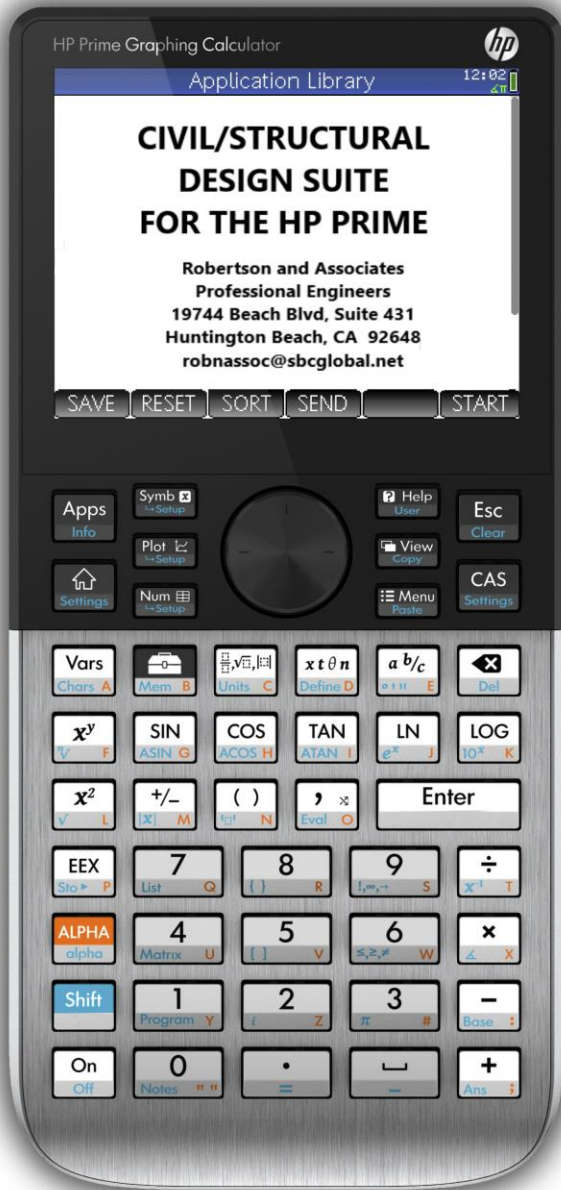


CIVIL/STRUCTURAL DESIGN SUITE FOR THE HP PRIME CALCULATOR



- Structural Steel Beam and Column Design and Analysis in Accordance with AISC 360
- Steel Frame Stability Analysis in Accordance with AISC 360
- Reinforced Concrete Beam and Column Design and Analysis in Accordance with ACI 318
- Reinforced Masonry Design and Analysis in Accordance With TMS-402
- Analysis of Beams for Various Support and Loading Conditions
- Section Properties For Common Shapes and Built-Up Sections
- Seismic Response Calculator
- Open Channel Hydraulics
- Detailed Output of Variables and Results
- Valuable Tools for University Students and Engineers Preparing for the Professional Engineer and Structural Engineer Exams
- User Manuals with Many Design Examples and Program Validation

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CIVIL/STRUCTURAL DESIGN SUITE FOR THE HP PRIME®

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Other programs available in the “**Civil/Structural Design Suite for the HP Prime**” include the following. Each program is written as a standalone program to allow for selective loading on the HP Prime. Included with each program is a User Manual which describes how to use the program and provides detailed worked examples of its use.

PROGRAM	CAPABILITIES
REINFORCED CONCRETE BEAM	Design and Analysis of Singly and Doubly Reinforced Rectangular Concrete Beams
CONCRETE TEE BEAM	Design and Analysis of Reinforced Concrete Tee Beams
CONCRETE COLUMN	Design and Analysis of Reinforced Concrete Columns
STEEL BEAM	Design and Analysis of Steel WF, C, HSS, WT and Hybrid Sections
STEEL FRAME STABILITY	Analysis of Steel Frame for Stability Requirements Using the Direct Analysis, Effective Length, First Order and Approximate Second Order Methods
CMU BEAM	Design and Analysis of Singly and Doubly Reinforced Masonry Beams
CMU COLUMN	Design and Analysis of Reinforced Masonry Columns
SECTION PROPERTIES	Calculation of Section Properties of Angle, Channel, Tee, HSS, WF, Zee, and Built-Up Sections
BEAM EQUATIONS	Calculation of Support Reactions, Shear, Moment and Deflection of Beams for Various Loading and Support Conditions
CONTINUOUS BEAM	Analysis of Multiple Span Continuous Beams
SEISMIC RESPONSE CALCULATOR	Calculation of Seismic Design Spectral Response Parameters, Response Spectrum and Seismic Design Category for Given Site Spectral Response Acceleration Parameters
FORCE TRANSFER AROUND OPENINGS	Analysis of Plywood Shear Walls with Force Transfer Around Openings
HYDRAULIC PARAMETERS	Calculation of Hydraulic Parameters in Various Sections Under Open Channel Flow Conditions
OPEN CHANNEL HYDRAULICS	Calculation of Discharge, Normal Depth, Critical Depth in Prismatic Channels for Uniform Flow Conditions
WATER SURFACE PROFILE	Calculation of Water Surface Profile for Gradually Varied Flow in Open Channels Using the Standard Step Method
HYDROGRAPH ROUTING	Routing of Inflow Hydrograph Using the Muskingum and Modified Puls Methods

SECTION PROPERTIES FOR THE HP PRIME®

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“Section Properties for the HP Prime” is part of the **Civil/Structural Design Suite**, a collection of programs written for the HP Prime to assist civil/structural engineers with routine calculations and analyses when portability and expediency is desired or when a computer is not available.

“Section Properties for the HP Prime” will evaluate structural properties of typical structural shapes and sections including:

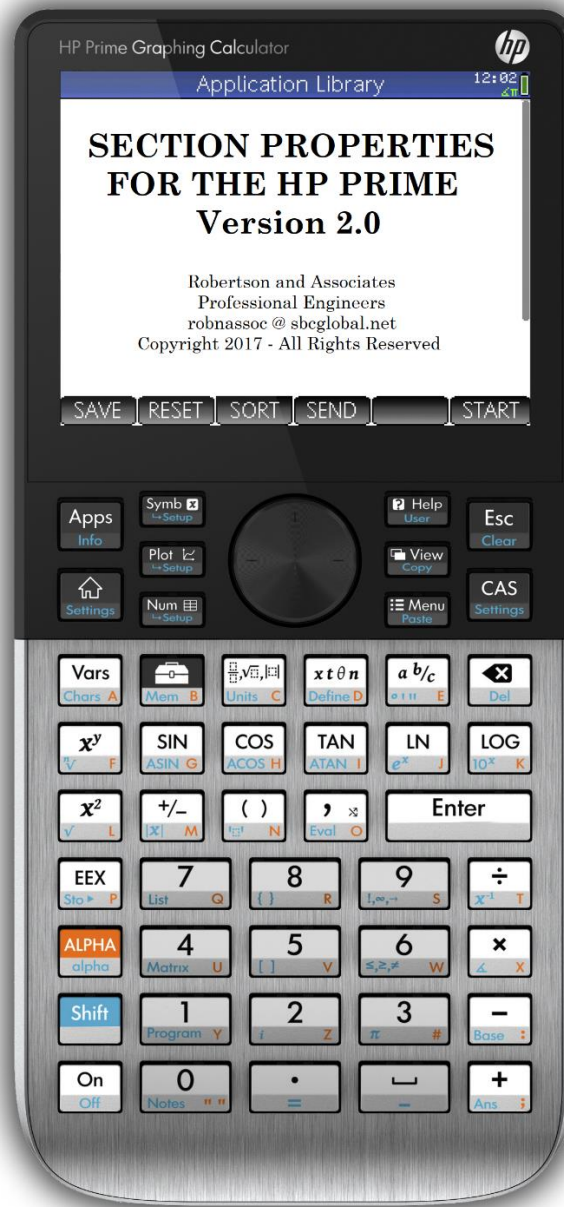
- Angles
- Channels
- Hollow Rectangular Sections (HSS)
- Symmetrical Plate Girders
- Solid Rectangles
- Tee Sections
- Built-Up Girders/Beams
- C Sections
- Hollow Circular Sections (HSS)
- Unsymmetrical Plate Girders
- Solid Rounds
- Zee Sections

For each section selected, both elastic and plastic properties will be calculated about both principle axes, X-X and Y-Y. These properties include:

- Cross Section Area
- Location of Plastic Neutral Axis
- Elastic Section Modulus
- Radius of Gyration
- Location of Elastic Neutral Axis
- 2nd Area Moment of Inertia
- Plastic Section Modulus
- Torsional Constant

A User Manual is included which provides a more detailed description of the program's capabilities, as well as a step by step explanation for using the program and validation of the program results through the use of worked examples.

SECTION PROPERTIES FOR THE HP PRIME USER MANUAL



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CONTENTS

COPYRIGHT AND LICENSING	1
SYMBOLS AND NOTATION	2
INTRODUCTION	3
OVERVIEW OF PROGRAM	4
USE OF PROGRAM	5
APPENDIX A - PROGRAM VALIDATION	A-1
APPENDIX B - SHAPE DEFINITIONS	B-1

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SYMBOLS AND NOTATION

The system of units used in the “Section Properties for the HP Prime Calculator” is the English (inch-pound) System. The following general symbols and units are used in the program:

Symbol/Notation	Definition	Units
<i>A</i>	<i>Area</i>	<i>in²</i>
<i>b</i>	<i>Width of Section</i>	<i>in</i>
<i>bf</i>	<i>Width of Flange</i>	<i>in</i>
<i>bf1</i>	<i>Width of Built Up Top Flange Plate</i>	<i>in</i>
<i>bf2</i>	<i>Width of Built Up Bottom Flange Plate</i>	<i>in</i>
<i>cx</i>	<i>Distance to Centroid, X Axis</i>	<i>in</i>
<i>cxL</i>	<i>Distance to Centroid From Left Fiber</i>	<i>in</i>
<i>cxR</i>	<i>Distance to Centroid From Right Fiber</i>	<i>in</i>
<i>cy</i>	<i>Depth to Centroid, Y Axis</i>	<i>in</i>
<i>cyBot</i>	<i>Depth to Centroid From Bottom Fiber</i>	<i>in</i>
<i>cyTop</i>	<i>Depth to Centroid From Top Fiber</i>	<i>in</i>
<i>d</i>	<i>Depth of Section</i>	<i>in</i>
<i>Dia</i>	<i>Diameter of Circular Section</i>	<i>in</i>
<i>h</i>	<i>Clear Distance Between Flanges</i>	<i>in</i>
<i>Ix</i>	<i>Moment of Inertia About X Axis</i>	<i>in⁴</i>
<i>Iy</i>	<i>Moment of Inertia About Y Axis</i>	<i>in⁴</i>
<i>J</i>	<i>Torsional Constant</i>	<i>in⁴</i>
<i>rx</i>	<i>Radius of Gyration About X Axis</i>	<i>in</i>
<i>ry</i>	<i>Radius of Gyration About Y Axis</i>	<i>in</i>
<i>SFx</i>	<i>Shape Factor About X Axis</i>	
<i>SFy</i>	<i>Shape Factor About Y Axis</i>	
<i>Sx</i>	<i>Elastic Section Modulus About X Axis</i>	<i>in³</i>
<i>SxBot</i>	<i>Elastic Section Modulus of Bottom Fiber</i>	<i>in³</i>
<i>SxTop</i>	<i>Elastic Section Modulus of Top Fiber</i>	<i>in³</i>
<i>Sy</i>	<i>Elastic Section Modulus About Y Axis</i>	<i>in³</i>
<i>SyL</i>	<i>Elastic Section Modulus of Left Fiber</i>	<i>in³</i>
<i>SyR</i>	<i>Elastic Section Modulus of Right Fiber</i>	<i>in³</i>
<i>t1</i>	<i>Thickness of Built Up Section Top Flange Plate</i>	<i>in</i>
<i>t2</i>	<i>Thickness of Built Up Section Bottom Flange Plate</i>	<i>in</i>
<i>tf</i>	<i>Thickness of Flange</i>	<i>in</i>
<i>tw</i>	<i>Thickness of Web</i>	<i>in</i>
<i>xPNA</i>	<i>Distance to Plastic Neutral X Axis</i>	<i>in</i>
<i>xPNAL</i>	<i>Distance PNA From Left Fiber</i>	<i>in</i>

Section Properties for the HP Prime Calculator
User Manual

Symbol/Notation	Definition	Units
$xPNAR$	<i>Distance to PNA From Right Fiber</i>	<i>in</i>
$yPNA$	<i>Distance to Plastic Neutral Y Axis</i>	<i>in</i>
$yPNABot$	<i>Distance to PNA From Bottom Fiber</i>	<i>in</i>
$yPNATop$	<i>Distance to PNA From Top Fiber [in]</i>	<i>in</i>
Zx	<i>Plastic Section Modulus About X PNA Axis</i>	<i>in³</i>
Zy	<i>Plastic Section Modulus About Y PNA Axis</i>	<i>in³</i>

INTRODUCTION

This User Manual is intended for those users experienced with the operation of the HP Prime Calculator and an extensive background in structural engineering analysis and design. This User Manual also provides a discussion regarding program development and validation.

The “Section Properties for the HP Prime” is intended to assist Professional Engineers with routine analysis and determination of structural properties of common structural members. It is not intended to be used in place of more rigorous computer programs. The program can be used where portability is desired and is a great tool for structural engineering students and those preparing for the Professional Engineers and Structural Engineers Exams.

The program accommodates numerous typical structural shapes that may be encountered in structural analysis efforts.

Other similar programs covering Concrete, Steel, Aluminum and Masonry Design, Properties of Composite Materials Sections, Structural Analysis and Frame Stability Analysis are also available.

OVERVIEW OF PROGRAM

The Section Properties Program performs calculations to determine the structural properties of typical shapes. The user inputs the physical dimensions for a selected shape and the program calculates the following properties for both the X-X and Y-Y orthogonal axes:

- Area
- Centroid Depth
- (2nd Area) Moment of Inertia
- Elastic Section Modulus
- Plastic Section Modulus
- Radius of Gyration
- Plastic Neutral Axis
- Shape Factor
- Torsional Constant

The program can evaluate the following structural shapes.

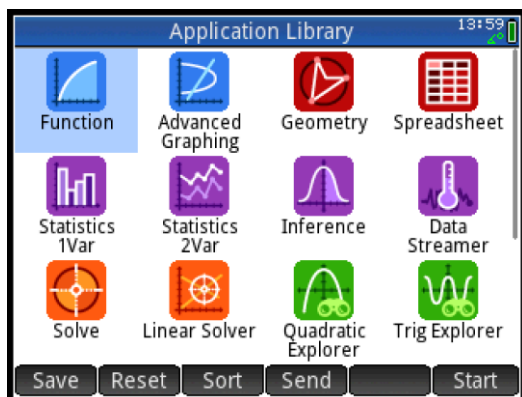
Shape	Description
Angle	Equal and Unequal Leg Angle Section
Built-Up Girder	I-Shape Girder with Flange Plates
Channel	Channel Section
Symmetrical Plate Girder	Doubly Symmetrical I-Shaped Plate Girder
Unsymmetrical Plate Girder	Singly Symmetrical I-Shaped Plate Girder
Solid Rectangle	Solid Rectangular and Square Section
Solid Round Bar	Solid Round Bar Section
Rectangular Tube	Hollow Rectangular Tube Sections
Circular Tube	Hollow Circular Tube Sections
Tee	Tee Shaped Sections
Zee	Zee Shaped Sections

USE OF PROGRAM

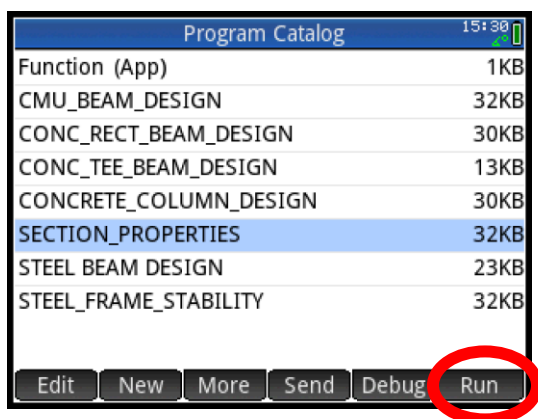
Program usage is quite simple and consists of the following steps:

1. Selection of Structural Shape
2. Input of Shape's Dimensional Variables
3. Display of Results

The Symmetrical Plate Girder is used for illustrative purposes.

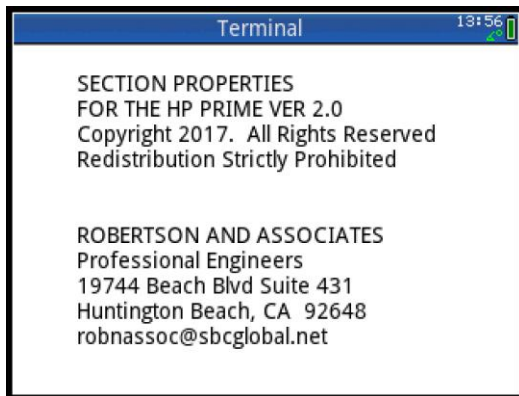


From the calculator's main screen enter **[Shift] [1]** to display the Program Catalog

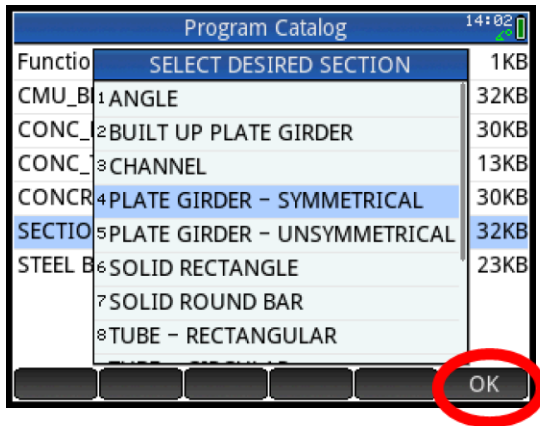


From the Program Catalog screen highlight ***Section Properties*** and press ***Run***

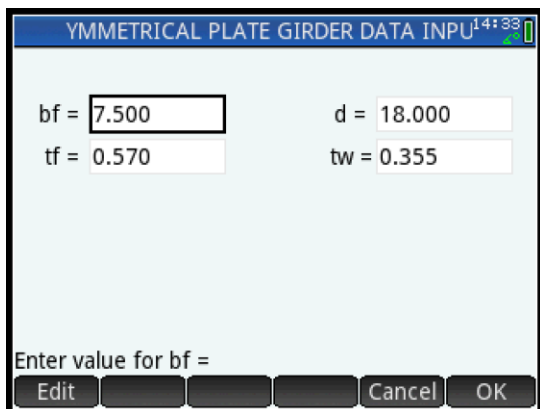
Section Properties for the HP Prime Calculator
User Manual



A brief introduction screen will be displayed

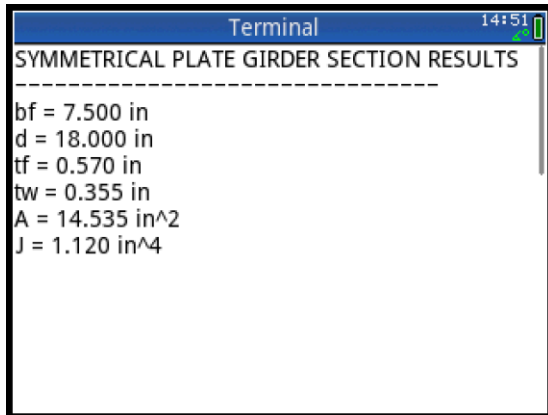


Following the introduction screen the Shape Selection Menu will be displayed. Highlight the desired shape and press **[OK]**.

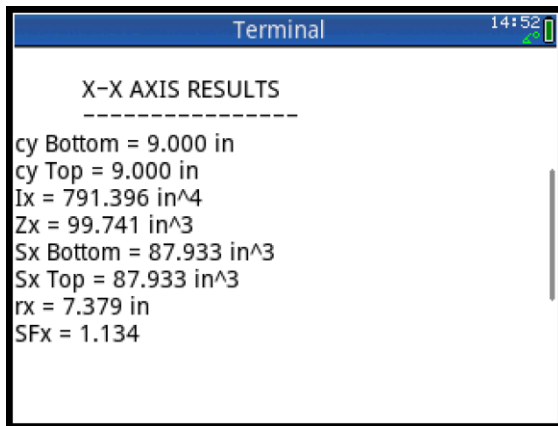


On the Data Input Screen, enter the shape's dimensional properties as prompted.

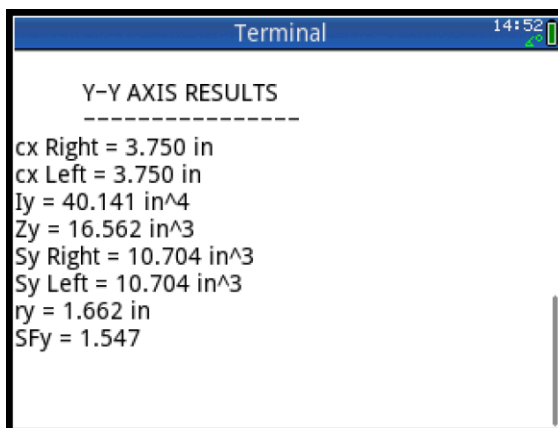
Section Properties for the HP Prime Calculator
User Manual



Results of the analysis will then be displayed. The display of results will include multiple pages. Use the calculator's touch screen interactive feature to scroll through the pages.



Results Screen Page 2



Results Screen Page 3. Press any key on the calculator's keypad to return to the Program Catalog.

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	Section Program Validation				Sheet no./rev. A-1	
	Calc. by AAR	Date	Chk'd by	Date	App'd by	Date

SHEET INDEX

	<u>Sheet</u>
1. Approach and Methodology	A-2
2. Angle Section	A-5
3. Built-Up Plate Girder	A-7
4. Channel Section	A-12
5. Plate Girder - Symmetrical	A-14
6. Plate Girder – Unsymmetrical	A-15
7. Solid Rectangle	A-16
8. Solid Round Bar	A-17
9. Tube - Rectangular	A-18
10. Tube - Circular	A-19
11. Tee Section	A-20
12. Zee Section	A-22

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1. APPROACH

The results produced by the Section Properties Program were validated against results produced using the RISA Section computer program and tabulated values contained in the Shape Properties Tables of the AISC Steel Construction Manual when a similar shape was available in the tables.

The results produced by the Section Properties Program were validated against results produced using the RISA Section computer program and tabulated values contained in the Shape Properties Tables of the AISC Steel Construction Manual when a similar shape was available in the tables.

2. METHODOLOGY

Section Geometry

The Section Properties Program segments the composite section into individual geometric shapes, principally rectangles, and calculates the sectional properties of the individual shapes. These sectional properties are then used to calculate the sectional properties of the composite shape as presented in the following discussion. The same approach was taken in the RISA Section comparison analysis.

Elastic Neutral Axis

The elastic neutral axis was determined by calculating the centroids of the structural shape was determined using the traditional polygon approach. The reference datum for the elastic neutral axis is the extreme bottom fiber of the section for cy , (Equation 1), and the extreme left fiber of the section for cx , (Equation 2).

$$cy = \frac{(\sum A_i) (cx_i)}{\sum A_i} \quad \text{Equation (1)}$$

$$cx = \frac{(\sum A_i) (cy_i)}{\sum A_i} \quad \text{Equation (2)}$$

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Moment of Inertia (Second Area)

The section's moment of inertia was determined using the parallel axis theorem while considering the local moment of inertia for each subdivided part comprising the total shape. The moment of inertia of the total section was then determined by summing the equivalent moment of inertia of each subdivided part taken about the total section's elastic neutral axis as calculated in Equations (3) and (4).

$$I_x = \Sigma[I_{xi} + (A)(d_{yi}^2)] \quad \text{Equation (3)}$$

$$I_y = \Sigma[I_{yi} + (A)(d_{xi}^2)] \quad \text{Equation (4)}$$

Elastic Section Modulus

The section's elastic section modulus was determined using the conventional relationship of the moment of inertia divided by centroidal distance to elastic neutral axis.

$$S_x = I_x / c_y \quad \text{Equation (5)}$$

$$S_y = I_y / c_x \quad \text{Equation (6)}$$

Radius of Gyration

The section's radius of gyration was determined using the conventional relationship of the moment of inertia and total cross sectional area.

$$r_x = \sqrt{I_x / A} \quad \text{Equation (7)}$$

$$r_y = \sqrt{I_y / A} \quad \text{Equation (8)}$$

Plastic Neutral Axis

The plastic neutral axis (PNA) was determined such that the cross sectional area above and below or to the left and right of the PNA is equal. The reference datum for the PNA is the extreme bottom fiber of the section for *cyPNA* and the extreme left fiber of the section for *cxPNA*.

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Plastic Section Modulus

The plastic section modulus was determined as the sum of the areas of the cross section on each side of the PNA multiplied by the distance from the local centroids of the two areas to the PNA. The plastic section modulus can also be called the first moment of area.

Shape Factor

The shape factor is defined as ratio of the plastic section modulus and elastic section modulus.

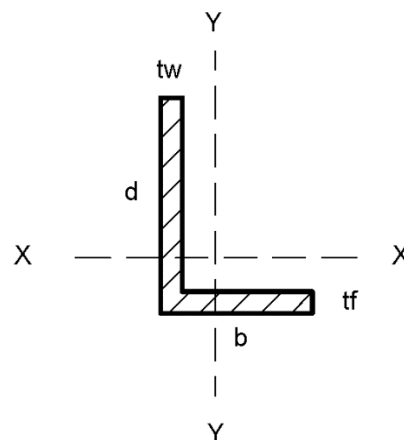
$$SF_x = Z_x / S_x \quad \text{Equation (9)}$$

$$SF_y = Z_y / S_y \quad \text{Equation (10)}$$

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	Calc. by AAR	Date	Chk'd by	Date	App'd by	Date

3x2x1/4 ANGLE SECTION

$b = 2 \text{ in}$
 $d = 3 \text{ in}$
 $t = 1/4 \text{ in}$



X-X Axis PNA Located in Horizontal Leg
Y-Y Axis PNA Located In Vertical Leg

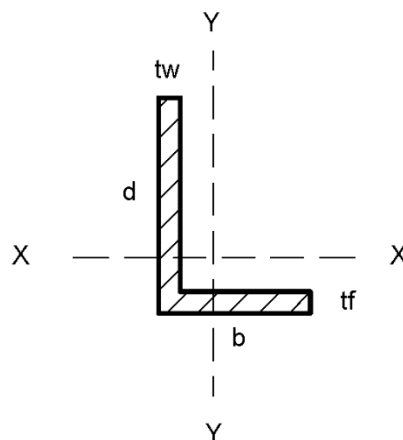
ANGLE 3x2x1/4

Property	HP Prime	RISA Section	Δ	AISC Manual	Δ
Area	1.188 in ²	1.188 in ²	0.00%	1.19 in ²	0.17%
J	0.025 in ⁴	0.023 in ⁴	8.70%	0.027 in ⁴	7.41%
I _x	1.087 in ⁴	1.087 in ⁴	0.00%	1.09 in ⁴	0.28%
S _x	0.542 in ³	0.542 in ³	0.00%	0.514 in ³	0.19%
S _x Bottom	1.094 in ³	1.094 in ³	0.00%	N/A	N/A
S _x Top	0.542 in ³	0.542 in ³	0.00%	N/A	N/A
Z _x	0.973 in ³	0.973 in ³	0.00%	0.969 in ³	0.41%
r _x	0.957 in	0.957 in	0.00%	0.953 in	0.40%
I _y	0.392 in ⁴	0.392 in ⁴	0.00%	0.390 in ⁴	0.51%
S _y	0.260 in ³	0.260 in ³	0.00%	0.258 in ³	0.78%
S _y Left	0.794 in ³	0.794 in ³	0.00%	N/A	N/A
S _y Right	0.260 in ³	0.260 in ³	0.00%	N/A	N/A
Z _y	0.468 in ³	0.468 in ³	0.00%	0.463 in ³	1.08%
r _y	0.574 in	0.574 in	0.00%	0.569 in	0.88%

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8x4x1/2 ANGLE SECTION

$b = 4 \text{ in}$
 $d = 8 \text{ in}$
 $t = 1/2 \text{ in}$



X-X Axis PNA Located in Horizontal Leg
Y-Y Axis PNA Located Outside Vertical Leg

ANGLE 8x4x1/2

Property	HP Prime	RISA Section	Δ	AISC Manual	Δ
Area	5.750 in ²	5.750 in ²	0.00%	5.75 in ²	0.00%
J	0.479 in ⁴	0.455 in ⁴	5.28%	0.501 in ⁴	4.39%
I _x	38.489 in ⁴	38.489 in ⁴	0.00%	38.60 in ⁴	0.29%
S _x	7.486 in ³	7.486 in ³	0.00%	7.48 in ³	0.08%
S _x Bottom	13.464 in ³	13.464 in ³	0.00%	N/A	N/A
S _x Top	7.486 in ³	7.486 in ³	0.00%	N/A	N/A
Z _x	13.031 in ³	13.031 in ³	0.00%	13.10 in ³	0.53%
r _x	2.587 in	2.587 in	0.00%	2.58 in	0.27%
I _y	6.739 in ⁴	6.739 in ⁴	0.00%	6.75 in ⁴	0.16%
S _y	2.145 in ³	2.145 in ³	0.00%	2.15 in ³	0.23%
S _y Left	7.848 in ³	7.848 in ³	0.00%	N/A	N/A
S _y Right	2.145 in ³	2.145 in ³	0.00%	N/A	N/A
Z _y	3.904 in ³	3.904 in ³	0.00%	3.91 in ³	0.15%
r _y	1.083 in	1.083 in	0.00%	1.08 in	0.28%

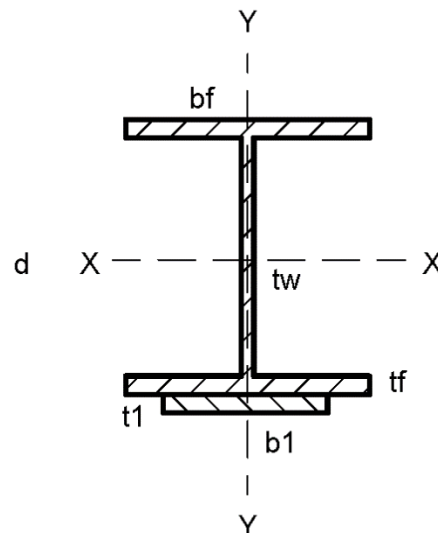
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	Section Program Validation				Sheet no./rev. A-7	
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BUILT-UP GIRDER WITH BOTTOM FLANGE PLATE

W12x79 With 3-In Bottom Plate

$d = 12.40$ in $tw = 0.470$ in
 $bf = 12.10$ in $tf = 0.735$ in
 $b1 = 10.00$ in $t1 = 3.00$ in

X-X Axis PNA Located in 3-In Bottom Flange Plate
Y-Y Axis - Symmetrical



W12x79 WITH 3-IN BOTTOM FLANGE PLATE

Property	HP Prime	RISA Section	Δ
Area	52.92 in ²	52.92 in ²	0.00%
J	93.58 in ⁴	76.76 in ⁴	21.91%
cy Bottom	4.84 in	4.84 in	0.00%
cy Top	10.57 in	10.57 in	0.00%
Ix	1449.97 in ⁴	1449.97 in ⁴	0.00%
Sx	137.25 in ³	137.25 in ³	0.00%
Sx Bottom	299.87 in ³	299.87 in ³	0.00%
Sx Top	137.25 in ³	7.486 in ³	0.00%
Zx	185.88 in ³	185.88 in ³	0.00%
rx	5.23 in	5.23 in	0.00%
cx Right	6.05 in	6.05 in	0.00%
cx Left	6.05 in	6.05 in	0.00%
Iy	467.11 in ⁴	467.11 in ⁴	0.00%
Sy	77.21 in ³	77.21 in ³	0.00%
Sy Left	77.21 in ³	77.21 in ³	0.00%
Sy Right	77.21 in ³	77.21 in ³	0.00%
Zy	129.41 in ³	129.41 in ³	0.00%
ry	2.97 in	2.97 in	0.00%

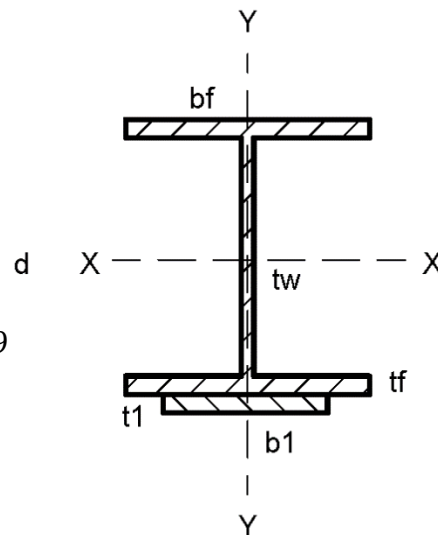
Robertson and Associates Professional Engineering and Project Management 19744 Beach Blvd. #431 Huntington Beach, CA 92648 robnassoc@sbcglobal.net	Project Section Properties for the HP Prime				Job Ref.	
	Section Program Validation				Sheet no./rev. A-8	
	Calc. by AAR	Date	Chk'd by	Date	App'd by	Date

BUILT-UP GIRDER WITH BOTTOM FLANGE PLATE

W12x79 With 3/4-Inch Bottom Plate

$d = 12.40$ in $tw = 0.470$ in
 $bf = 12.10$ in $tf = 0.735$ in
 $b1 = 10.00$ in $t1 = 0.75$ in

X-X Axis PNA Located in Bottom Flange of W12x79
Y-Y Axis - Symmetrical



W12x79 WITH 3/4-IN BOTTOM FLANGE PLATE

Property	HP Prime	RISA Section	Δ
Area	30.42 in ²	30.42 in ²	0.00%
J	4.99 in ⁴	4.97 in ⁴	0.40%
cy Bottom	5.33 in	5.33 in	0.00%
cy Top	7.82 in	7.82 in	0.00%
Ix	901.68 in ⁴	901.68 in ⁴	0.00%
Sx	115.29 in ³	115.29 in ³	0.00%
Sx Bottom	169.20 in ³	169.20 in ³	0.00%
Sx Top	115.29 in ³	115.29 in ³	0.00%
Zx	140.03 in ³	140.03 in ³	0.00%
rx	5.44 in	5.44 in	0.00%
cx Right	6.05 in	6.05 in	0.00%
cx Left	6.05 in	6.05 in	0.00%
Iy	279.61 in ⁴	279.61 in ⁴	0.00%
Sy	46.22 in ³	46.22 in ³	0.00%
Sy Left	46.22 in ³	46.22 in ³	0.00%
Sy Right	46.22 in ³	46.22 in ³	0.00%
Zy	73.16 in ³	73.16 in ³	0.00%
ry	3.03 in	3.03 in	0.00%

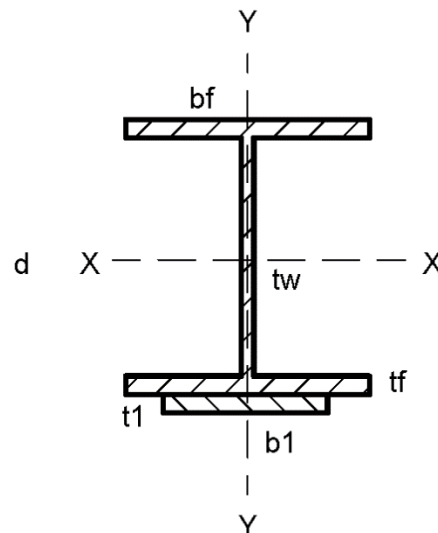
Robertson and Associates Professional Engineering and Project Management 19744 Beach Blvd. #431 Huntington Beach, CA 92648 robnassoc@sbcglobal.net	Project Section Properties for the HP Prime				Job Ref.	
	Section Program Validation				Sheet no./rev. A-9	
	Calc. by AAR	Date	Chk'd by	Date	App'd by	Date

BUILT-UP GIRDER WITH BOTTOM FLANGE PLATE

W18x86 With 3/4-Inch Bottom Plate

$d = 18.40$ in $tw = 0.480$ in
 $bf = 11.10$ in $tf = 0.770$ in
 $b1 = 6.00$ in $t1 = 0.75$ in

X-X Axis PNA Located in Web of W18x86
Y-Y Axis - Symmetrical



W18x86 WITH 3/4-IN BOTTOM FLANGE PLATE

Property	HP Prime	RISA Section	Δ
Area	29.69 in ²	30.42 in ²	0.00%
J	4.84 in ⁴	4.97 in ⁴	2.62%
cy Bottom	8.50 in	5.33 in	0.00%
cy Top	10.65 in	7.82 in	0.00%
Ix	1871.06 in ⁴	901.68 in ⁴	0.00%
Sx	175.66 in ³	115.29 in ³	0.00%
Sx Bottom	220.16 in ³	169.20 in ³	0.00%
Sx Top	175.66 in ³	115.29 in ³	0.00%
Zx	217.34 in ³	140.03 in ³	0.00%
rx	7.94 in	5.44 in	0.00%
cx Right	5.55 in	6.05 in	0.00%
cx Left	5.55 in	6.05 in	0.00%
Iy	189.17 in ⁴	189.17 in ⁴	0.00%
Sy	34.08 in ³	34.08 in ³	0.00%
Sy Left	34.08 in ³	34.08 in ³	0.00%
Sy Right	34.08 in ³	34.08 in ³	0.00%
Zy	55.16 in ³	55.17 in ³	0.02%
ry	2.52 in	2.52 in	0.00%

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	Section Program Validation				Sheet no./rev. A-10	
	Calc. by AAR	Date	Chk'd by	Date	App'd by	Date

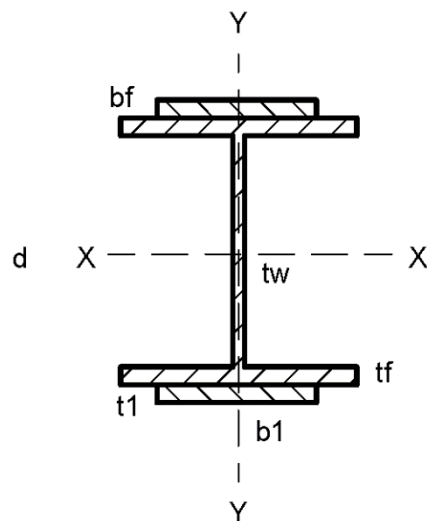
BUILT-UP GIRDER WITH TOP & BOTTOM FLANGE PLATES

W12x79 With 3/4-Inch Top & Bottom Plates

$d = 12.40$ in $tw = 0.470$ in
 $bf = 12.10$ in $tf = 0.735$ in
 $b1 = 10.00$ in $t1 = 0.75$ in

X-X Axis - Symmetrical

Y-Y Axis - Symmetrical



W12x79 WITH 3/4-IN TOP & BOTTOM FLANGE PLATES

Property	HP Prime	RISA Section	Δ
Area	37.92 in ²	37.92 in ²	0.00%
J	6.39 in ⁴	6.32 in ⁴	1.11%
cy Bottom	6.95 in	6.95 in	0.00%
cy Top	6.95 in	6.95 in	0.00%
Ix	1306.18 in ⁴	1306.18 in ⁴	0.00%
Sx	187.94 in ³	187.94 in ³	0.00%
Sx Bottom	187.94 in ³	187.94 in ³	0.00%
Sx Top	187.94 in ³	187.94 in ³	0.00%
Zx	216.41 in ³	216.41 in ³	0.00%
rx	5.87 in	5.87 in	0.00%
cx Right	6.05 in	6.05 in	0.00%
cx Left	6.05 in	6.05 in	0.00%
Iy	342.11 in ⁴	342.11 in ⁴	0.00%
Sy	56.55 in ³	56.55 in ³	0.00%
Sy Left	56.55 in ³	56.55 in ³	0.00%
Sy Right	56.55 in ³	56.55 in ³	0.00%
Zy	91.91 in ³	91.91 in ³	0.00%
ry	3.00 in	3.00 in	0.00%

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	Section Program Validation				Sheet no./rev. A-11	
	Calc. by AAR	Date	Chk'd by	Date	App'd by	Date

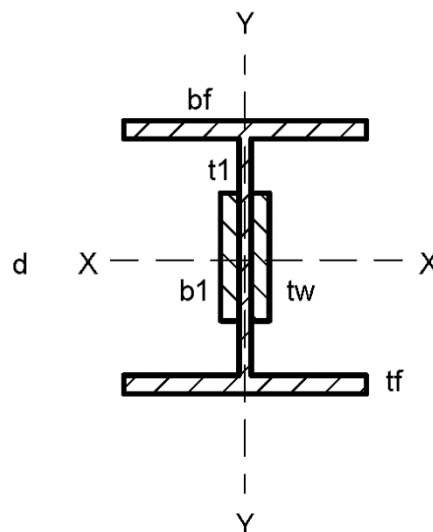
BUILT-UP GIRDER WITH WEB PLATES

W18x86 With 3/4-Inch Web Plates

$d = 18.40$ in $tw = 0.480$ in
 $bf = 11.10$ in $tf = 0.770$ in
 $b1 = 10.00$ in $t1 = 0.75$ in

X-X Axis - Symmetrical

Y-Y Axis - Symmetrical



W18x86 WITH 3/4-IN WEB PLATES

Property	HP Prime	RISA Section	Δ
Area	40.18 in ²	40.18 in ²	0.00%
J	6.81 in ⁴	6.86 in ⁴	0.73%
cy Bottom	9.20 in	9.20 in	0.00%
cy Top	9.20 in	9.20 in	0.00%
Ix	1645.83 in ⁴	1645.83 in ⁴	0.00%
Sx	178.89 in ³	178.89 in ³	0.00%
Sx Bottom	178.89 in ³	178.89 in ³	0.00%
Sx Top	178.89 in ³	178.89 in ³	0.00%
Zx	222.30 in ³	222.29 in ³	0.00%
rx	6.40 in	6.40 in	0.00%
cx Right	5.55 in	5.55 in	0.00%
cx Left	5.55 in	5.55 in	0.00%
Iy	182.05 in ⁴	182.09 in ⁴	0.02%
Sy	32.80 in ³	32.82 in ³	0.06%
Sy Left	32.80 in ³	32.82 in ³	0.06%
Sy Right	32.80 in ³	32.82 in ³	0.06%
Zy	57.63 in ³	57.67 in ³	0.07%
ry	2.13 in	2.13 in	0.00%

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	Section Program Validation				Sheet no./rev. A-12	
	Calc. by AAR	Date	Chk'd by	Date	App'd by	Date

CHANNEL SECTION

C8x18.7

d = 8.00 in

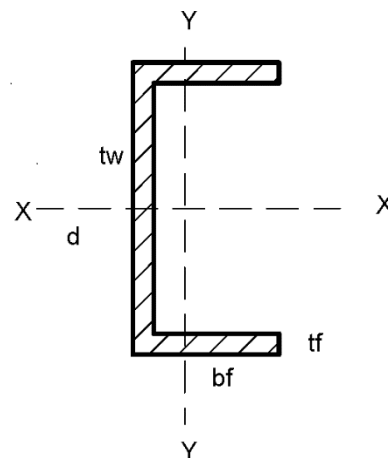
bf = 2.53 in

tw = 0.487 in

tf = 0.390 in

X-X Axis Symmetrical

Y-Y Axis PNA Located in Web



C8x18.7 SECTION

Property	HP Prime	RISA Section	Δ	AISC Manual	Δ
Area	5.49 in ²	5.49 in ²	0.00%	5.51 in ²	0.36%
J	0.35 in ⁴	0.36 in ⁴	2.78%	0.43 in ⁴	16.3%
cy Bottom	4.00 in	4.00 in	0.00%	N/A	N/A
cy Top	4.00 in	4.00 in	0.00%	N/A	N/A
Ix	43.87 in ⁴	43.87 in ⁴	0.00%	43.9 in ⁴	0.07%
Sx	10.97 in ³	10.97 in ³	0.00%	11.0 in ³	0.27%
Sx Bottom	10.97 in ³	10.97 in ³	0.00%	N/A	N/A
Sx Top	10.97 in ³	10.97 in ³	0.00%	N/A	N/A
Zx	13.86 in ³	13.86 in ³	0.00%	13.9 in ³	0.29%
rx	2.83 in	2.83 in	0.00%	2.82 in	0.36%
cx Right	1.92 in	1.92 in	0.00%	N/A	N/A
cx Left	0.61 in	0.61 in	0.00%	0.56 in	8.93%
Iy	2.44 in ⁴	2.44 in ⁴	0.00%	1.97 in ⁴	23.86%
Sy	1.27 in ³	1.27 in ³	0.00%	1.01 in ³	25.74%
Sy Left	4.00 in ³	4.00 in ³	0.00%	N/A	N/A
Sy Right	1.27 in ³	1.27 in ³	0.00%	N/A	N/A
Zy	2.41 in ³	2.41 in ³	0.00%	2.17 in ³	11.06%
ry	0.67 in	0.67 in	0.00%	0.43 in	55.81%

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	Section Program Validation				Sheet no./rev. A-13	
	Calc. by AAR	Date	Chk'd by	Date	App'd by	Date

CHANNEL SECTION

C15x40

d = 15.00 in

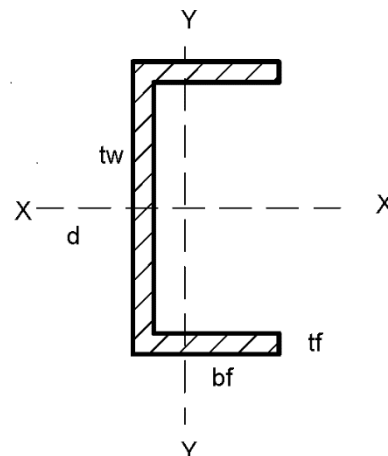
bf = 3.52 in

tw = 0.520 in

tf = 0.650 in

X-X Axis Symmetrical

Y-Y Axis PNA Located In Web



C15x40 SECTION

Property	HP Prime	RISA Section	Δ	AISC Manual	Δ
Area	11.70 in ²	11.70 in ²	0.00%	11.8 in ²	0.85%
J	1.20 in ⁴	1.20 in ⁴	0.00%	1.45 in ⁴	17.2%
cy Bottom	7.50 in	7.50 in	0.00%	N/A	N/A
cy Top	7.50 in	7.50 in	0.00%	N/A	N/A
Ix	347.16 in ⁴	347.16 in ⁴	0.00%	348 in ⁴	0.24%
Sx	46.29 in ³	46.29 in ³	0.00%	46.5 in ³	0.45%
Sx Bottom	46.29 in ³	46.29 in ³	0.00%	N/A	N/A
Sx Top	46.29 in ³	46.29 in ³	0.00%	N/A	N/A
Zx	57.23 in ³	57.23 in ³	0.00%	57.5 in ³	0.47%
rx	5.45 in	5.48 in	0.55%	5.45 in	0.00%
cx Right	2.67 in	2.67 in	0.00%	N/A	N/A
cx Left	0.847 in	0.847 in	0.00%	0.778 in	8.86%
Iy	11.16 in ⁴	11.16 in ⁴	0.00%	9.17 in ⁴	21.70%
Sy	4.17 in ³	4.17 in ³	0.00%	3.34 in ³	24.85%
Sy Left	13.18 in ³	13.18 in ³	0.00%	N/A	N/A
Sy Right	4.17 in ³	4.17 in ³	0.00%	N/A	N/A
Zy	7.63 in ³	7.62 in ³	0.00%	6.84 in ³	11.55%
ry	0.98 in	0.98 in	0.00%	0.883 in	10.99%

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	Section Properties for the HP Prime				Sheet no./rev.	
	Section				A-14	
Calc. by		Date		App'd by		Date
AAR						

PLATE GIRDER - SYMMETRICAL

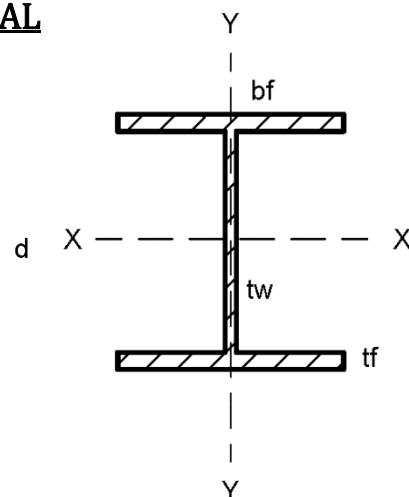
W18x50

d = 18.00 in

bf = 7.50 in

tw = 0.355 in

tf = 0.570 in



X-X Axis Symmetrical

Y-Y Axis Symmetrical

W18x50 SECTION

Property	HP Prime	RISA Section	Δ	AISC Manual	Δ
Area	14.54 in ²	14.54 in ²	0.00%	14.7 in ²	1.09%
J	1.18 in ⁴	1.28 in ⁴	7.81%	1.24 in ⁴	3.22%
cy Bottom	9.00 in	9.00 in	0.00%	N/A	N/A
cy Top	9.00 in	9.00 in	0.00%	N/A	N/A
Ix	791.40 in ⁴	791.40 in ⁴	0.00%	800 in ⁴	1.08%
Sx	87.93 in ³	87.93 in ³	0.00%	88.9 in ³	1.09%
Sx Bottom	87.93 in ³	87.93 in ³	0.00%	N/A	N/A
Sx Top	87.93 in ³	87.93 in ³	0.00%	N/A	N/A
Zx	99.74 in ³	99.74 in ³	0.00%	101 in ³	1.24%
rx	7.38 in	7.38 in	0.00%	7.38 in	0.00%
cx Right	3.75 in	3.75 in	0.00%	N/A	N/A
cx Left	3.75 in	3.75 in	0.00%	N/A	N/A
Iy	40.14 in ⁴	40.14 in ⁴	0.00%	40.1 in ⁴	0.00%
Sy	10.70 in ³	10.70 in ³	0.00%	10.7 in ³	0.00%
Sy Left	10.70 in ³	10.70 in ³	0.00%	N/A	N/A
Sy Right	10.70 in ³	10.70 in ³	0.00%	N/A	N/A
Zy	16.56 in ³	16.56 in ³	0.00%	16.6 in ³	0.24%
ry	1.66 in	1.66 in	0.00%	1.65 in	0.61%

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	Section Properties for the HP Prime					
	Section				Sheet no./rev.	
	Program Validation				A-15	
	Calc. by	Date	Chk'd by	Date	App'd by	Date
	AAR					

PLATE GIRDER - UNSYMMETRICAL

$d = 16.00$ in $tw = 0.500$ in
 $bf1 = 12.00$ in $tf1 = 0.750$ in
 $bf2 = 15.00$ in $tf2 = 1.00$ in

X-X Axis Unsymmetrical
Y-Y Axis Symmetrical

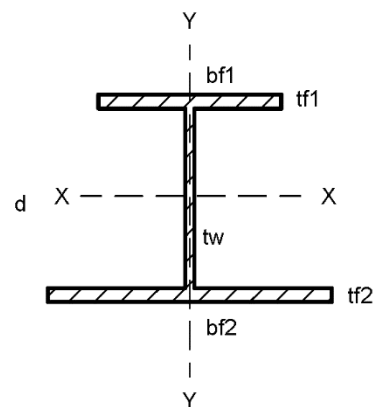


PLATE GIRDER - UNSYMMETRICAL

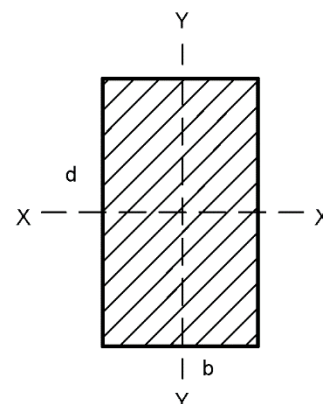
Property	HP Prime	RISA Section	Δ
Area	31.13 in ²	31.13 in ²	0.00%
J	7.28 in ⁴	7.49 in ⁴	2.80%
cy Bottom	6.62 in	6.62 in	0.00%
cy Top	9.38 in	9.38 in	0.00%
Ix	1430.01 in ⁴	1430.00 in ⁴	0.00%
Sx	152.44 in ³	152.44 in ³	0.00%
Sx Bottom	216.05 in ³	216.05 in ³	0.00%
Sx Top	152.44 in ³	152.44 in ³	0.00%
Zx	189.26 in ³	189.26 in ³	0.00%
rx	6.78 in	6.78 in	0.00%
cx Right	7.50 in	7.50 in	0.00%
cx Left	7.50 in	7.50 in	0.00%
Iy	389.40 in ⁴	389.40 in ⁴	0.02%
Sy	51.92 in ³	51.92 in ³	0.06%
Sy Left	51.92 in ³	51.92 in ³	0.06%
Sy Right	51.92 in ³	51.92 in ³	0.06%
Zy	84.14 in ³	84.14 in ³	0.07%
ry	3.54 in	3.54 in	0.00%

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	Section Program Validation				Sheet no./rev. A-16	
	Calc. by AAR	Date	Chk'd by	Date	App'd by	Date

RECTANGULAR SHAPED SECTION

d = 12.25 in

b = 5.50 in



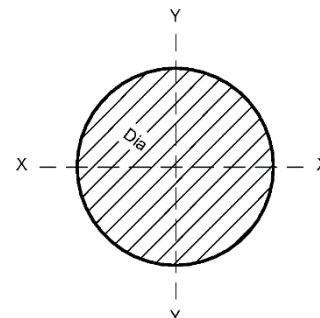
RECTANGULAR SHAPED SECTION

Property	HP Prime	RISA Section	Δ
Area	67.38 in ²	67.38 in ²	0.00%
J	487.85 in ⁴	488.50 in ⁴	0.13%
cy Bottom	6.125 in	6.125 in	0.00%
cy Top	6.125 in	6.125 in	0.00%
Ix	842.54 in ⁴	842.54 in ⁴	0.00%
Sx	137.56 in ³	137.56 in ³	0.00%
Sx Bottom	137.56 in ³	137.56 in ³	0.00%
Sx Top	137.56 in ³	137.56 in ³	0.00%
Zx	206.34 in ³	206.34 in ³	0.00%
rx	3.54 in	3.54 in	0.00%
cx Right	2.750 in	2.750 in	0.00%
cx Left	2.750 in	2.750 in	0.00%
Iy	169.84 in ⁴	169.84 in ⁴	0.00%
Sy	61.76 in ³	61.76 in ³	0.00%
Sy Left	61.76 in ³	61.76 in ³	0.00%
Sy Right	61.76 in ³	61.76 in ³	0.00%
Zy	92.64 in ³	92.64 in ³	0.00%
ry	1.59 in	1.59 in	0.00%

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	Section				Sheet no./rev.	
	Program Validation				A-17	
Calc. by	Date	Chk'd by	Date	App'd by	Date	
AAR						

ROUND SHAPED SECTION

Dia = 5.50 in



ROUND SHAPED SECTION

Property	HP Prime	RISA Section	Δ
Area	23.76 in ²	23.76 in ²	0.00%
J	89.84 in ⁴	89.84 in ⁴	0.00%
cy Bottom	2.750 in	2.750 in	0.00%
cy Top	2.750 in	2.750 in	0.00%
Ix	44.92 in ⁴	44.92 in ⁴	0.00%
Sx	16.33 in ³	16.33 in ³	0.00%
Sx Bottom	16.33 in ³	16.33 in ³	0.00%
Sx Top	16.33 in ³	16.33 in ³	0.00%
Zx	27.73 in ³	27.42 in ³	1.13%
rx	1.38 in	1.38 in	0.00%
cx Right	2.750 in	2.750 in	0.00%
cx Left	2.750 in	2.750 in	0.00%
Iy	44.92 in ⁴	44.92 in ⁴	0.00%
Sy	16.33 in ³	16.33 in ³	0.00%
Sy Left	16.33 in ³	16.33 in ³	0.00%
Sy Right	16.33 in ³	16.33 in ³	0.00%
Zy	27.73 in ³	27.42 in ³	0.00%
ry	1.38 in	1.38 in	0.00%

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	Section Program Validation				Sheet no./rev. A-18	
	Calc. by AAR	Date	Chk'd by	Date	App'd by	Date

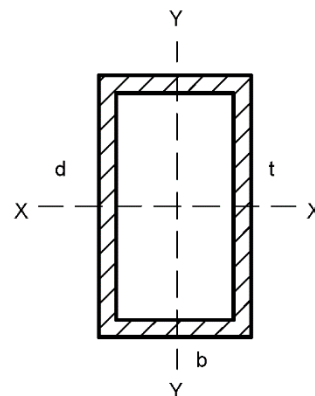
TUBE SHAPED SECTION - RECTAGULAR

HSS 8x8x1/2

d = 8.00 in

t = 0.465 in

b = 6.00 in



HSS 8x8x1/2

Property	HP Prime	RISA Section	Δ	AISC Manual	Δ
Area	12.16 in ²	12.16 in ²	0.00%	11.6 in ²	4.83%
J	123.77 in ⁴	129.09 in ⁴	4.12%	127 in ⁴	2.54%
cy Bottom	4.00 in	4.00 in	0.00%	N/A	N/A
cy Top	4.00 in	4.00 in	0.00%	N/A	N/A
Ix	106.69 in ⁴	106.69 in ⁴	0.00%	98.2 in ⁴	8.65%
Sx	26.67 in ³	26.67 in ³	0.00%	24.6 in ³	8.42%
Sx Bottom	26.67 in ³	26.67 in ³	0.00%	N/A	N/A
Sx Top	26.67 in ³	26.67 in ³	0.00%	N/A	N/A
Zx	32.64 in ³	32.64 in ³	0.00%	30.5 in ³	7.02%
rx	2.96 in	2.96 in	0.00%	2.91 in	1.72%
cx Right	3.00 in	3.00 in	0.00%	N/A	N/A
cx Left	3.00 in	3.00 in	0.00%	N/A	N/A
Iy	67.22 in ⁴	67.22 in ⁴	0.00%	62.5 in ⁴	7.55%
Sy	22.41 in ³	22.41 in ³	0.00%	20.8 in ³	7.74%
Sy Left	22.41 in ³	22.41 in ³	0.00%	N/A	N/A
Sy Right	22.41 in ³	22.40 in ³	0.00%	N/A	N/A
Zy	26.57 in ³	26.57 in ³	0.00%	24.9 in ³	6.71%
ry	2.35 in	2.35 in	0.00%	2.32 in	1.29%

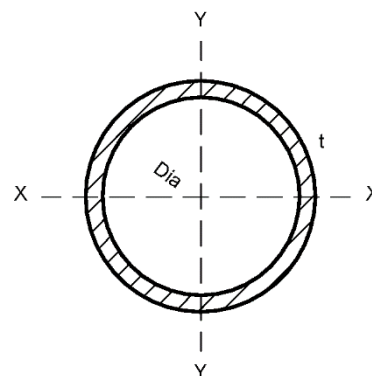
Robertson and Associates Professional Engineering and Project Management 19744 Beach Blvd. #431 Huntington Beach, CA 92648 robnassoc@sbcglobal.net	Project Section Properties for the HP Prime				Job Ref.	
	Section Program Validation				Sheet no./rev. A-19	
	Calc. by AAR	Date	Chk'd by	Date	App'd by	Date

TUBE SHAPED SECTION - CIRCULAR

HSS 5.50x0.500

Dia = 5.50 in

t = 0.465 in



HSS 5.50x0.500

Property	HP Prime	RISA Section	Δ	AISC Manual	Δ
Area	7.36 in ²	7.36 in ²	0.00%	7.45 in ²	1.21%
J	47.01 in ⁴	47.01 in ⁴	0.00%	48.8 in ⁴	3.67%
cy Bottom	2.75 in	2.75 in	0.00%	N/A	N/A
cy Top	2.75 in	2.75 in	0.00%	N/A	N/A
Ix	23.51 in ⁴	23.51 in ⁴	0.00%	24.4 in ⁴	3.65%
Sx	8.55 in ³	8.55 in ³	0.00%	8.77 in ³	2.51%
Sx Bottom	8.55 in ³	8.55 in ³	0.00%	N/A	N/A
Sx Top	8.55 in ³	8.55 in ³	0.00%	N/A	N/A
Zx	11.82 in ³	11.71 in ³	0.94%	12.1 in ³	2.31%
rx	1.79 in	1.79 in	0.00%	1.81 in	1.11%
cx Right	2.75 in	2.75 in	0.00%	N/A	N/A
cx Left	2.75 in	2.75 in	0.00%	N/A	N/A
Iy	23.51 in ⁴	23.51 in ⁴	0.00%	24.4 in ⁴	3.65%
Sy	8.55 in ³	8.55 in ³	0.00%	8.77 in ³	2.51%
Sy Left	8.55 in ³	8.55 in ³	0.00%	N/A	N/A
Sy Right	8.55 in ³	8.55 in ³	0.00%	N/A	N/A
Zy	11.82 in ³	11.71 in ³	0.94%	12.1 in ³	2.31%
ry	1.79 in	1.79 in	0.00%	1.81 in	1.11%

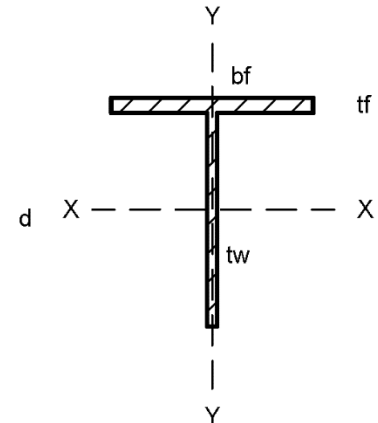
Robertson and Associates Professional Engineering and Project Management 19744 Beach Blvd. #431 Huntington Beach, CA 92648 robnassoc@sbcglobal.net	Project				Job Ref.	
	Section Properties for the HP Prime				Sheet no./rev.	
	Section				A-20	
Calc. by		Date	Chk'd by	Date	App'd by	Date
AAR						

TEE SECTION

WT20x74.5

d = 19.10 in
bf = 11.80 in

tw = 0.630 in
tf = 0.830 in



X-X Axis PNA Located in Web
Y-Y Axis Symmetrical

WT20x74.5

Property	HP Prime	RISA Section	Δ	AISC Manual	Δ
Area	21.30 in ²	21.30 in ²	0.00%	21.9 in ²	2.74%
J	3.77 in ⁴	3.66 in ⁴	3.01%	4.66 in ⁴	19.10%
cy Bottom	13.525 in	13.525 in	0.00%	N/A	N/A
cy Top	5.575 in	5.575 in	0.00%	5.45 in	2.29%
Ix	803.32 in ⁴	803.32 in ⁴	0.00%	815 in ⁴	1.43%
Sx	59.39 in ³	59.39 in ³	0.00%	59.7 in ³	0.52%
Sx Bottom	59.39 in ³	59.39 in ³	0.00%	N/A	N/A
Sx Top	144.10 in ³	144.10 in ³	0.00%	N/A	N/A
Zx	108.04 in ³	108.04 in ³	0.94%	108 in ³	0.37%
rx	6.14 in	6.14 in	0.00%	6.10 in	0.66%
cx Right	5.90 in	5.90 in	0.00%	N/A	N/A
cx Left	5.90 in	5.90 in	0.00%	N/A	N/A
Iy	114.02 in ⁴	114.02 in ⁴	0.00%	114 in ⁴	0.02%
Sy	19.33 in ³	19.33 in ³	0.00%	19.4 in ³	0.36%
Sy Left	19.33 in ³	19.33 in ³	0.00%	N/A	N/A
Sy Right	19.33 in ³	19.33 in ³	0.00%	N/A	N/A
Zy	30.71 in ³	30.71 in ³	0.00%	30.9 in ³	0.62%
ry	2.31 in	2.31 in	0.00%	2.29 in	0.87%

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	Section Program Validation				Sheet no./rev. A-21	
	Calc. by AAR	Date	Chk'd by	Date	App'd by	Date

TEE SECTION

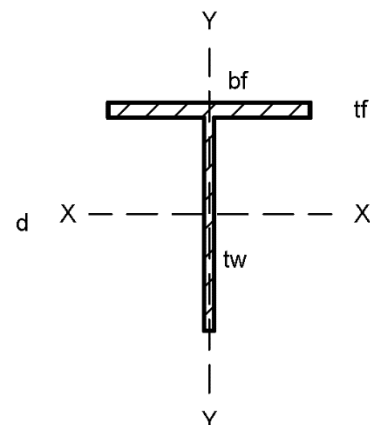
WT12x81

d = 12.50 in

bf = 13.00 in

tw = 0.705 in

tf = 1.220 in



X-X Axis PNA Located in Flange

Y-Y Axis Symmetrical

WT12x81

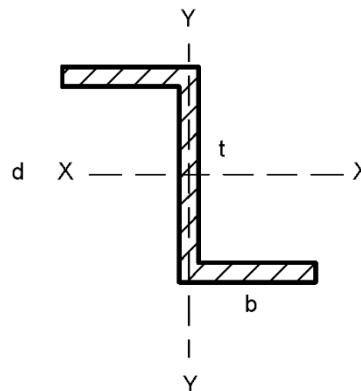
Property	HP Prime	RISA Section	Δ	AISC Manual	Δ
Area	23.81 in ²	23.81 in ²	0.00%	23.9 in ²	0.38%
J	9.19 in ⁴	8.07 in ⁴	13.88%	9.22 in ⁴	0.32%
cy Bottom	9.803 in	9.803 in	0.00%	N/A	N/A
cy Top	2.697 in	2.697 in	0.00%	2.70 in	0.11%
Ix	293.19 in ⁴	293.69 in ⁴	0.17%	293 in ⁴	0.07%
Sx	29.91 in ³	29.91 in ³	0.00%	29.9 in ³	0.03%
Sx Bottom	29.91 in ³	29.91 in ³	0.00%	N/A	N/A
Sx Top	108.70 in ³	108.70 in ³	0.00%	N/A	N/A
Zx	53.32 in ³	53.32 in ³	0.00%	53.3 in ³	0.04%
rx	3.51 in	3.51 in	0.00%	3.50 in	0.29%
cx Right	6.500 in	6.500 in	0.00%	N/A	N/A
cx Left	6.500 in	6.500 in	0.00%	N/A	N/A
Iy	223.69 in ⁴	223.69 in ⁴	0.00%	221 in ⁴	1.22%
Sy	34.41 in ³	34.41 in ³	0.00%	34.2 in ³	0.61%
Sy Left	34.41 in ³	34.41 in ³	0.00%	N/A	N/A
Sy Right	34.41 in ³	34.41 in ³	0.00%	N/A	N/A
Zy	52.95 in ³	52.95 in ³	0.00%	52.6 in ³	0.67%
ry	3.07 in	3.07 in	0.00%	3.05 in	0.67%

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	Section Program Validation				Sheet no./rev. A-22	
	Calc. by AAR	Date	Chk'd by	Date	App'd by	Date

ZEE SECTION

d = 12.50 in
t = 0.75 in

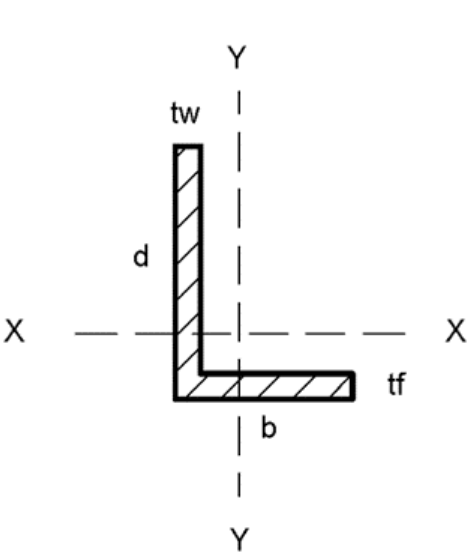
b = 6.50 in



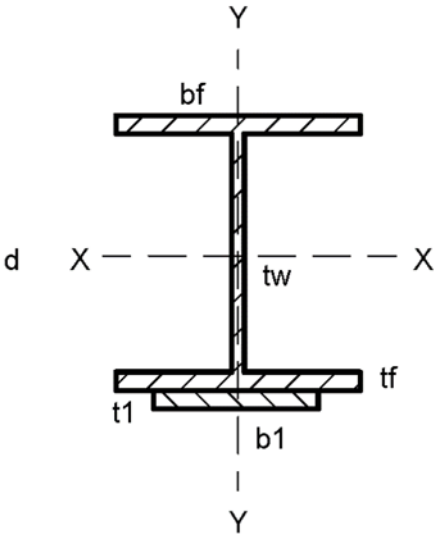
ZEE SECTION

Property	HP Prime	RISA Section	Δ
Area	18.00 in ²	18.00 in ²	0.00%
J	3.38 in ⁴	3.19 in ⁴	5.96%
cy Bottom	6.250 in	6.250 in	0.00%
cy Top	6.250 in	6.250 in	0.00%
Ix	420.17 in ⁴	420.17 in ⁴	0.00%
Sx	67.23 in ³	67.23 in ³	0.00%
Sx Bottom	67.23 in ³	67.23 in ³	0.00%
Sx Top	67.23 in ³	67.23 in ³	0.00%
Zx	79.97 in ³	79.97 in ³	1.13%
rx	4.83 in	4.83 in	0.00%
cx Right	6.125 in	6.125 in	0.00%
cx Left	6.125 in	6.125 in	0.00%
Iy	115.31 in ⁴	115.44 in ⁴	0.00%
Sy	18.83 in ³	18.37 in ³	2.50%
Sy Left	18.83 in ³	18.37 in ³	2.50%
Sy Right	18.83 in ³	18.37 in ³	2.50%
Zy	29.58 in ³	29.81 in ³	0.77%
ry	2.53 in	2.53 in	0.00%

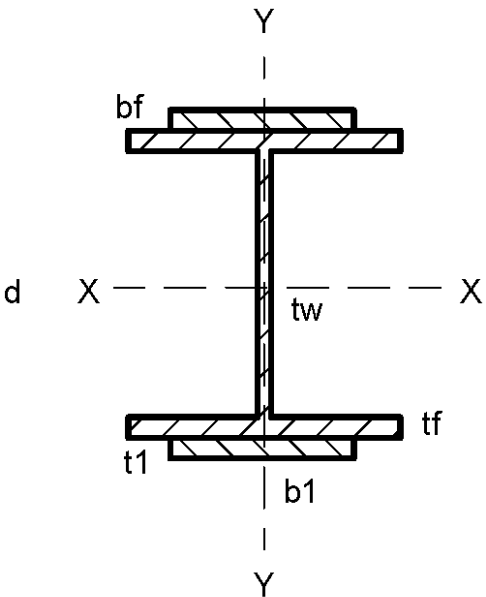
Robertson and Associates Professional Engineering and Project Management 19744 Beach Blvd. #431 Huntington Beach, CA 92648 robnassoc@sbcglobal.net	Project				Job Ref.	
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	Section				B-1	
Calc. by	Date	Chk'd by	Date	App'd by	Date	
AAR						



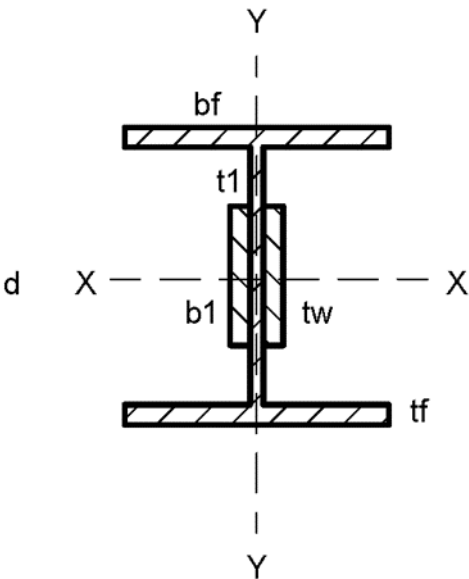
ANGLE



BUILT-UP PLATE GIRDER
BOTTOM PLATE

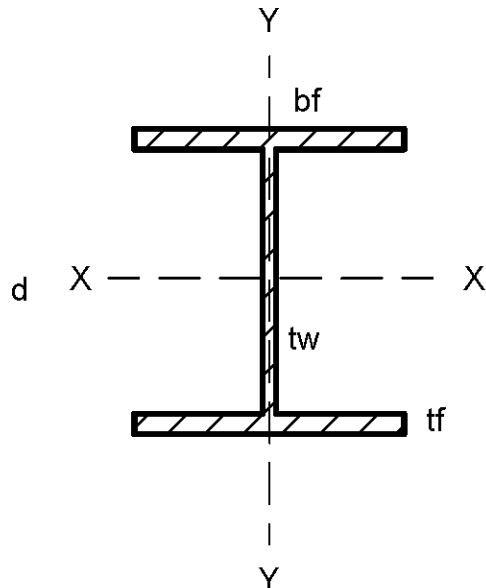


BUILT-UP PLATE GIRDER
TOP & BOTTOM PLATES

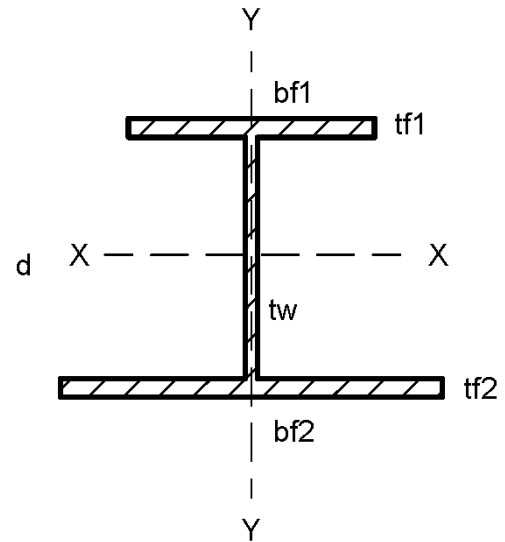


BUILT-UP PLATE GIRDER
WEB PLATES

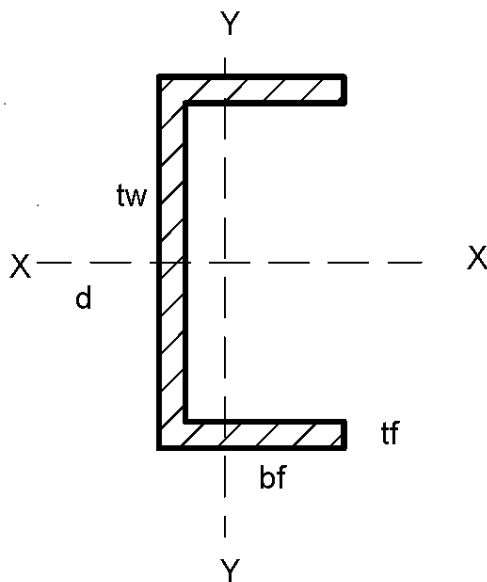
Robertson and Associates Professional Engineering and Project Management 19744 Beach Blvd. #431 Huntington Beach, CA 92648 robnassoc@sbcglobal.net	Project				Job Ref.	
	Section Properties for the HP Prime				Sheet no./rev.	
	Structural Shapes				B-2	
Calc. by	Date	Chk'd by	Date	App'd by	Date	
AAR						



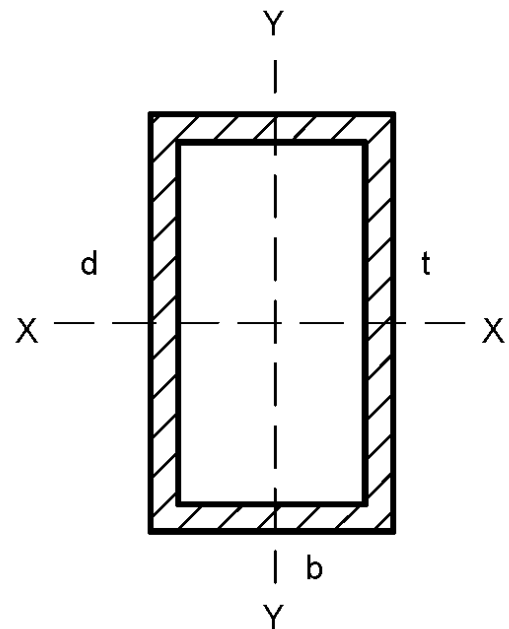
**SYMMETRICAL
PLATE GIRDER**



**UNSYMMETRICAL
PLATE GIRDER**

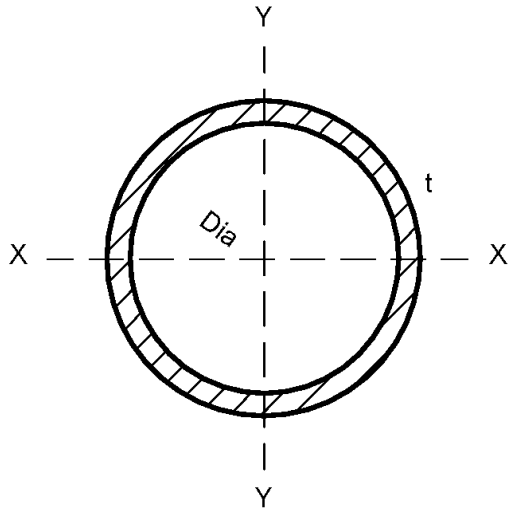


CHANNEL

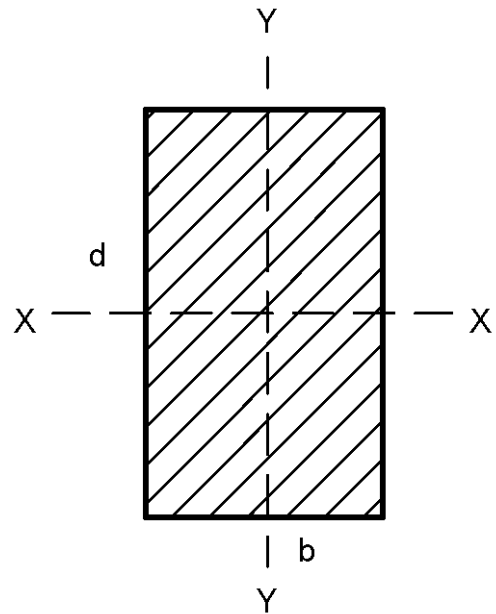


TUBE - RECTANGULAR

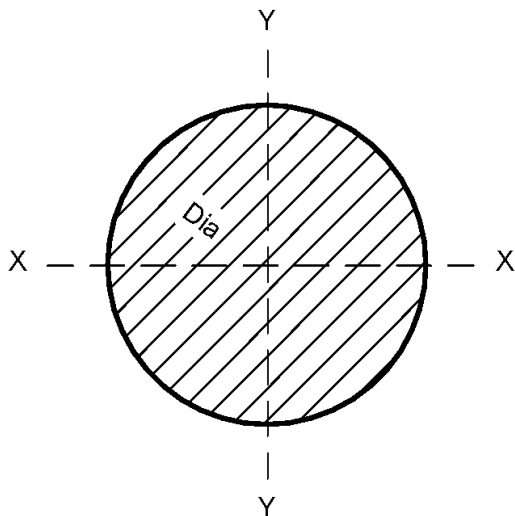
Robertson and Associates Professional Engineering and Project Management 19744 Beach Blvd. #431 Huntington Beach, CA 92648 robnassoc@sbcglobal.net	Project				Job Ref.	
	Section				Sheet no./rev.	
	Structural Shapes				B-3	
Calc. by	Date	Chk'd by	Date	App'd by	Date	
AAR						



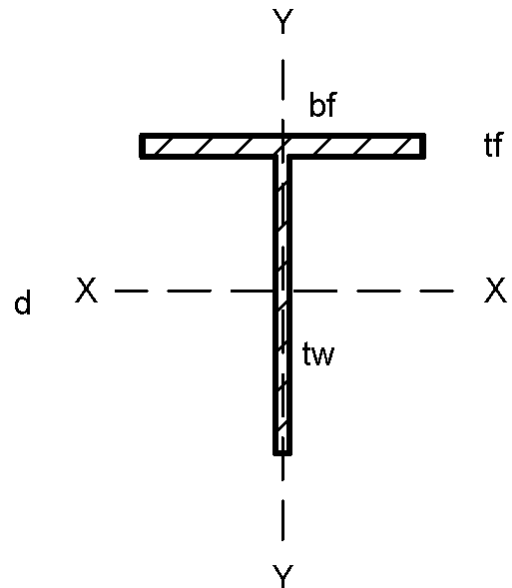
TUBE –CIRCULAR



SOLID RECTANGLE

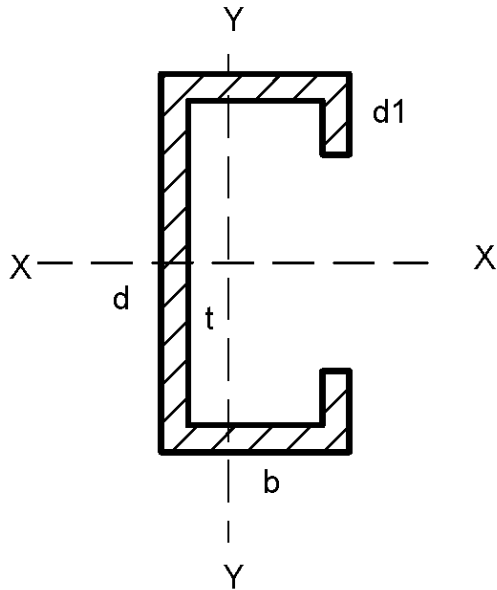


SOLID ROUND

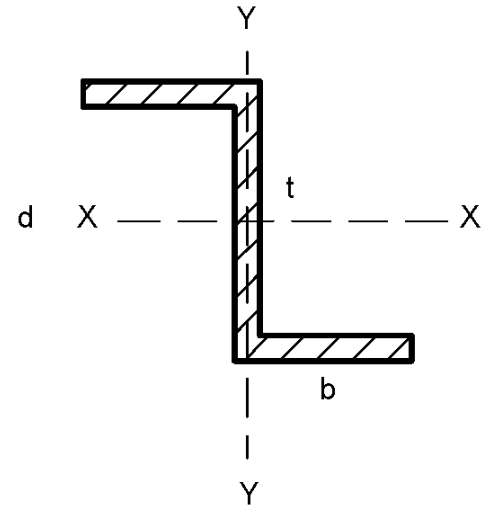


TEE SECTION

Robertson and Associates Professional Engineering and Project Management 19744 Beach Blvd. #431 Huntington Beach, CA 92648 robnassoc@sbcglobal.net	Project				Job Ref.	
	Section Properties for the HP Prime				Sheet no./rev.	
	Section				B-4	
Calc. by		Date	Chk'd by	Date	App'd by	Date
AAR						



C SECTION



ZEE SECTION