NYS Roll Design

Ed Cable

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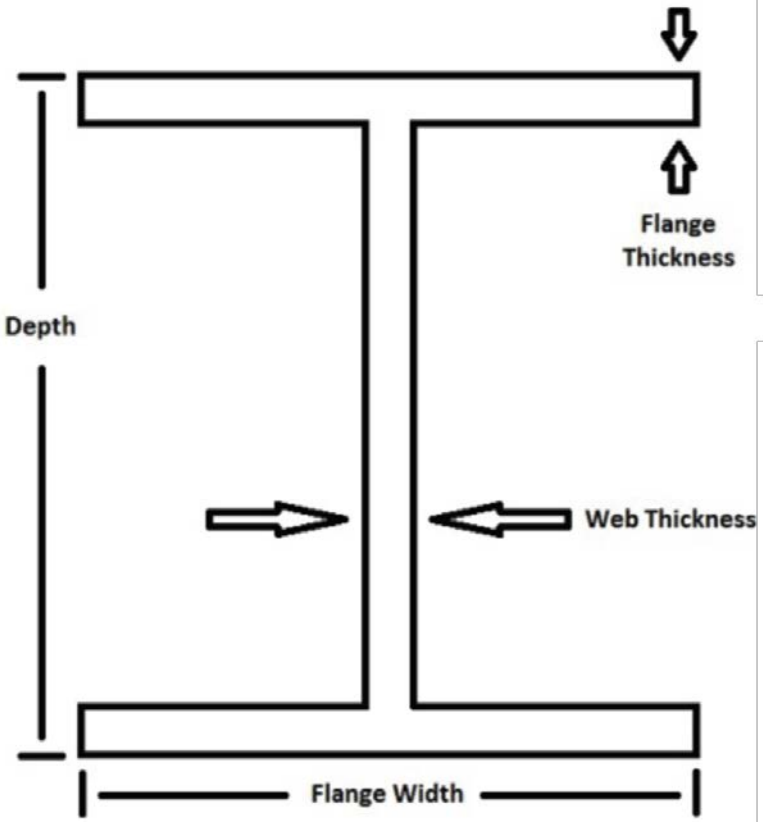
How to design pass schedule for a new W-section ?



W17X8 Beam:

Flange Thickness = 1.60”
Flange Width = 8.0”
Web Thickness = 1.0”
Radius= 19mm
Depth= 17”

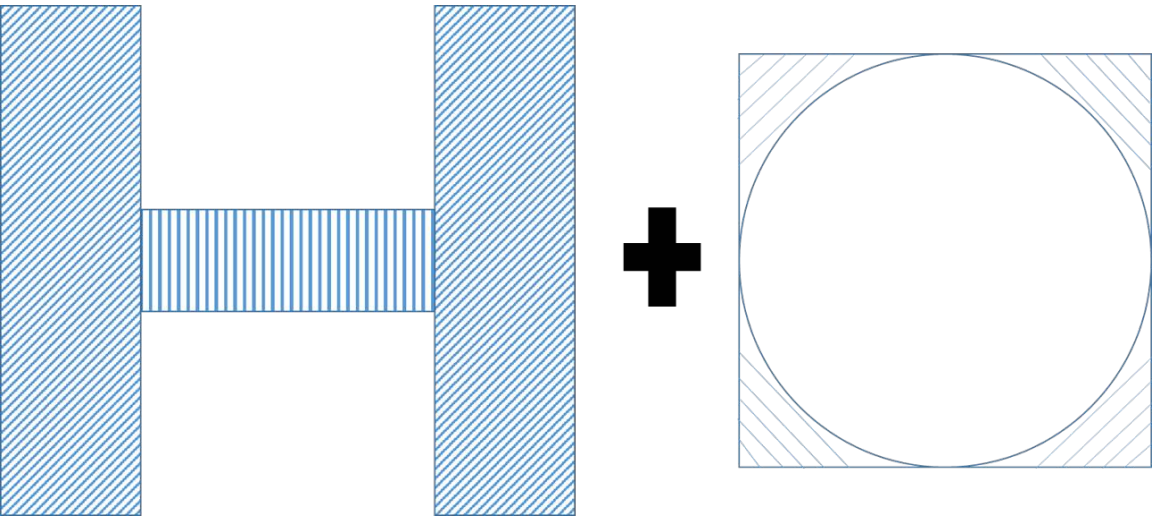
Unknown Variables:

- P/T ratio
- How high flange is with respect to web
- ID (internal depth)
- Weight

Variable calculation:

- P/T = $(\frac{Flange\ Thickness}{Web\ Thickness})$ = **1.6**
- How high flange is with respect to web = = $(\frac{Flange\ Width - Web\ Thickness}{2})$ = (8-1)/2 = **3.5”**
- ID (internal depth) = (Depth – 2XFlange Thickness) = (17 – 2X1.6) = **13.8”**
- Weight ?

Weight Calculation



Area of cross-section of the beam = Shaded region

Shaded region = 2[Flange Width X Flange Thickness] +
[(Depth – 2XFlange Thickness) X Web Thickness] +
[2RX2R – πR^2]

= 2[8x1.6] + [(17-2x1.6)x1] + [2x0.75x2x0.75 – 3.14x0.75x0.75]
= 25.6 + 13.8 + 0.48375
= 39.88 square inches

Density of steel = 0.284 lb/in^3

Foot. Weight = 0.284 X 39.88 X 12 = **136 lb/ft**

UF Horizontal Width

Formula

- [{ID x 1.01 (shrinkage)} + .125 (tolerance)]= 14.063in
- 14.063 x 25.4 (to get mm)= 357.2mm

Rule of Thumb

- 1.01 shrinkage
- 0.125 tolerance
- **Cut rolls to 357mm with 19mm radius**

UR Roll Width

Formula

- UR roll width = UF roll width – 2mm= 357-2= **355mm**
- UR roll radius = UF roll radius + 2mm = 19+2= **21mm radius**

Rule of Thumb

- -2mm off roll width
- +2mm to roll radius

Edger Roll Width

Formula

- Edger roll width = UR roll width- 10mm = 355-10= **345mm**
- Radius is same as UR roll radius = **21mm**
- Wing depth= (F-W/2) = 3.5”- .3(web clearance desired) = **3.2” @ 6° taper**

Rule of Thumb

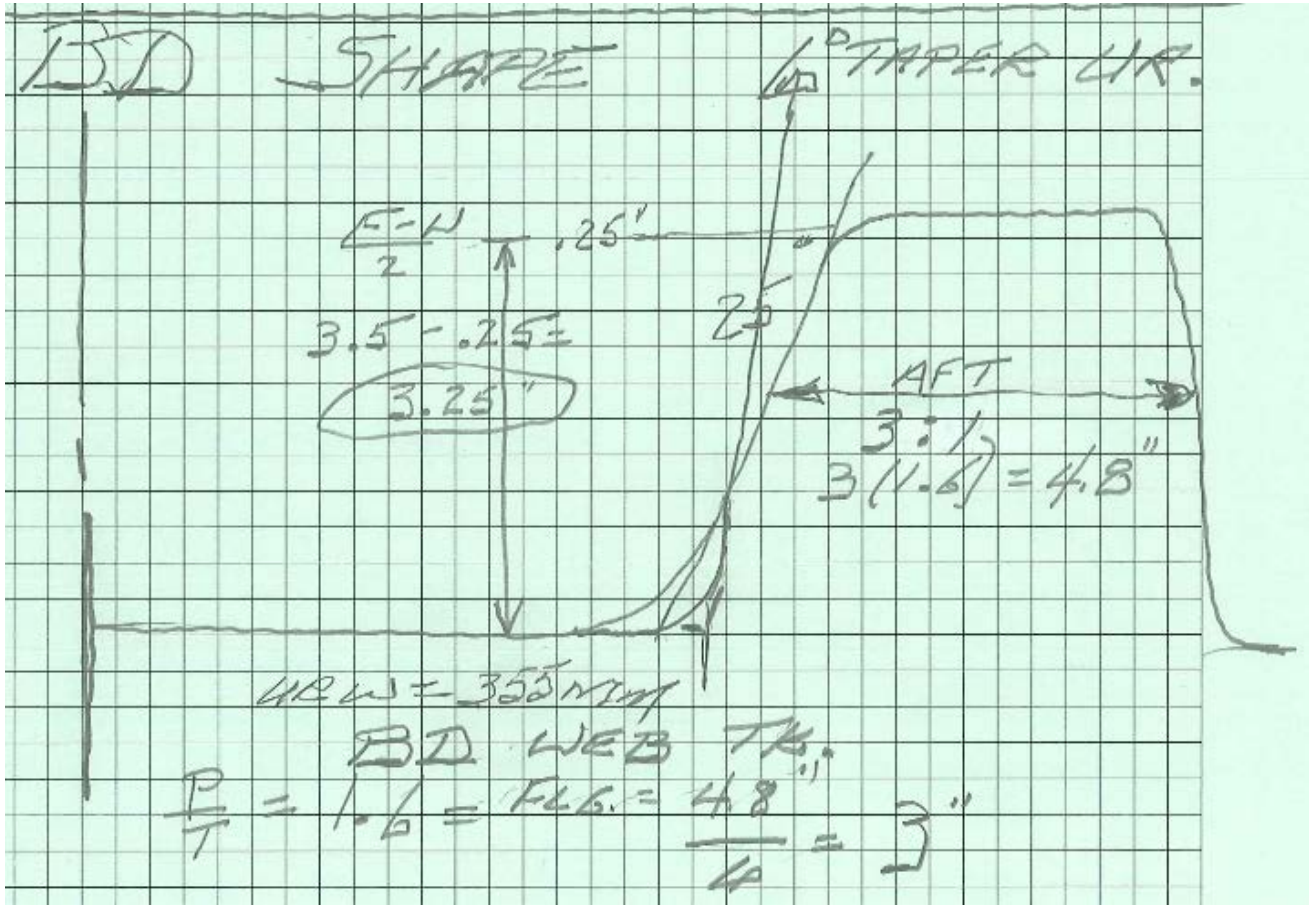
- -10mm off roll width
- Radius is same as UR roll radius
- Wing Depth
- 0.3” web clearance
- 6° taper

BD Shape

Formula

- (F-W/2) - 0.25”= 3.5 - 0.25= 3.25”
- 6° taper UR
- 25° taper is constant
- AFT (average flange thickness)= 3:1
  - 3x1.6= 4.8”
- UR roll width = 355mm & P/T = 1.6
- Flange = 4.8/6 = 3”

❖*<u>End up with 3” web for BD shape</u>*



Pass Schedule

Rule of Thumb

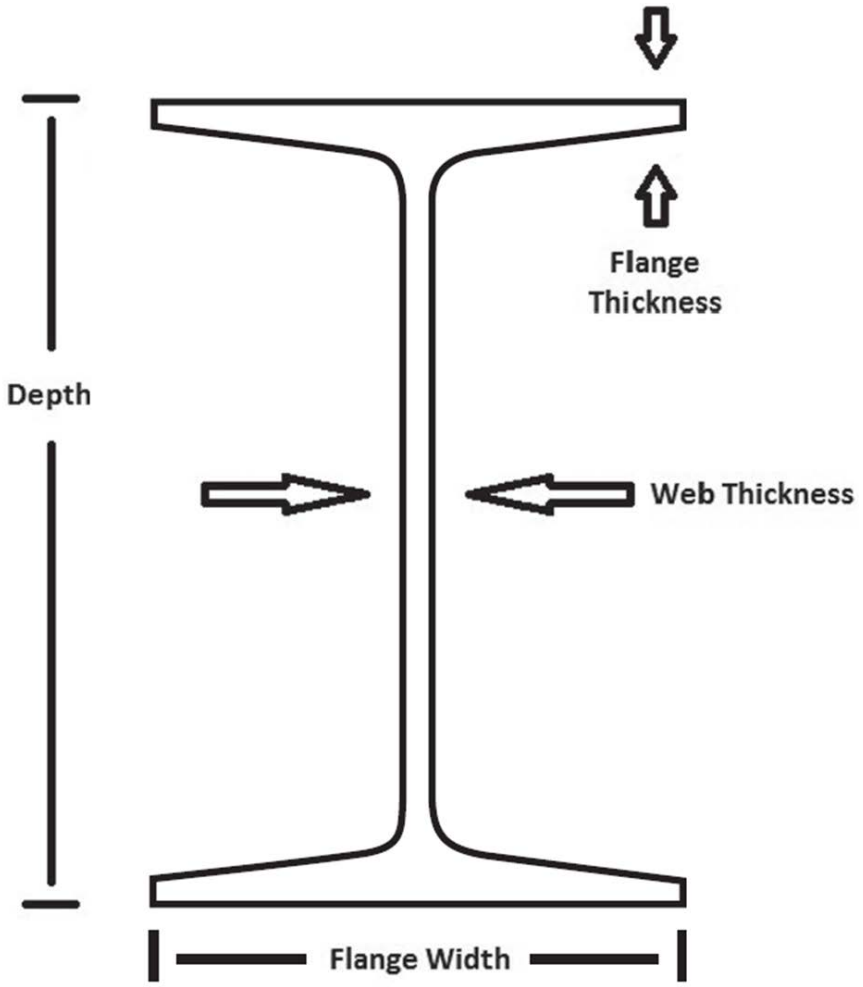
- Don’t go over 0.32” reduction on the web
- Don’t go over 0.70” reduction on the flange
- Reduction in web vs flange: ± 3% in each pass
- Go from smaller to larger reductions in later passes back to initial passes

± 3%

Pass Schedule								
	3"			4.8"				
Pass	Web	Reduction	%Reduction	Flange	Reduction	%Reduction	P/T	E
1	2.8"	0.19	6.3	4.5	0.3	6.2	1.6	
2	2.49"	0.32	11.3	3.98	0.52	11.5	1.6	
3	2.17"	0.32	12.8	3.47	0.51	12.8	1.6	
4	1.85"	0.32	14.7	2.96	0.51	14.6	1.6	
5	1.57"	0.28	15.1	2.51	0.45	15.2	1.6	
6	1.33"	0.24	15.2	2.13	0.38	15.1	1.6	
7	1.15"	0.18	13.5	1.84	0.29	13.6	1.6	
8	1.05"	0.1	8.6	1.68	0.16	8.6	1.6	
9	.99"	0.06	5.7	1.58	0.1	5.9	1.6	
	UF							
		0.95	0.04	1.52	0.06			

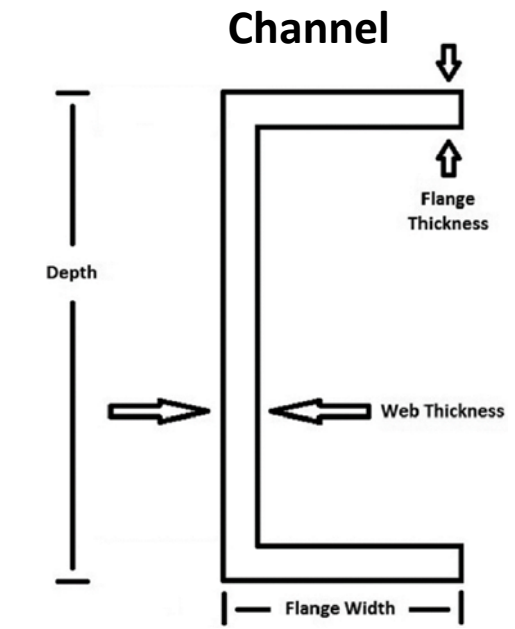
S-beam Rolling

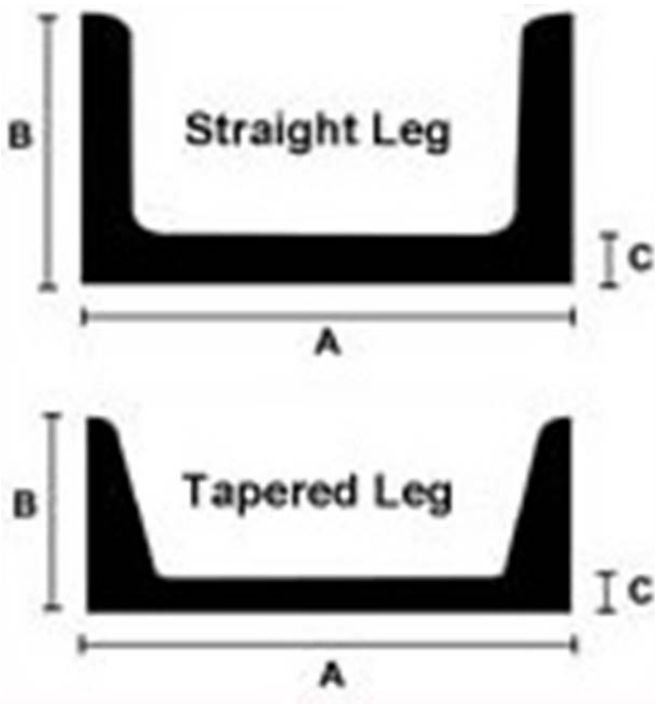
- Started in 1900
- Made on 2 high mills (universal rolling didn’t existed)
- Normally used in old blue prints
- Not strong as W-beam and section modulus is less
- 9° tapered flanges requires tapered washers



Shape Rolling

- Two types: MC Channel (2° tapered flanges) and C Channel (9° tapered flanges)
- MC Channel are stronger due to longer flanges
- C Channel requires 9° washers





MC

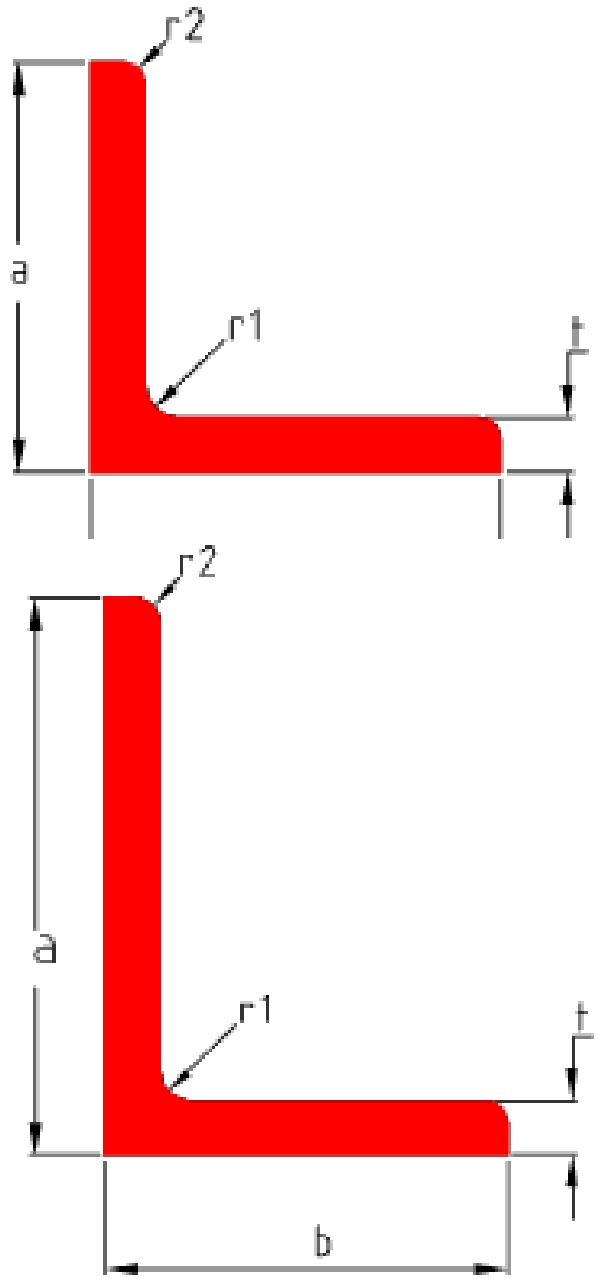
Vs

C

Shape Rolling

Angle

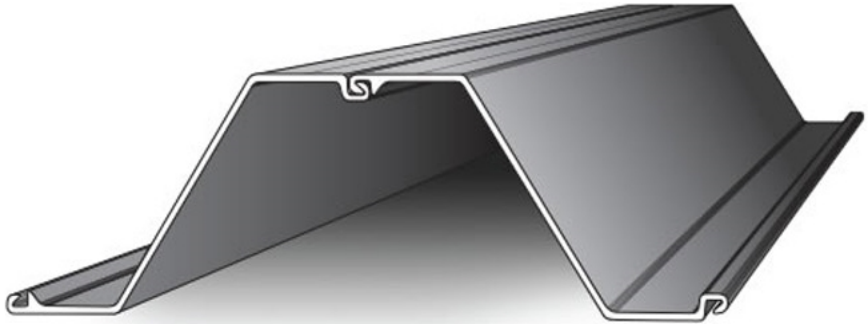
- Two types: Equal and Unequal leg
- Thickness varies from ½” to more than 1”
- Leg length tolerance do not vary

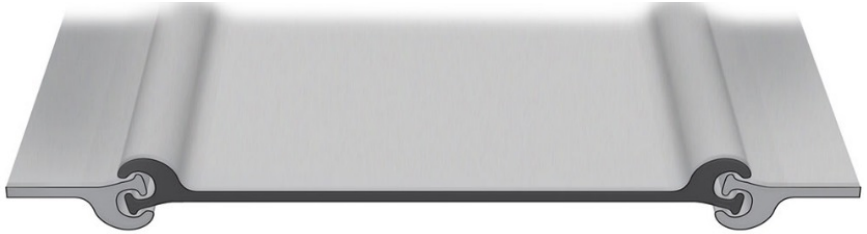


Shape Rolling: NZ/PZ/PS

- Three types of piling at NYS
  - PZ (ball and socket interlock)
  - NZ (Larssen interlock)
  - PS (flat-piling: finger and thumb interlock)
- NZ :
  - Lighter, wider, and stronger
  - Requires good soil condition
- PZ:
  - More interlock clearance
  - Can be reused
  - Easier to drive (narrower)
  - Soil condition is not a limitation

- PS:
  - Cellular structure (swing necessary)
  - Interlocks are in tension (interlock strength needed)





Thank You