

Chapter 2

CADD Drafting Standards

Introduction

CADD Drafting Standards are a collection of standards and procedures preferred by the Bridge Program. For uniformity and consistency of drawings and procedures, these drafting standards need to be followed.

Naming Design Files

The names of **DESIGN FILES** shall be consistent throughout the Bridge Program. This file name shall be placed below the title block on each detail sheet. The format shall be as follows.

Project_Account number Sheet abbreviation Sheet number.dgn

Where: Project - Seven character number from ERP
Account Number – Numerical value for account from 1 through 20
Sheet abbreviations – See below
Sheet Number - Number of that sheet if more than one sheet with the same abbreviation

Example:

0703014, Bridge Over Wind River, Account Number 1, Second sheet of Superstructure Details

Use File Name: 0703014_1ss2.dgn

I804117, Bridge Over Sheep Creek, Account Number 13, First sheet of Slab Details

Use File Name: I804117_13ss1.dgn

The preferred sheet titles, shown in the title block, are also shown in the Sheet Abbreviations.

Sheet Abbreviations

Preliminary Layout	
pl1, pl2, pl3, etc., respectively, for Preliminary Title Sheet, General Notes (if required), and Layout (s)	
Preliminary Geology Layout -----	pg
Preliminary Irrigation Company Layout -----	pi
Preliminary Railroad Site Layout -----	ps
Preliminary Environmental Impact Area Layouts----	pe
Title Sheet -----	ts
General Notes -----	gn
General Plan and Elevation -----	gp
Substructure Layout -----	sb
Riprap Details -----	rr
Gabion Details -----	gb
Log Boring Sheet -----	lb
Abutment Details -----	ab
Pier Details -----	pr
Bent Details -----	bt
Superstructure Details -----	ss
Deck Drain Details -----	dd
Bridge Railing Details -----	br
Pedestrian Railing Details -----	pd
Pedestrian Safety Railing Details-----	sr
Barrier Rail Transition Details -----	rt
Lighting Details -----	lt
Slab Details -----	sl
Approach Slab Details -----	ap
Slope Paving Details -----	sp
Utility Details -----	ut
Culvert Details -----	cu
Bulkhead Details -----	bh
Headwall Details -----	hd
Siphon Inlet & Outlet Details -----	io
Siphon Drain Box Details -----	db
Siphon Miscellaneous Details -----	sm
Diversion Box Details -----	dv
Grate Details -----	gr
Sign Structure Details -----	sg
Retaining Wall Details -----	rw
Embankment Reinforcement Details -----	em
Bridge Railing Modification Details -----	rm
Temporary Traffic Rail Details -----	tr
Resurfacing Details -----	rs
Expansion Joint Details -----	ex
Curb Modification Details -----	cm
Concrete Repair Details -----	cr
Removal Details -----	rd

Repair Details ----- rp
 Miscellaneous Details ----- ms
 Final Geology Layout ----- fg
 Joint Modification Details ----- jm
 Erosion Repair Details ----- er
 Bridge Concrete Repair Details ----- bc

Lines

MicroStation uses level libraries that manage the level structure used by each program within WYDOT. Two level libraries should be attached to the Bridge Program CADD files: br.dgnlib and standard.dgnlib

Bridge Program Levels			
Use	Level Name	Weight	Color
Centerlines	BR_Center	2	Blue (1)
Concrete Break Lines	BR_ConcBrk	5	Orange (6)
Concrete / Saw Cut Lines	BR_Concrete	8	White (0)
Construction Lines	BR_Constr	1	Orange (6)
Phantom Lines	BR_Phantom	2	Green (2)
Ground Lines	BR_Ground	5	Brown (230)
Hidden Lines	BR_Hidden	2	Green (2)
Miscellaneous 1	BR_Misc1	10	Pink (24)
Miscellaneous 2	BR_Misc2	2	Grey (9)
Area Patterning	BR_Pattern	1	Lt Green (12)
Reinforcing Steel	BR_Rebar	5	Yellow (4)
Riprap	BR_Riprap	5	Yellow (4)
Sheet & Title Blocks	BR_Sheet	Varies	Med Green (11)
Steel / Removal Borders	BR_Steel	5	Yellow (4)
Survey Lines	BR_Survey	5	Green (2)
Large Text	BR_TextLg	5	Yellow (4)
Small Text	BR_TextSm	2	Red (3)
Utilities	BR_Uilities	2	Lt Green (15)
Water	BR_Water	2	Blue (1)
Batch Plotting Border	Sheet Border	0	Yellow (4)
Geotextile	BR_Geotextile	5	Yellow (68)
Wetland Impacts	BR_Wetland	Varies	Varies

Line Styles

Hidden Line (BREngHidden) -----
 Center Line (BREngCenter) _____
 Phantom Line (BREngGhost) _____
 Reinforcing Steel (BREngRebar) _____

New structures shall be detailed using solid lines of the appropriate weight to indicate the structure components being constructed. Use phantom lines to indicate structure components that will not be in place at the time the components pertaining to that sheet are being constructed.

Widenings and rehabilitations shall be detailed using phantom lines to indicate the existing structure, solid lines and area patterning (hatch pattern) to indicate areas of the existing structure to be removed, and solid lines of the appropriate weight to indicate new construction.

Text

All **TEXT** within a set of Bridge Plans shall be consistent. When referring to acts, requirements, and responsibilities, active voice and imperative mood will be used. This will match the Standard Specifications. In a sentence written in active voice, someone acts on something. Imperative mood is used when the party issuing an instruction (WYDOT) and the receiving party (Contractor) are already understood.

On all sheets in the project, including preliminaries, the sheet cells shall be placed around the drawing to the scale required. Correct text size and weight on any detail sheet is obtained by matching the “Small Text” or “Large Text” in the lower right corner of the sheet cell.

Verdana_WYDOT is to be used on all drawings. Final plot size for text shall be 0.156" for text used in details and subtitles and 0.2" for text used in titles. Make fractions with a horizontal line. The entire fraction is twice the height of normal figures.

Working Units

Maintaining consistent **WORKING UNITS** in a design file allows the detailer to draw “full size” elements without regard to plotting scale. The following working units shall be used.

Unit Names:

Master Unit: Survey Feet Label: '

Sub Units: Inches Label: ''

Resolution:

1000 per survey foot

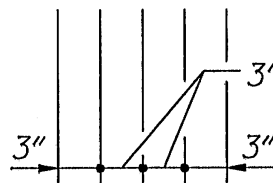
Dimensioning and Detailing

The details for highway structures are combination engineering and construction details from which the structure must be bid and built. Not all dimensions are for construction, some are engineering

dimensions given for convenient reference, checking, and estimating quantities.

Some basic rules to follow when working with text and dimensioning include the following.

- 1) Each dimension should be given clearly, so that it can be interpreted in only one way.
- 2) Dimensions shall be given so that further calculations will be minimal.
- 3) Dimensions shall be placed in the view where the features dimensioned are shown true shape.
- 4) Extension lines, leader lines, and centerlines shall be broken so they do not cross each other or dimension lines. Centerlines may cross centerlines. Do not break leader lines if possible.
- 5) Leader lines shall extend from the beginning or the end of a note, with a horizontal “shoulder” extending from the mid-height of the text. Leader lines shall be kept to a reasonable length and shall consist of an inclined straight line. Leader lines may be constructed of multiple lines when necessary.
- 6) Extension lines shall extend past the dimension line and be held back from the object being dimensioned a distance of one-half of the established text size.
- 7) Dimension text shall be placed above the dimension line and approximately centered between the arrowheads. If dimension text is crowded or difficult to read, text may be moved or leadered as shown.

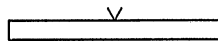


- 8) Dimension structural steel to the nearest $\frac{1}{16}$ ".
- 9) Dimension concrete to the nearest $\frac{1}{8}$ ".
- 10) Dimension slab thickness in the slab thickness diagrams to the nearest $\frac{1}{16}$ ".
- 11) For dimensions up to 12", use inches. For dimensions 12" and over, use feet and inches. Express reinforcing steel spacing between individual bars in inches only and express the total run length in feet and inches (see Section 4.19 - Reinforcing Steel). For round plate dimensions including the diameter symbol (ϕ), use inches.

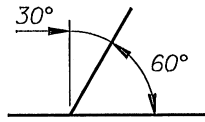
- 12) Spacing between text for multi-line text shall be one-half of the established text size, except General Notes which is three-quarters of the established text size.
- 13) The distance between dimension lines, when stacked, shall be three times the established text size.
- 14) The distance between dimension lines, when text is below a dimension line, shall be 4.5 times the established text size.
- 15) Minimum spacing between the detail and the first dimension line shall be four times the established text size.
- 16) Due to the size and scale of some details, parts of a detail may be difficult to read. Therefore, it is recommended these parts be exaggerated, or enlarged and dimensioned in a separate detail (i.e., DETAIL A).
- 17) Plate and bar sizes shall be called out once in full on the detail that includes their dimensions (i.e., $\text{PL } 1 \times 12 \times 1'-3"$). All other call-outs shall be partial (i.e., $\text{PL } 1 \times 12$). Plate and bar sizes shall not be broken into two lines.
- 18) Text size for dimensioning bar bending and set diagrams shall be 80% of established text size.
- 19) Terminators for dimensioning shall be the bridge cells PT1, PT2, and PT11. Terminators for leader lines shall be the bridge cells PT1 and PT3. When automatic dimensioning is used, the terminator scale shall be defined as 1:0.33. For the leader line terminators, terminator scale shall be the scale of the sheet.
- 20) All dimension for bent plates, pipes, bars, and bolts shall be to the inside radius, unless noted.
- 21) Station tick mark sizes:
 - Large (50' and 100" interval) - Text size
 - Small (10' interval) - $\frac{1}{2}$ Text size
- 22) The primary detail for the sheet should be shown as the largest detail (maximize scale).
- 23) Avoid overcrowding of details.

Additional detailing practices are illustrated below.

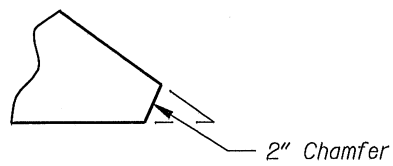
Finish Marks:



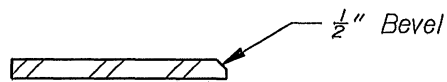
Angles:



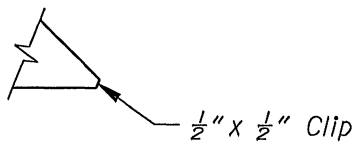
Chamfer:



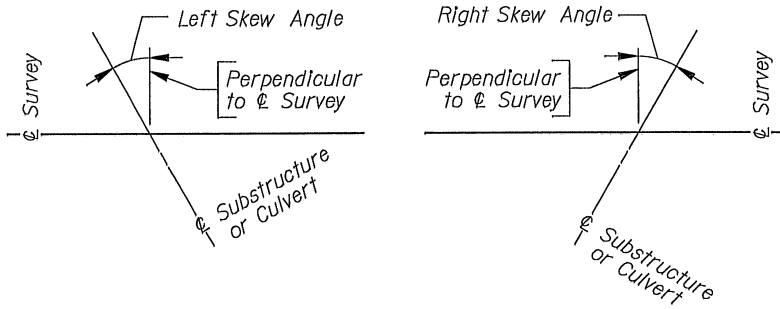
Steel bevel:



Steel clip:



Skew Angles: Skew angles are measured from a line normal to the Centerline of Survey.



The vehicle's left tire intersects structure first.

The vehicle's right tire intersects structure first.

Note Symbols: When an item in a detail requires an explanation, a note symbol shall be placed to the left of the item and referred to in a note explaining the item. The following is a list of note symbols to be used for denoting certain items.

Symbol	Explanation	Cell Name
*	coated bars	
**	dimensions and elevations	
Δ	temperature adjustment	DELTA
◇	doweling, dowel bars	SYMDOW
‡	miscellaneous note	SYMMS1
⌘	miscellaneous note	SYMMS2
■	sheet revision	SYMREV

Capitalization

Structure components and miscellaneous elements shall only have the first letter of each word capitalized when used to call out, or identify, the component or element, or when used in conjunction with a numeric unit or centerline. Other words that shall have the first letter of each word capitalized include detail and personal (i.e. State Bridge Engineer) titles; specific products; abbreviations as shown later in this chapter; and the first letter of a sentence, phrase, or in parentheses. For pay items, only the first letter of each noun shall be capitalized and only when referred to as a contract pay item. However, when the pay item is shown in the Table of Estimated Quantities, all the letters shall be capitalized. All letters of titles under details shall be capitalized. The detail examples should be used as a reference.

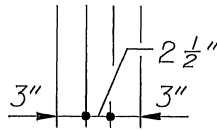
Scaled Details

Details identified in Chapter 4.0 - Bridge Program Drawings need to be scaled so they can be verified by using an Engineers Scale. Typical Sheet Scales are 5, 10, 15, 20, 25, 30, 40, 50, and 60, even scales are preferred.

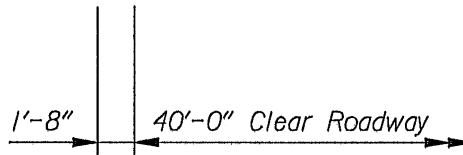
When the sheet is placed at the above Sheet Scale, around a 1:1 drawing, the scale of the drawing on the resulting print can be checked using the 10, 20, 30, 40, 50, or 60 scales on the Engineers Scale.

Terminators

The standard arrowhead terminator is the bridge cell PT1. The height of the arrowhead shall be one-third the width and proportional to the text size. If the logical placement of an arrowhead interferes with the logical placement of another arrowhead within a string of dimensions, a dot (PT2) may be substituted for two arrowheads. A dot may not be used as the final terminator in a dimension or dimension string.



Double arrowheads shall be used when one of the extension lines cannot be shown.



Uniformities Between Programs

Uniformities between the Bridge Program and other programs are essential for consistencies within the final project package. Clarity and ease of reading details are increased if the same detailing symbols (or patterns) are used throughout for the same purpose. Consult Project Development Program's Legend Sheet for standard detailing symbols and line styles that are common to all WYDOT Programs.

Uniformities Between Bridge and Outside Agencies

Uniformities between the Bridge Program and outside agencies are the communication links encompassing the design, detailing, and manufacturing of materials, and the construction of structures.

The terminology for identifying steel shapes, concrete shapes, reinforcing steel, hardware, welds, and specialty products shall be consistent with current practices utilized by domestic and foreign manufacturers.

Typical Designations for Steel Shapes

Type of Shape	Example Designation
W Shapes -----	W 30 x 99
M Shapes -----	M 12 x 10.8
S Shapes -----	S 24 x 90
HP Shapes -----	HP 12 x 42
American Standard Channels (C) -----	C 15 x 33.9
Miscellaneous Channels (MC)-----	MC 18 x 42.7
Equal Leg Angles (L) -----	L 5 x 5 x $\frac{3}{8}$
Unequal Leg Angles (L) -----	L 5 x 3 x $\frac{3}{8}$
Structural Tees (Cut from W Shapes) -----	WT 15 x 49.5
Pipes -----	Pipe 2½ STD
	Pipe ¾ XS
Square Structural Tubing -----	HSS 6 x 6 x $\frac{1}{4}$
Rectangular Structural Tubing -----	HSS 6 x 2 x $\frac{1}{4}$
*Plates -----	PL $\frac{1}{2}$ x 18
*Flat Bars -----	Bar 4 x 1¾
Square Bars -----	Bar 1 ϕ
Round Bars -----	Bar 1 ϕ

*Plates and Flat Bars are classified as follows.

Plates: Over 8" to 48" in width, 0.230" and over in thickness. Over 48" in width, 0.180" and over in thickness.

Flat Bars: 6" or less in width, 0.203" and over in thickness. Over 6" to 8" in width, 0.230" and over in thickness.

When billing steel shapes on the details, shape designations are given in inches without inch marks.

Example: PL 2 x 10 x 0'-11"
 PL ¾ x 19" ϕ
 HSS 6 x 2 x $\frac{1}{4}$ x 18'-0"
 Bar 4 x 1 x 1'-6"

Typical Designations for Hardware

Type of Hardware	Example Designation
High Strength Bolt -----	$\frac{7}{8}$ " ϕ x $3\frac{3}{4}$ " HS Bolt
Standard Bolts -----	1" ϕ x 5" Bolt $\frac{7}{16}$ " ϕ M-Bolt (machine bolt) $\frac{3}{8}$ " ϕ Lock Pin & Collar Fastener $\frac{3}{4}$ " ϕ Twist-Off Type Bolt $\frac{5}{8}$ " ϕ x 2" Carriage Head Bolt
Swedge Bolt -----	1" ϕ x 1'-10" Swedge Bolt
Washers -----	Washer (Plain or Flat) Lock Washer 2" x $\frac{3}{8}$ " x 0'-5" \mathbb{R} Washer 2" x $\frac{3}{8}$ " x 0'-4" Bevel \mathbb{R} Washer
U-Bolt -----	$\frac{3}{8}$ " ϕ U-Bolt
Nuts -----	Hex Nut or Heavy Hex Nut (Nuts are either standard or heavy strength, depending on the type of bolt specified)
Screws -----	$\frac{1}{4}$ " ϕ x 1" M-Screw (machine screw) $\frac{1}{4}$ " ϕ x $\frac{1}{8}$ " x $1\frac{1}{8}$ " Head Hex Self Tapping Screw $\frac{7}{8}$ " ϕ x $3\frac{1}{2}$ " Hex Sock Flat Head Cap Screw $\frac{3}{8}$ " x 2" Lag Screw

When billing bolts on the detail, nuts and washers shall be included.

Welding

The purpose of **WELDING SYMBOLS** is to facilitate communication among designers, fabricators, inspectors, welders, and all persons concerned with producing welded parts. Symbols provide visualization of the intended weld data. They also lead to universal use of approved terminology. For a complete guide of welding rules, with examples, see the [AWS \(American Welding Society\) Structural Welding Code](#), the [AWS Bridge Welding Code](#), and the [AISC \(American Institute of Steel Construction\) Manual for Steel Construction](#).

Specialty Products

SPECIALTY PRODUCTS include expansion joints and fillers, grouts, bonding and curing compounds, sealers, coatings, and many more items that can be found by accessing the Bridge Program Tech Files. These materials shall be identified on the plans generically (i.e., epoxy resin bonding compound, curing compound, strip seal, compressed joint material, etc.) unless a specific product is preferred by the Squad Team Leader. Specific products shall be identified in either the General Notes or Special Provision according to the literature provided by the manufacturer.

Standard Abbreviations

Abbreviations should never be used when the meaning may be in doubt. Avoid abbreviations in titles, subtitles, and notes (except for number, centerline, quantity unit, lane, thermal degrees, diameter, and designation for steel shape). The omission of periods after abbreviations is recommended by the International Committee on Weights and Measures for Metric Units and is advocated by the American Standards Association Sectional Committee on Scientific Symbols and Abbreviations. The American Society of Civil Engineers also follows this practice. The above practice shall be used for all Bridge Program details. Abbreviations that would spell out complete English words that may be misunderstood must have periods after them, such as in No. (Number).

When abbreviations are needed, the following list shall be used.

Term	Abbreviation or Symbols
Abutment -----	Abut
Adjustable -----	Adj
Ahead -----	Ah
Alternate -----	alt
American Association of State Highway and Transportation Officials -----	AASHTO
American Concrete Institute-----	ACI
American Institute of Steel Construction, Inc -----	AISC
American National Standards Institute -----	ANSI
American Railway Engineering Association -----	AREA
American Society for Testing and Materials -----	ASTM
American Welding Society-----	AWS
And -----	&
Approximate -----	approx
At -----	@
Avenue -----	Ave
Average -----	avg
Average Daily Traffic -----	ADT
Average Annual Daily Traffic -----	AADT
Average Daily Truck Traffic -----	ADTT
Back -----	Bk
Back to back -----	b-b
Barrel -----	BBL
Bench Mark -----	BM

Bituminous pavement -----	Bit Pvmt
Blows per foot -----	bpf
Board feet, 1000 -----	MBM
Bottom -----	Bott
Center to center -----	c-c
Centerline -----	☉
Clear -----	Cl
Computer Aided Design and Drafting -----	CADD
Concrete -----	Conc
Connector -----	conn
Construction joint -----	Const Jt
Continuous -----	Cont
Contraction joint -----	Contr Jt
Corrugated Metal Pipe -----	CMP
Cubic feet -----	CF
Cubic yards -----	CY
Degrees, angular -----	deg (°)
Degrees, thermal -----	°F or °C
Diameter -----	dia (ϕ)
Dimension -----	Dim
Each -----	Ea
Elevation -----	Elev
Embankment -----	Emb
Equal -----	Eq
Expansion -----	Exp
Exterior -----	Ext
Face:	
Each Face -----	EF
Front Face -----	FF
Rear Face -----	RF
Feet -----	ft (')
Flow Line -----	FL
Flux cored arc welding -----	FCAW
Future wearing surface -----	FWS
Gage -----	ga
Galvanizing -----	Galv
Gas metal arc welding -----	GMAW
Ground Water Surface -----	GWS
High Strength Bolt -----	HS bolt
Horizontal Scale -----	H
Hour -----	hr
Inches -----	in. (")
Inside diameter -----	ID
Interior -----	int
International System of Units -----	SI
Joint -----	Jt

Kilometers -----	km
Lanes:	
North Bound Lane -----	NBL
South Bound Lane -----	SBL
East Bound Lane -----	EBL
West Bound Lane -----	WBL
Left -----	Lt
Linear feet -----	LF
Longitudinal -----	long.
Lump sum -----	LS
Machine bolt -----	M-Bolt
Maximum -----	(Max)
Meters -----	m
Mile post -----	MP
Miles per hour -----	mph
Millimeters -----	mm
Minimum -----	(Min)
Minor Single Structure -----	MSS
Miscellaneous -----	misc
Number -----	No.
Optional -----	opt
Outside Diameter -----	OD
Plans, Specifications and Estimates -----	PS&E
Plate -----	Ⓟ
Pounds -----	LB
Pounds per square inch -----	psi
Pounds, 1000 -----	kip
Projection -----	Proj
Reinforced Concrete Pipe -----	RCP
Radius -----	R
Reinforced concrete -----	RC
Required -----	req'd
Revised (date) -----	Rev
Right -----	Rt
Right-of-Way -----	R/W
Roadway -----	Rdwy
Section, Township, Range -----	Sec, T, R
Shielded metal arc welding -----	SMAW
Side:	
Far Side -----	FS
Near Side -----	NS
Spacing, Spaces, or Spaced -----	Spa
Square feet -----	SF
Square miles -----	Sq Mi
Square yards -----	SY
Standard -----	Std

Chapter 2 – CADD Drafting Standards

Station -----	Sta
Street(s) -----	St
Submerged arc welding -----	SAW
Symmetric -----	Sym
Thread -----	Thd
Tons -----	T
Typical -----	Typ
Vertical Scale -----	V
Water Rights -----	WR
Wide Flange -----	W
With -----	w/