all the grid lines in the N-S direction in the drop down box, and grid line, including all the drop down grid lines again, of diaphragm, and it will show all diaphragms, to Grid Line, and it will again show all N-S grid lines. The user just needs to enter them in order and then hit the insert button and they appear in the lower window so the user can keep track of them.

<u>With structures of more than one-story, it is important to remember to transfer the upper story gridline forces down to the next story using this window in the lower stories</u>. The user does this by entering in the same gridline number that the user is assigning forces from the diaphragm to in the **"Upper Story Gridline Lateral Force Transfer" box**. If there are any additional, lateral forces the user wants to add there is a box to add them adjacent to this box. The final box is a check box that allows the user to directly transfer the forces into a foundation instead of a wall below at this level, an example being a steep hillside structure where part of the second floor ends directly into a concrete foundation and the part continues into a floor diaphragm.

SHEAR WALLS

When starting to enter shear walls the hit the Add N-S or E-W Shear Wall button and only the N-S or E-W Gridlines will come up in the first box, pick one to start and LatPro will automatically enter the Wall # based on how many you have entered already. Next enter the offset from the X or Y Axis in feet; this is the distance away from Grid Line A or Grid Line 1 depending on which way you are specifying and can be zero on up. Enter whether it is an exterior or interior shear wall, the length of the shear wall, the height of the shear wall, the thickness of the shear wall (4 means 3 ½ inches, and 6 means 5 ½").

For dead load enter the tributary width of the framing that falls upon the shear wall from above in feet, from which diaphragm, and what the live load is on that diaphragm. If there is any additional tributary width such as an overhang, a deck, etc enter that with its Unit dead load and Live load in pounds per square foot.

Note the question "Is shear wall above or is there a Floor Beam/Blocking or a Post not in a Shearwall?" this is for added dead and live loads at the ends of a shear wall and the user enters these amounts below in pounds. Then note the Asymmetric check box because the loads through beams or headers may be of differing amounts on each side of a shear wall. If this happens, check this box and enter the amounts for the N and S side or E and W side of the shear wall.

When there is more than one diaphragm, there is a link shear wall box that the user can check when the ends of a shear wall line up with the ends of shear wall above. LatPro will then automatically calculate the uplift, bending, crushing, etc. on the outside chord members of the lower shear wall and add up the uplift forces for the lower connectors.

If there are more than one shear walls on the grid line than it is best to just hit the Insert Data button when done with the first one or two, rather that the Insert and Spec button or the user will be over specifying shear walls at the beginning of each wall line until LatPro knows how many linear feet of shear wall are in the grid line. Depending on loads and after the user gets a feel for the program, it is better to wait for three or more walls before hitting the Insert and Spec button to specify the shear wall.

If an error message comes up later about story drift, after making sure there is the correct connector specified one the easiest ways of dealing with it is to specify a stiffer shear wall. The user may want to go up the list of site built walls, for example if a 'B' wall is specified the user may want to try a 'C' wall next and so on until the story drift is resolved. Sometimes this will not solve the story drift and more shear wall or another solution is needed to solve this issue.

CHORD MEMBERS AND CONNECTORS

When specifying chord members and connectors the user starts by picking the supporting shear wall, check off the part of the structure that the Strap/Holdown joins the shear wall to, any additional connection deflection (if other than a program connector), the end or corner distance to the edge of concrete in inches, and the stem wall width in inches. The last two will show up in the LatPro program only if the user chooses one of the first four check boxes showing the shear wall is supported by concrete.

This is the only section which does not have the use of the edit and delete buttons are the Specify Connectors input boxes. With these boxes, the user just needs to choose the drop-down wall and edit or delete from the menu using this window. When specifying connectors **it is very important to enter a number in the end distance to the concrete input box**, so that LatPro can calculate the correct connector value based on that end distance to a concrete corner or edge.

This section can be a little tricky at first because the user is specifying two components instead of just one, because the chord member size can have a big influence on the connector options. The user must get used to trying various options for chord members if you are not seeing the connector options you would like to see based on the uplift and crushing numbers.

This is also a section that two information boxes in the lower window, Connectors and Edgemembers. Since the connectors box is what automatically shows up, the user may not see the problems in the edgemembers untill you check that box and check on all those forces.

SPECIFYING POSTS

The user will need to specify posts that support shear walls above them because these members need to be calculated using an overstrength factor, Em. The IBC says that all members supporting shear walls including posts, beams or other members need to use this overstrength factor in the design of these members so that the structure holding up the force-resisting system does not fail during a wind or seismic event. LatPro allows the user to specify these posts and automatically calculates the overstrenth factor into the post design.

The user hits the Specify Posts button for the floor and direction and a drop down list of the shear walls above the post is available to choose from along with a check list of construction materials that the post may be situated on. Chose the wall above and the structure below, the post height in feet, any added dead load at this floor line, any added live load at this floor line, the end distance to a concrete corner or end (if applicable), and the stem wall width in inches (in applicable). Hit the Spec Post & Connector button and two drop down menus come up in a new window, one for specifying the post size and one for specifying the connector size.

Again, the lower window has two check boxes, one for that defaults to show the connectors that have been entered and all the related forces and one that the user can check to see the posts that have been entered and all the related forces. Also again LatPro is specifying two members at once, so the user may need to do some what if tries at various post sizes to see what connectors are available with each post type.

LatPro allows the user to specify a shear wall, over a post, over another post in a three-story building and it will calculate and transfer all the uplift and crushing down to each connector if done correctly. This is a powerfull tool and allows the computer to calculate these forces from shearwall to foundation throughout the program.

USER DEFINED MANAGER

The user can use the User Defined Manager to define the user preferred Site Built Walls, Pre Built Walls, or Connectors that will remain in the users program to use on any future projects after they have been defined. This is a powerful tool to allow the user the ability to enter walls or connectors that you are more comfortable using or need to use in special circumstances. Just follow the input boxes and enter all the information that is called for so the program can calculate the force risistance and drift from these entries.

COMPONENTS & CLADDING

The user adds components and cladding based on the requirements as reguired in the IBC. You will just need to hit the Add Components and Cladding button and the input menu appears to add any component or cladding that is a par of the roof or wall force-resisting system. The user starts by naming the component or cladding with the name of the specific component or cladding item, uses the next three drop down menus to choose the Type, Zone and Diaphragm that the Component or Cladding Item relate to and finally enters the square footage of the effective wind area that affects the item.

The user enters the Insert button and the item will appear as ussual in the window below showing all the information you entered along with the maximum positive and negative design pressures LatPro calculates will be placed upon the item per the ASCE, building with a mean roof height of 60 feet or less.

IMPORTANT THINGS TO REMEMBER:

1. **DO NOT OPEN LATPRO WHEN EXCEL IS RUNNING ON YOUR COMPUTER. IF YOU OPEN LATPRO WITH EXCEL RUNNING IN THE BACKGROUND OR OPEN TWO COPIES OF LATPRO AND RUN INTO A PROBLEM, CLOSE THE LATPRO PROGRAM FIRST THEN GO INTO THE WINDOWS SECURITY MENU BY HITTING CONTROL, ALT AND DELETE AT THE SAME TIME TO BRING UP THAT MENU. THEN GO INTO THE TASK MANAGER BUTTON AND THEN THE PROCESSES TAB AND SCROLL DOWN TO SEE IF THERE IS THE EXCEL PROGRAM RUNNING ON YOUR COMPUTER IN THE BACKGROUND. IF YOU SEE IT THERE, THEN YOU HAVE A BUTTON THERE WHERE IF YOU SELECT THE PROCESS, YOU CAN DELETE IT. THEN CLOSE OUT OF THIS MENU AND START THE PROGRAM UP AGAIN.**

2. **IF YOU GET AN ERROR THAT SHUTS DOWN THE PROGRAM, REBOOT THE PROGRAM, OPEN THE FILE AND DO AN ERROR CHECK TO SEE IF YOU CAN IDENTIFY THE ERROR THAT IS CAUSING THE PROGRAM TO SHUT DOWN. WE ARE WORKING TO IDENTIFY AND CLARIFY ALL THESE ERRORS, BUT DUE TO ALL THE COMPLEX POSSIBLITIES, WE ARE STILL WORKING ON THEM ALL.**

3. **THE LOWER STORY OF ALMOST ALL THREE-STORY PROJECTS WILL NEED TO HAVE SIX-INCH THICK WALLS FOR CRUSHING LOADS AND/OR BUILDING CODES.**

4. **A GOOD HABIT TO GET INTO IS TO USE THE ERROR CHECK BUTTON OFTEN DURING THE INPUTS OF A PROJECT. TO DO THIS, GO TO THE TOP MENU AND HIT THE "DESIGN" TAB, THEN HIT THE "ERROR CHECK" TAB AS OFTEN AS YOU NEED TO KEEP CHECKING YOUR WORK. IT IS A GOOD PRACTICE TO HIT THE ERROR CHECK AFTER ENTERING EACH AND EVERY SECTION OF INPUT IN THE "BUILDING DESIGN" INFORMATION.**
   SOMETIMES A PROJECT COULD HAVE SO MANY ERRORS SHOWING UP, THAT THIS IS WILL LEAD TO THE PROGRAM SHUTING DOWN ON THE USER. IF THIS HAPPENS, WE RECOMMEND THAT YOU START AT THE TOP OF THE ERROR CHECK WINDOW AND WORK YOUR WAY THROUGH ALL THE ERRORS BEFORE ADDING ANY ADDITIONAL INFORMATION.

5. **IF YOU ARE STUCK ON A PROJECT AND HAVE READ THE MANUAL AND STILL CANNOT FIND AN ANSWER, EMAIL THE PROJECT AND AN EXPLANATION OF THE PROBLEM TO SUPPORT@LATERALPRO.COM SO WE CAN LOOK AT THE PROJECT FIRST HAND.**