

# How to Design and Scratchbuild a Structure

By CWRailman

“I wish I could learn how to scratchbuild.” Is a comment I have heard many times. In this presentation I hope to demonstrate the basic techniques used in designing a building to be built from scratch. We will then go about building the structure from scratch, or what has become an accepted definition of the term scratch. Designs like this draw (no pun intended) heavily on what you have seen in real life or in photographs. If you’ve never seen any old time buildings in person or have any books to use as reference, Googling “Ghost Town Photos” will provide you with a few images of structures similar to what we will be designing.

Every build has to start somewhere. In this case I found some window and door castings at a swap meet that looked like they needed a new home so..... Anyway the other day I found them in a drawer and decided to put them to use. These will become the basis for our design and build. In engineering terms it is what we call the “known’s” or “givens”. By that we mean we know the dimensions of these items and these dimensions will govern the design and other aspects of the structure. The type of windows and doors will also determine the type of structure you build. In this case these castings resemble those you might find in an old time store or maybe a bakery or a café or some such. You probably have some such castings laying around so grab a few sheets of paper out of your printer and lets get started.

Prior to making a drawing place your window and door castings on a flat surface and move them around until you’re happy with the arrangement. We’ll talk about “proper” design later but this will give you some sort of idea what you want to do.

In all honesty, I have to admit that I usually use one of several professional CAD programs when I do this. However, most folks do not have such tools at their disposal. For this demonstration I am going really “Old School” using inexpensive tools which can be found at a Dollar Store, stationary store or stores such as Target or Wal-Mart. I ask that you please forgive my hand lettering!

Here are the “Old School tools” you will need to do this or a similar design.



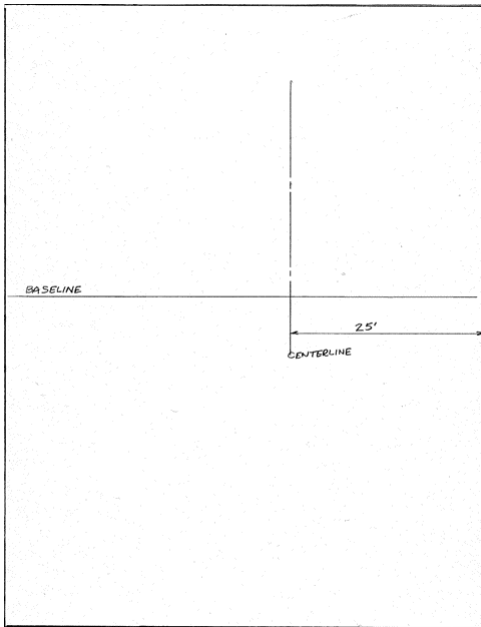
Before we get going. When I show 1' that means one foot. 1'-6" means one foot six inches. 9" means 9 inches.

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Fasten a sheet of paper to a clip board, piece of glass or whatever flat portable surface you can find and line it up even with one of the edges, in this case I used the right side edge. Using your t-square which can be purchased at almost any dollar shop, draw a BASELINE. That is the base, for your structure. All other vertical dimensions will be based on this BASELINE.

Using whatever scale you are working in, for me this is HO, measure a scale distance from the edge of the paper, in this case 25' and leave a mark. Do that near the top of the sheet and again down about mid way. Now draw a dashed line between those two points. This will be the centerline of your structure. Congratulations you are now a draftsman so go update your resume. (I have shown the 25" dimension only as reference. It is not needed)



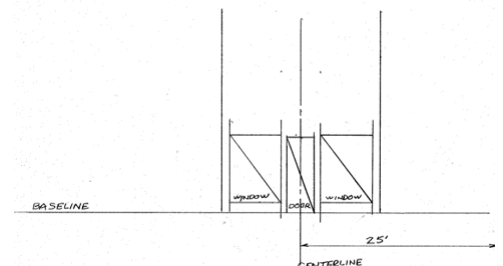
After looking at the door and window castings I have on hand, I have already determined that I am building a small business though I don't yet know what it is. Maybe the design itself will inspire me. I will place the door between the two large windows in normal observed fashion. Measure your door casting, mine is 3'-6" which divided in half is 1'-9". From the centerline mark 1'-9" on either side of the centerline. Go up or down a few inches and do it again. Now connect the marks so you have a line on each side of the centerline. Throughout this design, what you just did will be a reoccurring process.

Measure the height of your door. Mine is 10'-9". From the base line measure up 10'-9" and make a mark. Slide your T-Square up making sure it is flush against the edge of the clip board and draw a line at that point between the two lines you just drew defining the width of the door. You have now established the "Outer Boundary" of your door.

I've determined that I want 9" between the door and the windows. You can make it whatever you want. I made a mark out from the edge of door 9". I measured that mark back to the centerline and found it's 2'-6" from the centerline. I went up a few inches and made another mark 2'-6" from the centerline. I then drew a line a bit longer than what I thought the window would be. Don't worry about making it too long or too short. I did this on both sides of the door.

I measured the window and it was 6'-6" wide. From the lines I just drew I measured and marked 6'-6" top and bottom and as before I connected the marks. Again do this on both sides. This is now the side Boundary of the windows. But how high should they be?

Take a look at old structures and you will find that the display windows were almost down to ground level to maximize the amount of area to display merchandise. I have also noted that in many cases with windows and doors of this type the top of the window lined up with the top of the door frame or the windows are slightly higher. Since this is a "double hung" window



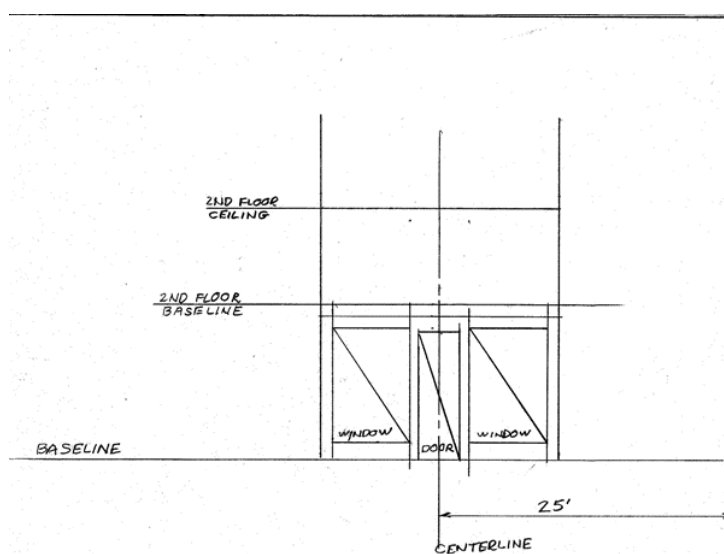
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meaning the window can be opened by moving either the lower portion up or the top portion down, I decide I would make my windows about 3" higher than the top of the door. I am also thinking this structure may become a rooming house or maybe a restaurant with tables against those windows that could be cracked open to let a little "fresh air" in. ( The business concept for this building is now starting to develop in my mind.)

Using my HO scale, I measured and made a mark 3" above the top of the door and using my T-Square drew lines between the two window boundaries even with the top of the door. Now measure how long the window is. In this case it is 9'-9". I marked down from the top by that amount and again using my T-Square I drew lines between the window boundary lines indicating the bottom of the window.

I determined I wanted the side walls to be 1' out from the edge of the windows. You can make it whatever you want. You're the architect here but allow for the thickness of the side wall and since we are building a frame structure that would be about 9" to 1'-0". So again I measured from the edge of the window 1' and made a mark. Measure from that mark back to the centerline which in this case is 10'-0". Go up near the top of your centerline and mark off 10'-0". Do that on both sides and draw a line from your Baseline up to the top That shows the Outer Boundaries of you structure. Lay the casting over your markings to get an idea of how it will look.



MY door is 10'-9" high so that means I should have a first floor ceiling height of at least that amount. While it could have been anything more that 10'-9", I decided on a 12' ceiling height for my first floor. Mark up 12' from your baseline and using your T-Square draw a line across the sheet.

Most floors are between 1' and 1'-3" thick. I'm going with 1'. From the ceiling line I mark up 1' and again using the T-Square make a line at that point. This is my second floor base line if you will.

In my structure this floor might be used as living quarters for the proprietor and family. Check the ceiling height in your home and

you will see it is about 8'-9' high. Higher if you have one of those cathedral ceiling homes. I decide to use 8' for my ceiling height. I mark from the second floor base line up 8' and draw a line again using the T-Square. That will be the ceiling of my second floor. ( I removed the lower part of the drawing because there is nothing there at this point and to give you a better look at what I am doing. )

I now go to my extensive selection of window castings and select some that have architectural characteristics similar to those I used on the first floor. In this case these are Grandt Line #5125. But, the question is how many and where should they be placed. Again, take a look at prototype structures. I throw a few casting down on my plan sheet and move them around a bit. One two three or more. I think I'll use three evenly spaced across the front. I could have used two windows or maybe one window or maybe none. I could have 2 windows with a door in the middle which would lead out onto a balcony of sorts. Look at photo's of old buildings for inspiration. Go ahead, Google it right now.

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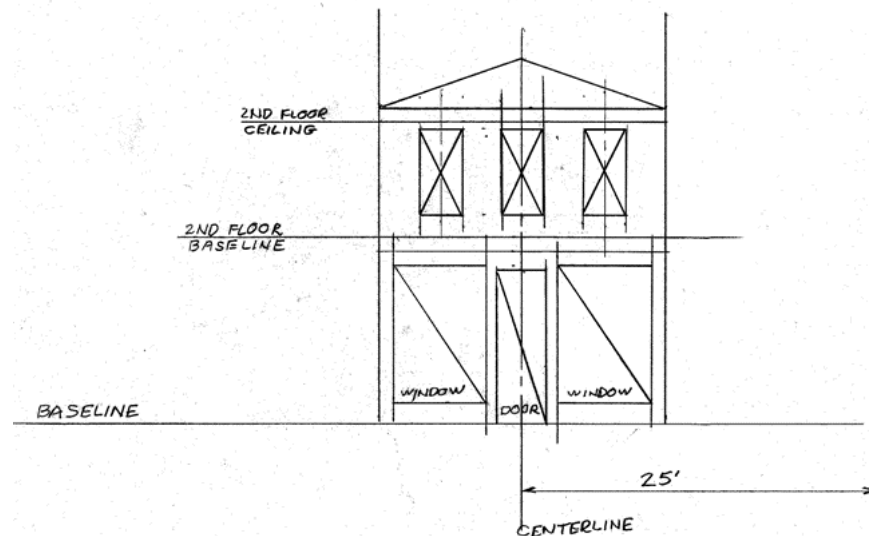
Like we did with the door, measure the window, mine was 3'0" wide, divide that amount in half 1'-6" and mark that amount on both sides of the centerline. Do it at the second floor baseline and up a bit further along your centerline. The further up the better. Connect the two marks on both sides. That is the boundary for your center window. Measure from either boundary to the outer edge of your structure, in my case that was 8'-6". Divide that in half, in my case 4'-3" and mark that off from the centerline near the base line and up higher. Do so on both sides of the centerline. This will be the centerline for the two outer windows. Now draw lines parallel on both sides to the proper width of your window castings. Note, we have not yet identified the upper and lower boundaries of your windows.

The windows I have selected are 6' tall. From floor to ceiling the second floor is 8'. That leaves 2'. I marked 6" down from the ceiling. That will be the top boundary of my windows. Then mark down 6' for the window height which puts the bottom of the window 1'-6" off the floor.

There are rafters holding up that second floor ceiling and they are about the same thickness as that second floor so from the second floor ceiling measure up 1' and make a mark. Using your T-Square mark a line all the way across your structure. This is the top of the rafters or if you wish the floor for the attic. I'm going with attic here.

I am modeling the West and our roofs usually have a 3 to 1 or 4 to 1 slope. What is that? Well you draw a line out 3 feet and then down one foot and draw a line connecting those two points and you have a 3 to 1 slope.

In this case it is 10' from the centerline to the edge of my building. I mentally (Only because I could not find my calculator.) divide that by 3 which gives me about 3'-4". From the "attic" floor line I mark a spot 3'-4" up on the centerline. From that point I draw a line to the intersection of the "attic line and the edge of the building. That is the slope of the roof. Mark both sides. However I want a false front look so I went up another 1'-9" from the peak of the roof and made a mark. Using my T-Square I drew a line completely across from side to side. This will be the top of the false front. Again use photo's to determine the configuration and how much detail you want to include on the upper part of the false front.



Place all your castings in their appropriate location and see what you think of your design.

Now below your drawing draw the sides and back. If you use the same windows for the second floor on the sides locate them at the same elevation. You decide how many you want. The windows for the first floor will require a bit more thought. Most windows start about 2' to 3' foot off the floor so I would lay out the windows and see what looks correct and locate them using the same techniques we

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just used on the front wall. It helps a lot if you have an idea of the inside configuration but it's not mandatory. In fact I have looked at a few expensive kits and wondered what the designer had in mind when he located the windows and doors.

Now you have your drawing complete but WAIT! (Sounds like one of those info commercials.) We were using the outer dimensions for all the doors and window castings in determining their outer boundaries. Now go back and look at the back side of all those castings. Note that the back side of the casting is set in from the outer edge. So...go back to your drawing and draw lines inside those you have previously drawn to represent the actual size of the opening required for the castings. The differential is usually about 3" inward but check that to be sure. There will be no differential on the bottom of the doors.

So not to offend Architects or Structural Engineers or those who study either of those fields, please let me state that there are other considerations that go into designing a building however for our modeling purposes we have touched on some of the "basic" design considerations that will provide the foundation for a believable model. I will point out that the two 9" posts on each side of the doorway would probably be supplemented by headers running across those windows however for our purposes such considerations are unnecessary. Just wanted to let you Engineering types know that I was thinking about it.

Compare the above drawing to this photo of the front of the structure as built. Prior to the upper cap and related trim being installed.



All the marking and drawing you did on this piece of paper was a trial run in preparation for the markups you will do on the back side of the siding material of your choice. On to the build of:

## ***Jolie's Bakery & Cafe***