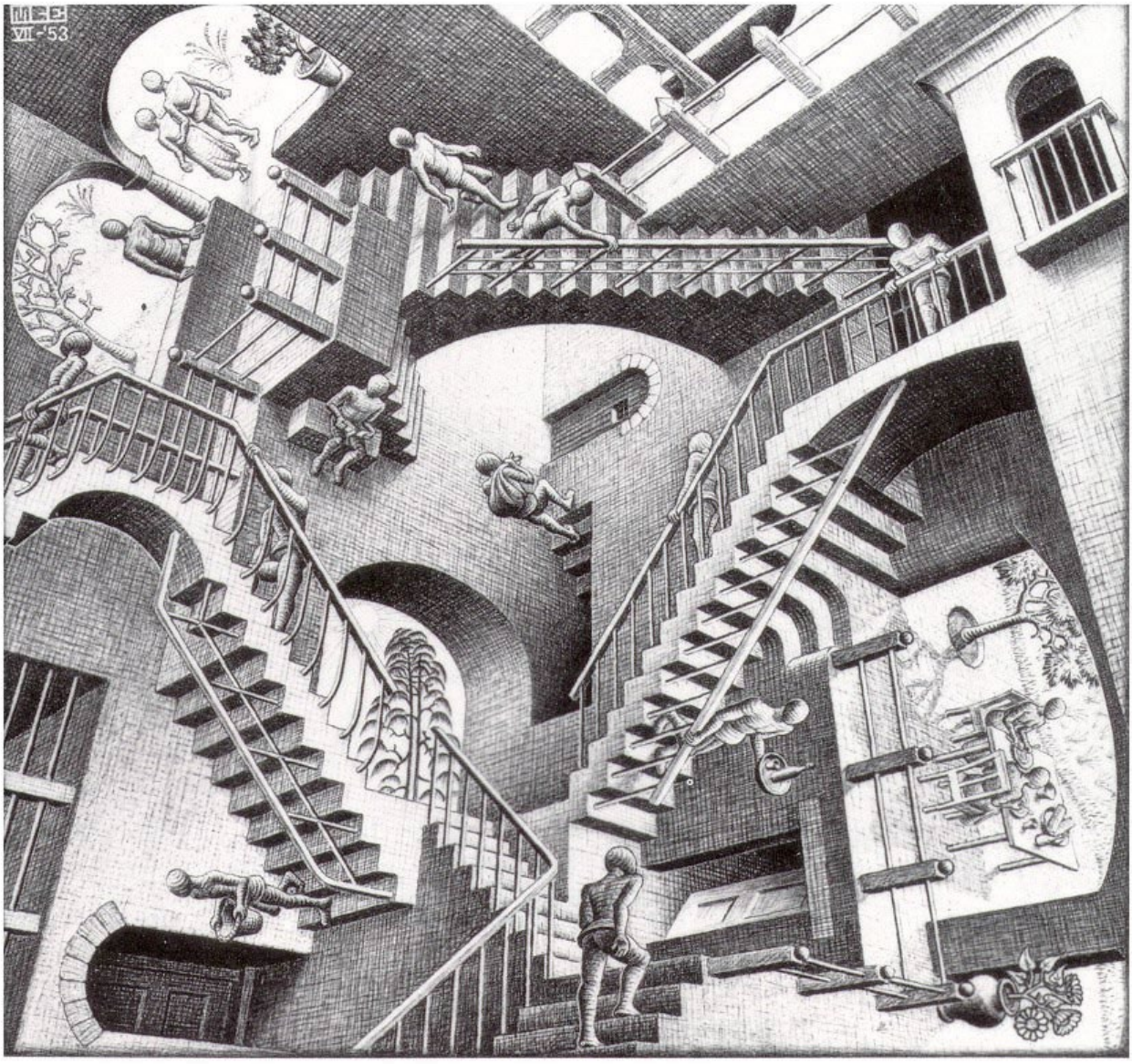
THE AE DRAWING HANDBOOK

De-mystifying the Craft of Making Excellent Drawings



an engraving by M.C. Escher

SECOND EDITION: September 2023

ARCHITECTURAL ENGINEERING | UNIVERSITY OF WATERLOO, ONTARIO, CANADA

WHY A DRAWING HANDBOOK?

Drawings are the **primary** means of communication between the members of any design team. They explain:

- Concepts
- Materials
- Sizes and layouts
- Range from distant to very close views
- Include dimensions as well as words

Drawings MUST follow *universal drawing conventions*. In an office environment many different people will work on the same drawing. Drawings are shared between different consulting offices as well. Cloud computing and drawing programs such as Revit allow collaboration between the architect, engineer and consulting members. There is no place for unusual approaches to hatching, for instance, as it will result to misunderstandings about the material make-up of the project. Worst case scenario, a lawsuit.

Whether drawing by hand or by computer, the same rules apply.

THE MORE QUICKLY YOU BECOME ADEPT AT DRAWING WELL, THE EASIER STUDIO BECOMES!

We decided to produce this drawing guide as an inordinate amount of crit and grading time is wasted in simply marking up drawings to correct their formatting. Much like learning proper spelling and grammar, or correct formatting of mathematical equations, drawings also must follow standards in production.

FORMAT OF THE GUIDE

The guide will provide you with a short checklist of the necessary ingredients for each drawing type plus a sample drawing to provide a visual target of what your drawing should look like. Do NOT copy any technical details that you might see in the drawings as they are likely not to match your own project requirements. They are provided so that you can look at the nature of the linework, hatching, dimensions, notes, etcetera included in each drawing type.

TYPES OF DRAWINGS

Depending on what the purpose of a drawing may be, there are different standards and expectations. For example, and early design idea might be best represented in a quick sketch, a set of drawings that is used to win a design competition might focus more on colour and ambience, while a set of construction drawings must be extremely detailed, accurate, and follow explicit conventions. The general rule is that as a project gets closer to construction, the level of detail and standardization in visual communication increases. Below is a list of drawing types organized roughly by when they might be produced in the lifespan of a project, from start to finish, categorized as either presentation drawings or technical drawings:

Preliminary Design (Presentation Drawing)

Types of Drawings: Hand Sketches of plans, sections, elevations, or 3D views, sketched diagrams, Parti ("big idea") drawings

Expectations: Low accuracy, high expression of ideas and feelings, thick or messy lines, not necessarily to scale, colour is welcome and encouraged, think 'architectural doodling'

Uses: Winning a competition, publishing in a journal, research proposals, communication with clients at initial meetings

Schematic Design (Presentation Drawing)

Types of Drawings: digitally or hand-drafted drawings of plans, sections, elevations, details, 3D images, diagrams

Expectations: true to scale, expressing ideas more than decisions, straight and more accurate lines, colour lives only in diagrams and 3D images

Uses: sharing ideas with other designers, confirming ideas work when drawn to scale, winning a competition, communicating with clients

Design Development (Technical Drawing)

Types of Drawings: digitally drafted drawings of plans, sections, elevations, details, 3D images

Expectations: increasingly detailed and accurate drawings showing confirmed decisions as they are decided, materials are partially known, dimensions are mostly correct, everything is to scale

Uses: sharing ideas with other designers, confirming ideas work when drawn to scale, preliminary cost estimates by consultants, preliminary co-ordination between consultants ('you can't put your duct there, my beam goes there' conversations), getting final sign-off from clients

Contract Documents (Technical Drawing)

Types of Drawings: digitally drafted drawings of plans, sections, elevations, details

Expectations: As close to perfect accuracy as possible, fully industry standard drawing convention, all drawings are to scale, and dimensions are correct, colour is not used to make copying easier, these are legally binding

Uses: Contractors bidding a project, Fabricators taking off information,

Construction (Technical Drawing)

Types of Drawings: Shop drawings, Sketches associated with Change Orders or Requests for Information, marked-up photographs

Expectations: Maximum accuracy and level of detail, clarity of communication may require more text or notes than previously seen on contract documents, fully industry standard drawing convention, often limited to one trade or one small detail, these are legally binding, colours may be used to provide increased clarity

Uses: Communicating between the design team, the fabrication team, the site team, and associated construction management team.

This Drawing Handbook focusses mostly on the industry standards which are seen in technical drawings. The use of these standards in preliminary or schematic design drawings is not discouraged but may be found cumbersome when the project is not at a high level of resolution.

WHAT CONSTITUTES A COMPLETE DRAWING SET?

This will vary from project to project as relates to the physical size of the project and to what level of detail you are tasked with development. Each of your AE studios has a different focus and so there may be more or more specific drawings required based on the focus.

Generally you need to include:

- Site plan
- Ground floor plan
- Second and above floor plans
- Roof plan
- Elevations of all sides (usually 4)
- Sections through the building in each direction (cross section and longitudinal section)

For more detailed projects you will also add:

- Framing plans
- Detailed sections (showing materials)
- Enlarged details (showing exactly how all of the pieces attach together)

Further requirements:

- Renders and views
- 3D drawings – axonometric/isometric or perspective

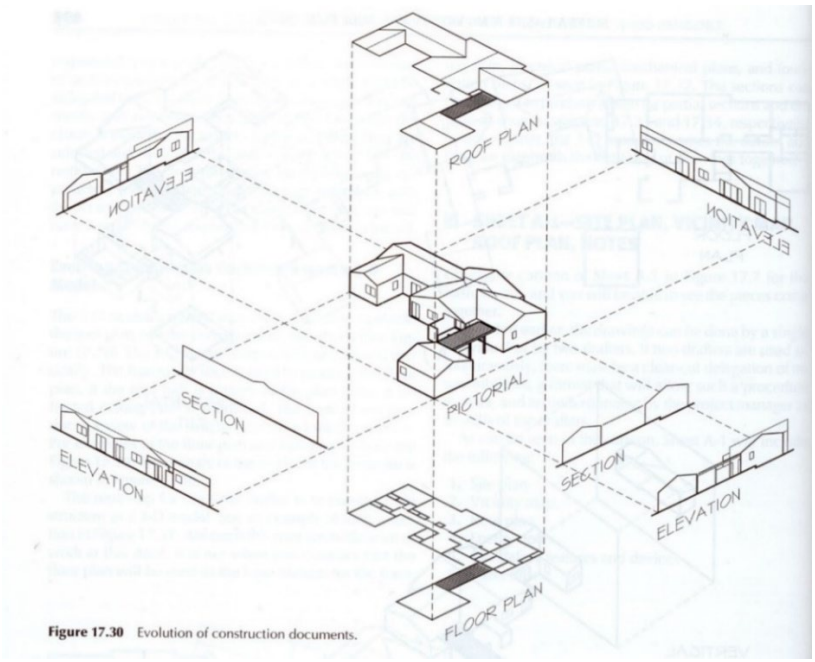


Figure 17.30 Evolution of construction documents.

Architectural Working Drawings by Wakita and Linde

This 3D view describes the relationship between all of the views in the base drawing set.

<u>The order of drawings as seen in a complete drawing set moves from the largest scale (lowest level of detail) to the smallest scale (highest level of detail).</u> There are also typically different consultant drawings in a full set of drawings, so the naming convention, and the order of their appearance is systematic. Here is one view of a common way in which drawing sets are arranged (note: commonly Heating and Plumbing are included in M for Mechanical):

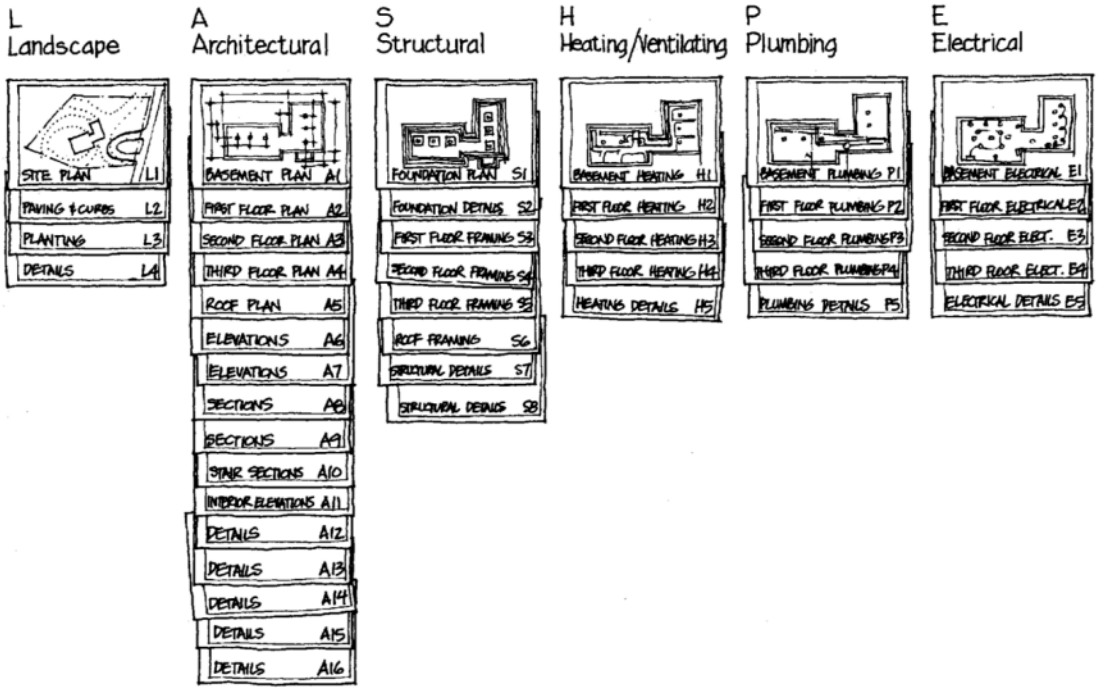


Image Source: Allen, How Buildings Work, Ch. 20

STANDARD SCALES

The use of industry-standard scales for creating drawings is more important than fitting a drawing on a page neatly. This practice is rooted in the use of physically printed documents that can be measured quickly using an architectural or engineering scale. If the scale that you used is not available on their measuring tool, then the reader is unable to quickly check a dimension. Thus, we have standard scales which you should use in your drawings:

X LARGE (maps, regional plans, urban plans, neighbourhood plans)

1:10000, 1:5000, 1:2000, 1:1000

LARGE (site plans, industrial building complex plans)

1:1000, 1:500, 1:200

MEDIUM (floor plans, building elevations, whole-building cross sections)

1:100, 1:50

SMALL (unit floor plans, interior elevations, wall sections, room finish plans, structural details)

1:20, 1:10

TINY (Details)

1:5, 1:2, 1:1

Note: In some circumstances 1:25 or 1:250 may be used, but they should be avoided if possible, ESPECIALLY if :120 and 1:200 drawings exist in your drawing set.

Certain drawings are best viewed and understood side by side and at the same scale, like exterior building elevations and whole-building sections. Using different scales for the same TYPE of drawing should be avoided (i.e. if your main floor plan is at 1:100 then your second floor plan should also be at 1:100)

LAYING OUT THE DRAWINGS

It is important when you are conceiving a drawing set to understand the scale at which the drawing is to be executed and the size of paper for printing. For AE studios the common paper size is 24” x 36”.

It is advisable to lay out the drawing to make efficient use of the page. Ensure that the sheet is well organized, that the drawings are aligned evenly, heights match, etc.

It costs money to print drawings and so you want to be efficient and not float single details on the page if it is avoidable.

Planning your set in advance using a cartoon method will save you a headache at crit time.

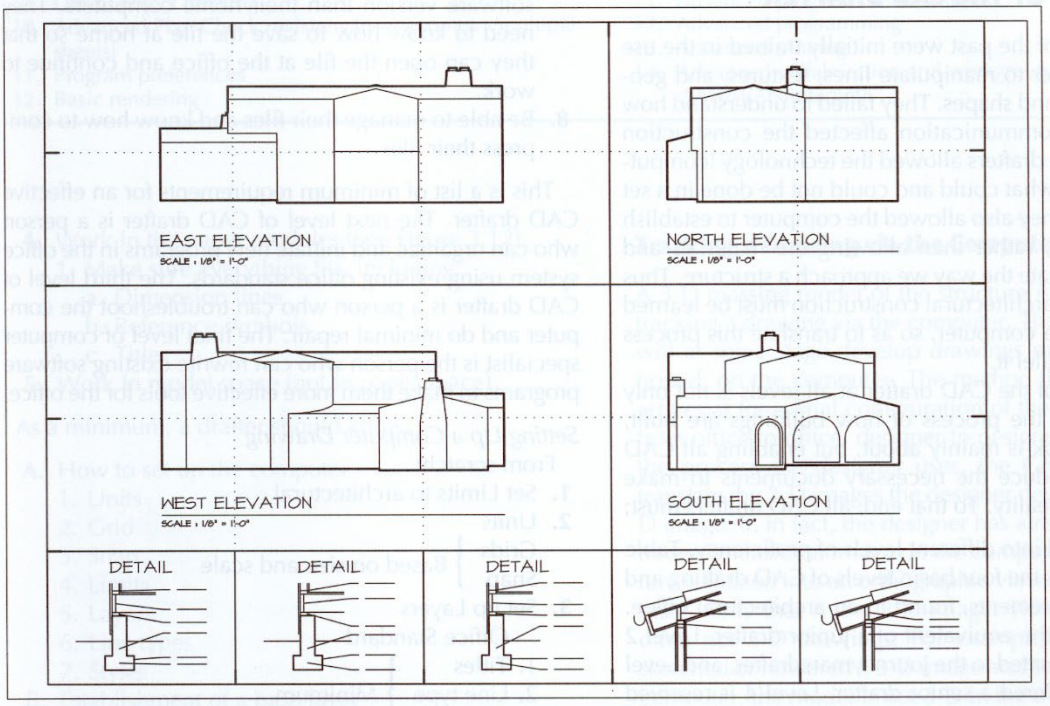
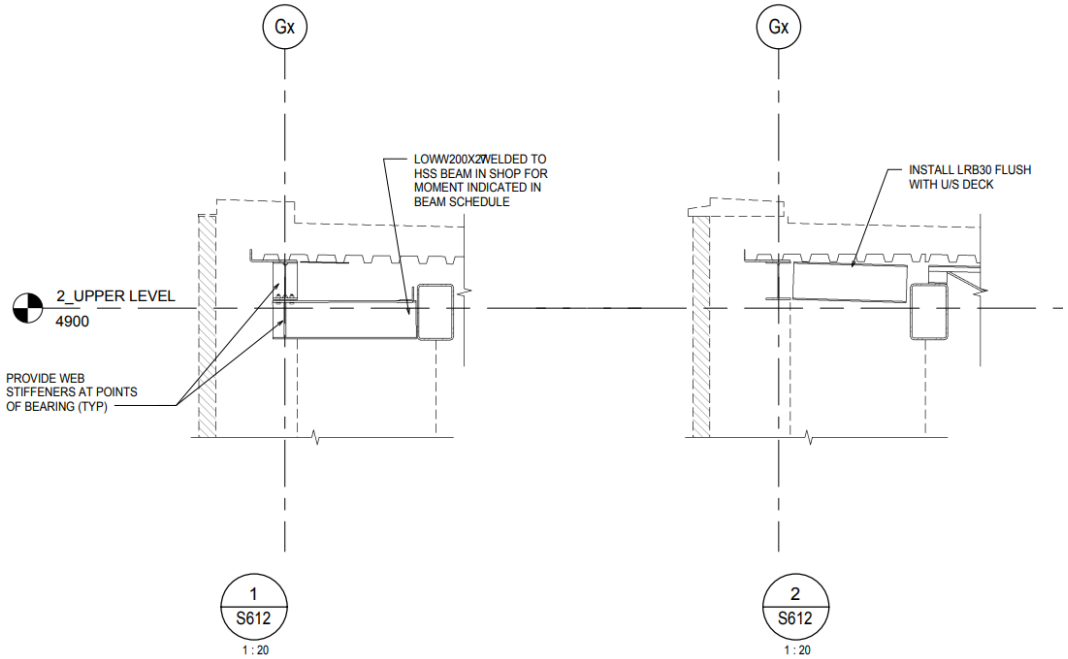


Figure 3.30 Sample cartoon/page layout. (Courtesy of Mike Adli, Owner; Nagy R. Bakhoum, President of Obelisk Architects.)

Architectural Working Drawings by Wakita and Linde

One trick to make drawings easier to read is to ensure that your level datums (the imaginary horizontal lines that define the floor, roof, or ceiling level, for example) all line up across a page which has multiple details on it.



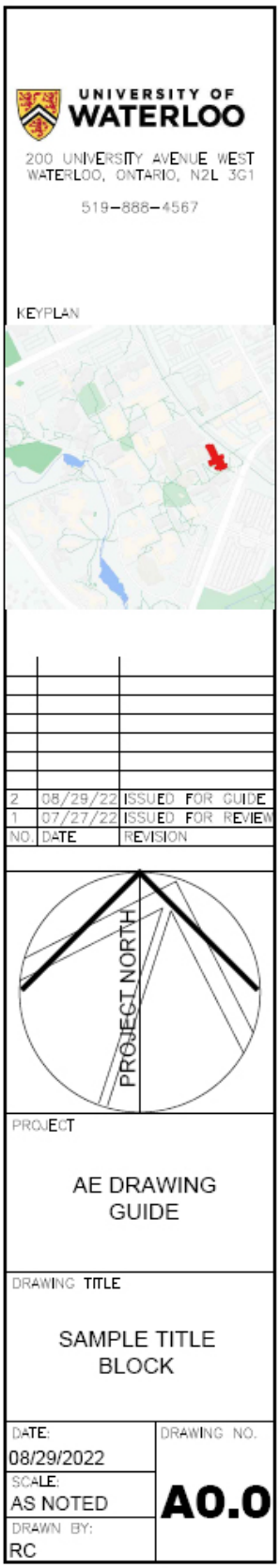
Blackwell Structural Engineers, 2015

TITLE BLOCK AND SHEET INFORMATION

Technical drawing sets will always have a title block strip, often at the right hand side of the page, sometimes along the bottom.

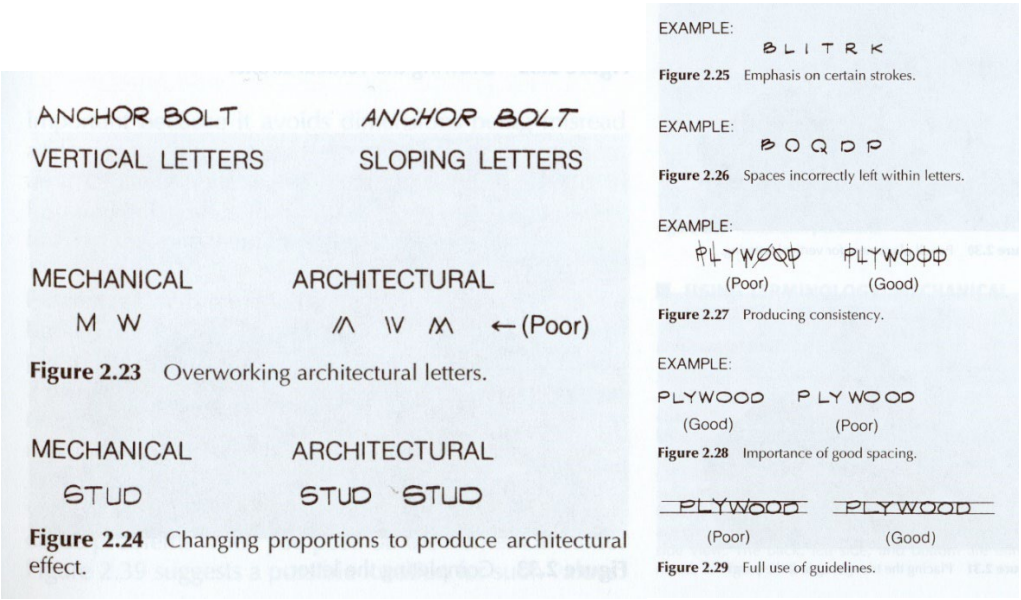
The sheet information must include:

- North arrow (exclude from non plan view sheets, and details smaller than 1:20)
- Name of drawings included on the sheet
- Scale if the scale of all the drawings on the sheet are the same
- Sheet number – this is needed so that details, sections that reference another sheet can be located
- Your name(s) as authors of the drawing
- Date



LETTERING ON THE DRAWING

Lettering on a drawing is traditionally done using ALL CAPS. Modern digital drawings sometimes include lower case text, but this continues to be uncommon in industry. When drawings were done by hand this allowed many people to work on a sheet over time and not have it look an utter mess. In computer drawings you are choosing a standard font that appears similar to the traditional hand lettering style. Legibility is more important than style: clean, plain, vertical lettering is always best.



Architectural Working Drawings by Wakita and Linde

When drawing by hand make very light horizontal guide lines on the page to ensure your spacing is even and the quality is clean.

When creating drawings on the computer use a very plain font such as Arial, again using ALL CAPS except for some specialized notations. Do not use the default AutoCAD font.

Every text label in a drawing set should be written using the same font, and be at the same size on the page, regardless of if the drawing is at 1:100 or 1:10. Drawing titles may be larger, but again should be standard for all drawings in the set. The label text is the right size when it is legible from about 1m away, when printed at full scale. This may take practice and test prints to get right. Always test-print your drawings at 100% scale to check if the text size is appropriate.

DIFFERENTIATING LINE WEIGHTS

It is very important to change up the weight or thickness of the lines when you are drawing. You must also show the presence of building components *above* or *behind* as they impact your decisions. These would include in the plan view the lines of roof overhangs, ridge lines for pitched roofs and skylights.

Lineweights are differentiated, whether you are drawing in ink or pencil, by hand or with CAD.

Heavy line when cutting through a material to define the outside.

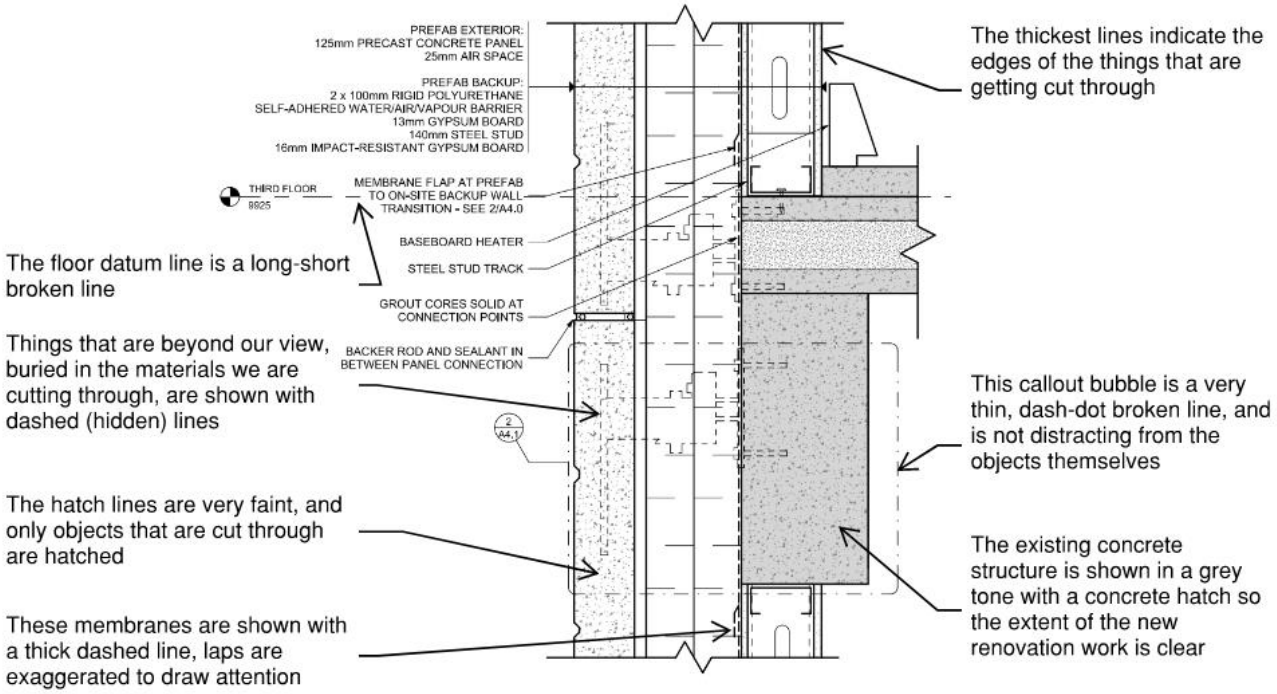
Lighter lines to show elements in elevation, or further away.

Even lighter lines still for hatching or objects further in the distance.

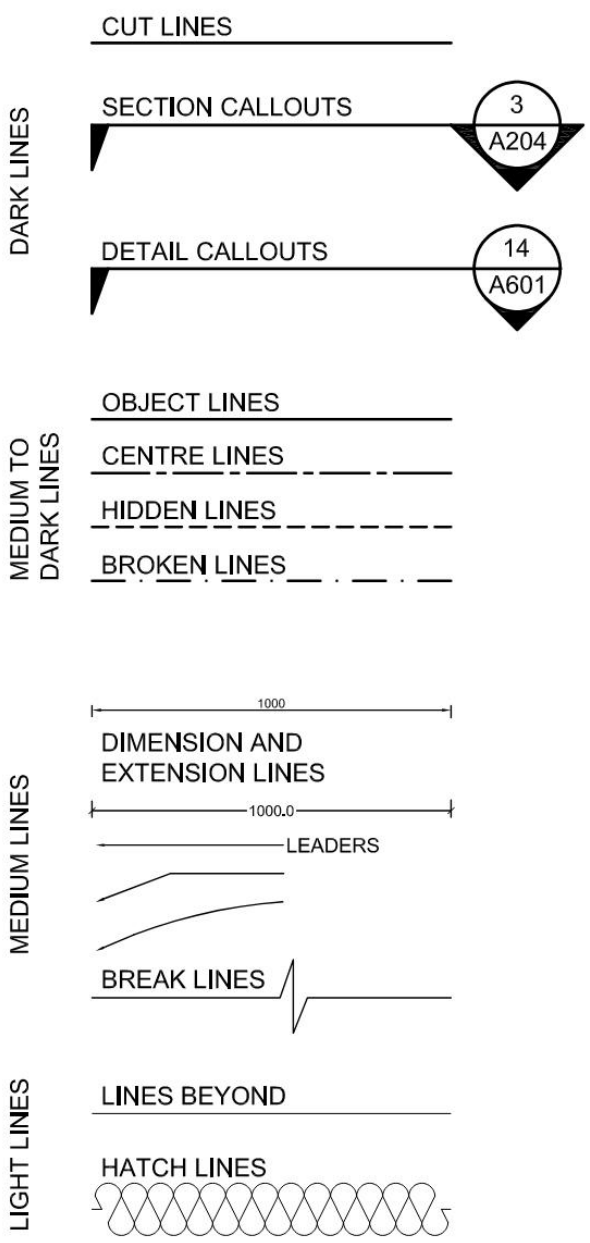
Dashed lines to show objects above you, hidden below something, or potential movement paths.

The precise nature of dashed and dotted lines will vary depending on the type of drawing you are preparing. Grid Lines, centre lines, easement lines, property lines, etc. all use variations of “non solid” line types.

Changing the **line weights** makes the drawing read more clearly.



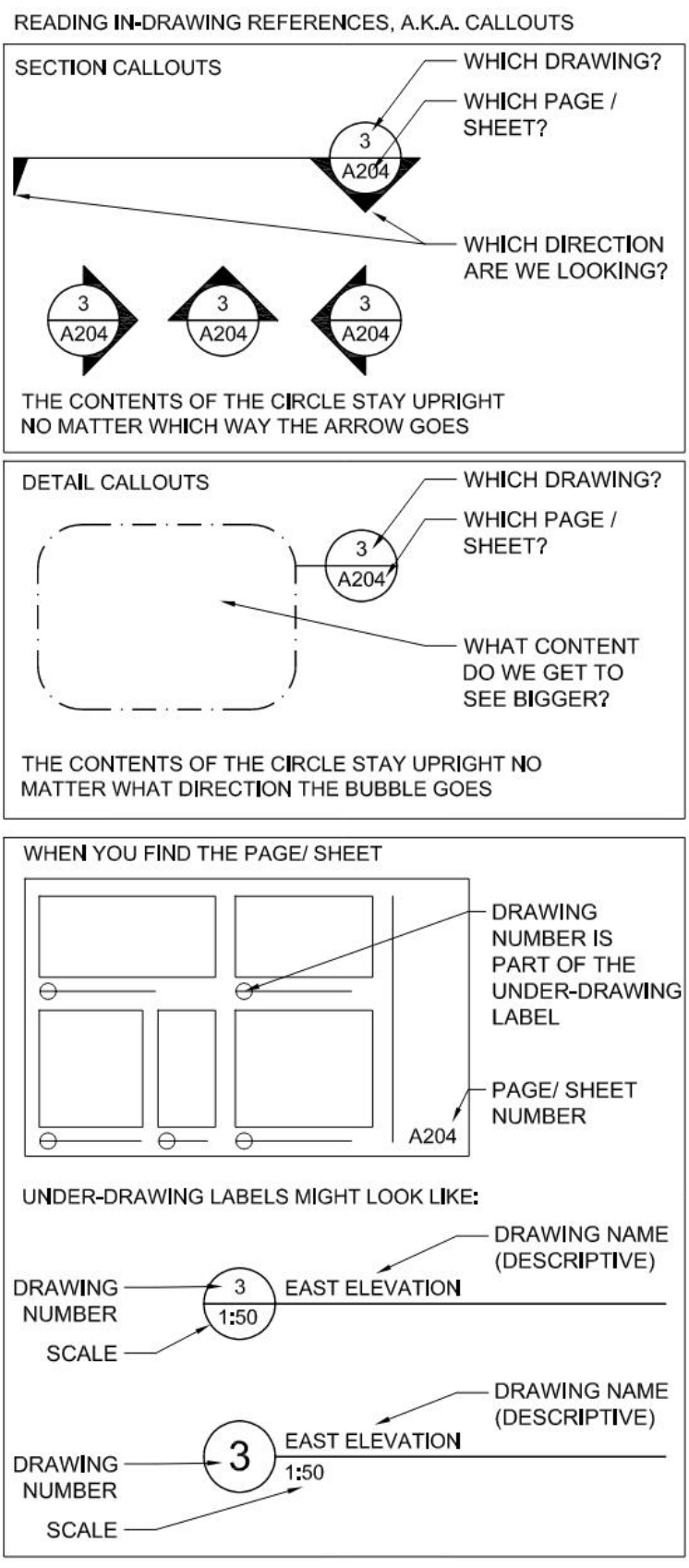
Façade Detail by Jasmine Liu



There are many different types of lines to be found on technical drawings. Some of the variations are pretty subtle, but different versions of dotted and dashed lines are needed to be associated with so many different parts of the drawing.

These may look slightly different in CAD produced drawings than hand drawn ones.

Regardless it is necessary to make some lines thicker and bolder looking and others quite light.



Bubbles are used to note where sections and details are taken. The letter or number in the top half of the bubble is the designation of the detail/section itself and the letter + number combination on the bottom is the page (or sheet) number. That is why you have to number your pages / sheets. In large drawing sets, we refer to pages as sheets.

The blackened in arrows show the direction of the view that the section takes. If you don't see an arrow, it refers to an enlarged detail that is located elsewhere in the drawing set.

Sometimes a sectional drawing will be at a scale where the level of detail of a certain connection cannot be shown accurately, and an even more zoomed-in drawing must be produced. The location of this detailed drawing is drawn with a broken line, and a detail callout bubble indicates that there is more to see here, and how the reader can find that detail. When you call out a detail on a section, you will navigate to the page noted to find the detail.

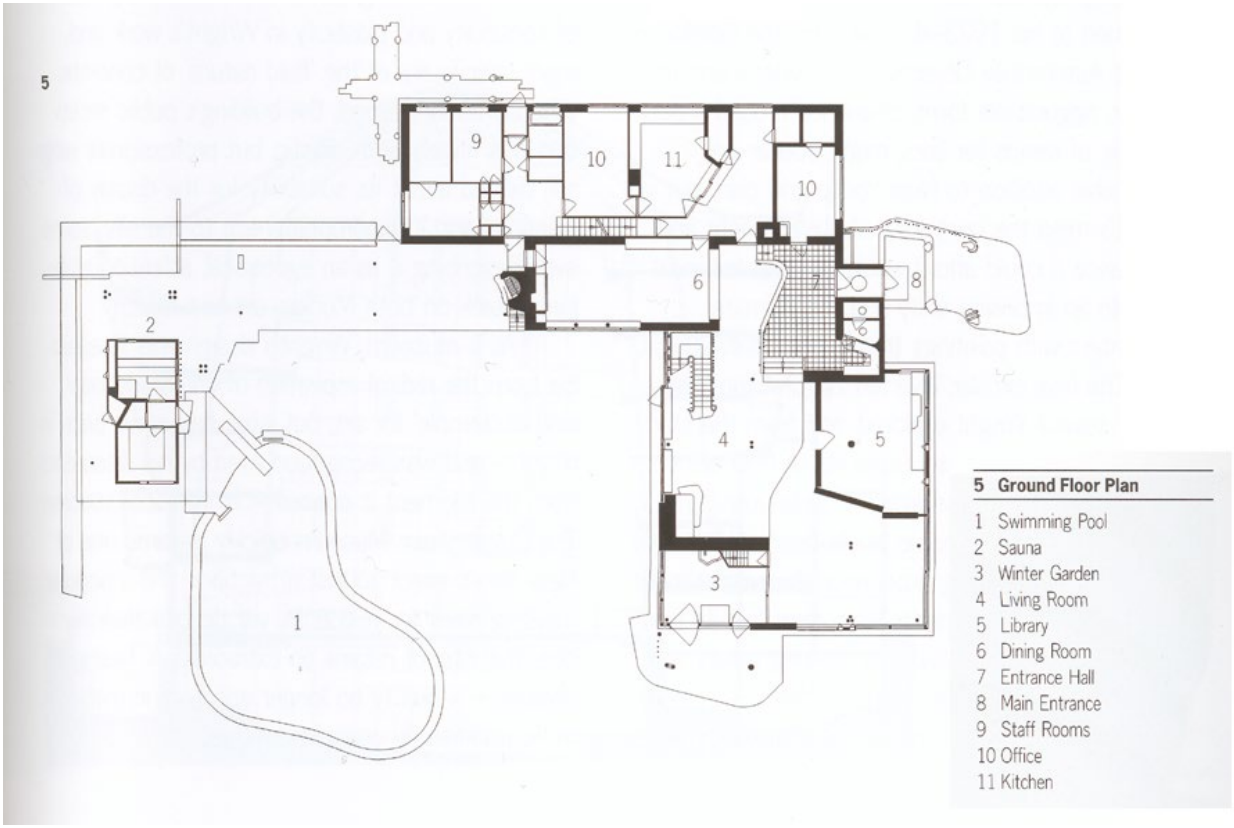
The "code" of navigating architectural drawings is standardized so that everyone can find the information that applies to them in an orderly manner. Most full construction drawing sets have dozens if not hundreds of sheets to look through. Skimming a drawing set until you hopefully find the information you are looking for is time consuming. The contract documents of a finished building design are the legal instructions for building that project, so clearly and consistently giving those instructions is important. The skill of quickly finding the drawing or detail that you are looking for takes practice but is critical to learn.

HATCHING

There are 2 approaches to “filling in the walls” when creating DESIGN / PRESENTATION versus TECHNICAL drawings.

DESIGN DRAWINGS

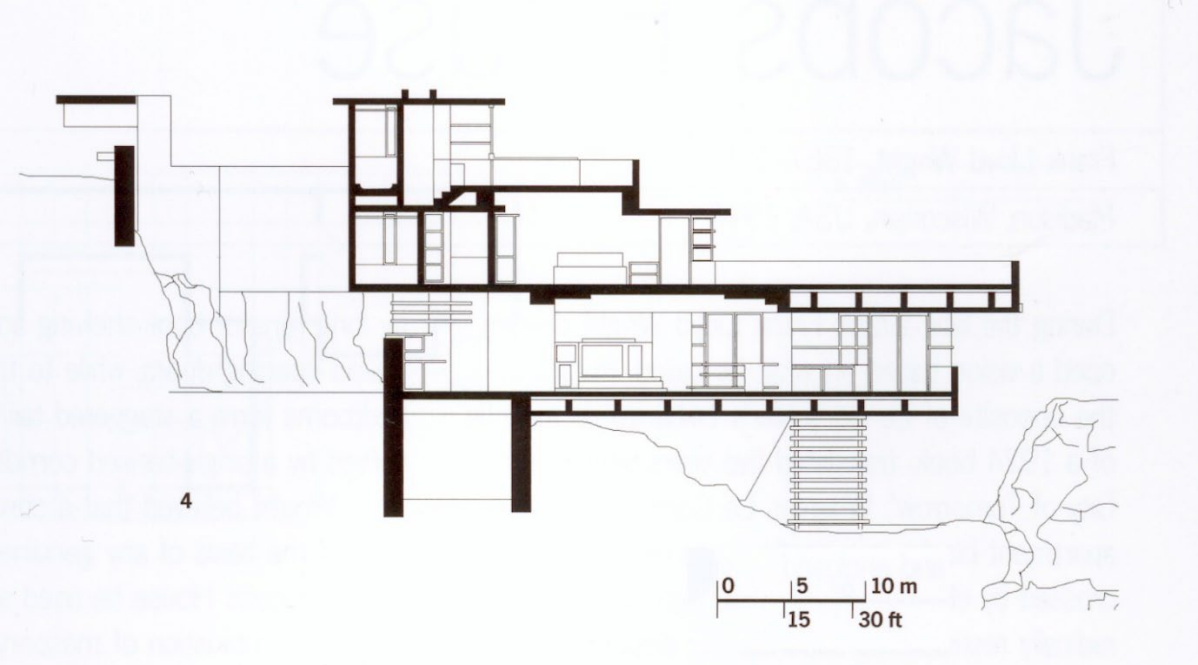
Design drawings will normally completely fill the walls, floors in black. This is called **poché** and is used to make the solid elements really stand out clearly.



Key Buildings of the 20th Century by Weston

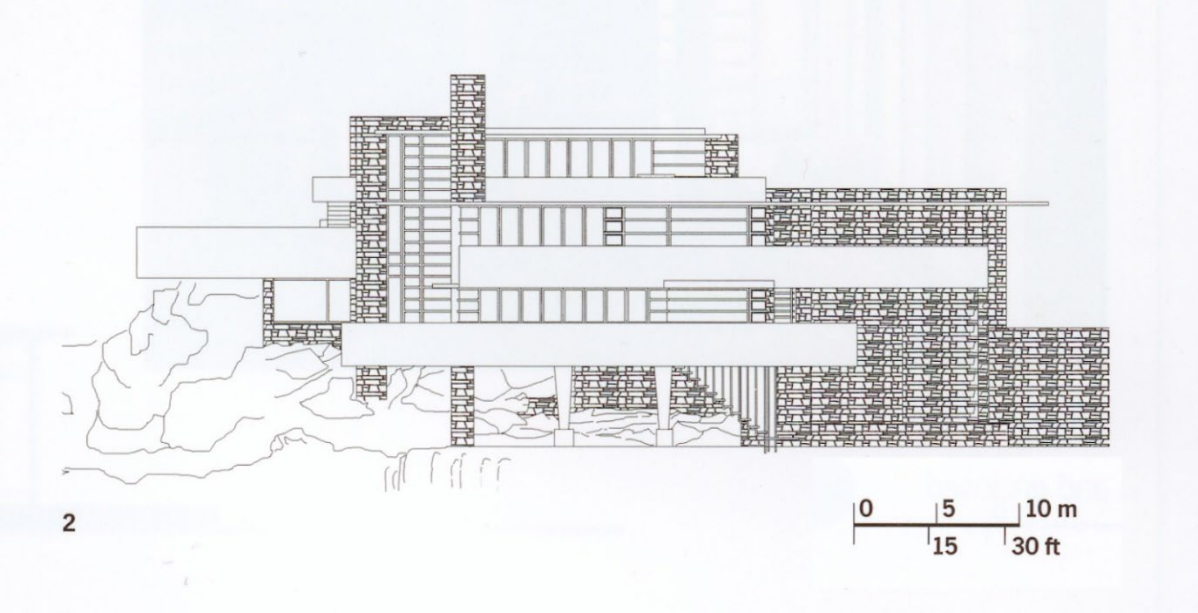
Notice that even though this is a DESIGN presentation drawing, the LOAD BEARING or exterior walls are visibly thicker than the interior partitions.

Hatch is used VERY SPARINGLY on plan drawings as it detracts from the clear reading of the walls, windows and door openings.



Key Buildings of the 20th Century by Weston

Sections for design drawings will also **poché** the walls and floors to make the structure stand out. These structural elements also have their approximate thicknesses represented. Very light lines are used to show the elements in elevation beyond. It is helpful to put scale figures (people) in these drawings to give a sense of the height of the space.

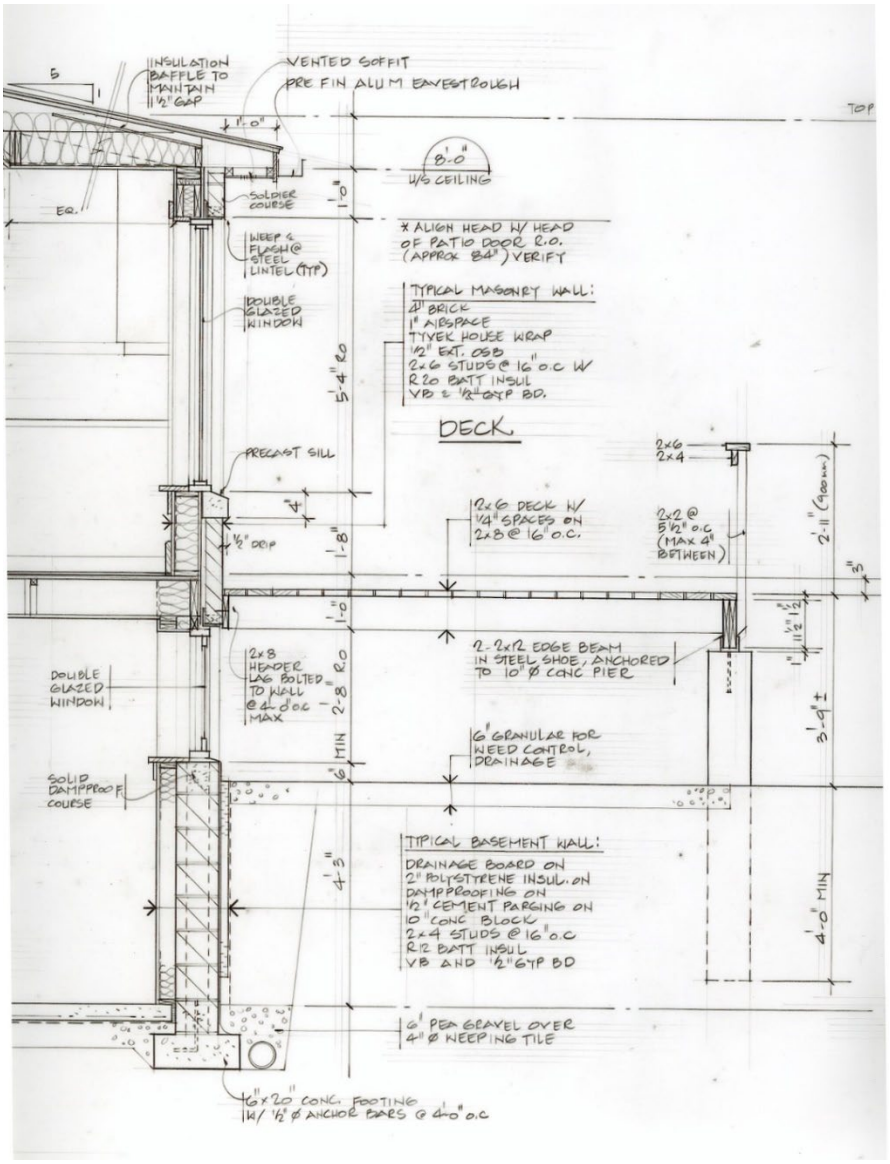


Key Buildings of the 20th Century by Weston

Elevations for design drawings will try to make the materials of the cladding read so that this is easily understood. Take care not to make the drawing look too cluttered by having the hatch too dense. Be sure if you are doing a CAD type drawing that the hatch does not go black when you reduce it to print.

TECHNICAL DRAWINGS

Technical drawings are also known as contract drawings and are generated so that the contractor can properly bid on the cost of the job and also accurately order all of the materials. Instead of blackening in the walls and floor with *poché* the lines representing the actual material layers are included. The nature of this will vary greatly depending on the scale of the drawing. If you are making a plan at 1:50 or a detail at 1:5 the amount of information that is possible to show will vary a lot!



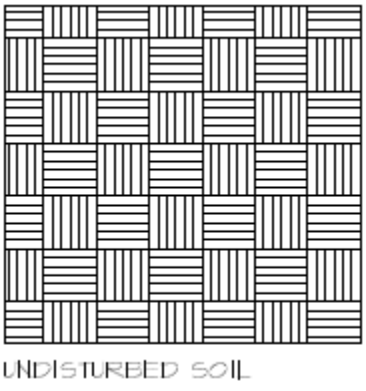
Hand drafting by Terri Boake

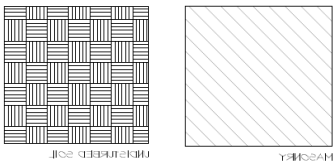
This hand drafted section through a house shows the nature of what level of material detail is possible at a scale of around 1:20. Drawings get quite intense by the time you include dimensions and materials labels so you have to be very organized when planning the drawing. Notice how the labels for the wall assemblies are created as “lists” rather than having a confusing spiderweb of arrows to each element. It makes the information much easier to understand.

HATCHING

Hatching is used instead of *poché* in technical drawings to provide clarity in the representation of your materials. It helps to understand the layering of walls, floors and roofs. Hatches are universally used in the industry and you should always use standard hatches. Do not invent something unique.

Be sure that the density of the hatch you use matches the scale of the drawing. If you are using AutoCAD or Revit, check to see that the printed out version of the drawing does not “go black” or become otherwise hard to read (see example below).



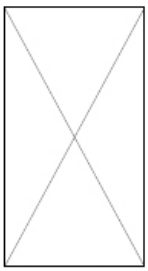


When hatches are scaled down they can change appearance or become hard to read.

As a rule you should check the readability of your CAD based drawings at the scale you will be printing them at to make sure that they read properly.

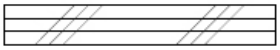
Tone existing construction grey or a fine dotted hatch to make it clear that it is existing and not new construction.

NOTE: These hatches are industry standard and should be used in all your technical drawings unless there is a very specific reason not to

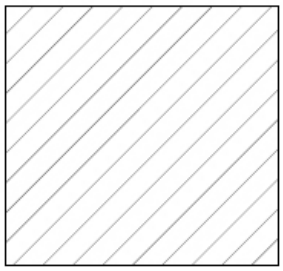


STRUCTURAL WOOD

FINISHED WOOD

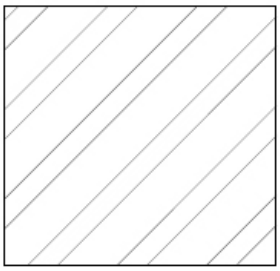


PLYWOOD

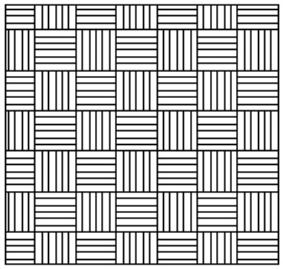


MASONRY

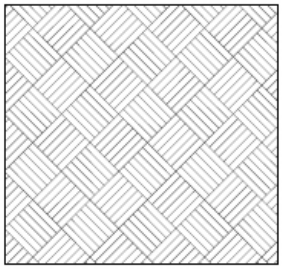
CONCRETE BLOCK



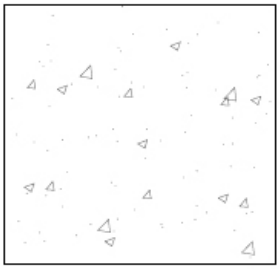
STRUCTURAL STEEL



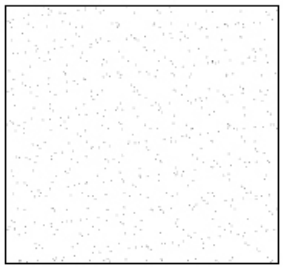
UNDISTURBED SOIL



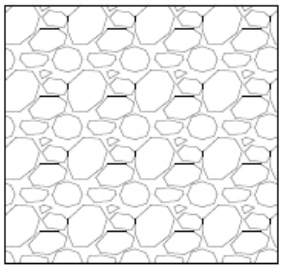
BACKFILL



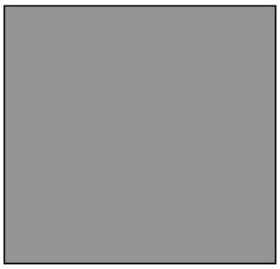
CONCRETE



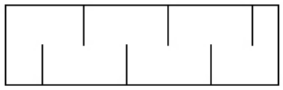
SAND



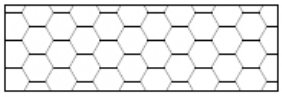
PEA GRAVEL



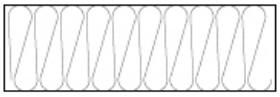
EXISTING STRUCTURE



RIGID INSULATION



SPRAY FOAM INSULATION



BATT INSULATION

Drawn by: Renee Champion

DIMENSION LINES

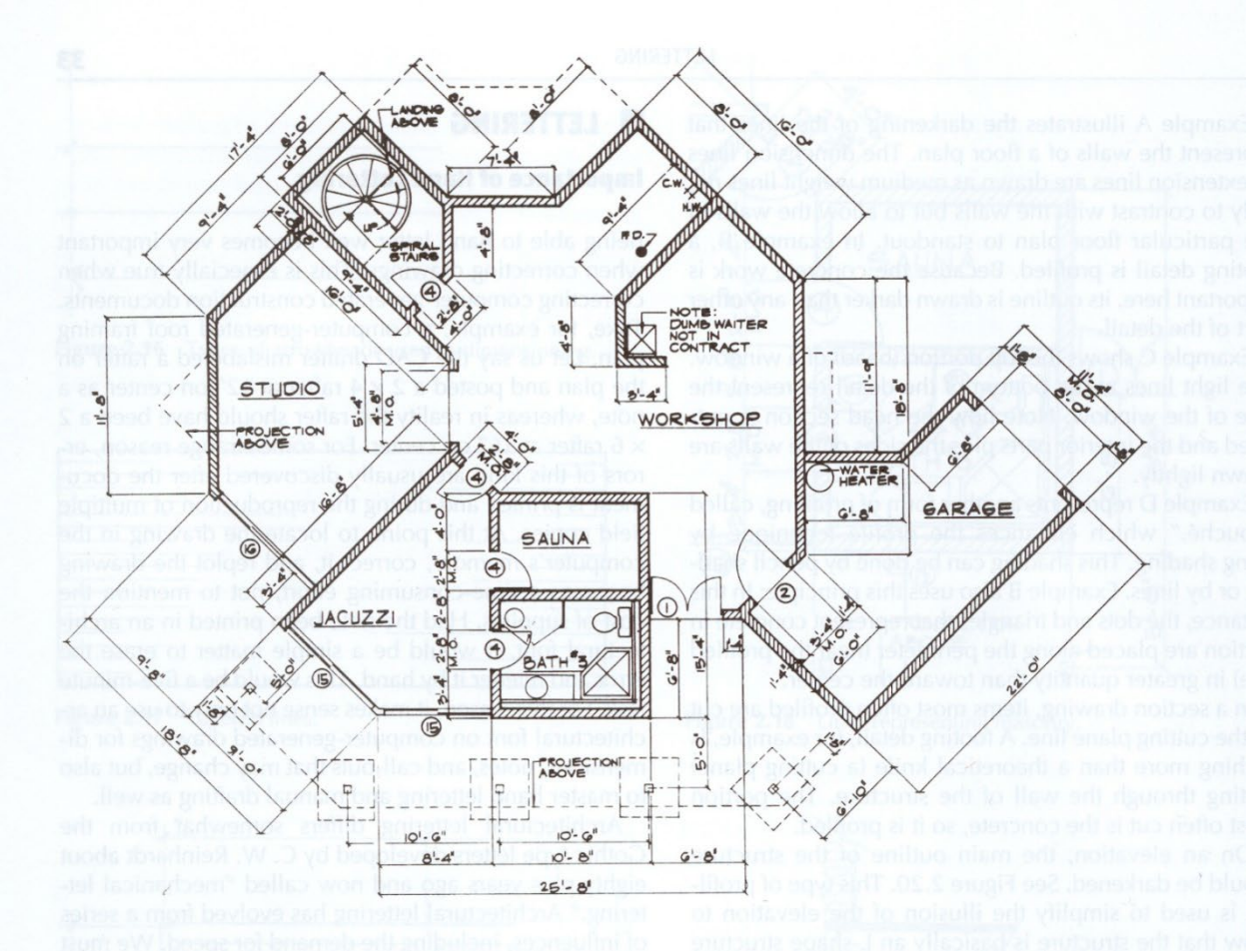
This is an example of dimension lines on a basic floor plan of a building. Notice that overall dimensions of a building face are provided on the outside string, with subdivisions spaced closer to the building. You need to keep them a far enough away from the drawing to also allow for notes.

NEVER MIX UNITS. Drawings are either in Metric or Imperial. In some instances you might be asked to provide both, with one set included in brackets after the other.

Horizontal dimensions go on PLAN type drawings.

Vertical dimensions go on ELEVATIONS AND SECTIONS.

Please make note of the use of dimensions throughout the drawings provided in this book.



Architectural Working Drawings by Wakita and Linde

The dimension lines are evenly spaced and the dimension numbers centered along the lines. They are always oriented so that they are easy to read. Use a / and not an arrow.

GRID LINES

Larger buildings that use a column grid as a structural system will have a system of grid lines to locate the column grid and allow for ease of dimensioning and for the contractor to be able to easily reference a certain position in the large project. If they talk about the column at grid B1 on the third floor everyone knows which one they are talking about.

The grid goes through the CENTRE of the column or bearing wall so that if the column size or wall thickness changes it doesn't impact the grid placement and dimension string.

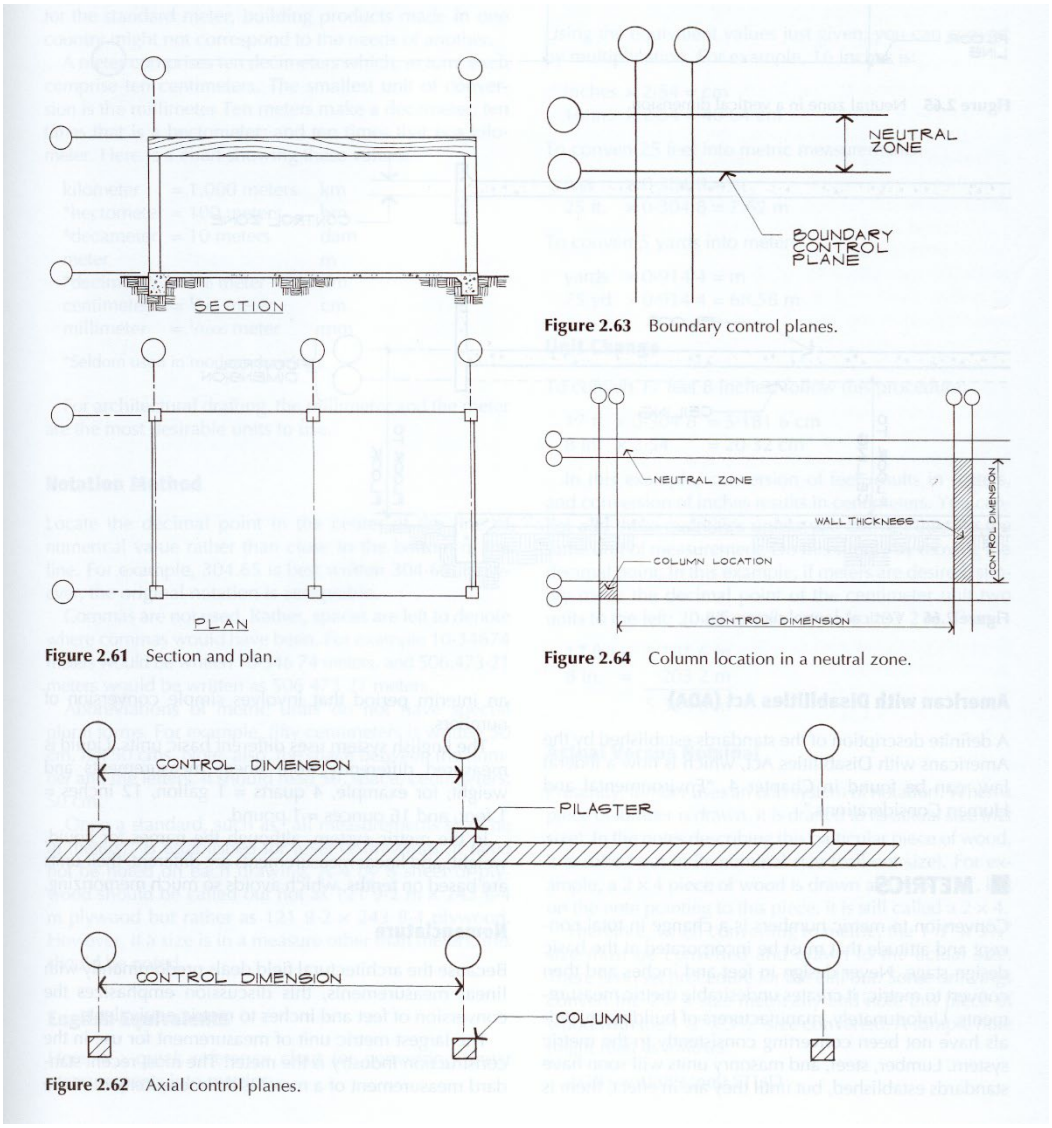


Figure 2.61 Section and plan.

Figure 2.63 Boundary control planes.

Figure 2.64 Column location in a neutral zone.

Figure 2.62 Axial control planes.

Architectural Working Drawings by Wakita and Linde

This is a very generic drawing of grid lines. Each has a round bubble into which goes the number or letter for the grid.

LABELLING DRAWINGS

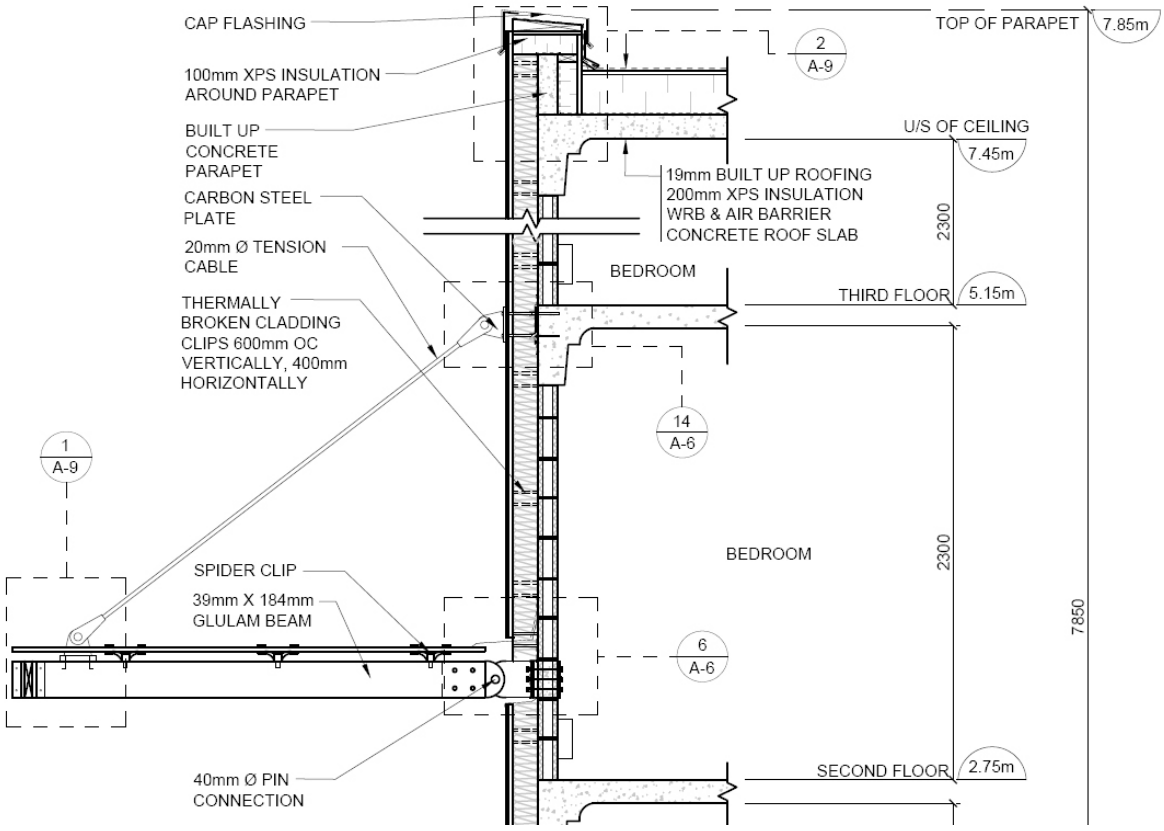
It is critical that the text on your drawing is clear and well organized. The more complex the drawing, as in the partial section on this page, the more labels are required and the greater potential for a mess to occur!

When drawing on CAD be sure that your text size is correct for the final printed drawing. It should be neither too large nor too small. You will need to do a test print to get accustomed to picking the correct size.

Assembly type labels should be used for elements like walls, roofs and floors where we have a sandwich of layers. Spiderweb type criss-cross lines are not acceptable. Only use single arrow labels for unique elements. Do not make individual lines cross over each other. Line text up neatly!

For assemblies labels are:

- Outside to inside layers (walls)
- Top to bottom layers (floors, roofs)
- Include the material thickness, material name and R-value if needed (150mm fibreglass batt insulation, RSI 3)



CAD drawing by Renee Champion

HOW TO DRAW DOORS IN PLAN

When we draw doors in the plan view we show how they open so that we can see:

- the type of door being used
- direction of travel
- that door swings do not interfere with traffic (overlapping other door swings, blocking vestibules for wheelchair access or hitting furniture)

Also note direction of door opening and make a point that *EXIT doors on public buildings always open in the direction of travel to let people out for fire reasons.* Residential doors open into the residence as it is assumed that your housemates will let you out in case of fire and also if snow is piled up outside you can open the door in and dig your way out.

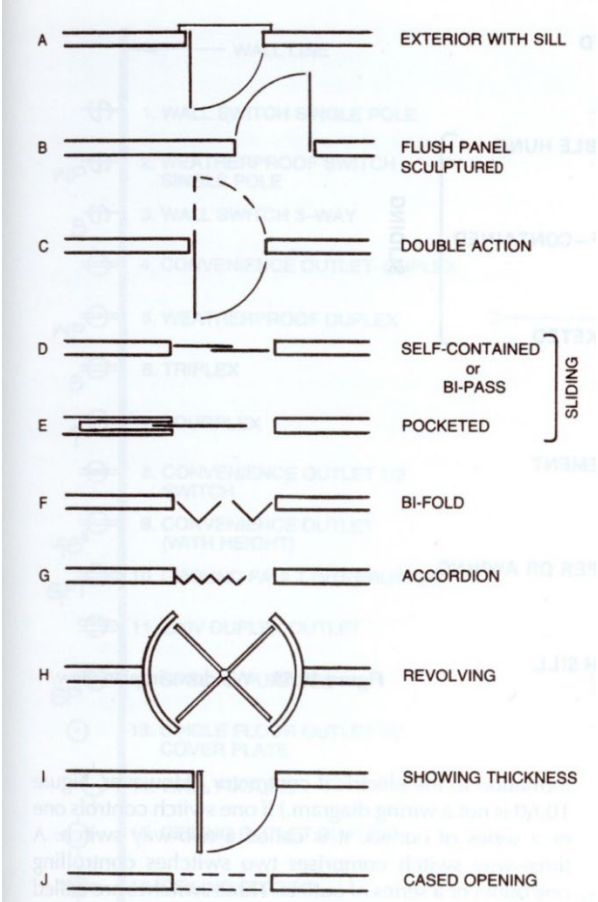


Figure 10.57 Doors in plan view.

Architectural Working Drawings by Wakita and Linde

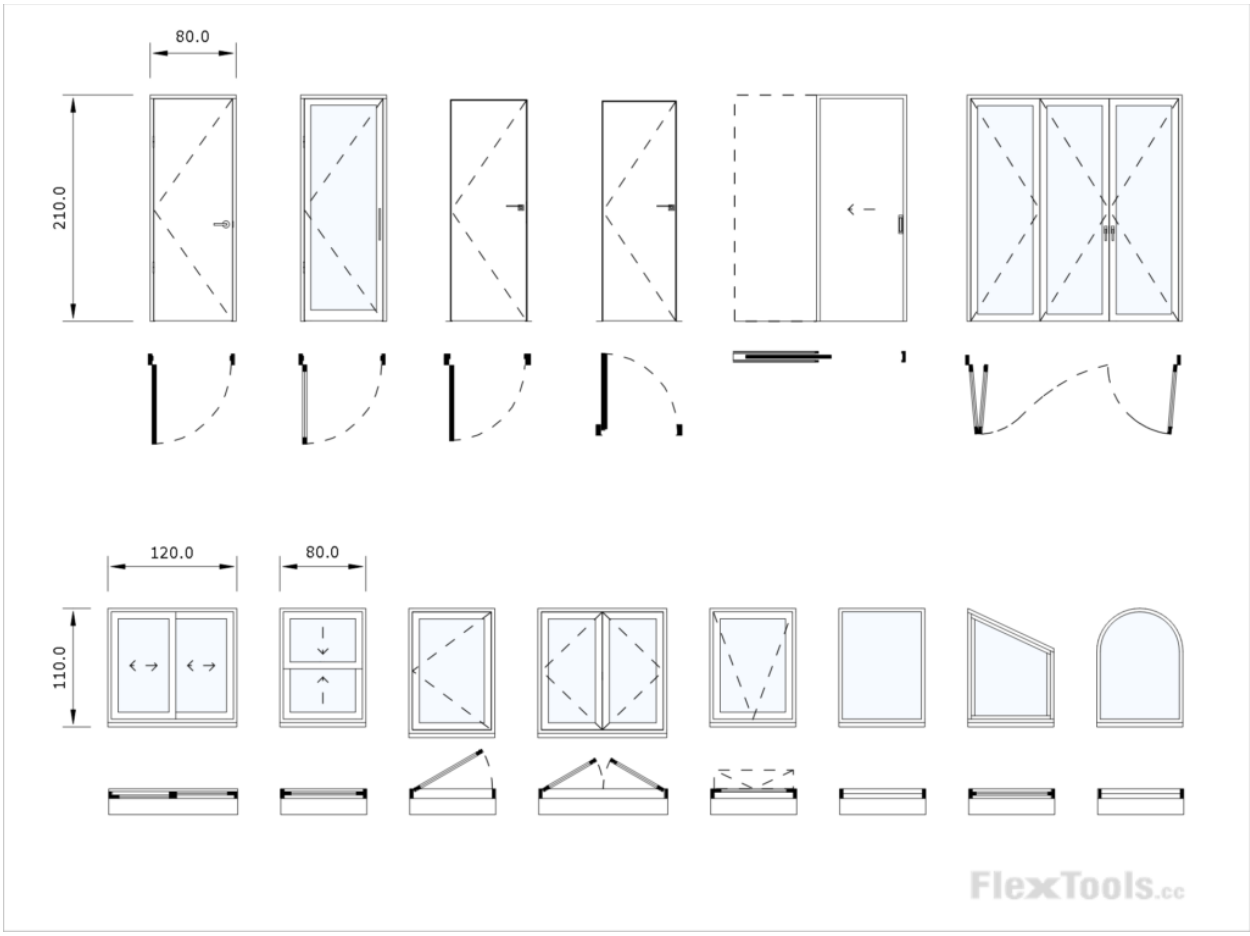
In a design drawing the walls will be blackened in. In a technical drawing the walls will show their true thickness and you will also see the door frame, its position and a threshold if the door is in an exterior wall – showing a change in the flooring material from inside to outside.

HOW TO DRAW WINDOWS and DOORS IN ELEVATION

Elevation drawings will show windows and doors. As part of this you need to draw them correctly to indicate which are fixed (non-operable) and operable. We need to show how they open. Where is the hinge side? Is it a slider?

The hinge is located at the pointy side of the dashed lines that form a triangle. If we don't see those dashed lines, or the slider arrow indication, the panel is assumed to be fixed. Note that these dashed lines in elevations DO NOT tell the reader if the door opens inwards or outwards: that must be shown in plan.

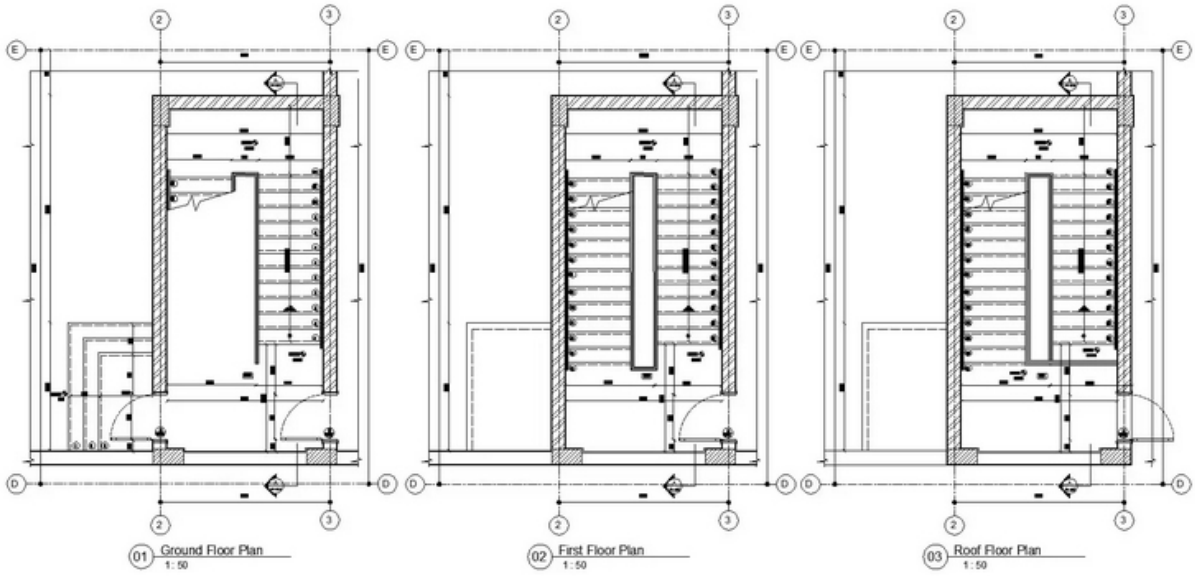
There is a double line around the opening to indicate the frame in the wall, and another line around the glass itself to show the frame that holds the glass. Any operable window (and door) MUST have a double-line around perimeter.



STAIRS

Stairs can be one of the more complex elements you include in your plans and sections. The number of treads needed depends on the height from floor to floor. There are strict codes regarding stairs to prevent tripping. Steps for stairs shall have a horizontal run of not less than 255 mm and not more than 355 mm between successive steps and shall have a vertical rise between successive treads not less than 125 mm and not more than 200 mm. *Normal stairs are generally 255 tread and 200mm riser.*

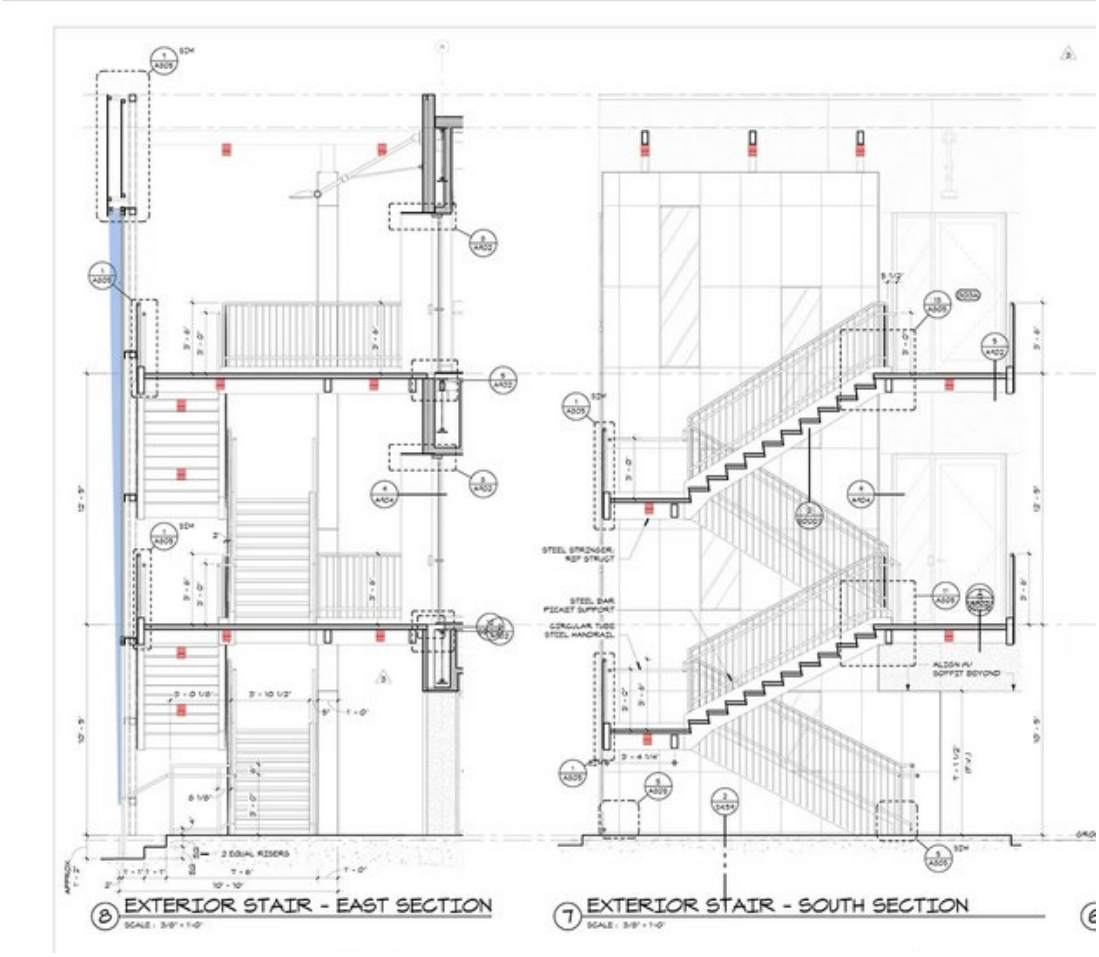
The width of the stair is related to how many people will be using it at one time. Can they comfortably pass by each other? Usually 1m is considered enough for a residential stair. Commercial and institutional buildings will have wider runs, up to 1.5m, due to high occupancy.



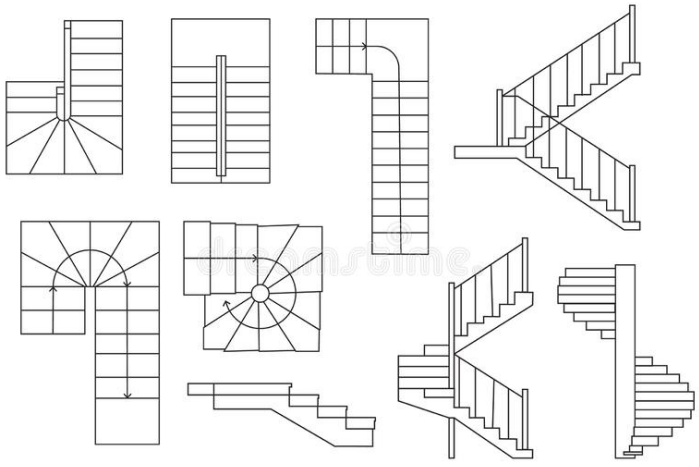
Floor plans of a typical exit stair. Note that there is a space between the door and the stair so when people are using the stair they don't get knocked over by someone opening the door.

Note UP and DOWN arrows on the stairs as they start at the floor you are drawing.

There is a "nosing" on the tread of around 20mm (part of the 255 tread dimension). This helps you not trip up the stairs. This is created regardless of what materials you are using to build the stair.



It is important when you are working out your stairs in section that you understand head room and clearances if you are planning on tucking in any program under the stairs.



There are various layouts for the stair (straight run not pictured). Spiral staircases and L shaped stairs with winders are not permitted as primary means getting from floor to floor in most buildings. Not to mention that moving a King sized bed up a spiral stair is impossible.

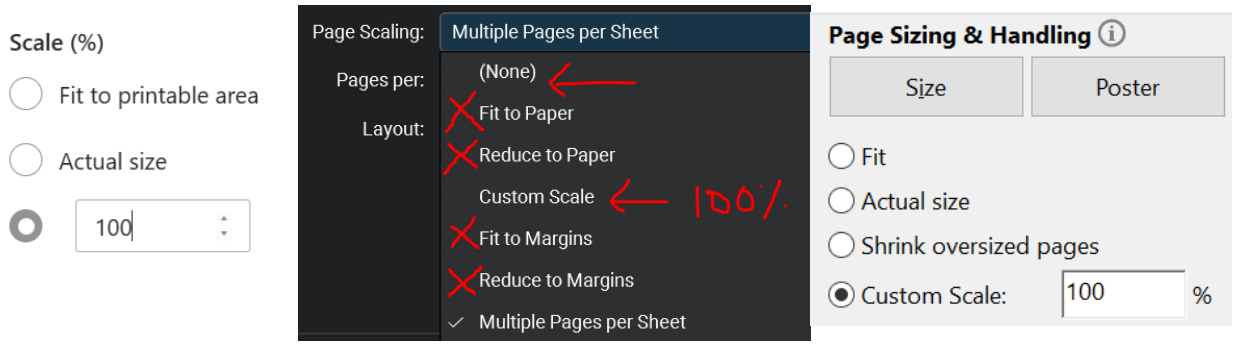
PRINTING / PLOTTING

The very last step in the preparation of a drawing set is often printing, also known as plotting when done at a large scale. However, if all the drawing is done on a computer screen where zooming is infinite, it is likely that when it comes time to hit "print" on that very expensive set of drawings, there will be some questionable line weights, line type scales, text scales, and formatting issues.

Tips for printing:

1) **Do a test print regularly**. Confirm that line weights, line type scales (is the hidden line now way too dense?), hatch scales, and fonts are all what you expect them to be. You don't have to plot a full-sized sheet to do a test print! If you make a PDF of the drawing, and then instead of printing the full sheet, print just a window of it (make sure it includes hatches, text, line types, etc.) and then set the printer to "print 100% scale" on a letter sized page.

2) **Never PRINT TO FIT**. In your exported PDF drawing, there is a white border around the edge accommodating that most printers and plotters can't get the ink to the very edge. However, if you "print to fit" then the PDF program will shrink down the image, adding extra white space around the edge because it's assuming that maybe you had important stuff right at the edge. Why do we care? Because our drawings were TO SCALE before, and now that the printer and PDF program have fit the page nicely, these drawings are no longer to scale. This could be very bad for you. See below for print window samples from Microsoft edge, Bluebeam, and Adobe Acrobat which all have "fit" options that should be avoided at all costs.



3) **Leave time for printing**. It's likely that you don't own a large format printer, and the places that do this kind of printing tend to require some lead time and are not open 24/7/365. There are options to print on campus through W-print, or you can go to third-party stores like Staples.

THE CHECKLIST

A way to be sure that you "have everything" on your drawings is to use a checklist. Each of the specific drawings will receive a checklist in this guide.

This checklist applies to all of your drawing sets.

AE BASIC DRAWING CHECKLIST

GENERAL NOTES	
Graphic clarity and uniformity in the set	
The contract is the drawing AND the notes	
Annotate thoroughly - prioritize notes over hatch	
Do not hatch dark or excessively it detracts from legibility	
Use industry standard hatches, do not improvise	
Make sure your notes align and do not create a chaotic visual	
Where possible, use assembly type (ganged) labeling to limit spiderweb type arrows and assist clarity	
Be consistent - Metric OR Imperial, do not mix. In some cases both can be included but be consistent in how you order them. DO NOT HARD-CONVERT imperial units and then keep more than one millimetre of accuracy.	
Generally material labels will include their thickness or size. This is clearer than dimensioning thicknesses within a detail. Imagine taking these assembly lists to Home Depot and filling your order.	
Technical drawings are not printed in colour. Use line weights, line types, hatches, and labels to communicate: never use colour unless explicitly told otherwise for diagrammatic reasons.	

Think of your drawing set as a set of instructions. A contractor could take these to Home Depot or Rona and know exactly what to pick up to build the building. They will go to the site and based on your measurements, set it out on the ground and put it up correctly.

SITE PLAN

The base drawing for most drawing sets is the Site Plan. It will show:

- Where your site is located, including
- Street names
- Adjacent neighbouring buildings
- North arrow
- Lines to show the property limits
- Significant vegetation such as large trees
- Pathways, roadways on the site
- Paved versus landscaped area
- Parking

The plan view of your building itself is normally a simple outline and doesn't include much detail.

SITE PLAN	
All about the location	
North Arrow	
Scale notation (numeric AND graphic)	
Plan of simplified ground floor of buildings	
Landscaping, trees, grassy areas, walkways	
Dotted lines to show limit of property size	
Partial plan of adjacent buildings if applicable	

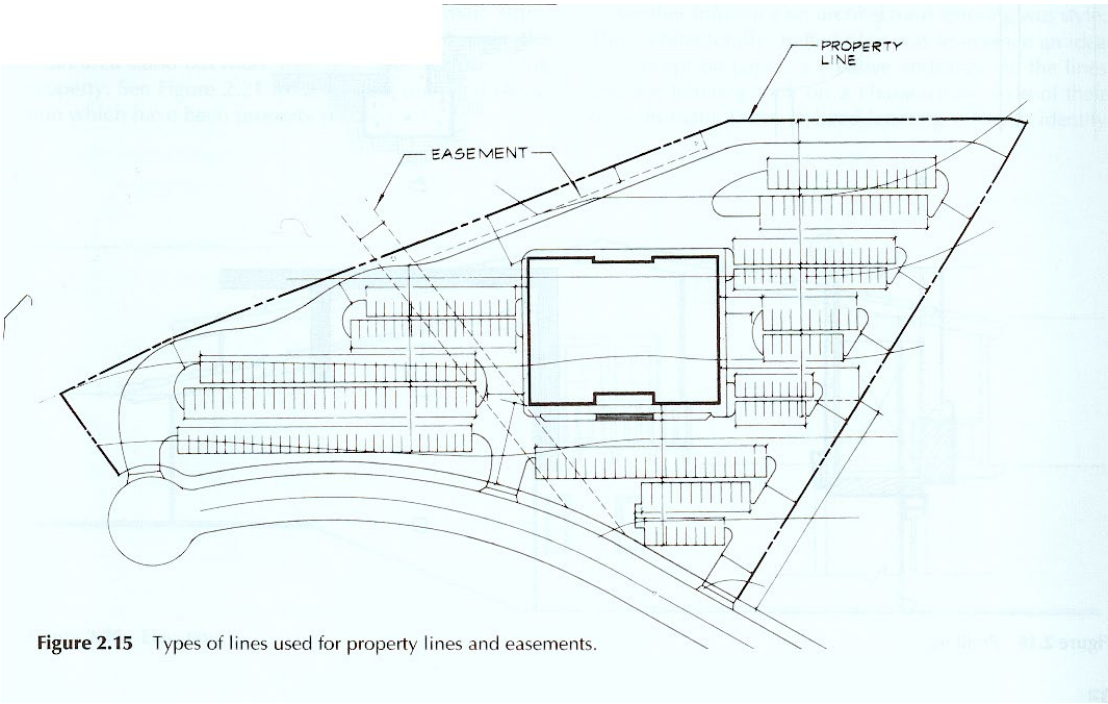
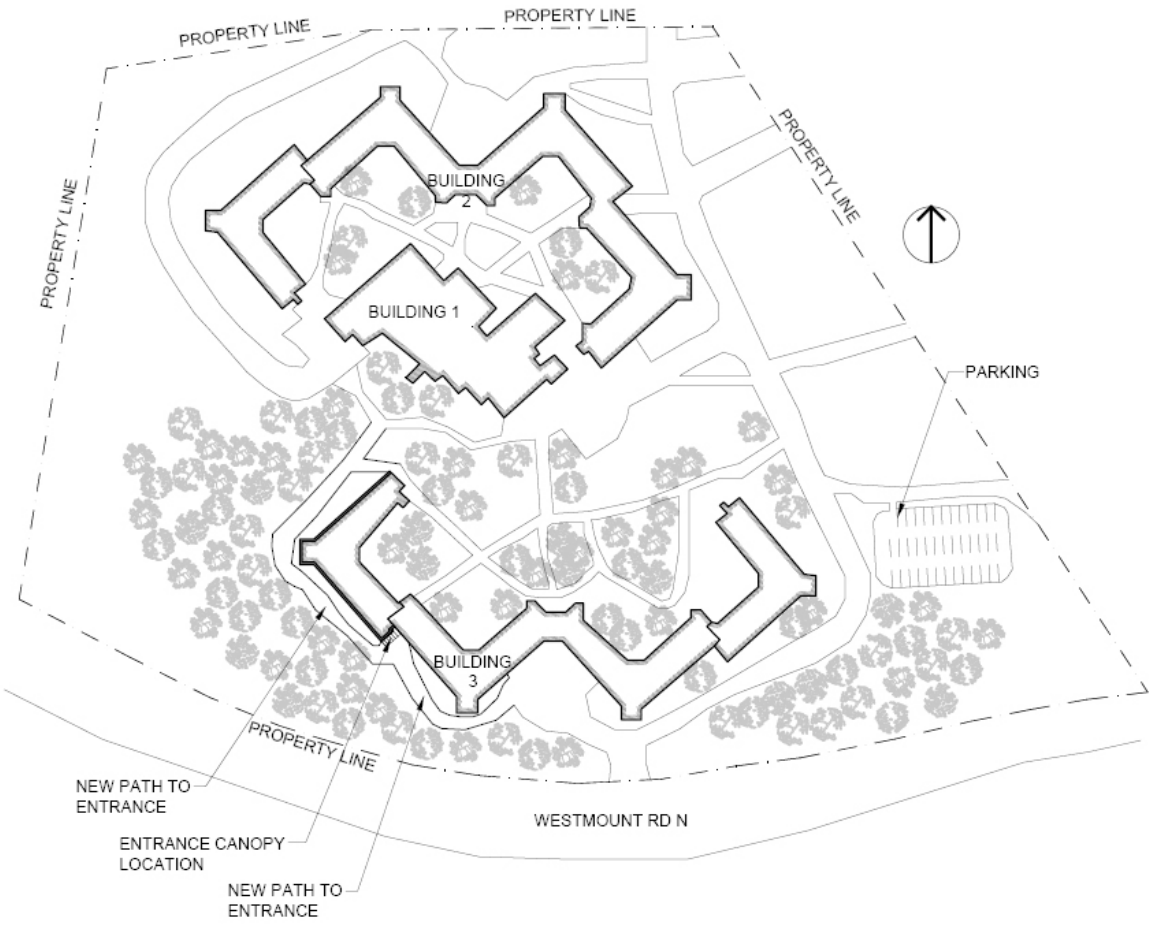


Figure 2.15 Types of lines used for property lines and easements.



Drawn by Renee Champion

There are different “special” lines used on site plans and property surveys.

- Property lines with the long double dash.
- Light dotted lines for easements (parts of the property that have utilities interfering either overhead or underground where you cannot build even if you own the land).

SURVEY DRAWING

The survey drawing is prepared by a registered Land Surveyor and provides you with accurate dimensions, site orientation for your north arrow and the setbacks (permitted distances from a building to a road, to a property line, to a creek, etc.) for the adjacent buildings.

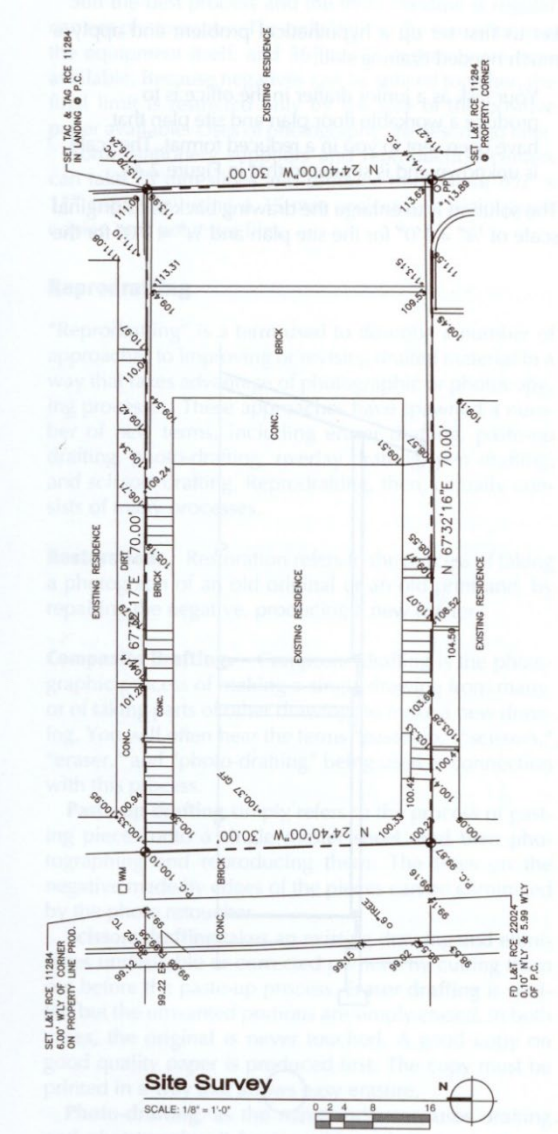


Figure 2.45 Site plan and floor plan (unknown scale).

Architectural Working Drawings by Wakita and Linde

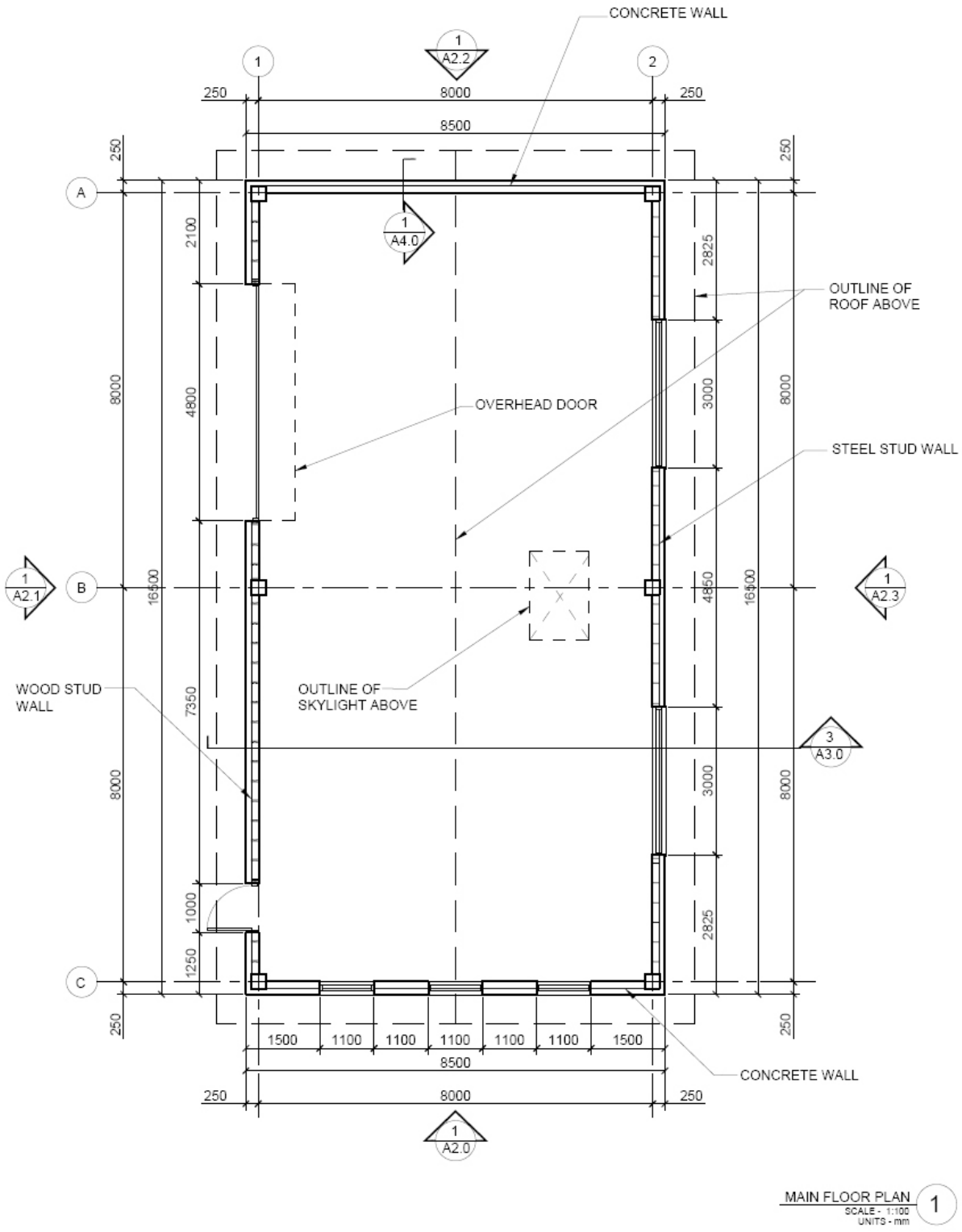
NORMAL PLAN VIEWS

Plans required for your drawing set will include Basement (if you have one), Ground Floor, Second and above and a Roof Plan. The drawing scale will vary based on the size of your building. Houses are usually drawn at 1:50 and larger commercial or institutional buildings at 1:100. DO NOT INVENT ODD SCALES SO THAT THE DRAWING FITS ON THE PAGE. After a time in the industry people can visualize these scales and so to make 1:75 or 1:25 plans is just confusing.

Special lines to include:

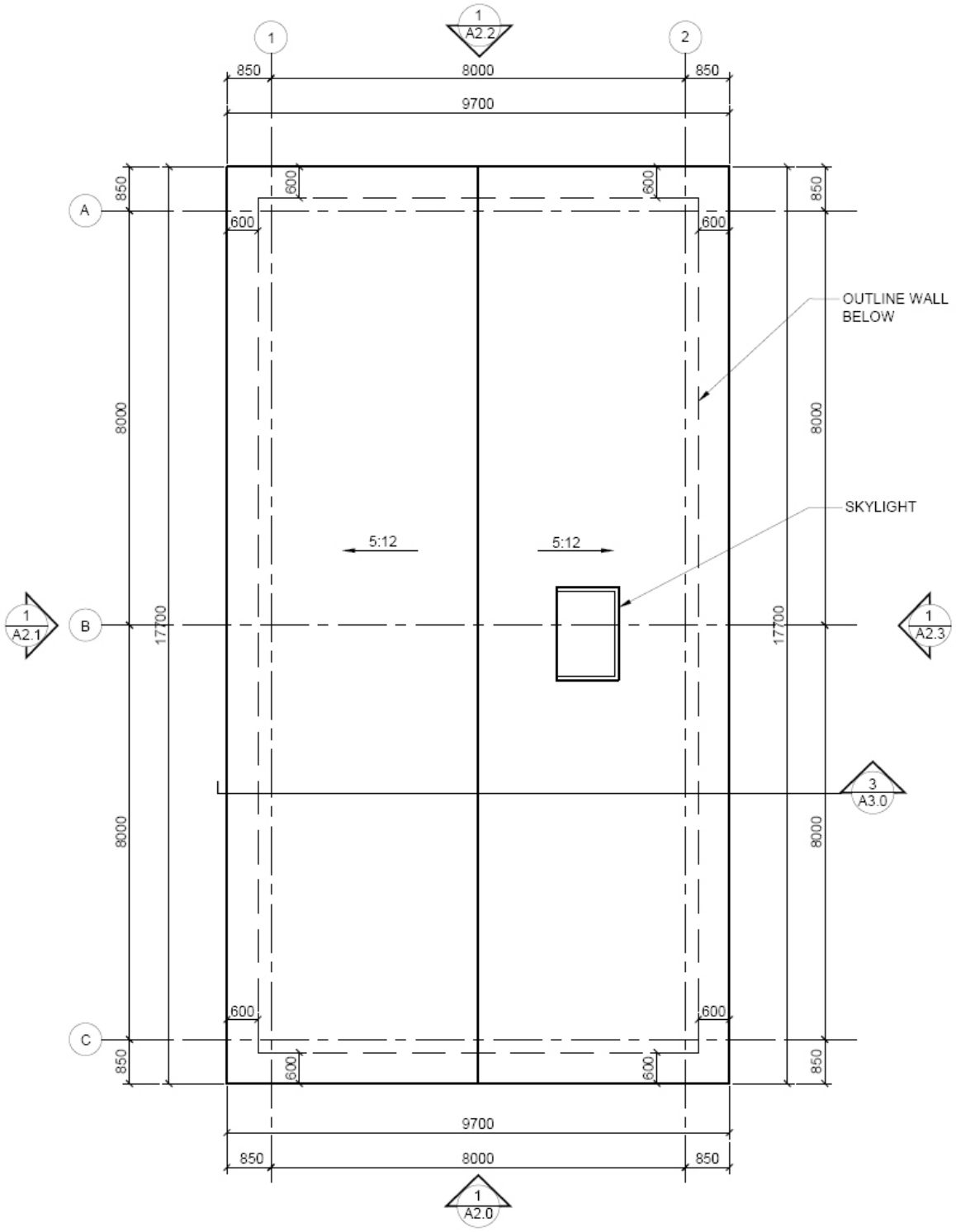
- Dotted lines to show what is happening overhead, including
- Roof overhangs
- Placement of roof ridges and valleys
- Mezzanines
- Open to above/double height spaces
- Skylights
- Gridlines if a column based building

PLANS (1:50 FOR SMALLER BUILDINGS, 1;100 FOR LARGER ONES)	
All about the walls, windows, doors, structural layout (columns)	
North Arrow	
Scale notation (numeric AND graphic)	
Label plan by floor level (Basement, Ground, Second, etc)	
Differentiated line weights emphasizing the exterior boundary of the wall elements	
Doors and door swings (public doors swing outward)	
Windows (no need to show operable but do include the frames and show the correct relationship to the insulation and exterior, show sills)	
Lines indicating the elements that make up the wall materials (for construction drawings - for design drawings these are normally filled in black)	
Dotted lines to indicate roof overhangs and ridge lines (if applicable, depends on the floor level)	
Dotted lines to show overhead openings, skylights, etc.	
For column based buildings, grid lines and bubbles	
Overall exterior dimension sets (amount depends on nature of the project)	
Indication of section cuts	
Hatch wall materials as appropriate to the scale you are working on (larger scale more detail here)	
Hatch floor materials very lightly if at all (don't detract from the wall information)	



MAIN FLOOR PLAN 1
SCALE - 1:100
UNITS - mm

Drawn by Renee Champion



ROOF PLAN 1
SCALE - 1:100
UNITS - mm

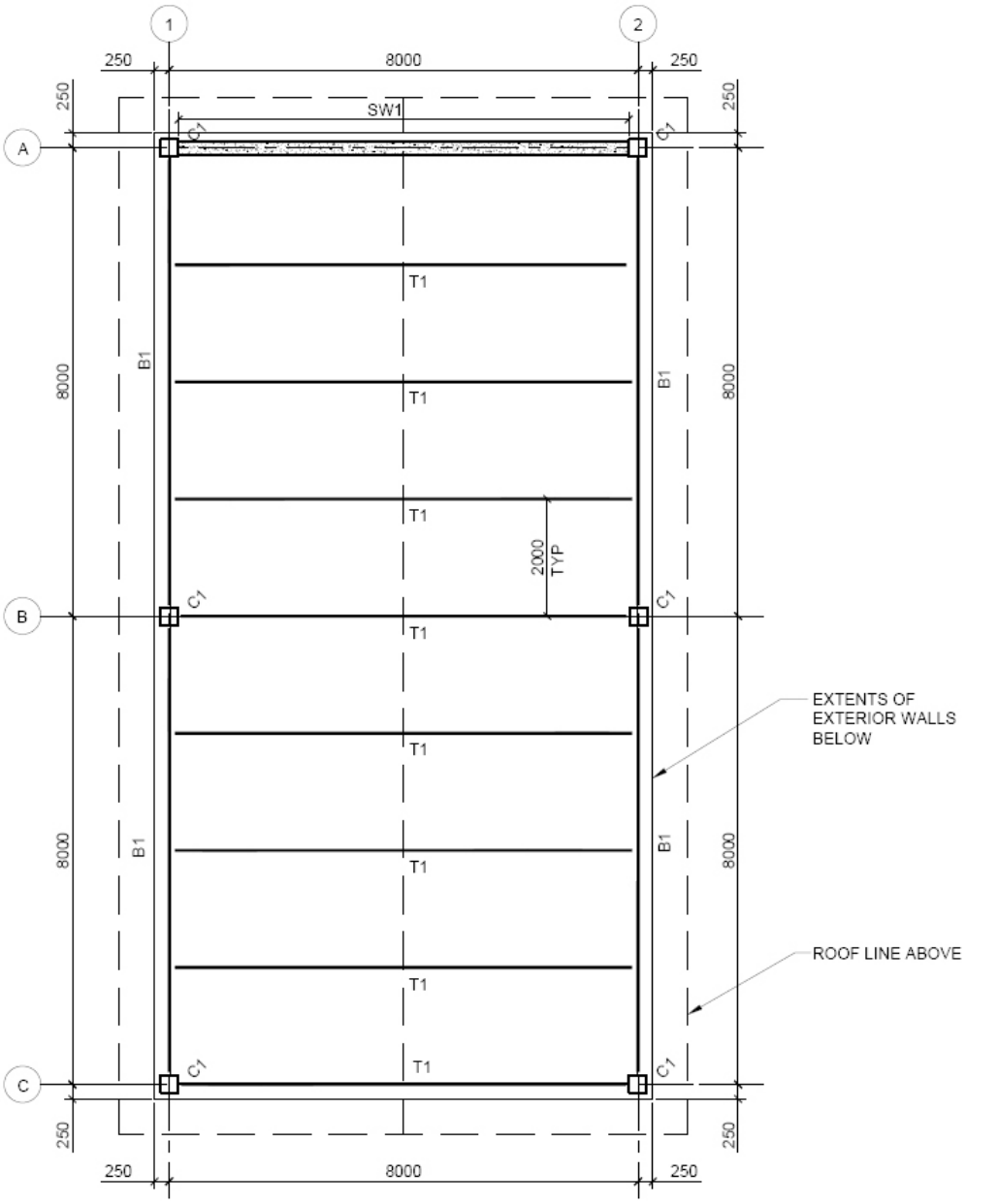
Drawn by Renee Champion

STRUCTURAL FRAMING PLAN

Often there is simply too much information to put on the floor plans, making them tough to decipher. As the structural requirements form a unique set of criteria, and are often done by the engineer and not the architect, we usually create a separate plan to describe the details of the structure. This includes a drawing as well as a schedule describing the specific requirements of each member.

STRUCTURAL FRAMING PLAN (scale to match associated floor plan)	
This drawing is a very simplified plan view that clearly shows the structure of the framing of the building. The more architectural aspects of the plan are stripped away to make it clearer.	
North Arrow	
Scale notation (at least numeric)	
Label plan by floor level that this structure supports	
Indicate the elevation (datum) of the top surface of the structure (+3000mm, -1200mm etc)	
Grid lines and bubbles at primary column intersections and structural wall centerlines	
Dimension between grid lines	
indication of section cuts	
Thin lines to indicate the perimeter of a floor or roof surface	
Draw all structural members as diagrammatic lines along the centerline of each member	
- pull back the ends of the lines so that they are visibly short of what they connect into	
- use Super Thick and dash-dot lines for joists	
- use Super thick solid lines for beams and trusses	
- use a Thick outline for columns	
Draw all load bearing walls diagrammatically with a bold outline and an appropriate hatch inside (wood or concrete)	
Tag all structural members, use a short hand like T= truss, 1B = first floor beam, RB = roof beam, SW= shear wall, LBW = Load bearing wall add a unique number for each different unique type of member, i.e. T1 and T2 might be slightly different shapes, or support different loads, or have different support conditions	
- Label horizontal members (beams, trusses, joists, etc) beside the diagrammatic line, near the centre of the member, in the direction of the member.	
- Label vertical members (columns, posts, hangers, etc) with a tag that is placed on a 45 degree angle, as close to the edge of the member as possible	
- Label structural walls with a dimension line along their extents (ßSW1->)	
Include a legend that shows what your tags mean. Structural Engineers include things like member size, length, material, maximum moment, camber, reaction on the left end, reaction on the right end, and comments	

MARK	TYPE	LENGTH	DIMENSION	COMMENTS
T1	DOUBLE HOWE TRUSS	8m	2.45m	SEE 5/S200 FOR ELEVATION
B1	D.FIR.L. GLULAM	8m	305x203mm	-
C1	D.FIR.L. GLULAM	4m	305x305mm	SEE SECTION 1/S400 FOR BASE DETAIL
SW1	REINFORCED CONCRETE	7.7m	250mm THICK	REINFORCED W/ 15M @ 300mm OC H&V



ROOF FRAMING PLAN 1
SCALE - 1:100
UNITS - mm
U/S ROOF TRUSS = +4.15m

Drawn by Renee Champioin

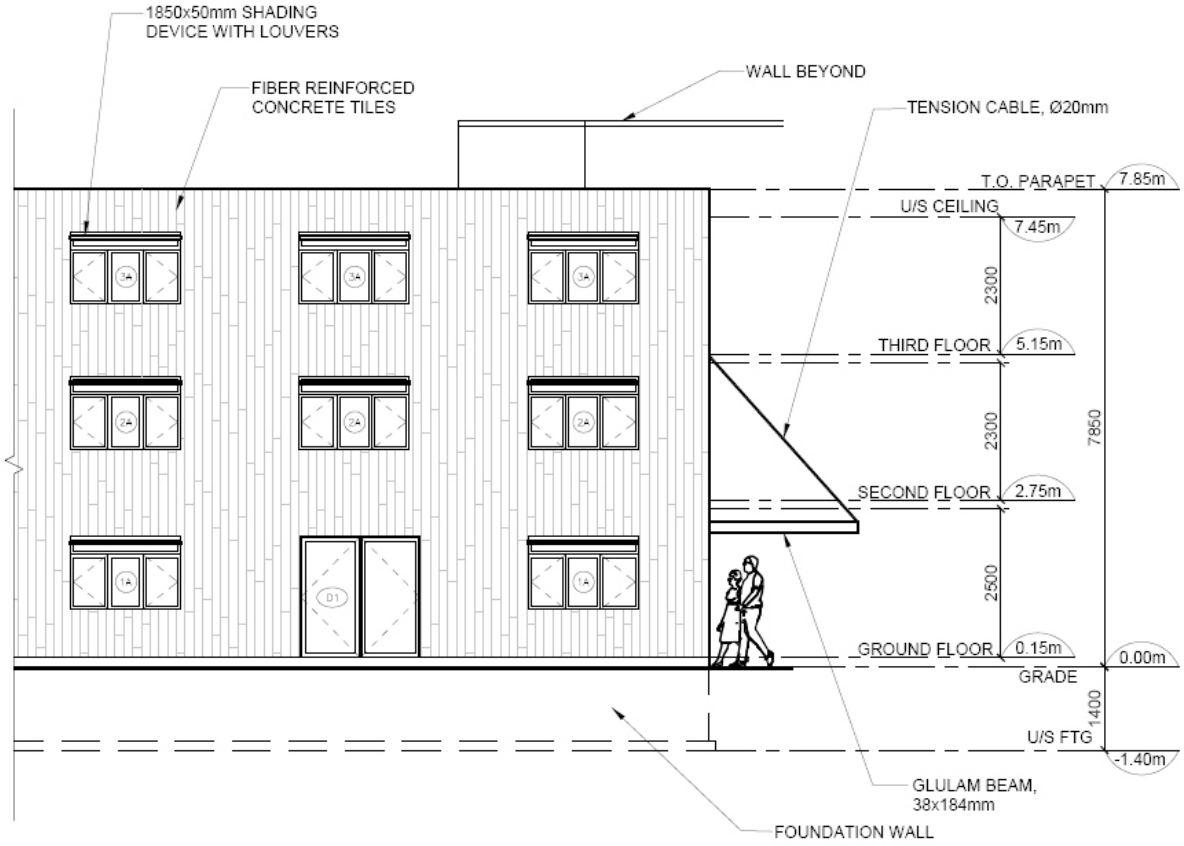
ELEVATIONS

Elevation drawings need to give information about the placement of windows and doors, materials and heights – including floor levels, basement levels, finished grade and roof heights.

The scale of the elevation drawing will match the scale of the plan drawings – so for residential usually 1:50 and for institutional or commercial 1:100. Always check that the drawings can fit on the page. For skyscrapers and the like other scales can be used.

On column based buildings with grids you will see the grids in the elevation.

ELEVATIONS (1:50 for smaller buildings, 1:100 for larger buildings)	
All about the exterior materials, glazing, heights	
NO North Arrow (irrelevant)	
Label elevations by cardinal direction (North, South, etc)	
Scale notation (numeric AND graphic)	
Accurately depict the arrangement of windows, doors and different façade materials	
Vary line weights. Outline entire building more heavily. Hatch is the lightest weight.	
Lightly hatch and label façade materials	
Indicate operability of doors and windows	
Dot in foundations and footings below grade	
Indicate the set-point vertical level, or “0” datum as it relates to something that DOES NOT MOVE, like an existing ground floor level in a renovation project, or the top of the ground floor slab in a new building. NEVER use the finished grade level as “0”	
Show vertical heights (note top of floor levels and roof/parapet top), usually relative to the defined “0” level	
If you are going to define the heights of key levels relative to sea level, units should be in “masl” for metres above sea level, and must be in METRES, even if all other dimensions are in millimetres. Use more decimal places to capture finer accuracy as needed.	
Do NOT include any horizontal dimensions, those only go on the plan view	
Indication of section cuts	
Indication of column grid bubbles if applicable	



SOUTH ELEVATION 1
SCALE - 1:100
UNITS - mm

Drawn by Renee Champion

Make note on the elevation of the very light use of texture hatch, the dashed lines on the windows to indicate how they open, height lines, and a dotted line to show the foundation.

CROSS SECTIONS

Cross sections and longitudinal sections are drawn at the same scale as the elevations and plans, so 1:50 for residential and 1:100 for institutional and commercial.

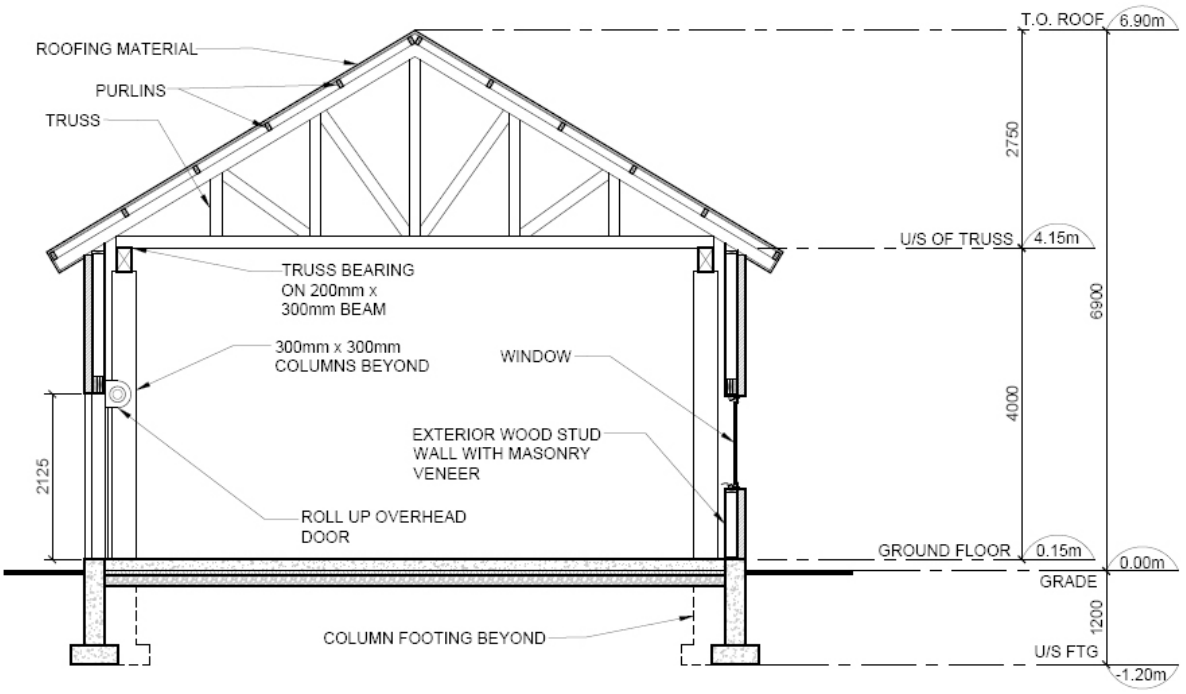
You will see the layers of materials in the walls, floors and roof elements.

Very important to note floor heights as this drawing is used by the contractor to set these out during construction.

You can draw parts of the building that you can see in elevation beyond the section cut, but only using very light lines and no hatch in this area.

For very limited scope projects like houses or industrial buildings this drawing might be the only detail provided in section. For more complex projects you will also be drawing enlarged details to show exactly how things go together. The assumption for smaller buildings is that nothing very unique is happening and the builder knows how to do the work.

CROSS SECTIONS (1:50 for smaller buildings, 1:100 for larger buildings)	
The detail here is equal to the floor plan at 1:50. Less hatching than at a larger scale. Important to show heights and location of grid bubbles.	
NO North Arrow (irrelevant)	
Drawing titled clearly to match section cut indications on plan and elevations	
Vary line weights. Outside of section is darkest, hatch is lightest.	
Hatch materials with industry standard hatch.	
DO NOT hatch materials in elevation beyond.	
Label heights: bottom of footing, top of ground, second, etc floors, top of parapet, peak of roof (these are bubble to the side markers)	
Include dimension string outside the building to indicate window sill and head heights. These are attached to the bubble type markers mentioned above.	
Label all assemblies with assembly notation. (All different wall types, floor, ceiling, foundation)	



BUILDING SECTION 1
SCALE - 1:75
UNITS - mm

Drawn by Renee Champion

Typically the cross or longitudinal section cuts through the entire length of width of the building, from top to bottom, without “cuts”.

WALL SECTIONS

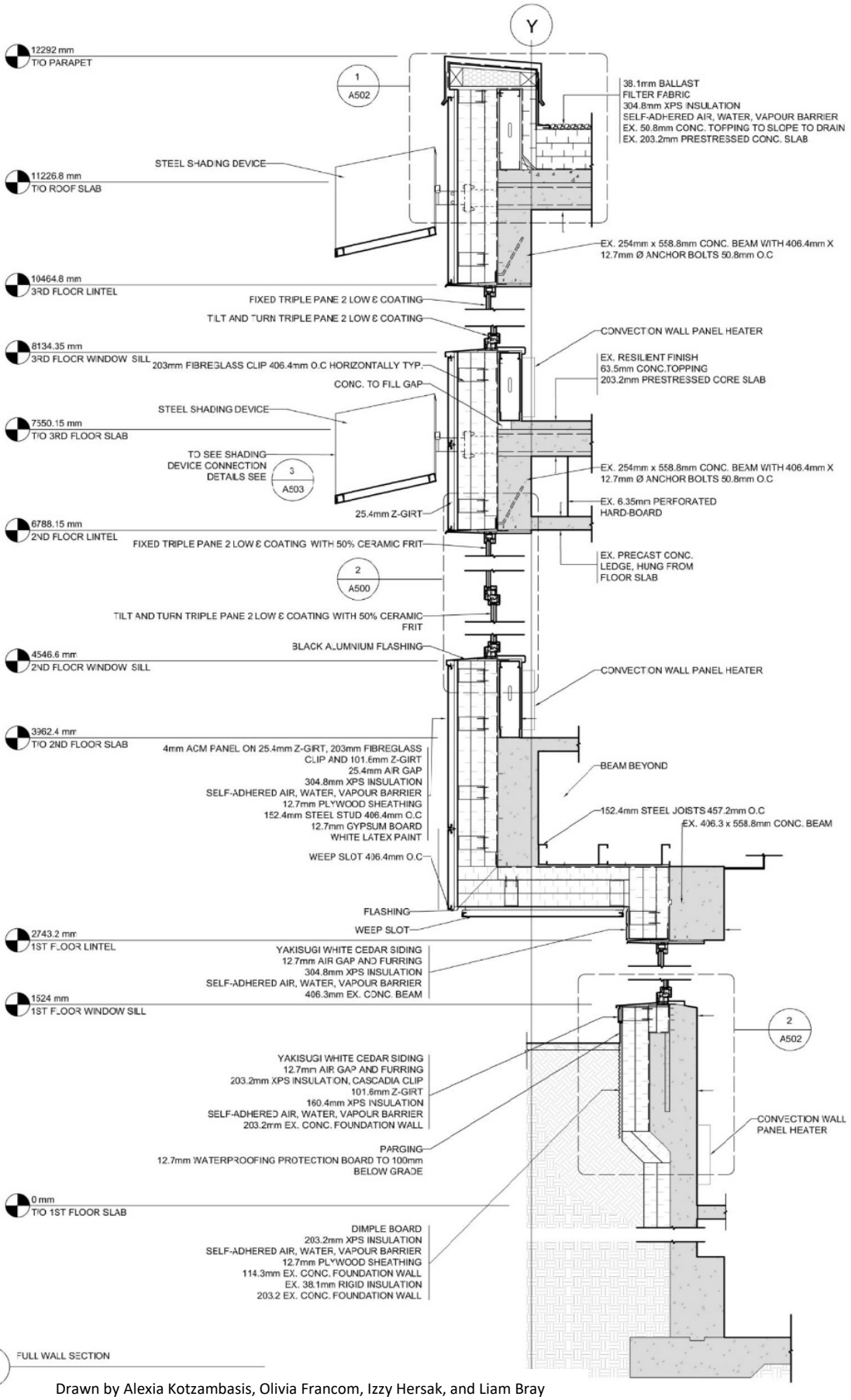
Wall sections take the information presented in the Cross Section to an even higher level of detail as the scale of the drawing allows for much more detail to be shown.

Essentially base ingredients are the same as the cross section, except that this is taken through a single wall and goes from the bottom of the foundations to the peak of the roof or top of parapet**.**

All of the relevant floor heights are show. Additional vertical dimensions will locate the precise placement and height of all openings in the wall.

Where additional 1:5 details also form part of the set, use call-out bubbles to note the location of these details so that they can be cross referenced.

WALL SECTIONS (1:20 or 1:10)	
All about materials and details of how the foundations, floors, wall assemblies, windows, roof fit together. For smaller projects they will not produce details so this has to convey everything to the builder to build the project.	
NO North Arrow (irrelevant)	
Drawing titled clearly to match section cut indications on plan and elevations	
Vary line weights. Outside of section is darkest, hatch is lightest.	
Hatch materials with industry standard hatch.	
DO NOT hatch materials in elevation beyond.	
Label heights: bottom of footing, top of ground, second, etc floors, top of parapet, peak of roof (these are bubble to the side markers)	
Include dimension string outside the building to indicate window sill and head heights. These are attached to the bubble type markers mentioned above.	
If doing a renovation clearly indicate the existing structure as separate from new construction by using a light grey tone over this part. You don't call out all of these materials as they are already included in the building.	
Label all assemblies with assembly notation. (All different wall types, floor, ceiling, foundation)	
Put separate notes to unique elements in the wall.	
Arrange notes so that they are clear and do not criss-cross note lines	



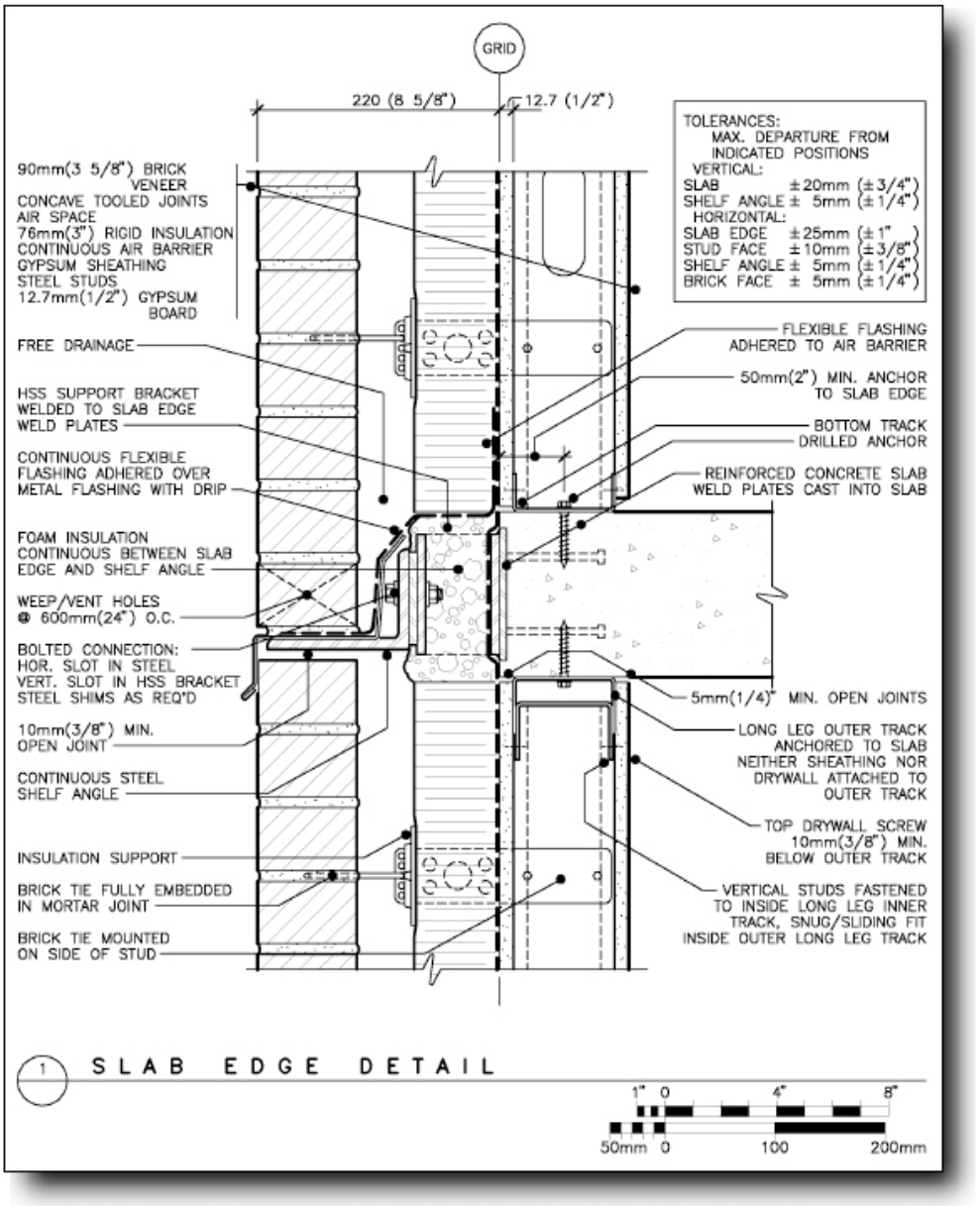
Drawn by Alexia Kotzambasis, Olivia Francom, Izzy Hersak, and Liam Bray

ENLARGED DETAILS

Where the construction gets very complicated or has some unique detailing additional details will be drawn at 1:5 scale to illustrate precisely how these work. Additional notes and dimensions as well as material specifications will be added. You will often use the previous section drawings as the base for this enlarged detail, but will add information not in the previous drawing.

These details can be plan view as well as section views.

ENLARGED DETAILS (1:5 OR 1:10)	
These will ADD more detail beyond what is already shown in the 1:20 drawing. Connections, membranes, flashing. Things that you cannot possibly draw/see clearly at 1:20.	
Detail views can be section or plan in nature	
Drawing titled to match callout on 1:20 section (or floor plan)	
Differentiated line weights, hatch being the lightest.	
Begin by enlarging the 1:20 version to the correct scale and start to fill in with more detail.	
Add connection information, membranes, flashing, likely a bit more hatching.	
Include the assembly notes from the 1:20 as these are often read separately by the contractor	
Include the grid bubble and section heights associated with the detail.	
Add labels to indicate all of the new material info added. Include thicknesses.	
Be specific about materials. These form the basis of the order list made by the contractor. Need to know what kind of rigid insulation. What sort of membrane? They vary a lot.	
Add dimensions that relate the position of material changes to the structure, gridlines, floor heights, etc.	

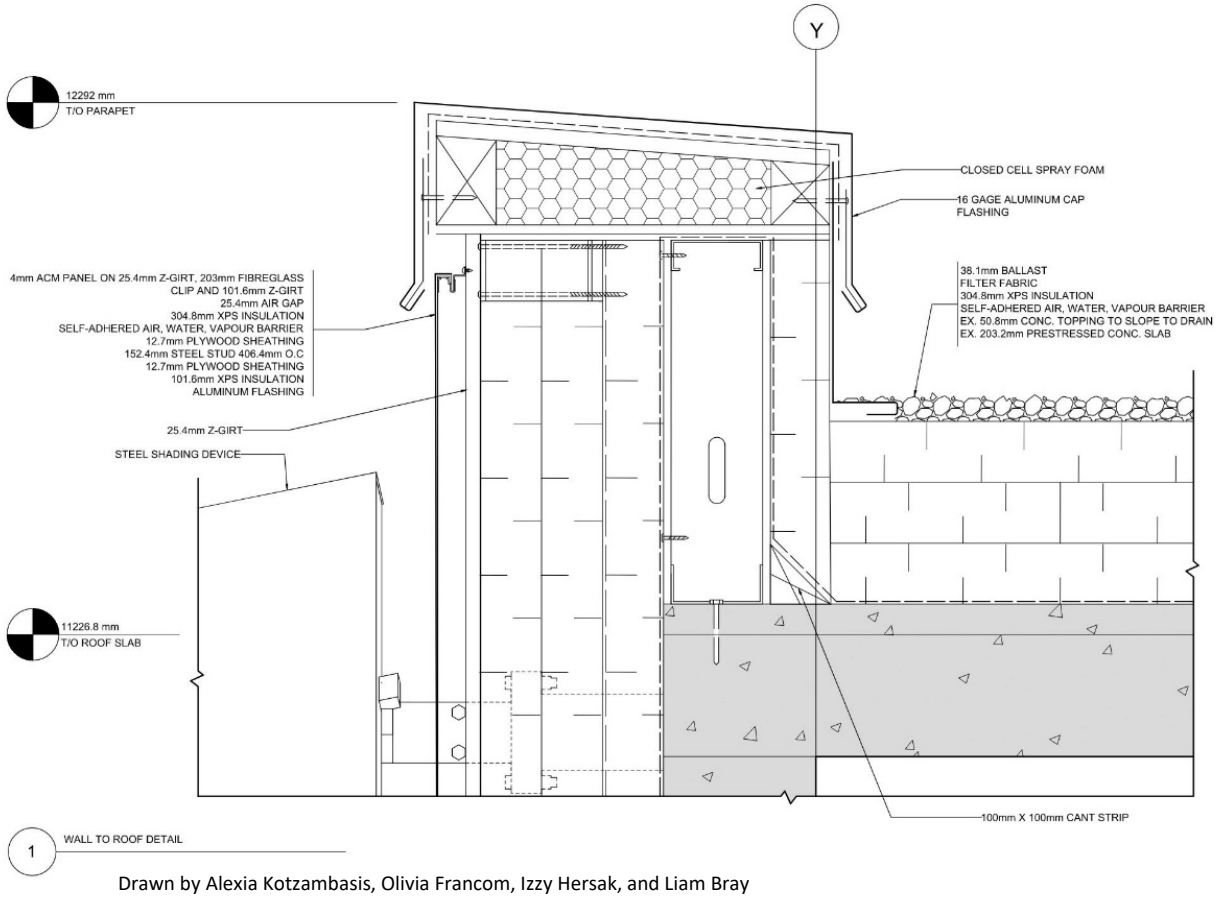


Detail 1: Slab Edge

CMHC Best Practice Guide for Brick and Steel Stud Walls

In a well -developed detail this is the level of information you are expecting to convey Note how the exterior lines have been darkened to help to punch out the drawing. The hatch is evident but not overpowering. The text is all lined up. All of the attachment mechanisms are shown.

Dashed lines are really important to show membrane continuity!



Drawn by Alexia Kotzambasis, Olivia Francom, Izzy Hersak, and Liam Bray

Make sure that you thoroughly label the adjacent assemblies of the walls and roof. The contractor doesn't want to go hunting around the entire drawing set to locate and understand this information.

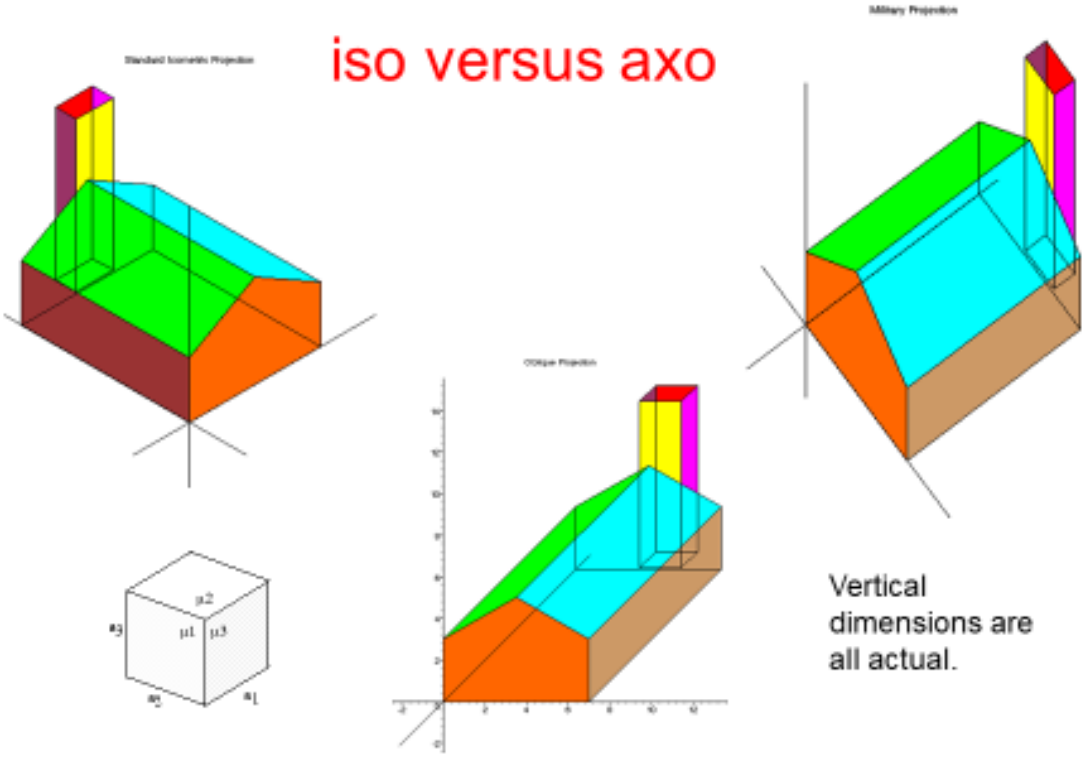
RENDERINGS

There are various ways to make 3D views of your project, some faster than others. An isometric or axonometric is a quick way to create a 3D drawing by hand.

The isometric requires that you redraw the plan with a 30° angle from the base line so that it looks like a diamond shape (top left). The vertical lines are all to scale and it looks almost like a perspective.

The axonometric (top right) uses the actual plan to project the vertical lines. It can be placed 30°, 60° or 45° to the base line, depending how you want it to look. The vertical lines are actual dimensions.

You can also make a projected drawing using the elevation (bottom center).



STRUCTURAL 3D VIEWS

It is often helpful to explain your structural system using a 3D view of just the skeleton of the building, cladding stripped away.

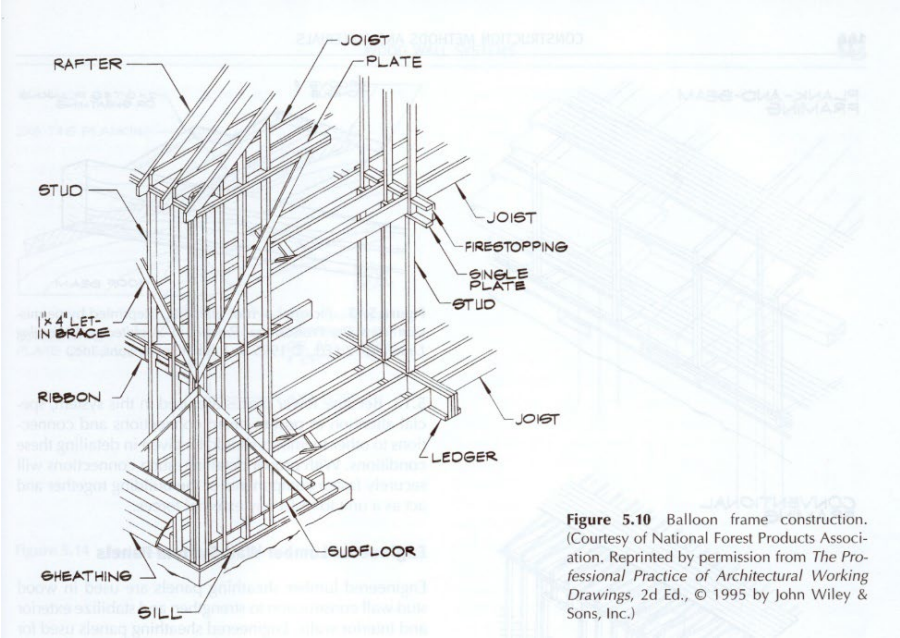


Figure 5.10 Balloon frame construction. (Courtesy of National Forest Products Association. Reprinted by permission from *The Professional Practice of Architectural Working Drawings*, 2d Ed., © 1995 by John Wiley & Sons, Inc.)

Architectural Working Drawings by Wakita and Linde

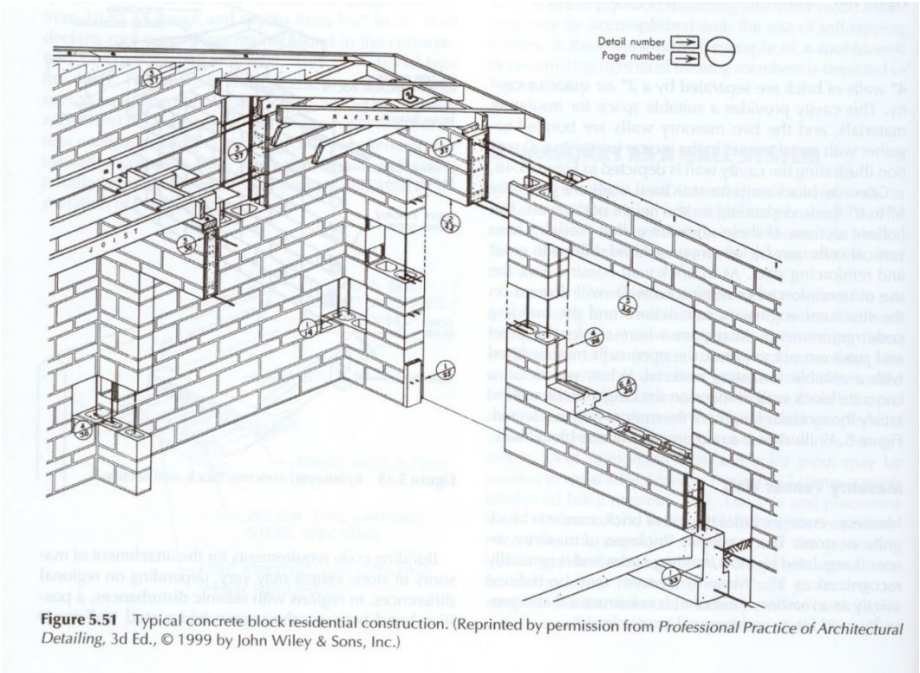
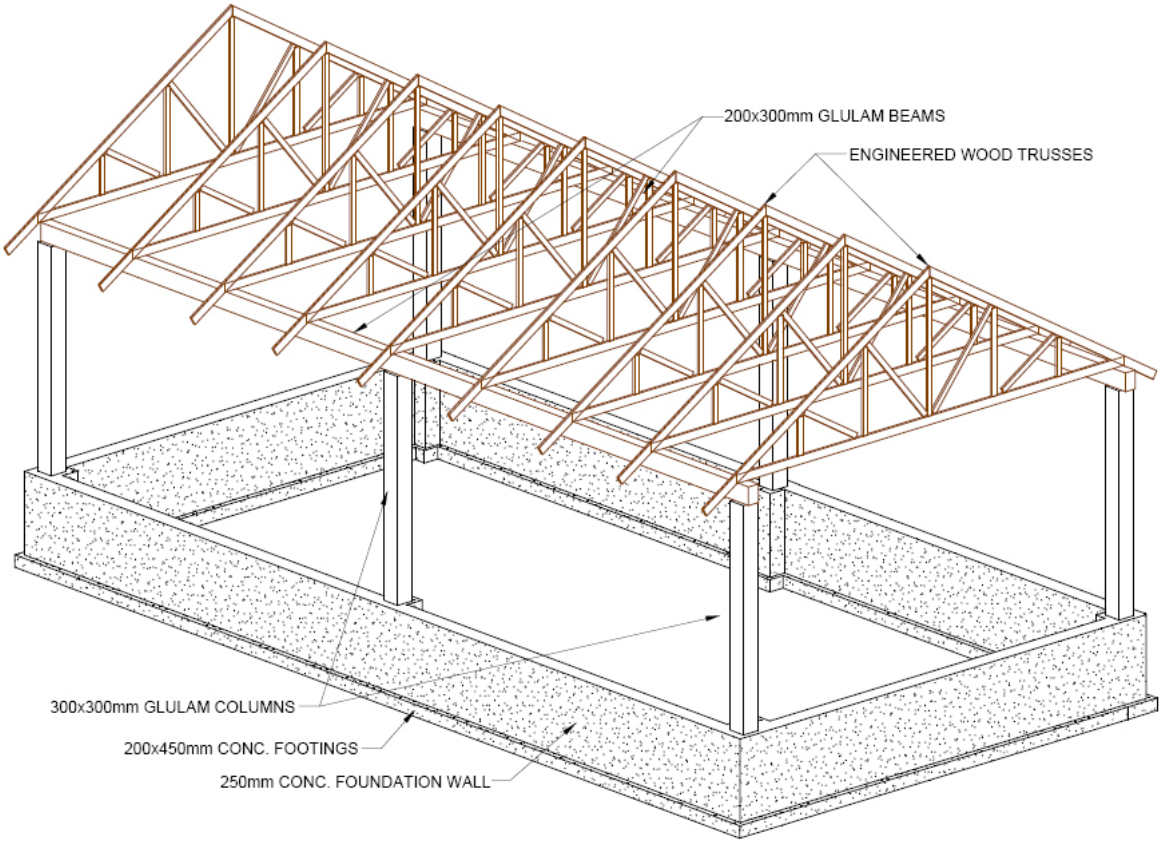


Figure 5.51 Typical concrete block residential construction. (Reprinted by permission from *Professional Practice of Architectural Detailing*, 3d Ed., © 1999 by John Wiley & Sons, Inc.)

Architectural Working Drawings by Wakita and Linde



STRUCTURAL AXONOMETRIC 1
SCALE - NTS
UNITS - mm

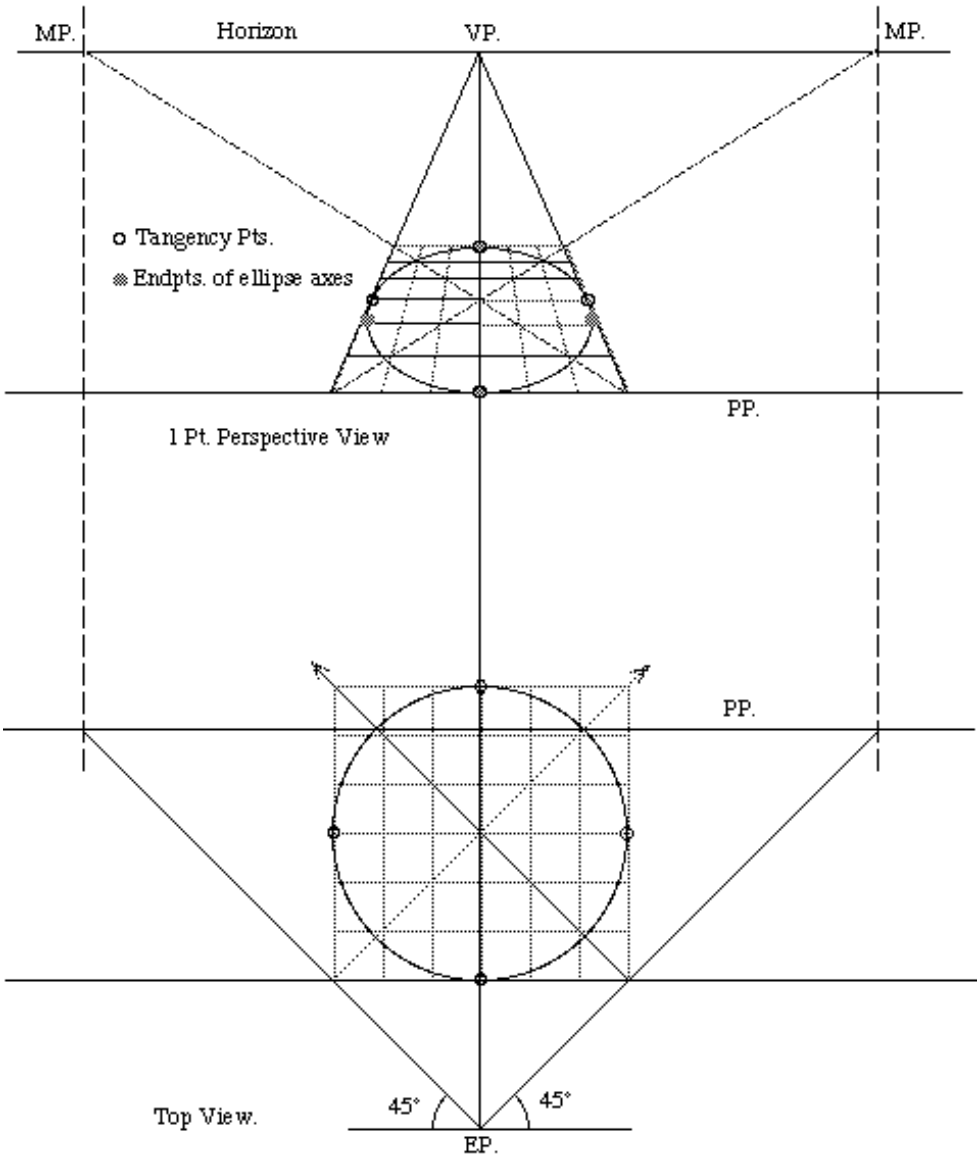
Drawn by Renee Champion

A structural axonometric is a great way to strip down a project and show an understanding of the major structural elements so that you can discern or explain your load paths and the spacing of your columns and spanning members.

ONE POINT PERSPECTIVE

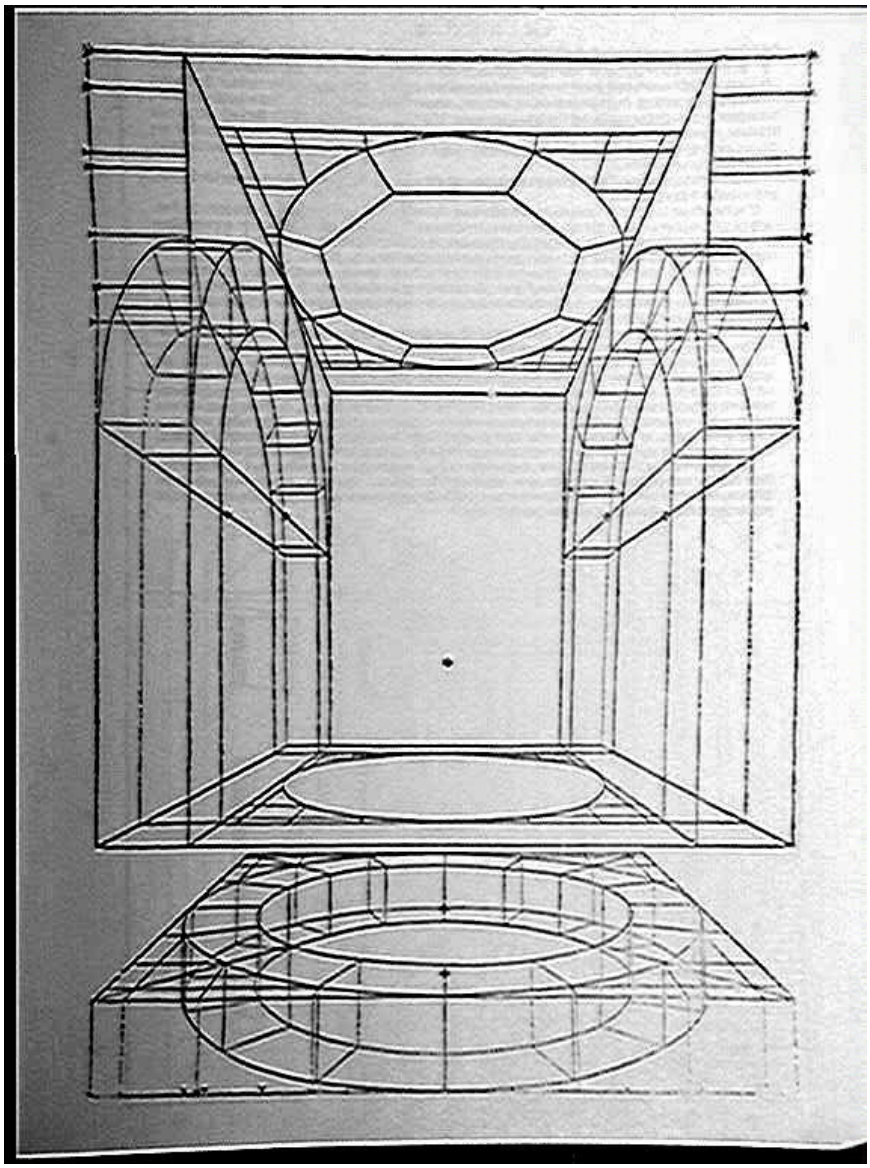
Hand drawing an accurate perspective is a big task, but you can quickly rough up a simple one point perspective using a method developed by Leon Battista Alberti in the Renaissance.

It starts from taking the actual plan, with a central vanishing point, and arbitrarily setting the rear line of the (in this case square) plan to make a trapezoid. All of the other lines are projected from this base. It isn't entirely accurate, but can give you a quick interior perspective.



Alberti One Point Method

As can be seen in this version of the Alberti Method, every line is extrapolated from the skewed plan that forms the base of the drawing. The measurements at the “front” are to scale.



Sebastiano Serlio’s Five Books of Architecture