

# **INFORMATION MANAGEMENT**

## **HOW TO DRAW ARCHITECTURAL BUILDINGS FOR CONSTRUCTION**

prof. G. Roldofi, PhD

# PAPERS, LINES AND SYMBOLS

## THE GRAMMAR

# PAPER FORMAT AND SHEET LAYOUT

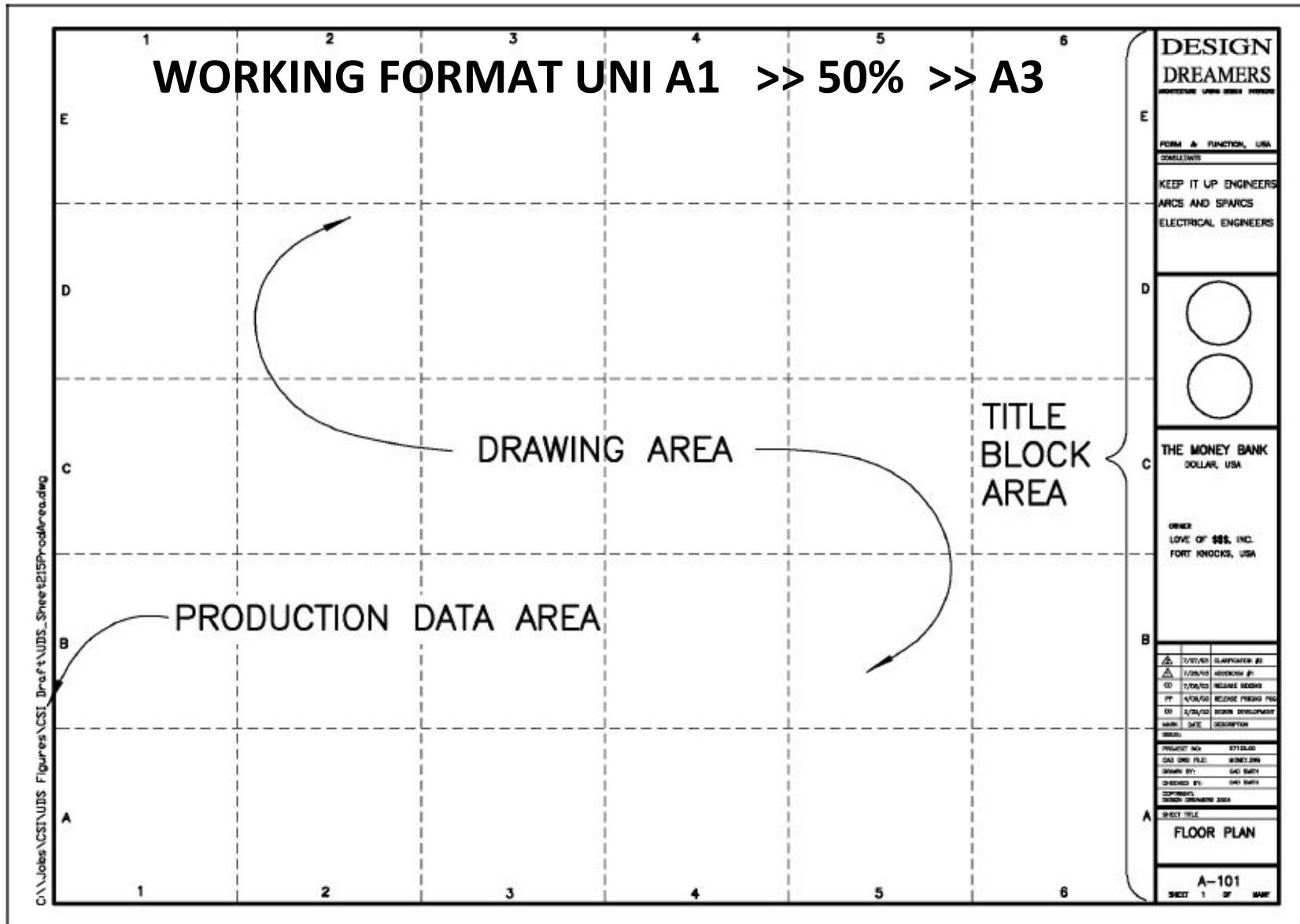
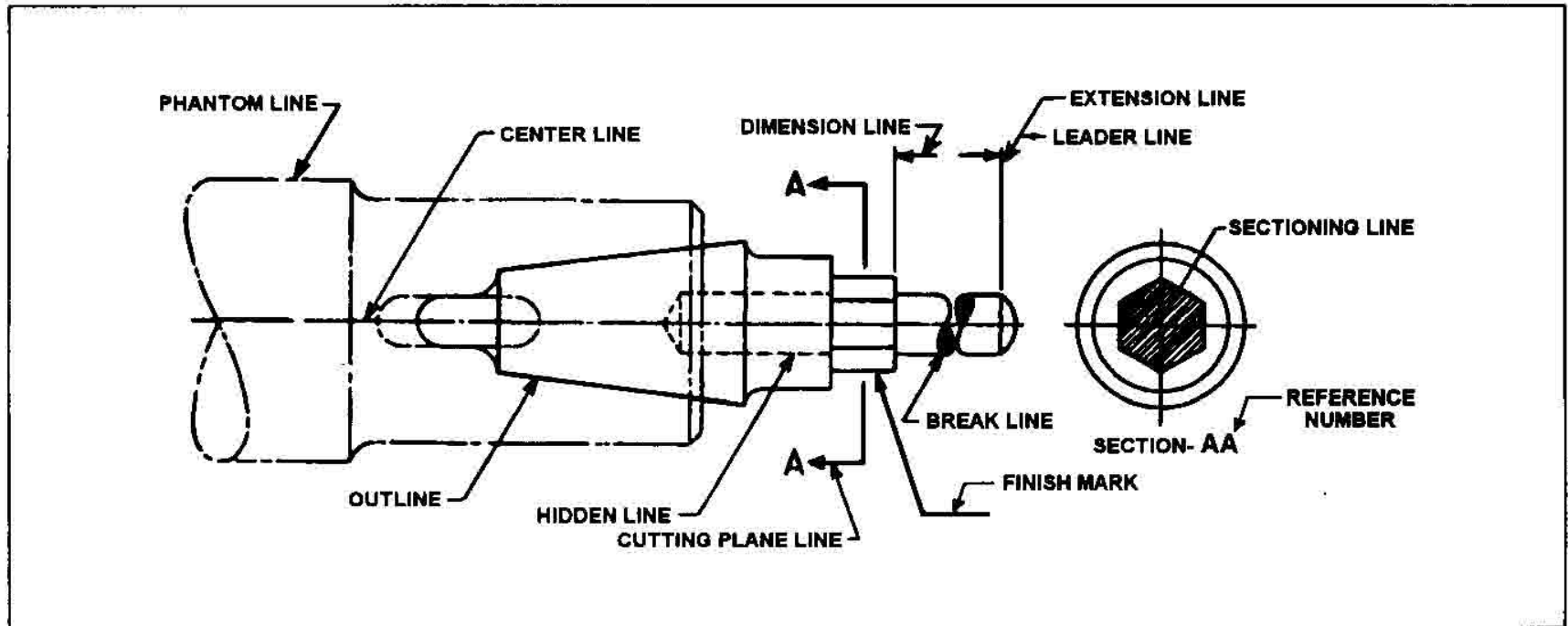


Figure 02.1 Overall sheet layout.


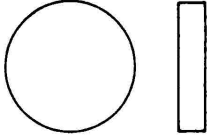

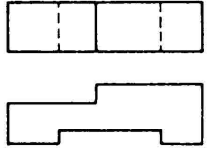

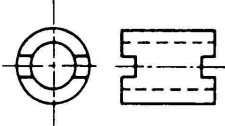

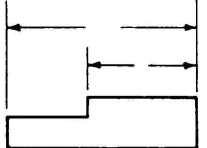

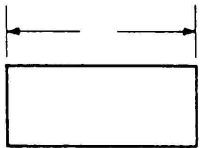
# THE MEANING OF ALPHABET LINES




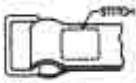

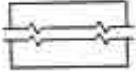








To read blueprints, you must understand the use of lines. The alphabet of lines is the common language of the technician and the engineer. In drawing an object, a draftsman arranges the different views in a certain way, and then uses different types of lines to convey information.



# MAIN CONVENTIONS

LINE STANDARDS			
NAME	CONVENTION	DESCRIPTION AND APPLICATION	EXAMPLE
VISIBLE LINES		HEAVY UNBROKEN LINES  USED TO INDICATE VISIBLE EDGES OF AN OBJECT	
HIDDEN LINES		MEDIUM LINES WITH SHORT EVENLY SPACED DASHES  USED TO INDICATE CONCEALED EDGES	
CENTER LINES		THIN LINES MADE UP OF LONG AND SHORT DASHES ALTERNATELY SPACED AND CONSISTENT IN LENGTH  USED TO INDICATE SYMMETRY ABOUT AN AXIS AND LOCATION OF CENTERS	
DIMENSION LINES		THIN LINES TERMINATED WITH ARROW HEADS AT EACH END  USED TO INDICATE DISTANCE MEASURED	
EXTENSION LINES		THIN UNBROKEN LINES  USED TO INDICATE EXTENT OF DIMENSIONS	

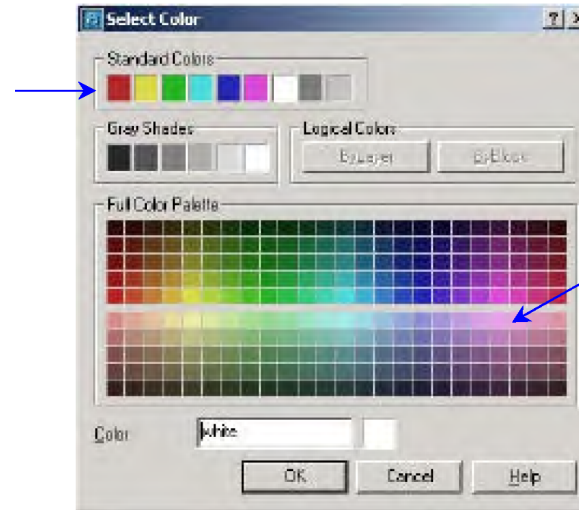
NAME	CONVENTION	DESCRIPTION AND APPLICATION	EXAMPLE
PHANTOM OR DATUM LINE		MEDIUM SERIES OF ONE LONG DASH AND TWO SHORT DASHES EVENLY SPACED ENDING WITH LONG DASH. USED TO INDICATE ALTERNATE POSITION OF PARTS, REPEATED DETAIL, OR A DATUM PLANE	
STITCH LINE		MEDIUM LINE OF SHORT DASHES, EVENLY SPACED AND LABELED. USED TO INDICATE STITCHING OR SEWING	
BREAK (LONG)		THIN, SOLID RULED LINE WITH FREE-HAND ZIGZAGS. USED TO REDUCE SIZE OF DRAWING REQUIRED TO DELINEATE OBJECT AND REDUCE DETAIL	
BREAK (SHORT)		THICK, SOLID FREE-HAND LINES. USED TO INDICATE A SHORT BREAK	
CUTTING OR VIEWING PLANE—VIEWING PLANE OPTIONAL		THICK, SHORT DASHES. USED TO SHOW OFFSET WITH ARROWHEADS TO SHOW DIRECTION IN WHICH SECTION OR PLANE IS VIEWED OR TAKEN.	
CUTTING PLANE FOR COMPLEX OR OFFSET VIEWS		THICK, SHORT DASHES. USED TO SHOW OFFSET WITH ARROWHEADS TO SHOW DIRECTION VIEWED.	

## Line Weights

Varying line widths on drawings substantially improve their readability. Any new work should be easily distinguishable from other information shown on the drawings. Show new work at 100% (unscreened) and show existing site conditions screened at 40%. Existing conditions on details may be screened but leadered text to the existing portion of the detail should still be 100% and indicate the words 'EXIST' or '(E)' in the annotation.

Existing topographic contours are typically screened at 40% for better clarity. Toned-back background contours on a complex drawing make the proposed design work stand out better, making for a drawing that is more understandable. (Intermediate contours should be a dash line type; Index contours should be heavier pen weight with a slighter longer dashed line type and annotation). See Chapter 5 for further Survey and topographic standard requirements.









New topographic (final grading) contours are shown with a solid 100% line complete with contour elevation labels on each line.
















Other 240 Colors  
Mapped to Various Pen  
Weights per Plot Style  
Table (Figure 3-3).

Figure 3-1

### AutoCAD 10 Standard Colors and Line Weights

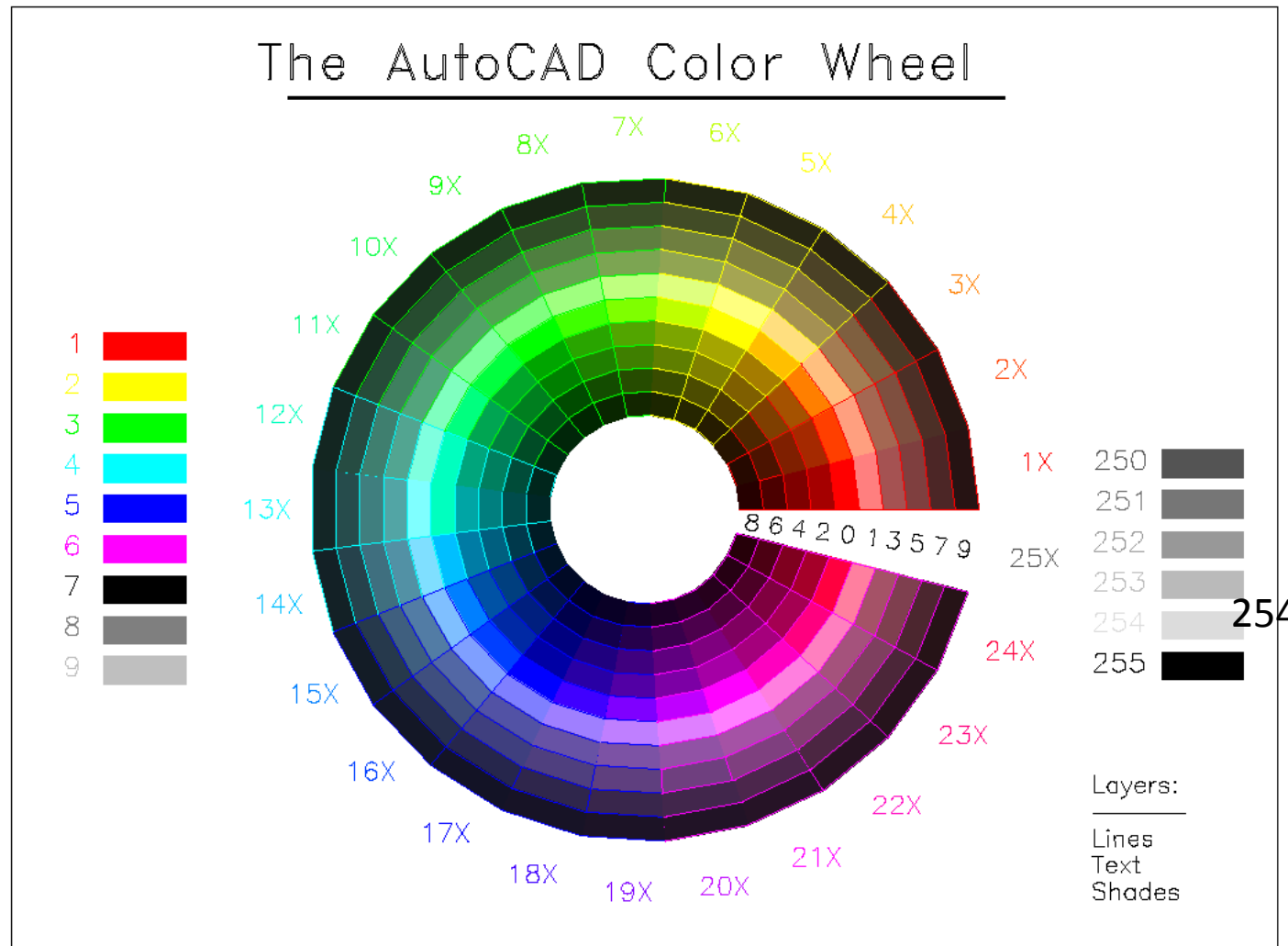
Color	Color Number	11" x 17" Line Weight when Plotted	22" x 34" Line Weight, when Plotted	Example	Equivalent LERO Or Rapido Pen
Red	(1)	0.002"	0.004"		0000
Yellow	(2)	0.004"	0.008"		000
Magenta	(6)	0.006"	0.012"		00
White	(7)	0.008"	0.016"		0
Cyan	(4)	0.011"	0.021"		1
Green	(3)	0.013"	0.026"		2
Blue	(5)	0.017"	0.033"		3
Orange	(30)	0.025"	0.050"		5
Dk Gray	(8) 40%	0.006"	0.012"	(Screened background info)	00
Gray	(9) 40%	0.008"	0.016"	(Screened background info)	0

# Linework in Drawings

CENTER LINE		0.25 mm
DIMENSION		0.25 mm
LEADER		0.25 mm
BREAK		0.25 mm
PHANTOM		0.25 mm
HIDDEN		0.25 mm
EXISTING FEATURE		0.25 mm
PRIMARY FEATURE		0.35 mm
EDGE OF INTERIOR/EXTERIOR ELEVATIONS		0.50 mm
SECTION CUTTING PLANE LINES		0.50 mm
BORDERS		0.70 mm
FOOTPRINTS		0.70 mm
MATCH LINE		0.70 mm

**PLOT STYLE TABLE / PEN COLORS**

Line Width (inches)	% Screen		Color Numbers	LEROY® or Rapido
.004	100	red	1, 28,50,71,92,113,134,155,176,197,218,239	0000
.008	100	yellow	2, 29,51,72,93,114,135,156,177,198,219,240	000
.026	100	green	3, 31,52,73,94,115,136,157,178,199,220,241	2
.021	100	cyan	4, 32,53,74,95,116,137,158,179,200,221,242	1
.033	100	blue	5, 33,54,75,96,117,138,159,180,201,222,243	3
.012	100	magenta	6, 34,55,76,97,118,139,160,181,202,223,244	00
.016	100	white	7, 35,56,77,98,119,140,161,182,203,224,245	0
.012	40	dk. gray	8 (screened or background info)	00
.016	40	gray	9 (screened or background info)	0
.004	100		11, 36,57,78,99,120,141,162,183,204,225	0000
.008	100		12, 37,58,79,100,121,142,163,184,205,226	000
.026	100		13, 38,59,80,101,122,143,164,185,206,227	2
.021	100		14, 39,60,81,102,123,144,165,186,207,228	1
.033	100		15, 40,61,82,103,124,145,166,187,208,229	3
.012	100		16, 41,62,83,104,125,146,167,188,209,230	00
.016	100		17, 42,63,84,105,126,147,168,189,210,231	0
.004	40		21, 43,64,85,106,127,148,169,190,211,232	0000
.008	40		22, 44,65,86,107,128,149,170,191,212,233	000
.026	40		23, 45,66,87,108,129,150,171,192,213,234	2
.021	40		24, 46,67,88,109,130,151,172,193,214,235	1
.033	40		25, 47,68,89,110,131,152,173,194,215,236	3
.012	40		26, 48,69,90,111,132,153,174,195,216,237	00
.016	40		27, 49,70,91,112,133,154,175,196,217,238	0
.050	40		10	5
.050	40		20	5
.050	100	orange	30	5
.008	40	dk. gray	250,251 (minor contours)	000
.012	40	gray	252,253 (major contours)	00
No Plot	-	lt. gray	254	
.008	50		255 (date stamp)	



## Pen Colors

Colors relate to pen weights (line widths) that are mapped to the plotters. The AutoCAD Color Wheel (Figure 3-4) displays all the 255 colors and shades available. Multi-digit color numbers ending in 8 or 9 (i.e. 19, 58, 99, 128, etc.) are NOT recommended for use since they are difficult to see on a black background screen. **Note: If you use a background screen color other than black, there may be other colors that do not display well.**

Pen '254' has been designated as 'No-Plot' pen. Although you would see the light gray color on your screen, the color does not plot.

All drawings will be generated using the FS Plot Style Table (Figure 3-3, previous page). Plot Style Table files (.ctb) are available for both half size drawings (**2005-fs-half.ctb**) and full size drawings (**2005-fs-full.ctb**). When plotting, all colors plot in black or grayshades depending on their configuration (exception: pen 254 does not plot). Screen percentages available include 100% and 40%. Drawings with very thin 40% screen pens should limit their use to non-critical background information, as they do not plot with much clarity.

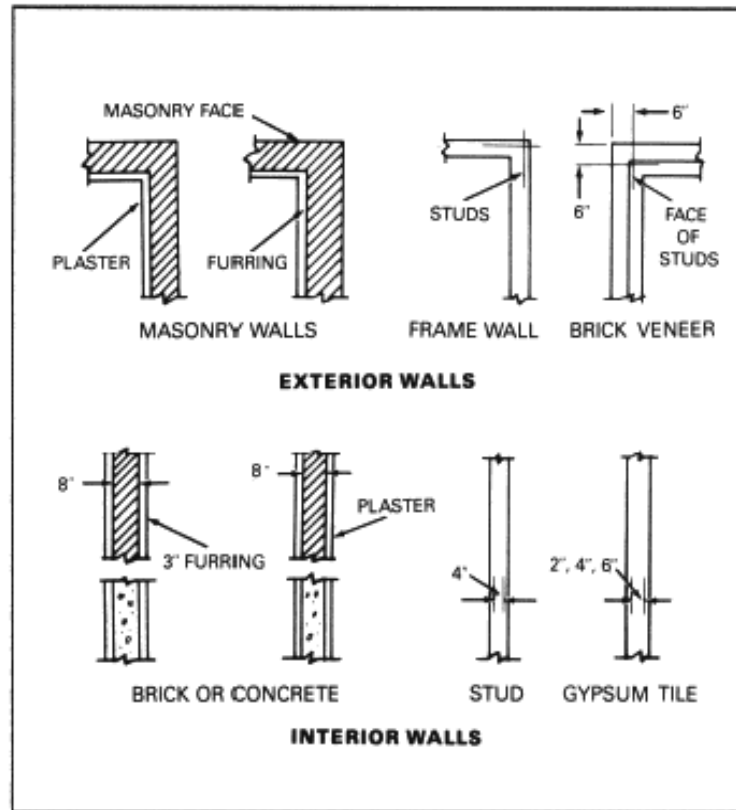


Figure 1-4. Typical wall symbols

## SITE PLANS

A site plan (also called a *plot plan*) shows—

- Property lines and locations,
- Contours and profiles,
- Building lines,
- Locations of structures to be built,
- Existing structures,
- Approaches,
- Finished grades,
- Existing and new utilities (such as sewer, water, and gas).

Break Lines: Break lines are used to indicate that only a portion of a drawing or a partial view is being shown.

Phantom Lines: Phantom lines shall be used to indicate the alternate position of parts, repeated detail, or the relative position of an absent part.

Hidden Lines: Hidden lines are used to show the hidden features of a part or object.

Existing Features: Existing-feature lines are used for all lines on the drawing representing objects or structures that already exist and will impact the design.

Primary Features: Primary features represent all new work in the design documents.

Edge of Interior/Exterior Elevations: The edges of interior/exterior elevations are the outlines around the perimeter of an elevation.

Section Cutting Plane Lines: Cutting plane lines shall be used to indicate a plane or planes in which a section is taken.

Borders: Border lines are used to create a margin on the drawing sheet.

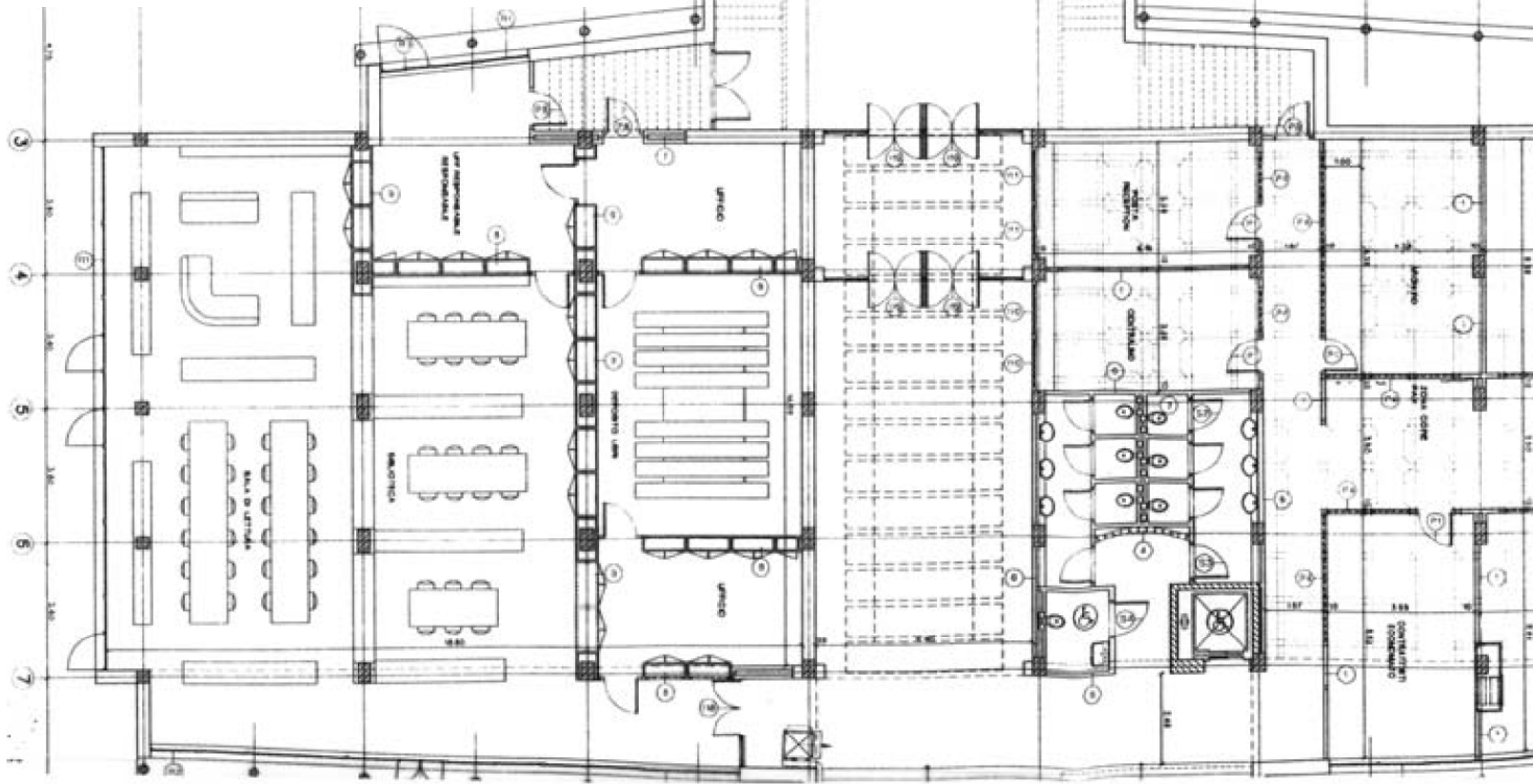
Footprints: Footprints show the outline of a building or other object within the drawing.

Match Lines: Match lines are used to show where part of a drawing that is too large to be contained on one sheet matches the continuation of that drawing on another sheet.



*La griglia di coordinamento.* Nell'elaborato è visibile l'organizzazione della griglia di coordinamento degli elaborati in pianta. Essa è solitamente organizzata per linee orizzontali (fili) e linee verticali (picchetti). Tale griglia svolge un'utilissima funzione di riferimento in tutta la comunicazione che intercorre tra gli operatori sia in forma scritta che orale come nel caso di varianti o azioni correttive da effettuare sul progetto e concordate, ad esempio, telefonicamente. I fili, i picchetti e i quadranti o gli incroci da questi generati servono per "collocarsi" nel punto interessato dall'eventuale modifica.

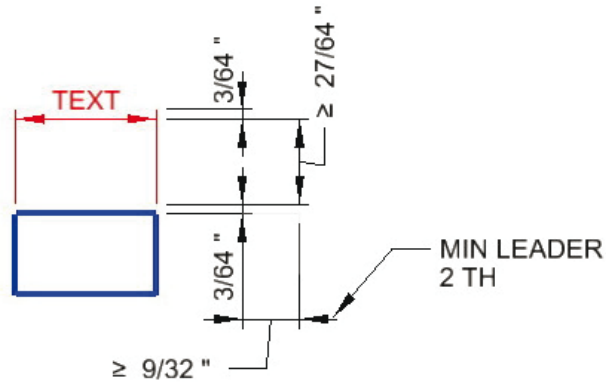
Generalmente, come si nota in figura tali linee corrono quanto più possibile sull'asse dei pilastri.



CS	TITOLO CRITERI DI SVILUPPO DEL PROGETTO ESECUTIVO	DP
	OGGETTO INDICAZIONI VINCOLANTI PER LO SVILUPPO DELLA DOCUMENTAZIONE DI PROGETTO	
	PAR. 2 - QUOTATURE	
<b>COD.ELEMENTI</b> <b>1</b> - Quote e loro disposizione	<b>CRITERI DI ACCETTABILITA'</b> Le quote vanno disposte preferibilmente nella parte inferiore del foglio e devono essere scritte sopra e leggermente staccate dalla linea di misura cui si riferiscono e disposte in modo da essere leggibili dal lato inferiore e dal lato destro del disegno. Le linee di misura devono essere separate dalle linee del disegno con uno spazio adeguatamente dimensionato. Quando le linee di misura sono più di una, disposte in modo gerarchico in relazione alla omogeneità delle parti quotate e alla dimensione, le linee di misura devono quindi trattare, in progressione dalla linea più vicina al disegno a quella più lontana, di elementi di minore, media e maggiore dimensione secondo un criterio di omogeneità grafica.	
<b>COD.ELEMENTI</b> <b>2</b> - Quote di misura relative agli assi strutturali	<b>CRITERI DI ACCETTABILITA'</b> Le quote di misura relative agli assi strutturali devono essere poste fuori dal disegno con linee di richiamo a tratto sottile, e in testata un cerchietto con segnata una numerazione progressiva degli assi strutturali sia trasversali che longitudinali, tra asse e asse, entro una cartella, dove essere segnalato il passo strutturale di ogni campata.	
<b>COD.ELEMENTI</b> <b>3</b> - Quote di tracciamento	<b>CRITERI DI ACCETTABILITA'</b> Le quote relative agli assi strutturali devono essere riferite ad alcune quote di tracciamento, riferite a situazioni esterne all'intervento ben identificabili in cantiere (il sistema di edifici conigli o comunque prossimi all'area di intervento, capitali di riferimento di rilievo cart., ...), queste quote di riferimento devono essere segnate come gli assi strutturali, differenziando la cartella di numerazione progressiva.	
<b>COD.ELEMENTI</b> <b>4</b> - Quote al "finito" ed al "grezzo"	<b>CRITERI DI ACCETTABILITA'</b> La quotatura deve essere in serie, riferita ad almeno una quota strutturale o di tracciamento facilmente identificabile in tutti i disegni. Le quote sono da intendersi riferite al "finito", sotto alle quote al "finito", tra parentesi devono essere inserite anche le quote al "grezzo". Per i casi di ristrutturazione, le quote da verificare in cantiere, devono essere accompagnate da un punto interrogativo. Ogni disegno quotato deve essere accompagnato da una nota di spiegazione per la lettura delle quote.	
<b>COD.ELEMENTI</b> <b>5</b> - Quotatura Infissi	<b>CRITERI DI ACCETTABILITA'</b> Le misure delle porte sono riferite alla luce libera risultante ad infisso montato. Aperture e spallate di vani ascensori e montacarichi sono soggetti a variazione in relazione al modello adottato, si rimanda quindi al progetto esecutivo meccanico degli stessi.	

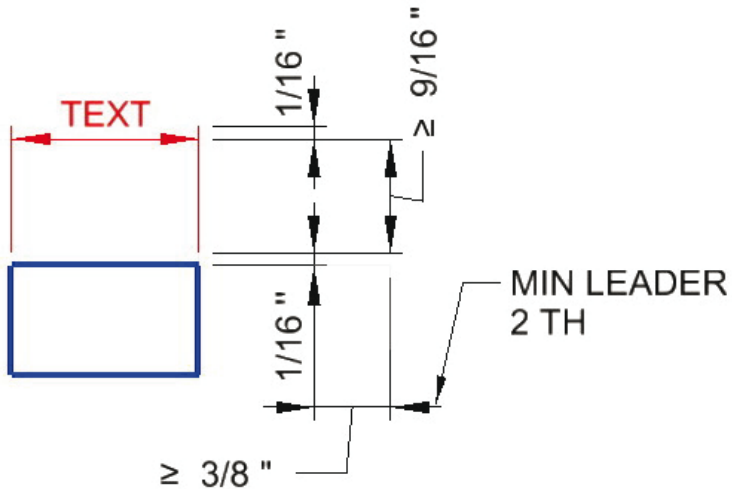


# TEXT READABILITY



## EXAMPLE "A"

TEXT HEIGHT (TH) =  $3/32"$



## EXAMPLE "B"

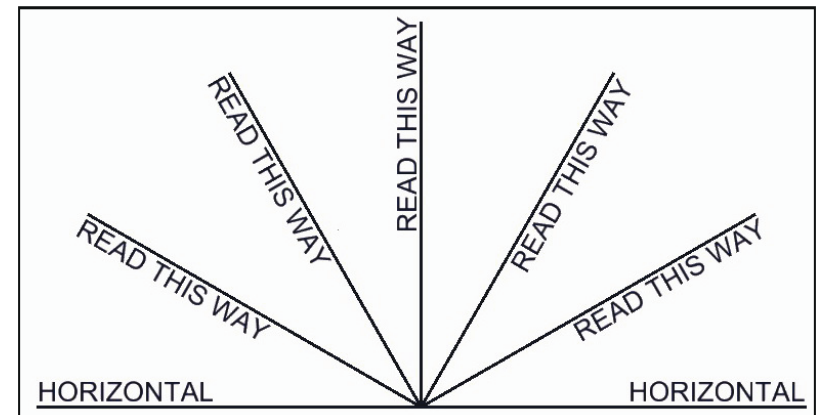
TEXT HEIGHT (TH) =  $1/8"$

## Capitalization

~~Text~~

TEXT

## Orientation of text



# Lettering Styles

LINE WIDTH

ROMANS @ .130" (.016")

ROMANS @ .150" (.021")

ROMANS @ .175" (.026")

ROMANS @ .250" (.050")

ARCHQUIK @ 1/8"

ARCHITXT @ 5/32"

ARCHTITL @ 3/16"

ARCHTITL @ 1/4"

Standard Lettering (RomanS)

.100 text height - .012" (Pen00) - minimum text height

.130 text height - .016" (Pen 0) - standard text and dimensioning

.150 text height - .021" (Pen1) - sub-titles, schedule headings

.175 text height - .026" (Pen2) - plan titles, detail titles, section titles, section or detail callouts, etc.

All text heights indicated here are for full size drawings (22"x34"). It's important to not go below the FS minimum for text height, especially when producing half-size drawings as the text can get difficult to read. All text should always be in capital letters.

Arch.	Standard	Metrical	Pen thickness
3/32">	0,093"	=2,36 mm	
	<b>0,100"</b>	<b>= 2,54 mm</b>	
	0,120"	= 3 mm	
	0,130"	= 3,3 mm	0,016"
1/8"	(0,125")	= 3,18 mm	
	0,150"	= 3,81 mm	0,021"
	0,175"	= 4,4 mm	0,026"
3/16"	(0,188")	= 4,78 mm	
1/4 "	0,250"	= 6,35 mm	0,05

Schedule and Charts

Standard text and dimensioning

Title for legends, notes and lists

Major Titles (plan, detail, section) & Callout

## Metric

**Model Space Drawing Unit = Meters**

**Paper Space Drawing Unit = Millimeters**

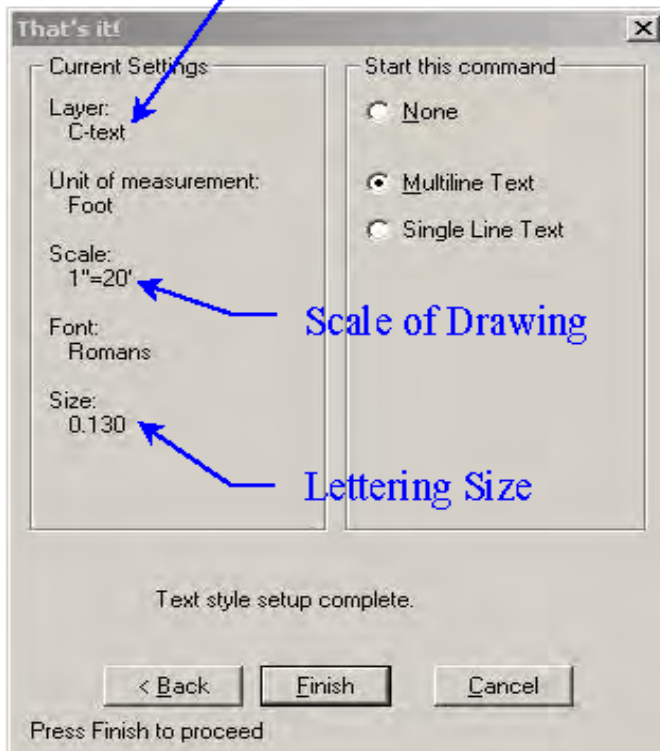
<u>Plot Scale</u>	<u>PS Zoom XP</u>	<u>Text Height:</u>					<u>Imperial Scale</u>
		<u>2mm</u>	<u>3mm</u>	<u>4mm</u>	<u>5mm</u>	<u>6mm</u>	
<b>Full</b>	1000	.002	.003	.004	.005	.006	1:1
<b>1:5</b>	200	.01	.015	.02	.025	.03	3"=1'-0"
<b>1:10</b>	100	.02	.03	.04	.05	.06	1"=1'-0"
<b>1:25</b>	40	.05	.075	.1	.125	.15	1/2"=1'-0", 3/8"=1'-0"
<b>1:50</b>	20	.1	.15	.2	.25	.3	1/4"=1'-0"
<b>1:100</b>	10	.2	.3	.4	.5	.6	1/8"=1'-0"
<b>1:125</b>	8	.25	.375	.5	.625	.75	1"=10'
<b>1:250</b>	4	.5	.75	1	1.25	1.5	1"=20'
<b>1:500</b>	2	1	1.5	2	2.5	3	1"=40', 1"=50'
<b>1:1000</b>	1	2	3	4	5	6	1"=60'
<b>1:2000</b>	.5	4	6	8	10	12	1"=100'
<b>1:2500</b>	.4	5	7.5	10	12.5	15	1"=200'



Dimension Wizard

Text Wizard

Layer Created



Scale of Drawing

Lettering Size

## Text Setup

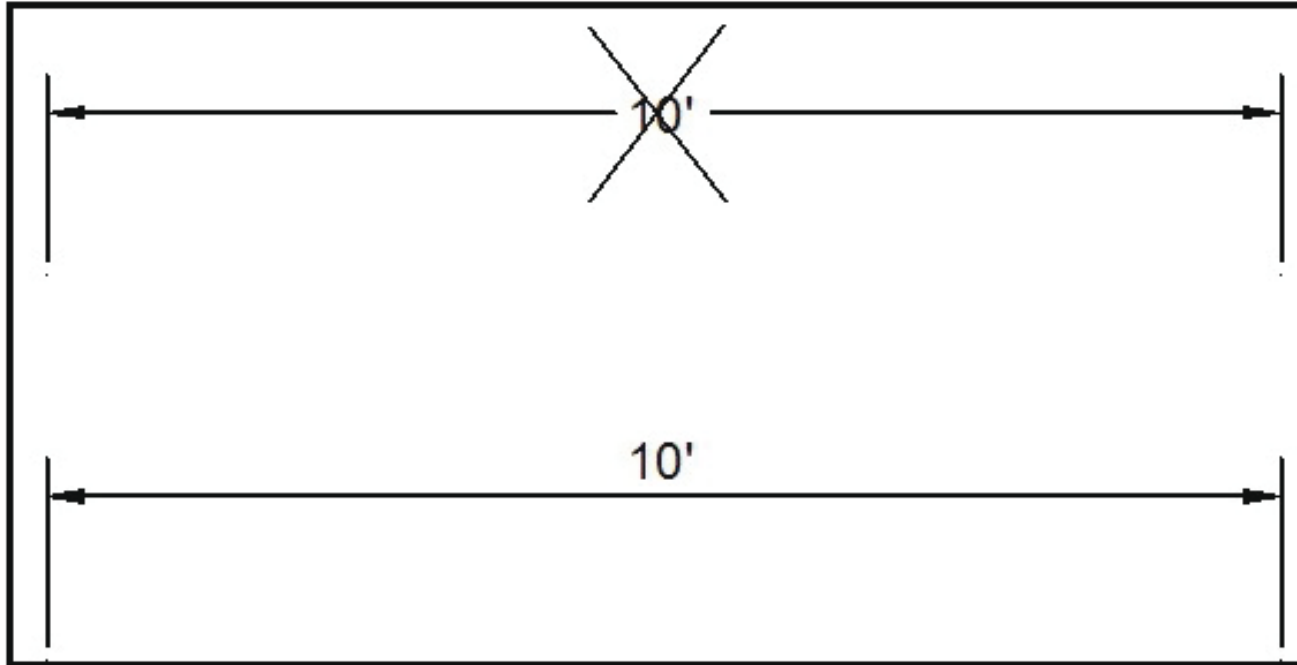
**TWIZ** - An AutoCAD command that has been created at CDI to simplify text setup within an AutoCAD drawing. 'TWIZ' (Text Wizard) configures your text styles based on user-selected options. The command can be entered at the AutoCAD command prompt or selected from the FS General Toolbar (Figure 3-6).

## Dimension Setup

**DWIZ** - Another AutoCAD command created at CDI for dimension setup. "DWIZ" (Dimension Wizard) configures your dimension styles based on user-selected options. This command can also be entered at the AutoCAD command prompt or selected from the FS General Toolbar (Figure 3-6).

Both **TWIZ** and **DWIZ** are bonus tools included with the FS AutoCAD Customization available through the CDI web page.

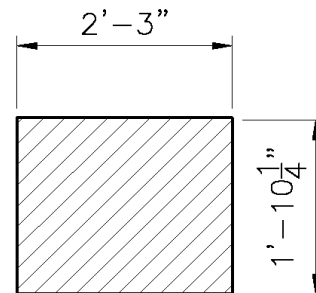
## Dimensions in Drawings



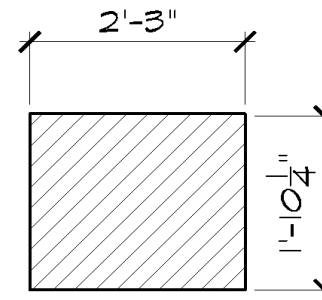
# Dimension and Leaders

Forest Service standards for dimension and leader annotation use arrowheads or ticks depending on the drawing discipline. Engineering format utilizes RomanS lettering with 1/8" arrowheads for both dimensioning and text leaders. Architectural format utilizes architectural fonts with 1/8" ticks (or optional 1/8" arrowheads) for dimensioning, and arrowheads for text leaders. If the Architect chooses to use ticks for dimensioning, then the entire set of Architectural drawings should follow that format. Examples of dimensioning and leader notes are shown in Figure 3-7 below. **Never explode dimension lines to edit.**

ENGINEERING FORMAT



ARCHITECTURAL FORMAT



Option:  
Arrowheads  
Can Be Used

Example:  
Leader Left  
of Text

THE QUICK BROWN  
FOX JUMPS OVER  
THE LAZY DOG

THE QUICK BROWN  
FOX JUMPS OVER  
THE LAZY DOG

THE QUICK BROWN  
FOX JUMPS OVER  
THE LAZY DOG

THE QUICK BROWN  
FOX JUMPS OVER  
THE LAZY DOG

Example:  
Leader Right  
of Text

The following setup values are to be used for consistency in dimensioning and leader annotation:

Arrowheads = Closed Fill

Arrowhead Size = 1/8" (.125")

Tick = Architectural Tick

Tick Size = 1/8" (.125")

Extend beyond dim lines = 1/16" (.0625")

Extend beyond ticks (Arch Only) = 1/16" (.0625")

Offset from Object = 1/16" (.0625")

Text Above Dim Line

Text Height = 1/8" (.130")

Text Offset Above Dim Line = 1/16" (.0625")

1/16" Offset  
From Object

1/16" Extension  
Beyond Dim Line

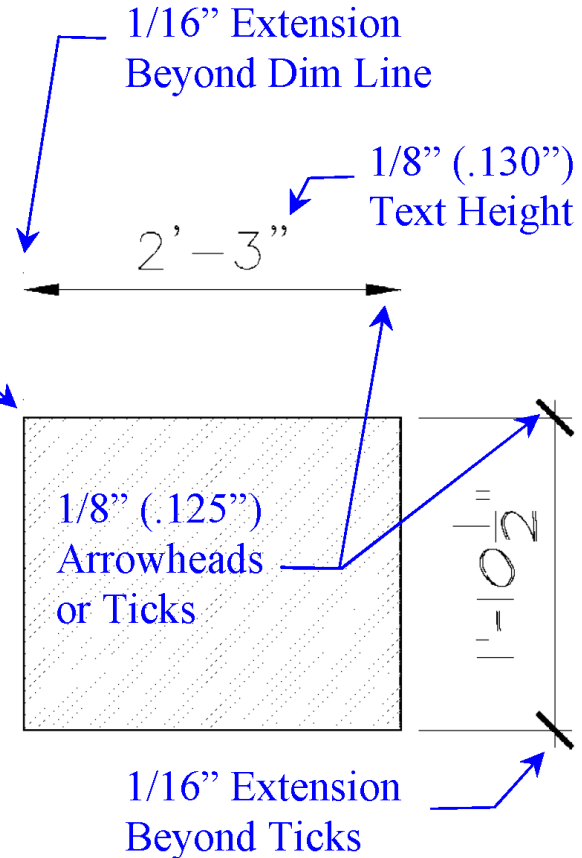
1/8" (.130")  
Text Height

2' - 3"

1/8" (.125")  
Arrowheads  
or Ticks

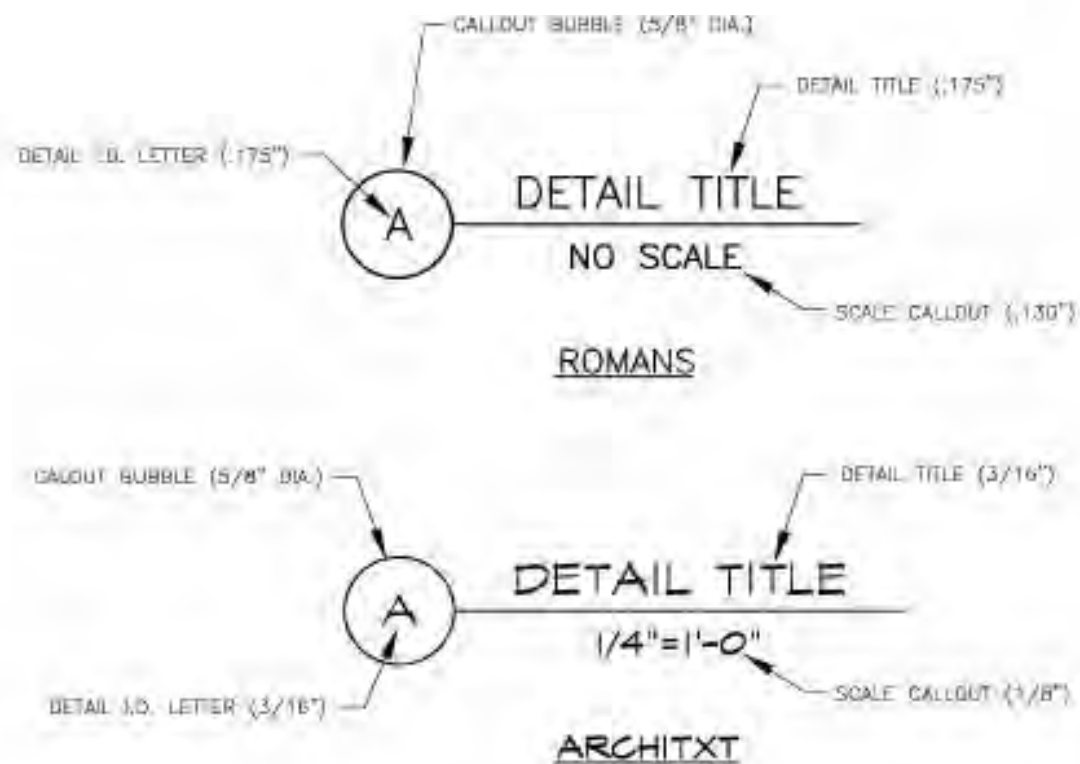
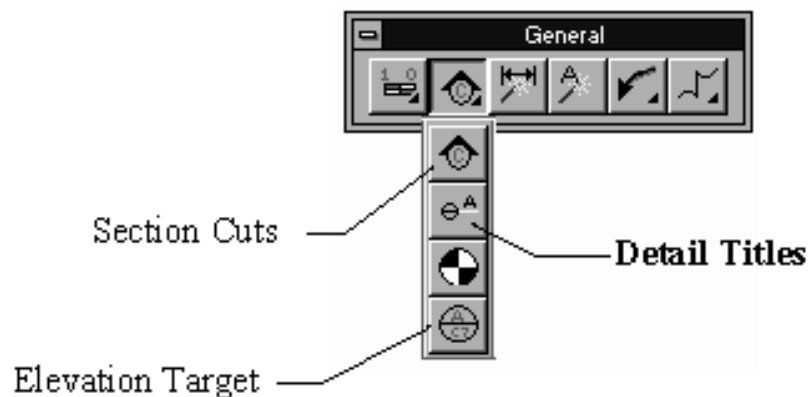
Never Explode  
Dimension Lines

1/16" Extension  
Beyond Ticks

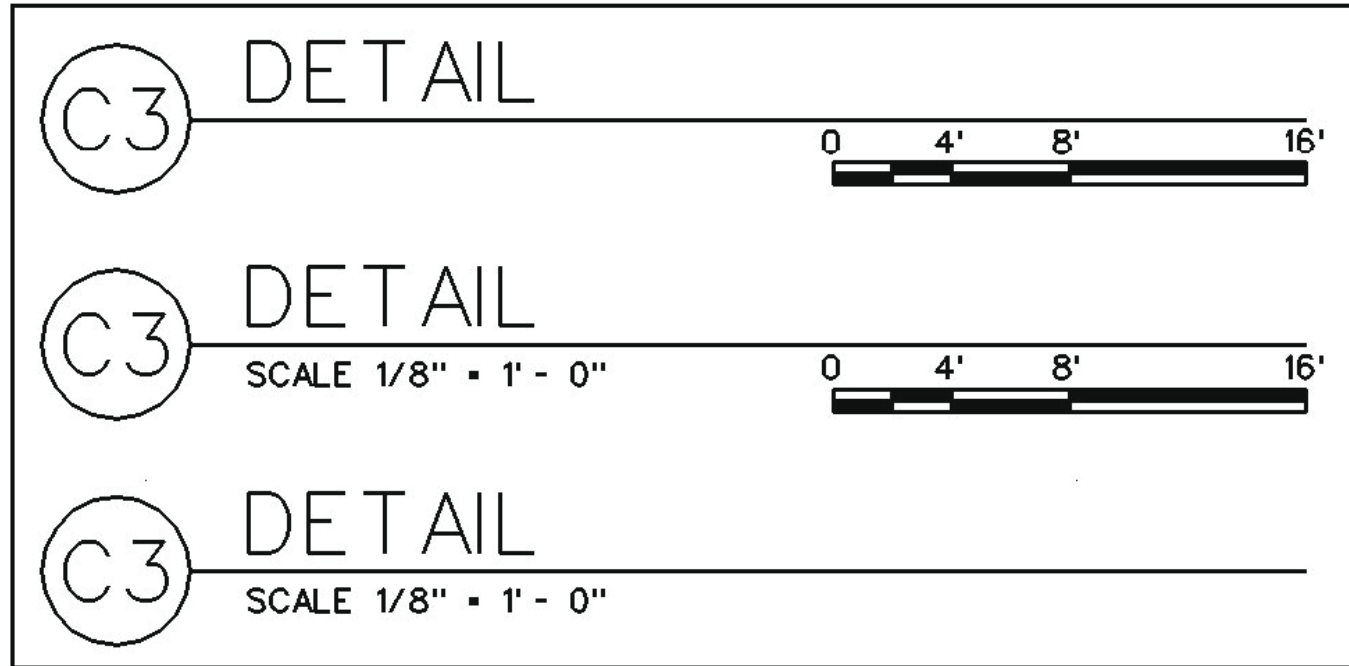


# Detail Titles

Drawing details are titled with a bubbled title bar (See examples Figure 3-10). Included in the FS AutoCAD Customization there is a fly-out on the General Toolbar (Figure 3-9) for insertion of Detail Title Bars, Section Cuts, etc. Clicking on the **Detail Title** icon will run a lisp routine that prompts the user for insertion scale, title information, sheet number, and scale; and inserts the title bar automatically. The user also has a choice between RomanS or Architectural fonts depending on their particular discipline. This title bar can also be edited using the attribute editing command (dda, or ddatte) or double-clicking on the title bar.







**Figure 16. Three acceptable NCS methods for showing scales.**

ensure that if a sheet is plotted, the sheet can be verified as plotted to the correct scale. The graphic scale or scales should be placed on the bottom right of the drawing sheet.

Graphic scales for maps shall be placed below the subtitle of each map.

When a drawing is not drawn to any particular scale, the words “SCALE: NTS” shall be so stated, where “NTS” indicates “Not To Scale.”

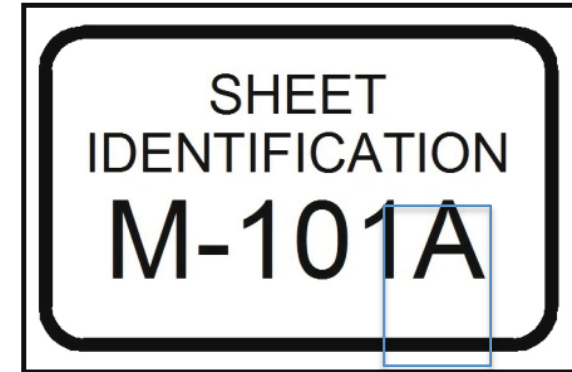
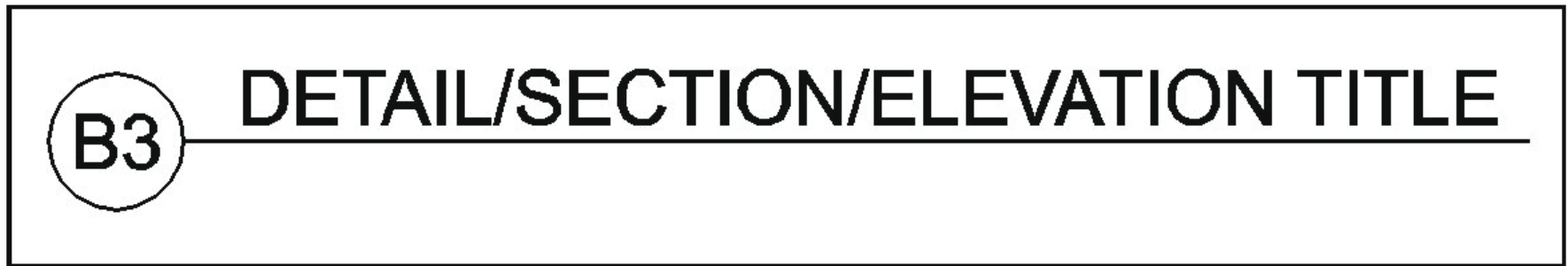


Figure 35. Numbering an added drawing.

*Adding or deleting drawing sheets and index sheet procedures*

- An added drawing shall be indicated as “NEW DRAWING” in the Sheet Title Block. The added drawing shall be shown on the index sheet by inserting the sequence, file name, drawing number, and title in the proper location and surrounding the entire identification with a Revision Cloud.
- To avoid renumbering other drawings, an added drawing shall be numbered as the previous drawing in the set and with an appended alphabetic character (i.e., a drawing following sheet M-101 would be labeled drawing M-101A, M-101B, etc.) (Figure 35).
- A deleted drawing shall be indicated as **DELETED FROM CONTRACT** or **DELETED FROM SOLICITATION** in the Description field of the Title Block. An X shall be placed across the extent of the drawing and the phrase “**DELETED SHEET**” in bold letters will be added.
- The deleted drawing shall not be included in the printed drawing set although the CAD file shall remain part of the CAD drawing files.

placed on the sheet grid. For instance, if the lower left corner of a detail is placed close to the intersection of sheet grid row B and sheet grid column 3, then the detail identification becomes B3. That identification is used in the top half of the callout symbols.



**Figure 20. Detail/section/elevation identification symbol.**

The NCS recommends that the decision on where to place details/sections/elevations within the drawing area of the sheet be based on priority and convenience: “Locate the most frequently used referenced drawing block [e.g., detail/section/elevation] at the lowest drawing module adjacent to the title or notation block [bottom right portion of the drawing area]. Add additional drawings in order of priority, from bottom to top and from right to left. Starting the drawings from the right to the left makes it easier to use partially filled sheets. This eliminates the need to open a heavy set of drawings all the way to the binding to refer to a few details drawn on the left-hand side of the sheets” (UDS Module 4 – Drafting Conventions (CSI 2011)).

# CALLOUT

## Detail indicator symbol

The detail indicator symbol (or callout) is a two-part circle (symbol DTLIND in the A/E/C CAD Standard) that points to an area of the drawing that will be enhanced in a detail on the details sheet (Figure 21). As described in the previous paragraph, the top part of the circle is filled in with the detail identification and the bottom part is filled in with the sheet number on which the detail occurs. The sheet number should always be an XX5NN designation where XX is the Discipline Designator (Level 1 or Level 2), 5 indicates that it is a Details sheet, and NN is the Sheet Sequence Number (01-99).

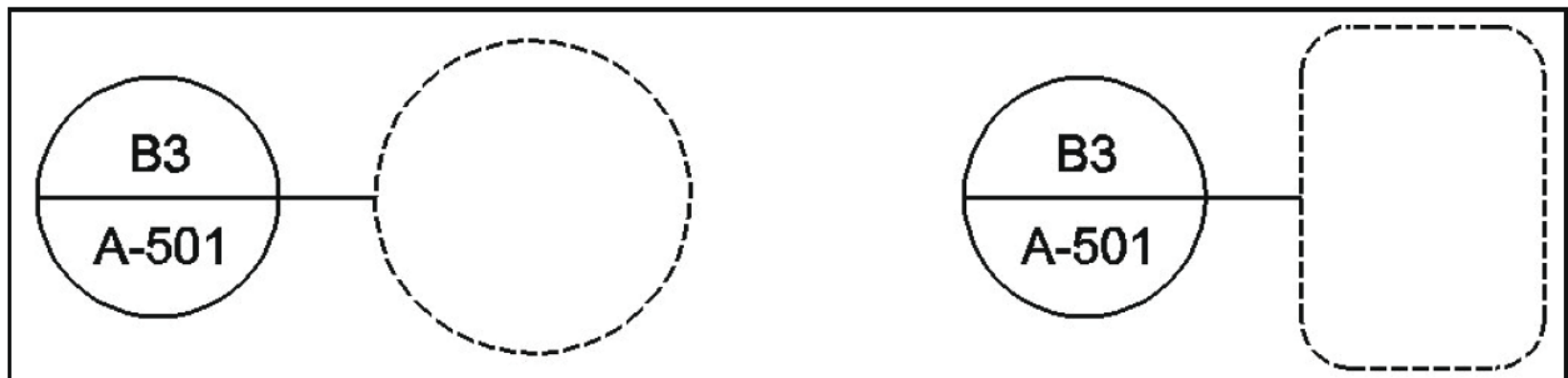


Figure 21. Detail indicator symbol.

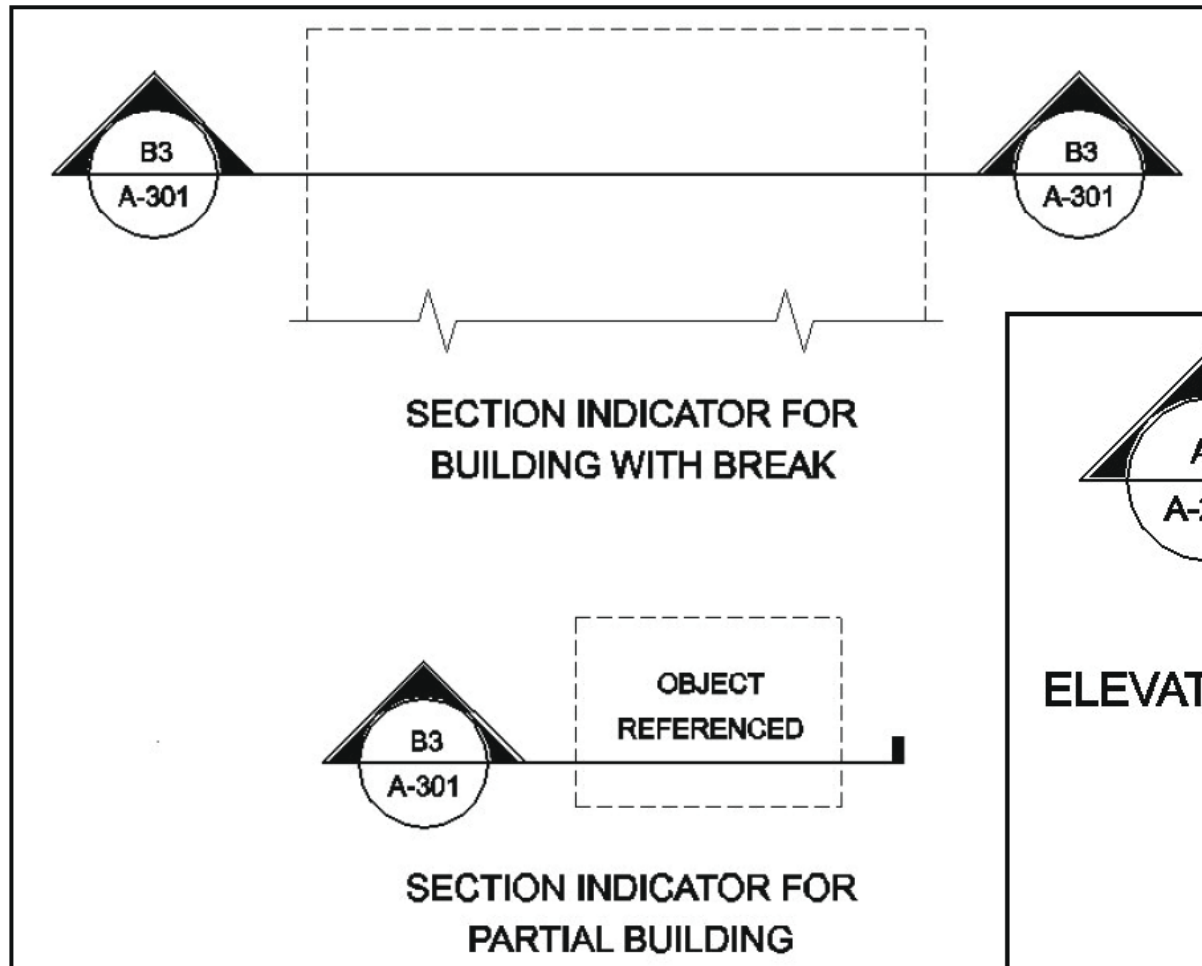


Figure 22. Section indicator symbol.

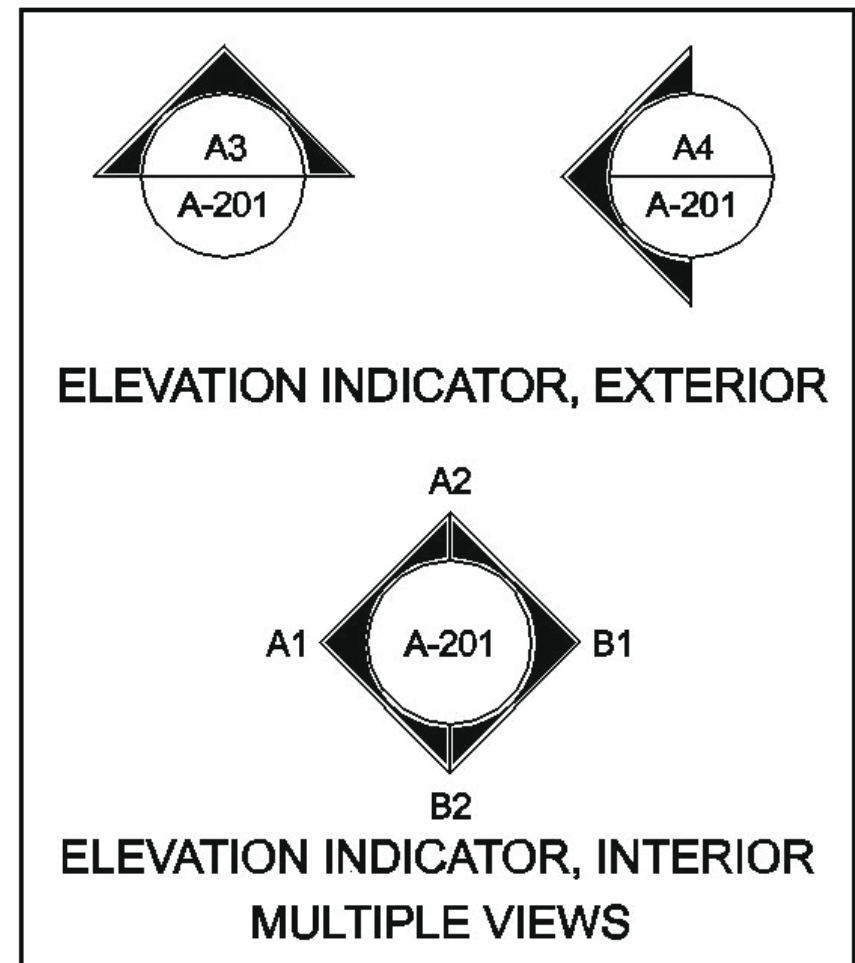


Figure 23. Elevation indicator symbol.

According to the NCS, the north arrow (or true north arrow) and the plan north arrow (Figure 17) should be placed in the lower right-hand corner of the drawing block title (UDS Module 4 – Drafting Conventions (CSI 2011)). While the A/E/C CAD Standard presents various north arrow symbols, the preferred symbol is the NCS north indicator symbol (NORNCS in the A/E/C CAD Standard “General” symbol library). Floor plans should be oriented so that the plan north arrow points to the top of the drawing block. The true north arrow (i.e., points to the North Pole) is adjusted so that the building grid and plan north arrow are parallel to the sheet orientation (UDS Module 4 – Drafting Conventions). If possible, the orientation of true north should be maintained throughout an entire set of drawings.



**Figure 17. Plan north arrow**

# 11 Drawing Revisions

## Revision strategies and symbology

During development of CAD contract drawings, revisions are inevitable. There are two different designations for these types of revisions – amendments and modifications. Amendments are revisions that occur during the contract advertisement period. Modifications are revisions that are made after award of a construction contract.

All revisions shall be flagged by a revision symbol (Figure 31). This symbol shall be an equilateral triangle as shown by symbols REVID1 or REVID2 in the A/E/C CAD Standard. These symbols comply with the look and format of the NCS symbol for revision indicators (UDS Module 6 – Symbols (CSI 2011)).

The revision symbol should be positioned adjacent to the revision. The revision shall be enclosed in a revision cloud (TREEL line style from the A/E/C CAD Standard could be used to create these clouds) drawn at medium thickness (0.35 mm). The revision triangle shall contain numbers or letters in sequence (i.e., 1, 2, 3, or a, b, c). The revision triangle shall also be shown in the border sheet Issue Block, including a description of the revision and the date. From the A/E/C CAD Standard (p. 33), “The first entry should be placed on the lower left-hand of the issue block and subsequent entries should be made above it.”

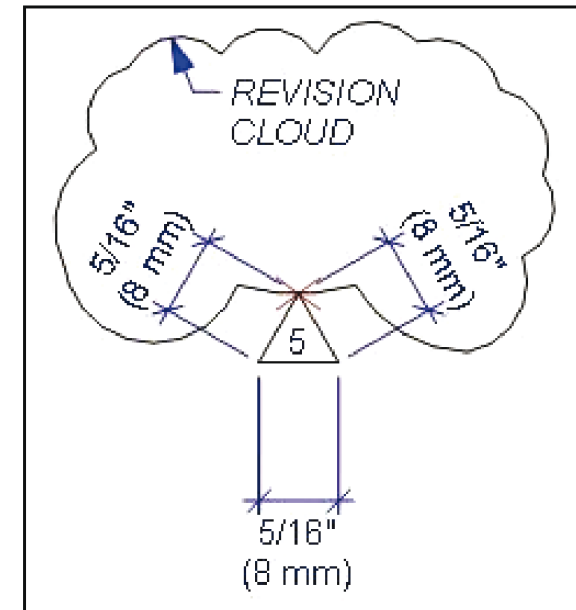


Figure 31. Revision symbol.

The angled arrows marked “A” in figure 7-11 indicate the location of the cutting plane for the sections.

To help you understand the importance of wall sections to the craftsmen who will do the actual building, look at the left wall section in figure 7-15 marked “masonry construction.” Starting at the bottom, you learn that the footing will be concrete, 1 foot 8 inches wide and 10 inches high. The vertical distance to the bottom of the footing below FIN GRADE (finished grade, or the level of the finished earth surface around the house) varies—meaning that it will depend on the soil-bearing capacity at the particular site. The foundation wall will consist of 12-inch concrete masonry units (CMU) centered on the footing. Twelve-inch blocks will extend up to an unspecified distance below grade, where a 4-inch brick facing (dimension indicated in the mid-wall section) begins. Above the line of the bottom of the facing, it is obvious that 8-inch instead of 12-inch blocks will be used in the foundation wall.

The building wall above grade will consist of a 4-inch brick facing tier, backed by a backing tier of 4-inch cinder blocks. The floor joists consist of 2 by 8s placed 16 inches OC and will be anchored on 2 by 4 sills bolted on the top of the foundation wall. Every third joist will be additionally secured by a 2 by 1/4 strap anchor embedded in the cinder block backing tier of the building wall.

Window A in the plan front elevation in figure 7-13 will have a finished opening 2 5/8 inches high. The bottom of the opening will be 2 feet 11 3/4 inches above the line of the finished floor. As shown in the wall section of figure 7-15, 13 masonry courses (layers of masonry units) above the finished floor line will equal a vertical distance of 2 feet 11 3/4 inches. Another 19

directed). A minimum of 2 vertical feet of crawl space will extend below the bottoms of the floor joists.

The middle wall section in figure 7-15 gives similar information for a similar building constructed with wood-frame walls and a double-hung window. The third wall section in the figure gives you similar information for a similar building constructed with a steel frame, a casement window, and a concrete floor finished with asphalt tile.

### DETAILS

Detail drawings are on a larger scale than general drawings, and they show features not appearing at all, or appearing on too small a scale, in general drawings. The wall sections in figure 7-15 are details as well as sections, since they are drawn on a considerably larger scale than the plans and elevations. Framing details at doors, windows, and cornices, which are the most common types of details, are nearly always shown in sections.

Details are included whenever the information given in the plans, elevations, and wall sections is not sufficiently “detailed” to guide the craftsmen on the job. Figure 7-16 shows some typical door and window wood framing tails, and an eave detail for a very simple type of cornice. Figure 7-17 shows architectural symbols for doors and windows.

### SPECIFICATIONS

The construction drawings contain as much information about a structure as can be presented graphically. A lot of information can be presented this way, but there is more information that the construction craftsman must have that is not adaptable to the graphic form of presentation. Information of this kind includes quality criteria for materials (for example, maximum amounts of aggregate per sack of cement), specified



DOOR SYMBOLS	
TYPE	SYMBOL
SINGLE-SWING WITH THRESHOLD IN EXTERIOR MASONRY WALL	
SINGLE DOOR, OPENING IN	
DOUBLE DOOR, OPENING OUT	
SINGLE-SWING WITH THRESHOLD IN EXTERIOR FRAME WALL	
SINGLE DOOR, OPENING OUT	
DOUBLE DOOR, OPENING IN	
REFRIGERATOR DOOR	
WINDOW SYMBOLS	
TYPE	SYMBOL
	WOOD OR METAL SASH IN FRAME WALL      METAL SASH IN MASONRY WALL      WOOD SASH IN MASONRY WALL
DOUBLE HUNG	
CASEMENT	
DOUBLE, OPENING OUT	
SINGLE, OPENING IN	

Figure 7-17.—Architectural symbols.

# ARCHITECTURAL SYMBOLS, LINE CONVENTIONS, AND MATERIAL CONVENTIONS

The plan for a building must give all the details necessary to construct the building. Therefore, it usually consists of a collection of sheets, called a *set of plans*. Each sheet shows the details of a different phase or part of the construction. Several of the sheets will be devoted to floor plans. Other sheets in the set will show construction details (such as wiring, plumbing, and air-conditioning details and types and quantities of materials). Refer to Appendix A for conversion tables.

*Architectural symbols* on construction drawings show the type and location of windows (Figure 1-1), doors (Figure 1-2), and other features. They show the general shape of an actual architectural feature and show any motion that is supposed to occur.

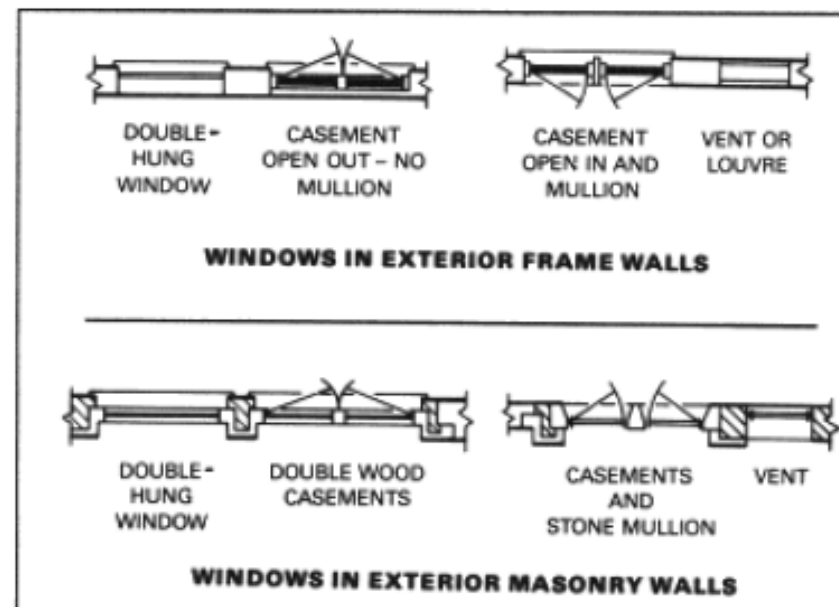


Figure 1-1. Window symbols

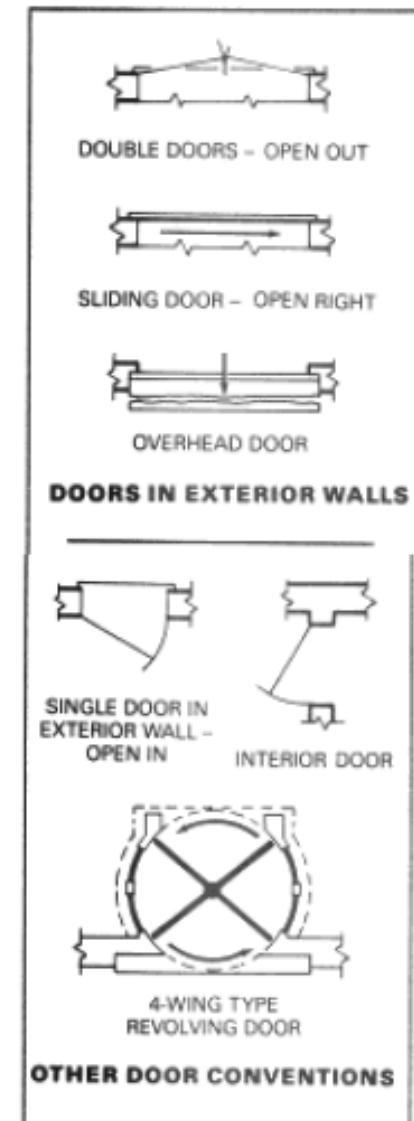


Figure 1-2. Door symbols

## Numbering of rooms

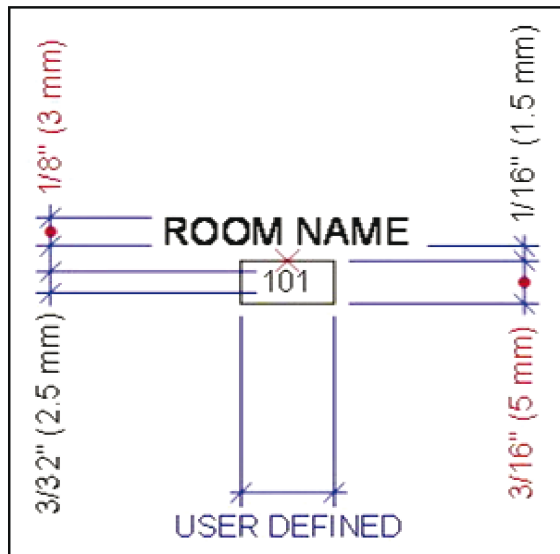


Figure 26. Room identifier symbol.

All floor plans (except structural) shall show room numbers. According to the NCS, "The first part of a room identifier should match the floor number. Room numbering should start at the most prominent means of access to the floor. For instance, the first room to the right of the major elevator or stair on the third floor would be 301 [the first room to the right of the major elevator or stair on the sixteenth floor would be 1601, and the first room to the right of the major elevator or stair on the basement would be B101]. Number rooms sequentially moving clockwise around the building" (UDS Module 4 – Drafting Conventions (CSI 2011)). If the building is a single-story structure, then the first room to the right of the main entrance would be 101. If the main entrance opens into a lobby or vestibule, then the lobby would be numbered 100 and numbering would continue with the first room to the right. The remaining rooms on that floor would be numbered sequentially moving clockwise around the building.

Per the NCS (UDS Module 6 – Symbols (CSI 2011)), the room name (Figure 26) should be centered 1/16 in. (1.5 mm) above the room identifier symbol (symbols ROMID3 or ROMID4 in the A/E/C CAD Standard).

**Note:** Room numbers on construction documents are typically for construction references and do not necessarily reflect the final room numbers. See the "Signage" schedule for final room number/names. It is recommended that the architect consult the building owner before beginning room numbering. Since there are not really any specific

# SCHEDULING: VISUAL MODELING & DATABASE

# BILL OF MATERIAL

ITEM NO.	DESCRIPTION	UNIT	ASSEMBLY OR FSN NO.	QUANTITIES	
				TROP	NORTH
3 - 1	LIGHTING CIRCUIT — NAVFAC DWG NO. 283414	EA.	3016	3	3
3 - 2	POWER BUS, 100A — NAVFAC DWG NO. 504131	EA	3047	1	1
3 - 3	RECEPTACLE CKT — NAVFAC DWG NO. 303668	EA	3019	2	2
3 - 4	BOX, RECEPTACLE W/CLAMP FOR NONMETALLIC SHEATH WIRE	EA	5325-102-604	5	5
3 - 5	LAMP ELECTRIC, MED BASE, INSIDE FROSTED, 200 W, 120 V	EA	6240-180-314	6 0	6 0
3 - 6	PLUG: ATTACHMENT, 3 WIRE, 15 AMP, 125 V.	EA	5935-102-309	1 0	1 0
3 - 7	PLATE: BRASS, DUPLEX RECEPTACLE	EA	5325-800-101	5	5
3 - 8	RECEPTACLE, DUPLEX, 3 WIRE, 15 AMP, 125 V.	EA	5325-100-102	5	5
3 - 9	ROD, GROUND, 3/4" x 10'-0"	EA	5308-200-180	1 2	1 2
3-10	WIRE, NO. 2 I/C STRANDED, HARD DRAWN, BARE	LB	6145-134-200	5 2	5 2
3-11	SWITCH, SAFETY, 2 P, 30 AMP, 250 V, PLUG FUSE	EA	5930-142-401	2	2
3-12	CLAMP, GROUND ROD	EA	5209-100-101	1 3	1 3
3-13	SWITCH, SAFETY, 200 AMP, 250 V, 3 P	EA	5930-201-903	1	1
3-14	FUSE, RENEWABLE, 200 AMP, 250 V	EA	5920-100-000	6	6
3-15	LINK, FUSE, 200 AMP, 250 V	EA	5920-100-001		
	FUSE PLUG, 50 AMP, 125 V	EA	5920-100-102		

## Bill of Material

The bill of material block contains a list of the parts and/or material needed for the project. The block identifies parts and materials by stock number or other appropriate number, and lists the quantities required.

The bill of material often contains a list of standard parts, known as a parts list or schedule. Figure 1-4 shows a bill of material for an electrical plan.

## **9 Identifying spaces and objects**

### **Numbering of doors**

According to the NCS, “Each door opening in a building must have a unique identifier. If a room has one door opening, the door opening number is the same as the secure side room number. If more than one door opening in a room exists, door openings within that room are identified by the room number followed by an alphabetical character starting clockwise from the corridor access door opening” (UDS Module 4 – Drafting Conventions (CSI 2011)). For example, for Room 126 (Figure 28), the corridor access door opening would be numbered 126A and the second door opening within Room 126 would be numbered 126B.

### **Numbering of stairs**

The most prominent stair with the largest egress capacity is identified as Stair 1. On the first floor, number the stairs sequentially moving clockwise from the first stair. The stair number remains the same for its entire height. Stairs above or below the first floor that do not connect with the

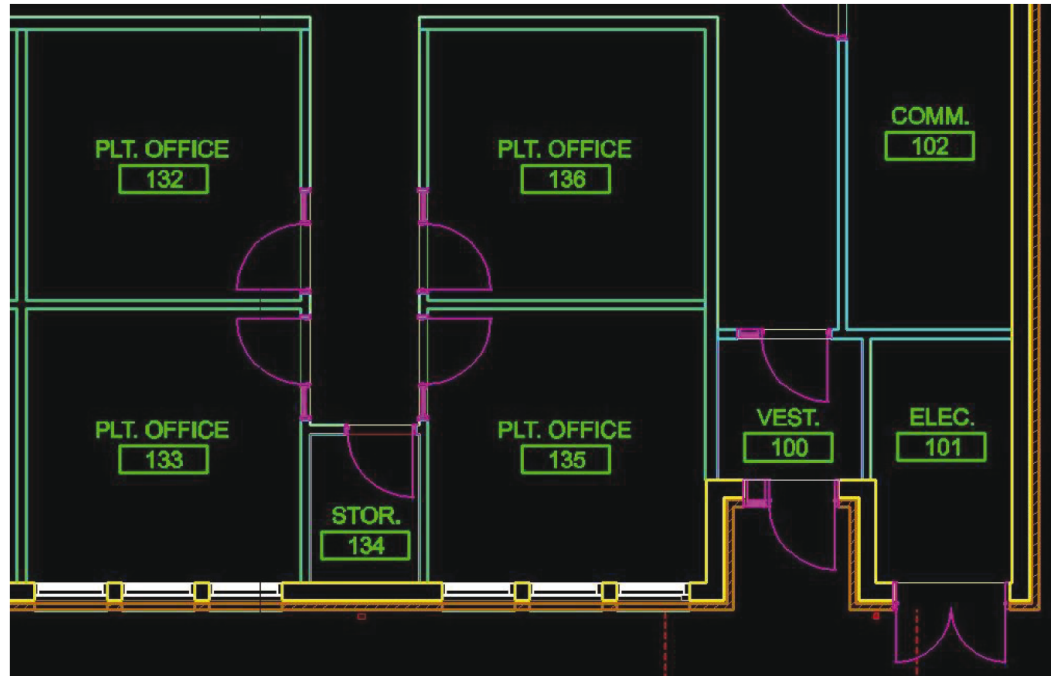


Figure 27. Room numbering example.

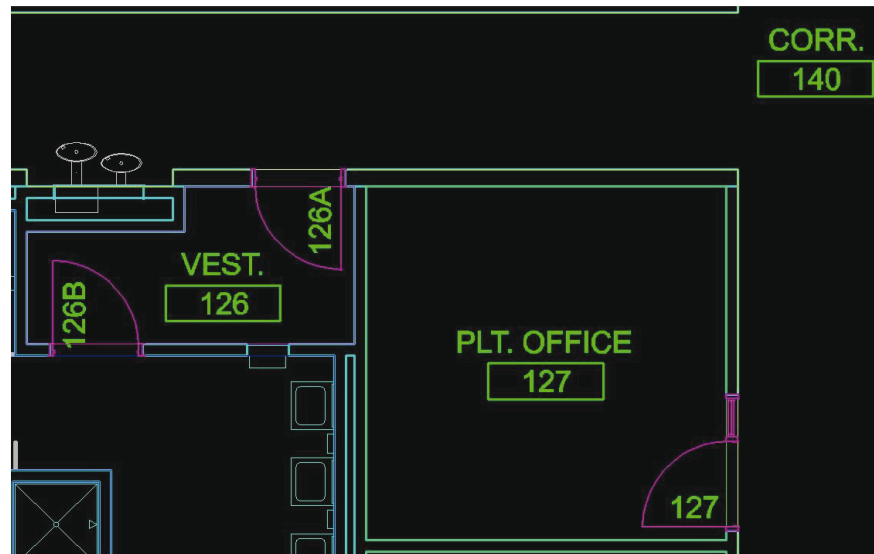
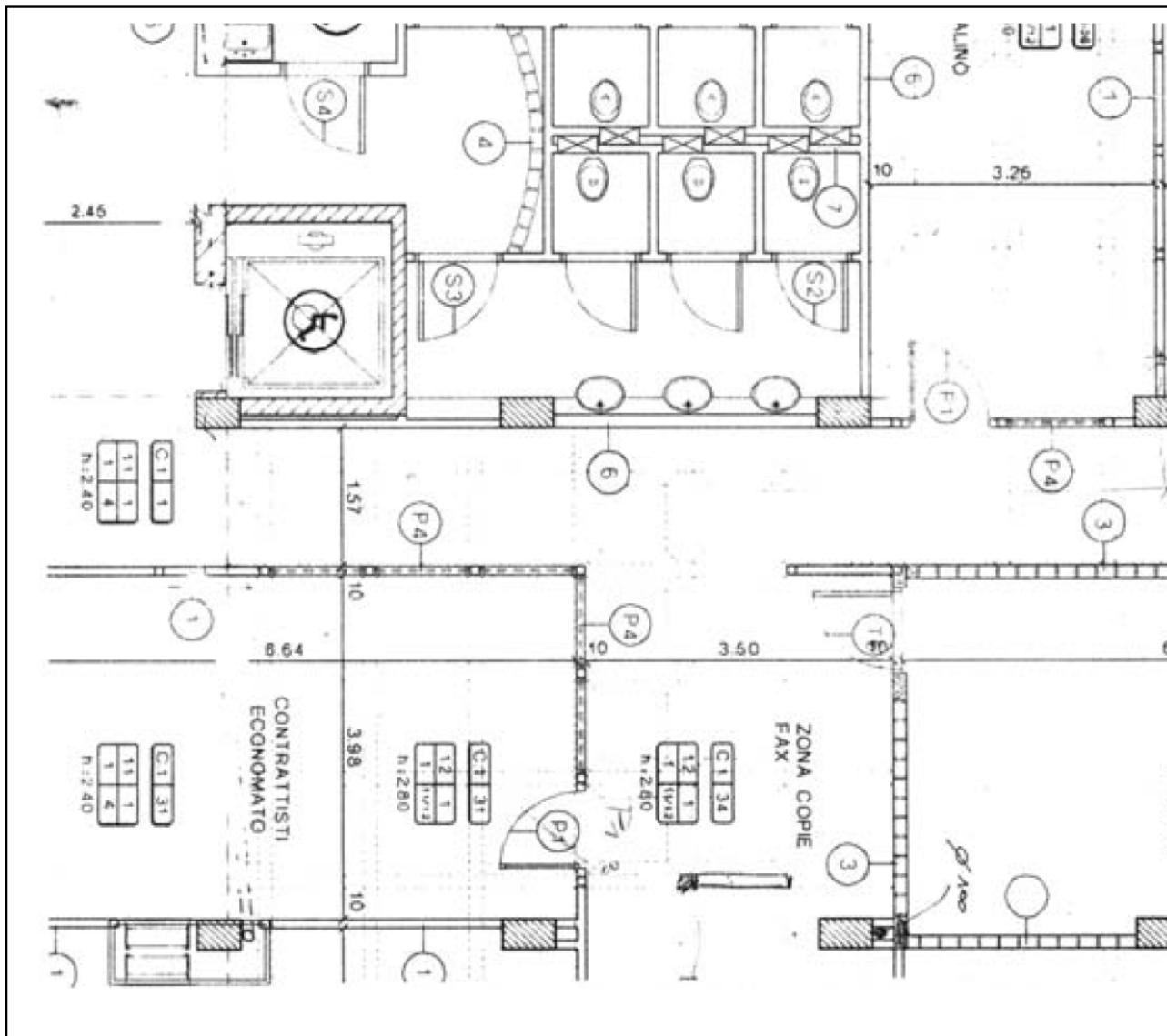


Figure 28. Numbering of doors.





## PAVIMENTI

- 11 Pavimentazione autogenica in PVC collocata sopra una mano d'assatura su pavimento esistente (codice 51-5-2)
- 12 Pavimentazione autogenica in PVC, colata sopra una mano d'assatura esistente, in stesura del piano di posacollati 215-51-5-2
- 13 Pavimento tecnico in silex di calcio e fibrarivestito superficialmente in PVC e che realizza di fatto una quota di -30cm (codice 611)
- 14 Pavimento tecnico in silex di calcio e fibrarivestito superficialmente in PVC e che realizza di fatto una quota di -15cm (codice 612)
- 15 Pavimento tecnico in silex di calcio e fibrarivestito superficialmente in PVC e che realizza di fatto una quota di -10cm (codice 613)
- 16 Pavimento tecnico in silex di calcio e fibrarivestito superficialmente in PVC, collocato su supporti metallici in modo di formare una rampa continua (codice 614)
- 17 Pavimento in gres ceramico tipo Floor Gres (codice 217)

## RIVESTIMENTI

- |     |   |               |
|-----|---|---------------|
| 1.0 | Integrità con tempera lavabile  | (codice 2.18) |
| 2.0 | Rivestimento in legno (noce nazionale)  |               |
| 3.0 | Intonaco premiscelato a base di gesso e pittura   | (codice 2.19) |
| 4.0 | Rivestimento in ceramica smaltata fino ad h.2.10  | (codice 2.19) |
|     | collocato su intonaco rustico, ed arricciatura eseguita su<br>intonaco rustico da h.2.10 ad h.2.40. (codice 2.13) |               |

## ZOCOLINO

- 1.0 Zoccolino in PVC h.7cm (codice 53)

**SOFFITTO**

- |    |   |               |
|----|---|---------------|
| 11 | Controsoffitto tecnico piano.   | (codice 7.1)  |
| 12 | Controsoffitto tecnico cassettonato   | (codice 7.2)  |
| 13 | Controsoffitto tecnico a doghe interrotte in alluminio                                  | (codice 7.3)  |
| 20 | Controsoffitto in cartongesso e successivamente intagliato con tempera lavabile         |               |
| 31 | Intonaco fonosorbente a base di fibre di vermiculite, legante naturale,ossido colorante | (codice 2.14) |
| 32 | Rasatura a base di gesso e pittura  | (codice 2.15) |
| 33 | Intagliatura con tempera lavabile   | (codice 2.16) |
| 34 | Controsoffitto a doghe di alluminio con materasso fonosorbente                          | (codice 2.22) |



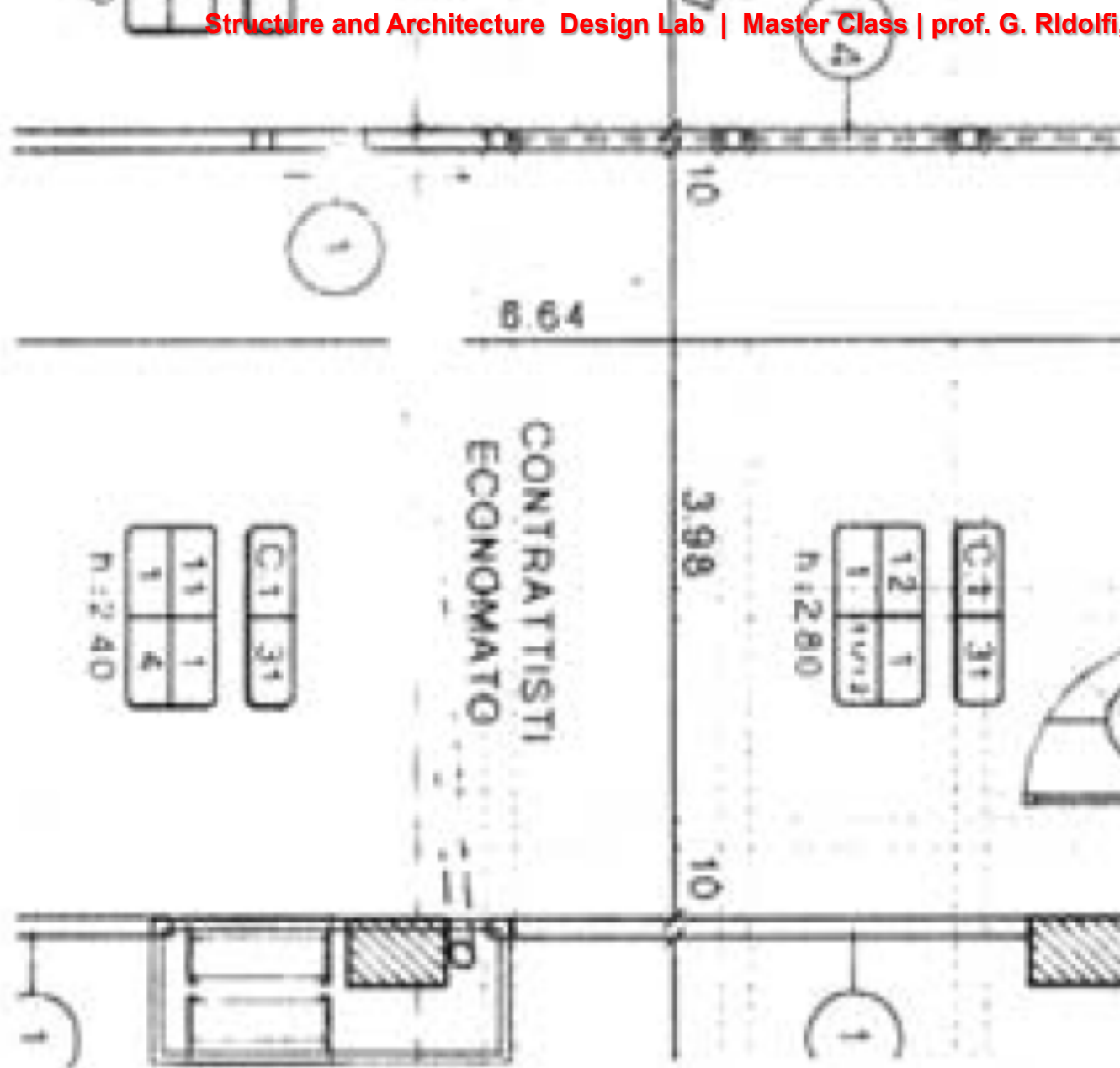
### PARTIZIONI INTERNE VERTICALI

- |  |                                |
|--|--------------------------------|
| 1 - Parete in intonaco   | lodec 31- 32-33                |
| 2 - Parete realizzata con blocchetti in leca (dm15x50)REI 240 rivestiti con intonaco premiscelato a base di gesso e pittura    | lodec 15x50REI 240 lodec 23-12 |
| 3 - Parete realizzata con blocchetti in leca (dm20x20x50)REI 240 rivestiti con intonaco premiscelato a base di gesso e pittura | lodec 20x20 lodec 2-4-12       |
| 4 - Parete realizzata con blocchetti in leca "facciavista" (dm15x20x50 REI 240) intonacati solo sul lato interno               | lodec 25-118                   |
| 5 - Parete realizzata con blocchetti in leca "facciavista" (dm20x20x50 REI 240)intonacati solo sul lato interno                | lodec 26-112                   |
| 6 - Parete realizzata con matton forati intonacati ( spessore di leca 12x12 )  | lodec 2-8-12                   |
| 7 - Parete realizzata con matton forati intonacati ( spessore dei forati cm12 )  | lodec 2-7-12                   |
| 8 - Parete attrezzata tipo "S&S Synthesis Olivetti"  | lodec 4                        |
| 9 - Parete attrezzata tipo "S&S Synthesis Olivetti"  | lodec 4/2                      |
| 10 - Parete scorrevole tipo "Esteller" altezza 240   | lodec 4/4                      |
| 11 - Parete scorrevole tipo "Esteller" altezza 360   | lodec 4/5                      |

## TRATTAMENTO PARETI VETRATE ESISTENTI

- R1** — Restauro infissi esistenti e protezione mediante pellicola riflettente
- R2** — Restauro infissi esistenti
- R3** — Restauro infissi. Modifica dell'attuale senso di apertura dell'infisso e installazione del maniglione antiganico.





CONTROSOFFITTO  
TECNICO PIANO

P

PAR

1 - Parate in ca  
2 - Parate co

## Numbering of elevators

The elevator nearest to the building entrance with the largest access and egress capacity is identified as Elevator 1. Number additional elevators moving clockwise within elevator banks. Use the same sequence and arrangement of numbers on additional banks of elevators if present (UDS Module 4 – Drafting Conventions (CSI 2011)).

## Identification of windows

According to the NCS, “Each type of window must have a unique identifier.” The window identifier symbol to be used from the A/E/C CAD Standard is WINID (Figure 29). This symbol with identifier number and/or letter should also be placed in the “Mark” column of Window Schedules that are developed.

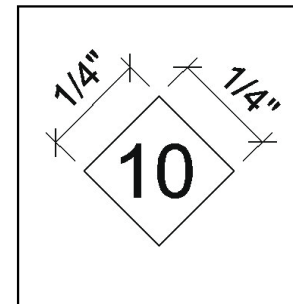
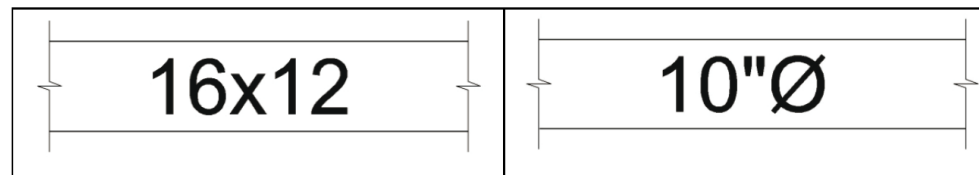


Figure 29. Window identifier symbol

## Labeling of duct

The Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) labels rectangular duct as shown in Figure 30a. The first value represents the side of the duct shown (width), and the second value represents the side of the duct not shown (depth).



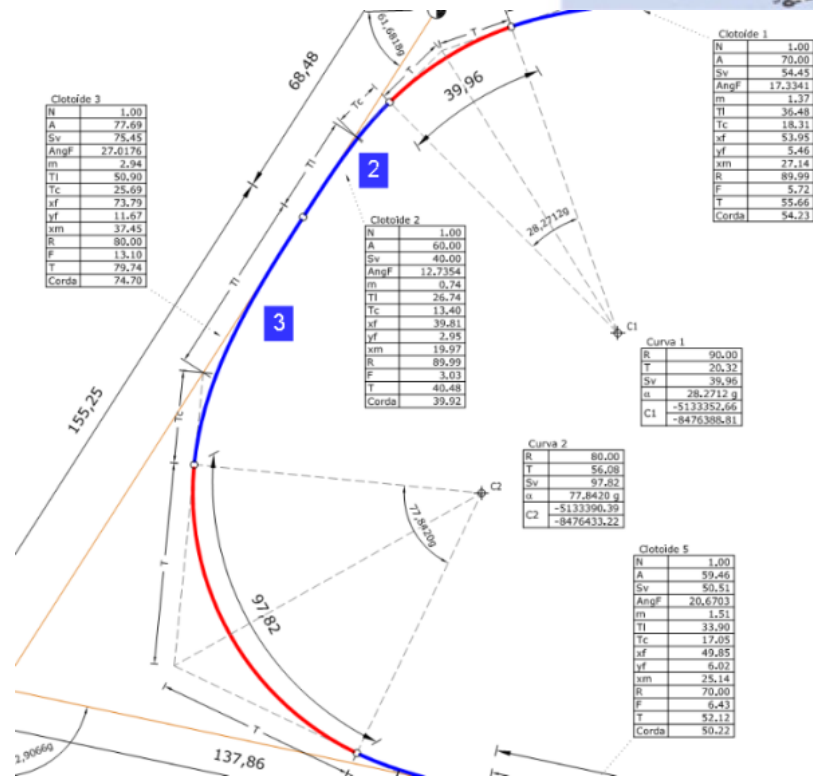
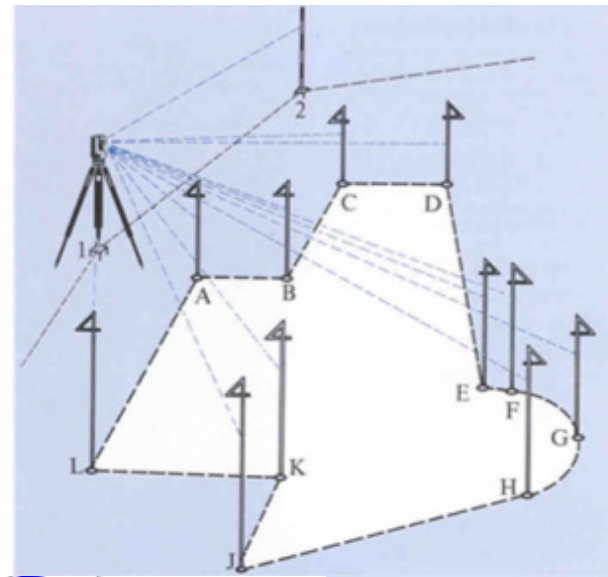
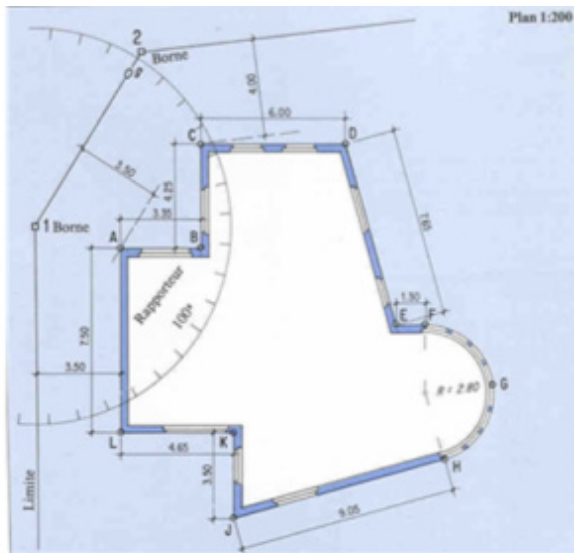
a. Rectangular duct

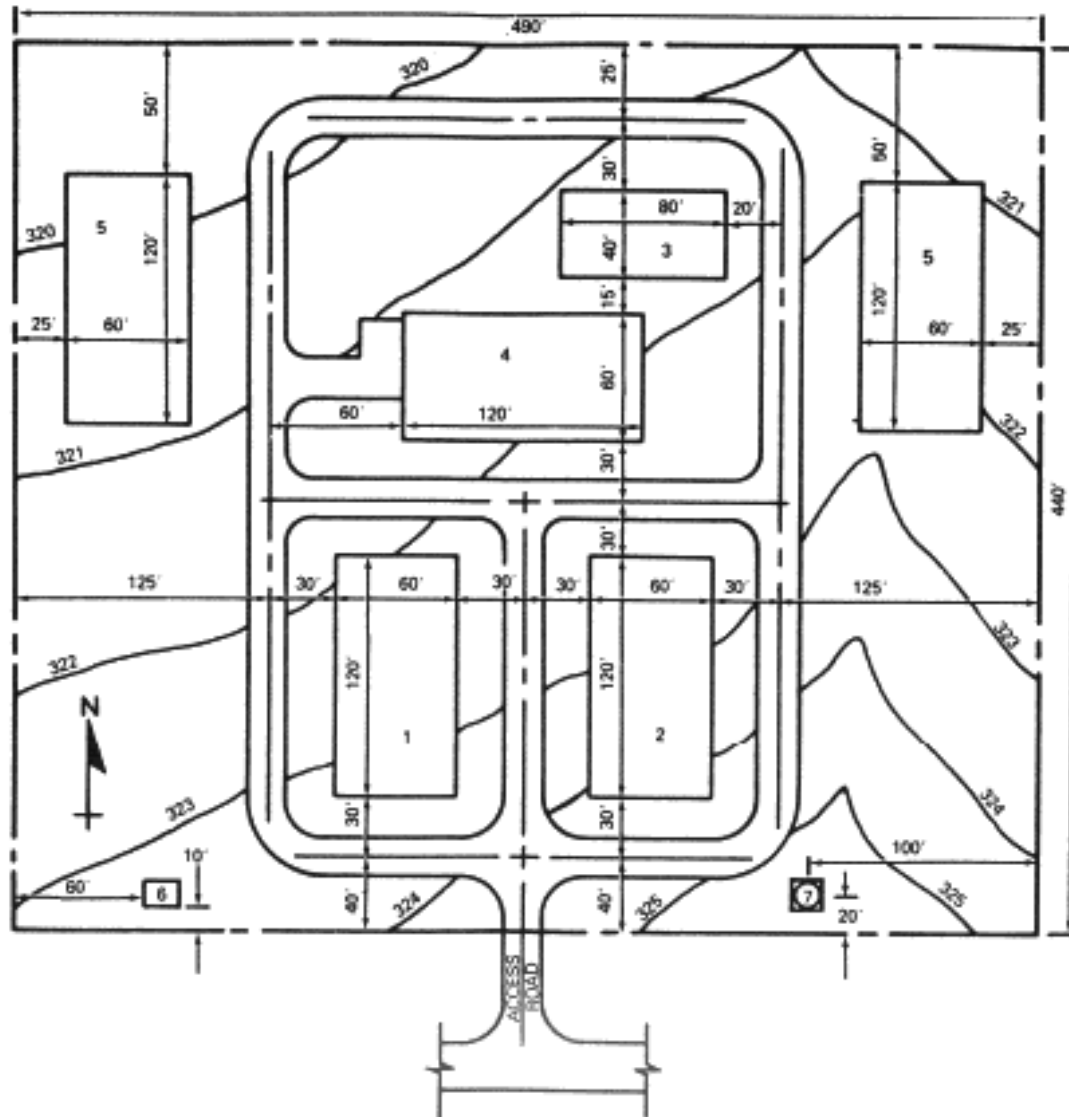
b. Round duct

Figure 30. Duct labeling.

Round duct is shown as the diameter of the duct, followed by a diameter symbol (Figure 30b).

# BUILDING PLACEMENT

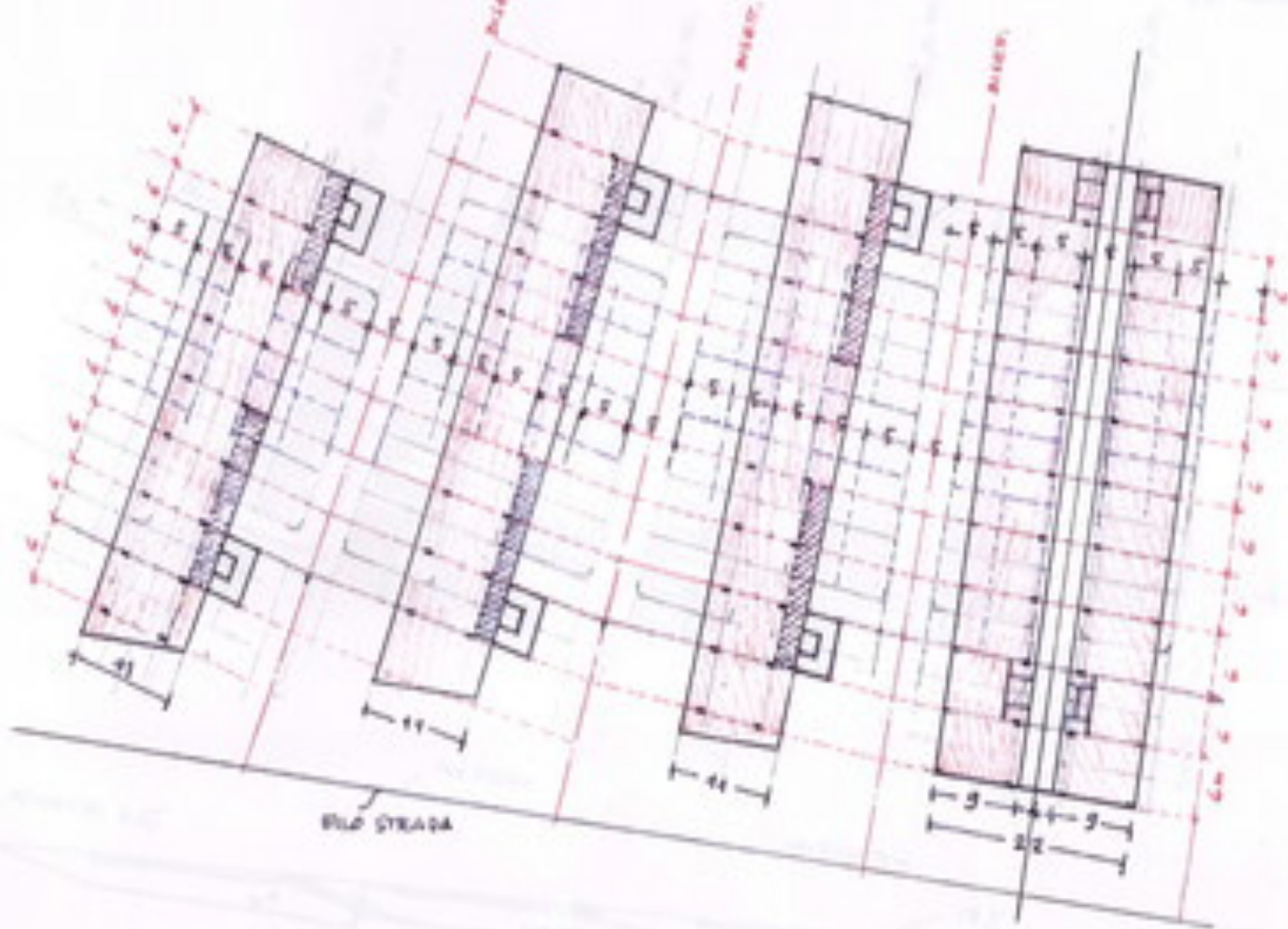




SCHEDULE OF FACILITIES			
NO.	ITEM	QTY	SIZE OR UNIT
BUILDINGS			
1	ARMY EXCHANGE	1	60' x 120'
2	CRAFTS SHOP	1	60' x 120'
3	LIBRARY	1	40' x 80'
4	RECREATION BUILDING	1	60' x 120'
OTHER CONSTRUCTION			
5	ATHLETIC COURTS	2	60' x 120'
6	SUMP FIRE PROTECTION	1	10,000 Gal
7	WATER TANK	1	10,500 Gal
	ROAD - 22' WIDE - (2 lane) 6" MACAM	0.5	MILE
	SITE AREA	11.2	ACRES

DEPARTMENT OF ARMY  
OFFICE OF THE CHIEF OF ENGINEERS

RECREATION BUILDING - 60' x 120'  
SITE PLAN

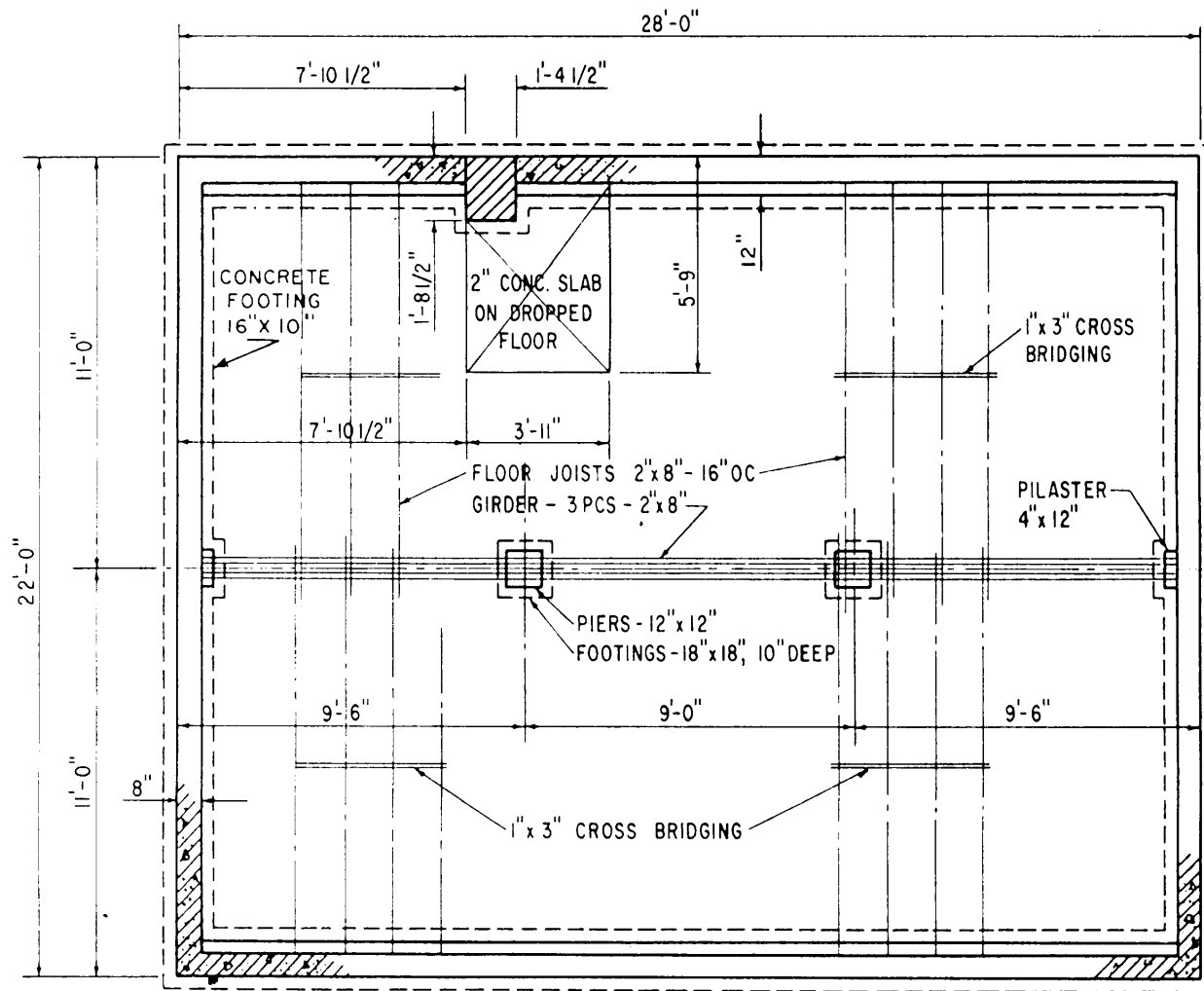


Schema di tracciamento dei corpi di fabbrica

A foundation plan (fig. 7-9) is a plan view of a structure projected on a imaginary horizontal plane passing through at the level of the tops of the foundations. The plan shown in figure 7-9 tells you that the main foundation of this structure will consist of a rectangular 8-inch concrete block wall, 22 by 28 feet, centered on a concrete footing 10 inches wide. Besides

the outside wall and footing, there will be two 12-inch square piers, centered on 18-inch square footings, and located 9 feet 6 inches from the end wall building lines. These piers will support a ground floor center-line girder.

Figure 7-10 shows the development of a typical floor plan, and figure 7-11 shows the floor plan itself.





## **General Survey Requirements**

Survey and indicate on the map:

- All roads, drives, walks, trails, campground spurs, fences, walls, ledges, ditches, culverts, catch-basins, water courses, hydrants, lamp posts, fire rings, tables, kiosks, fee stations, interpretive signs, and utility poles.
- Give minimum dimensions of all culverts.
- Outlines of all structures on site, showing steps, porches, belonging to them. Indicate the finished floor elevation, porches and landings, including steps to/from grade and record elevations thereof to the nearest 0.01 feet:
- Spot elevations at all corners.
- Locate and label recorded easements, rights-of-way, and Forest boundaries.

### **LOCATING TREES AND FOLIAGE**

- Indicate on the map the approximate extent of overhang of branches of dense masses of trees, and of high bushes.
- Locate accurately and show on map all isolated trees over six inches in diameter.
- Unless otherwise directed, the kind of every tree so located is to be indicated on the map by letters forming abbreviations of their common names. Identify trees common name and diameter breast height (d.b.h.) using point description or symbology.

### **UTILITIES**

- Locate and size all utilities on site or adjacent to, including gas, electric, sewer, water, and telephone. Locate all valves, meters and utility pedestals. If site is not served by a utility, try to locate nearest line or potential connection.
- Indicate invert elevation of sewers, storm drains, manholes, and catch basins.
- Indicate location and characteristics of power and communications systems above and below grade.

## TOPOGRAPHY

- Show contours at 1 or 2-foot intervals, with spot elevations at peaks and low points, and at key points where existing roadways meet proposed alignments. Display contours as dashed lines with Index contours (5 or 10 foot) labeled with appropriate elevation.
- Provide spot elevations at street intersections and at 20-foot intervals along the edges of walkways and at top and bottom of curbs.

## Deliverables

In house surveyors and contracted surveyors will provide the following:

### 1. CD-ROM

Preferred format, as it is also our archiving media. CD to include survey drawing, ASCII point file, and all TIN information, TIN boundaries, break lines, faults, and shape or font files used. Also include any orthographic photos images utilized.

### 2. Hard Copy

Full size (22"x34") hard copy drawing.

Layer Name	Description
CONT-I	Index Contours with Elevation Labels
CONT-N	Intermediate (Normal) Contours
CONTROL	Control Markers and Points
ASPHALT	Existing Asphalt Pavement
BLDG	Existing Buildings/Sheds
CONCRETE	Existing Concrete Areas
DRAIN	Existing Drainage/Ditches/Culverts
FENCE	Existing Fence lines
GRAVEL	Existing Gravel areas, Shoulders
RECREATION	Existing Fire-rings/Tables/ Dumpsters, Tent-Pads
SIGNS	Existing Signage
TRAILS	Existing Trail ways
TREES	Existing Vegetation/Trees
UTIL-WATER	Water Lines
UTIL-WATER-HYD	Water Hydrants
UTIL-WATER-SYM	Water Valves/Meters
UTIL-ELEC-UE	Underground Electrical Lines
UTIL-ELEC-OE	Overhead Electrical Lines
UTIL-ELEC-SYM	Electrical Pedestals/Power Poles
UTIL-GAS	Gas Lines
UTIL-SEWER	Sewer Lines
UTIL-TELE	Telecommunication Lines
WATER	Lake/Stream Water Edge
GRID	Grid Ticks
PROPOSED	Proposed Improvements As Flagged
BOUNDARIES	Property/Land Boundaries
SNOTES	Surveyor Info/Legends and Control Tables
TOPO-PTS	All Points (Except Control Points)
TEXT	Survey Text, Annotation
TIN-BDRY	Tin Boundary
TIN-FLT	Tin Fault/Break Lines
TIN-VIEW	Tin Model

Colors shown in table are recommended  
and defined in the FS Plot Style Table covered back i