TikZ-Sections Manual

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1 Purpose and Scope

TikZ-Sections provides TikZ commands for drawing structural cross-section sketches. The current package covers cold-formed steel (CFS), hot-rolled steel (HRS), and initial reinforced-concrete (RC) cross-sections.

The package has two command layers:

- Public key-value commands such as `\TikZSectionsChannel`. These are recommended for new documents because the options are readable and can be omitted when defaults are acceptable.
- Positional helper commands such as `\csChannel`. These remain available for lower-level drawings.

2 Installation and Loading

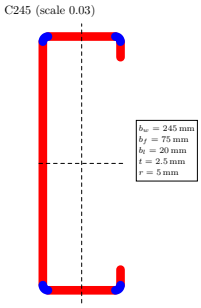
Place `tikz-sections.sty` next to your document or in a directory searched by your LaTeX installation, then load it in the preamble:

```
\usepackage{tikz-sections}
```

TikZ-Sections loads TikZ and the TikZ `calc` library.

3 Quick Start

The example below draws a lipped cold-formed channel with a label, centerlines, and a basic dimension legend.




```
\begin{tikzpicture}
  \TikZSectionsChannel[
    depth=245,
    flange=75,
    lip=20,
    thickness=2.5,
    radius=5,
    centerline=true,
    dimensions=true,
    label=C245,
    scale=0.03
  ]
\end{tikzpicture}
```

4 Key-Value Model

Every public drawing command accepts a single optional key list:

```
\TikZSectionsChannel[depth=180, flange=55, thickness=2, radius=4]
```

The keys are reset to package defaults each time a public drawing command is called. Use `at`, `x`, `y`, `scale`, `xscale`, `yscale`, and `rotate` to position a section inside a larger `tikzpicture`.

Public section commands draw into the current `tikzpicture`; they do not create a `tikzpicture` internally. They may be used inside ordinary TikZ `scope` environments and mixed with commands such as `\draw`, `\fill`, `\node`, and `\foreach`.

4.1 Default Keys

Key	Default	Meaning
`depth`	245	Section depth or vertical size
`width`	75	Section width, horizontal size, or circular diameter for RC commands
`diameter`	75	Alias stored as the circular width/diameter value
`flange`	75	Common CFS flange width used when top/bottom values are not supplied
`top flange`, `bottom flange`	75	Independent CFS flange widths honored in `detailed` mode
`left flange`, `right flange`	35	Hat-section flange widths
`lip`	0	Common CFS lip length used when top/bottom values are not supplied
`top lip`, `bottom lip`	0	Independent CFS lip lengths honored in `detailed` mode
`thickness`	2.5	Steel thickness or drawing line width in millimetres
`radius`, `inside radius`, `bend radius`, `root radius`	5	Bend radius or rolled-section root radius
`position`, `stiffener position`	0.5	Relative stiffener position along the web
`leg`	60	Equal-angle leg length
`vertical leg`, `horizontal leg`	60, 40	Unequal-angle leg lengths
`web depth`, `web thickness`	95, 1	Welded I-section web dimensions
`flange thickness`	2	Rolled flange thickness
`top flange width`, `bottom flange width`	35	Welded I-section flange widths
`top flange thickness`, `bottom flange thickness`	2	Welded I-section flange thicknesses
`reference line width`	0	Optional plate/bar reference line width
`line width`	1	Round-bar line width
`cover`	40	RC cover distance to the longitudinal bar centerline. Stirrups are drawn around the outside edge of the longitudinal bar envelope
`bar diameter`	16	RC rebar diameter
`top bars`, `bottom bars`	2	Rectangular RC bar counts
`left bars`, `right bars`	0	Rectangular RC side-bar counts
`top layers`, `bottom layers`, `side layers`	1	RC reinforcement layer counts
`layer spacing`	25	RC spacing between bar layers
`perimeter bars`	8	Circular RC perimeter bar count
`label`, `label x`, `label y`	empty, 0, 0	Optional text label. Without explicit coordinates, labels are placed above the top-left of the section with the local scale in brackets
`mode`	simplified	Input mode. `simplified` uses nominal symmetric dimensions; `detailed` honors independent detailed dimensions where available
`simplified`, `detailed`	–	Convenience styles for `mode=simplified` and `mode=detailed`
`filled`	false	Fill closed steel/bar shapes before drawing the outline
`centerline`	false	Draw horizontal and vertical centerlines

`dimensions`	false	Draw dimension assistance. Channel and zee commands use a boxed dimension legend; other families currently use the older guide overlay
`monochrome`	false	Draw straight and curved steel segments in black
`tie`	true	Draw RC tie/closed stirrup line
`at`, `shift`, `scale`, `xscale`, `yscale`, `rotate`, `x`, `y`	(0,0), (0,0), 1, 1, 1, 0, 0, 0	Placement and local transform values

5 Style Hooks

The package routes drawing through TikZ styles. This lets users keep the same geometry while changing color, line style, or fill appearance.

Style	Purpose
`tikzSections/straight`	Straight steel segments
`tikzSections/round`	Curved/radius steel segments
`tikzSections/centerline`	Optional centerlines
`tikzSections/hidden`	Hidden or reference lines
`tikzSections/dimension`	Current dimension overlay lines
`tikzSections/callout`	Reserved for future arrow-style annotations
`tikzSections/dimension legend`	Box style used by channel and zee dimension legends
`tikzSections/label`	Labels drawn with the `label` key
`tikzSections/fill`	Fills for closed steel/bar shapes
`tikzSections/concrete`	RC concrete fill
`tikzSections/concrete edge`	RC concrete edge. The default line is heavier than reinforcement lines
`tikzSections/rebar`	RC longitudinal rebar circles. The default fill is blue
`tikzSections/tie`	RC tie/stirrup outline. The default line is red

```
\TikZSectionsSetup{
  tikzSections/straight/.style={tikzSections/default, black},
  tikzSections/round/.style={tikzSections/default, gray},
  tikzSections/fill/.style={fill=gray!15}
}
```

6 Input Modes

The public key-value API supports two input modes. The default is `mode=simplified`.

`simplified` mode is the nominal engineering-sketch interface. For CFS channel and zee sections, use the main dimensions:

```
\TikZSectionsChannel[
  depth=180,
  flange=55,
  lip=18,
  thickness=2,
  radius=4
]
```

In simplified mode, `flange` is used for both top and bottom flanges, and `lip` is used for both lips. Independent top/bottom keys are not part of the simplified contract.

`detailed` mode is the explicit geometry interface. It honors independent dimensions where the section command supports them:

```
\TikZSectionsChannel[
```

```
  detailed=true,
  depth=180,
  top flange=55,
  bottom flange=60,
  top lip=18,
  bottom lip=20,
  thickness=2,
  radius=4
]
```

Detailed mode is intended for asymmetric dimensions and future section-specific options such as independent radii, stiffener geometry, or rolled-shape details.

7 Dimension Assistance

The `dimensions=true` key currently provides dimension assistance rather than a full traditional engineering dimensioning system. For `\TikZSectionsChannel` and `\TikZSectionsZee`, it draws a compact boxed legend for the web depth, flange, lip, thickness, and bend radius where those values are present. The current notation is b_w for web depth, b_f for flange width, b_l for lip length, t for thickness, and r for bend radius. Detailed asymmetric dimensions use b_{ft}, b_{fb}, b_{lt}, and b_{lb}. Other section families still draw the older generic horizontal and vertical dimension guide overlay.

The legend direction is deliberate: it avoids misleading arrow placement until traditional dimension lines with extension lines, standardized offsets, collision avoidance, and notation presets are implemented. Traditional engineering dimension lines remain future work.

8 Cold-Formed Lip Handling

Cold-formed channel and zee families use one geometry path for lipped and unlipped forms. Set `lip=0`, or set both `top lip=0` and `bottom lip=0`, to suppress the lips. This is also the default.

For equal top and bottom geometry, use `flange` and `lip`. For asymmetric geometry, use `detailed=true` with `top flange`, `bottom flange`, `top lip`, and `bottom lip`. The current CFS public API covers single-section primitives; built-up assemblies are intended to be composed with ordinary TikZ scopes and transforms.

```
% Equal flange/lip values
\TikZSectionsChannel[depth=180, flange=55, lip=18]

% Independent top and bottom values
\TikZSectionsChannel[
  detailed=true,
  depth=180,
  top flange=55,
  top lip=18,
  bottom flange=60,
  bottom lip=20
]

% Unlipped form through the same channel family
\TikZSectionsChannel[depth=180, flange=55, lip=0]
```

9 Command Summary

Command	Shape	Main keys	Group
`\TikZSectionsChannel`	Channel family	`depth`, `flange`/top/bottom flanges, `lip`/top/bottom lips, `thickness`, `radius`	CFS
`\TikZSectionsStiffenedChannel`	Intermediate-stiffened channel	`top flange`, `top lip`, `bottom flange`, `bottom lip`, `stiffener position`	CFS
`\TikZSectionsZee`	Zee family	`depth`, `flange`/top/bottom flanges, `lip`/top/bottom lips, `thickness`, `radius`	CFS
`\TikZSectionsSigma`	Sigma section	`top flange`, `top lip`, `bottom flange`, `bottom lip`	CFS
`\TikZSectionsHat`	Hat section	`depth`, `width`, `left flange`, `right flange`	CFS

`\TikZSectionsAngle`	Cold-formed angle	`vertical leg`, `horizontal leg`, `thickness`, `radius`	CFS
`\TikZSectionsLippedAngle`	Lipped angle	`vertical leg`, `horizontal leg`, `lip`	CFS
`\TikZSectionsRHS`	Rectangular hollow section	`depth`, `width`, `thickness`, `radius`	CFS
`\TikZSectionsSHS`	Square hollow section	`width`, `thickness`, `radius`	CFS
`\TikZSectionsCHS`	Circular hollow section	`radius`, `thickness`	CFS
`\TikZSectionsUniversalBeam`	Universal beam/I-section	`depth`, `width`, `flange thickness`, `web thickness`	HRS
`\TikZSectionsUniversalColumn`	Universal column/I-section	`depth`, `width`, `flange thickness`, `web thickness`	HRS
`\TikZSectionsWeldedI`	Welded I-section	`web depth`, `top flange width`, `bottom flange width`	HRS
`\TikZSectionsTee`	Tee section	`depth`, `width`, `flange thickness`, `web thickness`	HRS
`\TikZSectionsHRSChannel`	Hot-rolled channel	`depth`, `width`, `flange thickness`, `web thickness`	HRS
`\TikZSectionsEqualAngle`	Equal angle	`leg`, `thickness`, `root radius`	HRS
`\TikZSectionsUnequalAngle`	Unequal angle	`vertical leg`, `horizontal leg`, `thickness`	HRS
`\TikZSectionsPlate`	Plate	`width`, `thickness`, `filled`	HRS
`\TikZSectionsFlatBar`	Flat bar	`width`, `thickness`, `filled`	HRS
`\TikZSectionsRoundBar`	Round bar	`radius`, `line width`, `filled`	HRS
`\TikZSectionsHRSCHS`	Hot-rolled circular hollow section	`radius`, `thickness`	HRS
`\TikZSectionsHRSRHS`	Hot-rolled rectangular hollow section	`depth`, `width`, `thickness`, `root radius`	HRS
`\TikZSectionsHRSSHS`	Hot-rolled square hollow section	`width`, `thickness`, `root radius`	HRS
`\TikZRCRectangular`	Rectangular RC section	`width`, `depth`, `cover`, `bar diameter`, bar counts	RC
`\TikZRCCircular`	Circular RC section	`diameter`, `cover`, `bar diameter`, `perimeter bars`	RC

10 Visual Catalogue

The previews in this section are deliberately bounded with maximum width and height limits. The example code can be pasted into any `tikzpicture`.

10.1 Cold-Formed Steel

`\TikZSectionsChannel`

Channel family with the default unlipped form.

`depth`, `flange`, `lip=0`, `thickness`, `radius`

```
\TikZSectionsChannel[depth=180,flange=55,thickness=2,radius=4,scale=0.03]
```

`\TikZSectionsChannel`

Channel with equal lips at the flange tips. Use `flange` and `lip` for equal top/bottom values.

`depth`, `flange`, `lip`, `thickness`, `radius`

```
\TikZSectionsChannel[depth=180,flange=55,lip=18,thickness=2,radius=4,scale=0.03]
```

\TikZSectionsChannel

Asymmetric lipped channel using independent top and bottom flange/lip dimensions.

detailed, top flange, top lip, bottom flange, bottom lip

```
\TikZSectionsChannel[detailed=true,depth=180,topflange=55,toplip=18,bottomflange=60,bottomlip=20,thickness=2,radius=4,scale=0.03]
```

\TikZSectionsChannel

Explicit unlipped channel by setting `lip=0`.

depth, flange, lip=0, thickness, radius

```
\TikZSectionsChannel[depth=180,flange=55,lip=0,thickness=2,radius=4,scale=0.03]
```

\TikZSectionsStiffenedChannel

Channel with one intermediate web stiffener. Use `stiffener position` from 0 to 1.

depth, top flange, top lip, bottom flange, bottom lip, stiffener position

```
\TikZSectionsStiffenedChannel[detailed=true,depth=180,topflange=55,toplip=18,bottomflange=60,bottomlip=20,stiffenerposition=0.55,thickness=2,radius=4,scale=0.03]
```

\TikZSectionsZee

Zee family with the default unlipped form.

depth, flange, lip=0, thickness, radius

```
\TikZSectionsZee[depth=180,flange=55,thickness=2,radius=4,scale=0.03]
```

\TikZSectionsZee

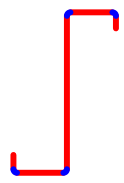
Zee section with equal lips. Use independent top/bottom keys for asymmetric geometry.

depth, flange, lip, thickness, radius

```
\TikZSectionsZee[depth=180,flange=55,lip=18,thickness=2,radius=4,scale=0.03]
```

\TikZSectionsZee

Asymmetric lipped zee using independent top and bottom flange/lip dimensions.



detailed, top flange, top lip, bottom flange, bottom lip

```
\TikZSectionsZee[detailed=true,depth=180,topflange=55,toplip=18,bottomflange=60,bottomlip=20,thickness=2,radius=4,scale=0.03]
```

\TikZSectionsZee

Explicit unlipped zee by setting `lip=0`.

depth, flange, lip=0, thickness, radius

```
\TikZSectionsZee[depth=180,flange=55,lip=0,thickness=2,radius=4,scale=0.03]
```

\TikZSectionsSigma

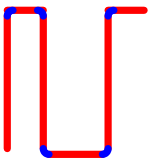
Sigma-style stiffened section with independent top and bottom flange/lip dimensions.

depth, top flange, top lip, bottom flange, bottom lip

```
\TikZSectionsSigma[detailed=true,depth=180,topflange=55,toplip=18,bottomflange=60,bottomlip=20,thickness=2,radius=4,scale=0.03]
```

\TikZSectionsHat

Hat section with independent left and right outward flanges.



depth, width, left flange, right flange, thickness, radius

```
\TikZSectionsHat[depth=100,width=45,leftflange=25,rightflange=25,thickness=2,radius=4,scale=0.04]
```

\TikZSectionsAngle

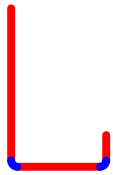
Cold-formed angle.

vertical leg, horizontal leg, thickness, radius

```
\TikZSectionsAngle[verticalleg=100,horizontalleg=60,thickness=2,radius=4,scale=0.04]
```

\TikZSectionsLippedAngle

Cold-formed angle with a lip at the horizontal leg tip.



vertical leg, horizontal leg, lip, thickness, radius

```
\TikZSectionsLippedAngle[verticalleg=100,horizontalleg=60,lip=20,thickness=2,radius=4,scale=0.04]
```

\TikZSectionsRHS

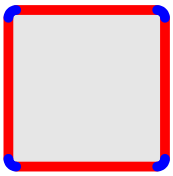
Rectangular hollow section. Set `filled=true` for a grey fill behind the outline.

depth, width, thickness, radius, filled

```
\TikZSectionsRHS[depth=120,width=70,thickness=2,radius=4,filled=true,scale=0.04]
```

\TikZSectionsSHS

Square hollow section.

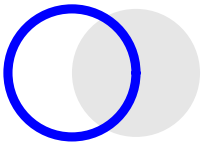


width, thickness, radius, filled

```
\TikZSectionsSHS[width=80,thickness=2,radius=4,filled=true,scale=0.04]
```

\TikZSectionsCHS

Circular hollow section.



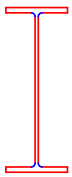
radius, thickness, filled

```
\TikZSectionsCHS[radius=35,thickness=2,filled=true,scale=0.04]
```

10.2 Hot-Rolled Steel

\TikZSectionsUniversalBeam

Rolled I-section/universal beam sketch.

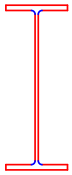


depth, width, flange thickness, web thickness, root radius

```
\TikZSectionsUniversalBeam[depth=61.2,width=22.9,flangethickness=1.96,webthickness=1.19,rootradius=1.4,scale=0.16]
```

\TikZSectionsUniversalColumn

Rolled I-section/universal column sketch.

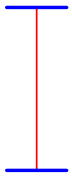


depth, width, flange thickness, web thickness, root radius

```
\TikZSectionsUniversalColumn[depth=61.2,width=22.9,flangethickness=1.96,webthickness=1.19,rootradius=1.4,scale=0.16]
```

\TikZSectionsWeldedI

Fabricated I-section with independent flange dimensions.

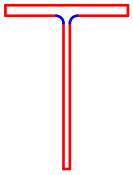


web depth, web thickness, top flange width, top flange thickness, bottom flange width, bottom flange thickness

```
\TikZSectionsWeldedI[webdepth=95,webthickness=1,topflangewidth=35,topflangethickness=2,bottomflangewidth=35,bottomflangethickness=2,scale=0.1]
```

\TikZSectionsTee

Hot-rolled tee section.



depth, width, flange thickness, web thickness, root radius

```
\TikZSectionsTee[depth=30.6,width=22.9,flangethickness=1.96,webthickness=1.19,rootradius=1.4,scale=0.2]
```

\TikZSectionsHRSChannel

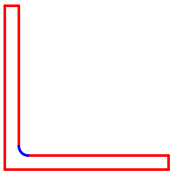
Hot-rolled channel.

depth, width, flange thickness, web thickness, root radius

```
\TikZSectionsHRSChannel[depth=61.2,width=22.9,flangethickness=1.96,webthickness=1.19,rootradius=1.4,scale=0.16]
```

\TikZSectionsEqualAngle

Hot-rolled equal angle.

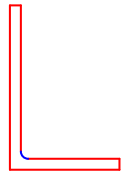


leg, thickness, root radius

```
\TikZSectionsEqualAngle[leg=35,thickness=3,rootradius=2,scale=0.18]
```

\TikZSectionsUnequalAngle

Hot-rolled unequal angle.



vertical leg, horizontal leg, thickness, root radius

```
\TikZSectionsUnequalAngle[verticalleg=45,horizontalleg=30,thickness=3,rootradius=2,scale=0.18]
```

\TikZSectionsPlate

Plate rectangle.

width, thickness, filled, reference line width

```
\TikZSectionsPlate[width=40,thickness=8,filled=true,scale=0.2]
```

\TikZSectionsFlatBar

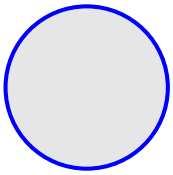
Flat bar.

width, thickness, filled, reference line width

```
\TikZSectionsFlatBar[width=40,thickness=8,filled=true,scale=0.2]
```

\TikZSectionsRoundBar

Round bar.

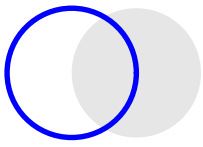


radius, line width, filled

```
\TikZSectionsRoundBar[radius=10,linewidth=1,filled=true,scale=0.2]
```

\TikZSectionsHRSCHS

Hot-rolled circular hollow section.



radius, thickness, filled

```
\TikZSectionsHRSCHS[radius=20,thickness=3,filled=true,scale=0.18]
```

\TikZSectionsHRSRHS

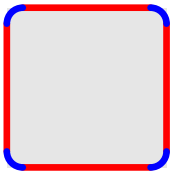
Hot-rolled rectangular hollow section.

depth, width, thickness, root radius, filled

```
\TikZSectionsHRSRHS[depth=50,width=35,thickness=3,rootradius=4,filled=true,scale=0.18]
```

\TikZSectionsHRSSHS

Hot-rolled square hollow section.



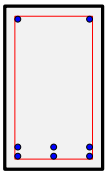
width, thickness, root radius, filled

```
\TikZSectionsHRSSHS[width=40,thickness=3,rootradius=4,filled=true,scale=0.18]
```

10.3 Reinforced Concrete

\TikZRCRectangular

Rectangular concrete section with top, bottom, and optional side bars.

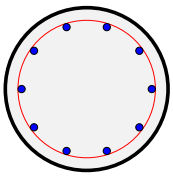


width, depth, cover, bar diameter, top bars, bottom bars, left bars, right bars

```
\TikZRCRectangular[width=300,depth=500,cover=40,bardiameter=18,topbars=2,bottombars=3,bottomlayers=2,layerspacing=28,scale=0.025]
```

\TikZRCCircular

Circular concrete section with perimeter bars.

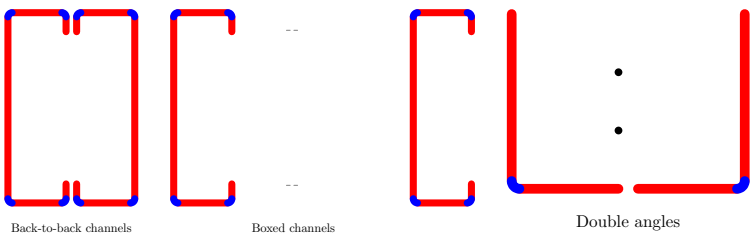


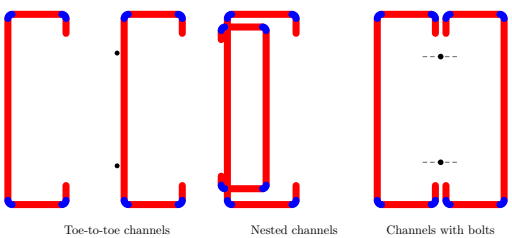
diameter, cover, bar diameter, perimeter bars, tie

```
\TikZRCCircular[diameter=450,cover=45,bardiameter=20,perimeterbars=10,scale=0.025]
```

11 Composing Sections With TikZ

TikZ-Sections focuses on single-section primitives. Built-up assemblies should be made with ordinary TikZ scopes and transforms so users can compose any combination without package-specific built-up commands.






```
\begin{tikzpicture}
  \TikZSectionsChannel[
    depth=180,
```

```
    flange=55,
    lip=18,
    thickness=2,
    radius=4,
    scale=0.03
  ]
  \begin{scope}[shift={(4,0)}, xscale=-1]
    \TikZSectionsChannel[
      depth=180,
      flange=55,
      lip=18,
      thickness=2,
      radius=4,
      scale=0.03
    ]
  \end{scope}
\end{tikzpicture}
```

The same composition pattern can be used for toe-to-toe channels, nested channels, bolts, weld marks, or plates. TikZ additions are drawn in the same picture as the section commands, so the package does not need a separate built-up command family for each assembly.

12 Positional Helper Commands

The following lower-level helper commands use positional arguments and therefore are less self-documenting than the public key-value API.

Command	Positional arguments
`\csCFSChannel`	depth, flange, thickness, radius
`\csCFSLippedChannel`	depth, flange, lip, thickness, radius
`\csCFSChannelGeneral`	depth, top flange, top lip, bottom flange, bottom lip, thickness, radius
`\csCFSEdgeStiffenedChannel`	depth, flange, lip, thickness, radius
`\csCFSChannelWithOneStiffener`	depth, top flange, top lip, bottom flange, bottom lip, thickness, radius, position
`\csCFSChannelWithTwoStiffeners`	depth, top flange, top lip, bottom flange, bottom lip, thickness, radius
`\csCFSChannelWithThreeStiffeners`	depth, top flange, top lip, bottom flange, bottom lip, thickness, radius, position
`\csCFSZee`	depth, flange, thickness, radius
`\csCFSLippedZee`	depth, flange, lip, thickness, radius
`\csCFSZeeGeneral`	depth, top flange, top lip, bottom flange, bottom lip, thickness, radius
`\csCFSSigma`	depth, top flange, top lip, bottom flange, bottom lip, thickness, radius
`\csCFSHat`	depth, left flange, width, right flange, thickness, radius
`\csCFSAngle`	vertical leg, horizontal leg, thickness, radius
`\csCFSLippedAngle`	vertical leg, horizontal leg, thickness, radius, lip
`\csCFSBox`, `\csCFSRHS`	depth, width, thickness, radius
`\csCFSSHS`	width, thickness, radius
`\csCFSCHS`	radius, thickness
`\csCFSFoldedPlate`	point list, thickness
`\csHRSUniversalBeam`, `\csHRSUniversalColumn`, `\csHRSISection`	depth, width, flange thickness, web thickness, root radius
`\csHRSWeldedI`	web depth, web thickness, bottom flange width, bottom flange thickness, top flange width, top flange thickness
`\csHRSTee`, `\csHRSChannel`	depth, width, flange thickness, web thickness, root radius
`\csHRSEqualAngle`	leg, thickness, root radius
`\csHRSUnequalAngle`	vertical leg, horizontal leg, thickness, root radius
`\csHRSPlate`, `\csHRSFlatBar`	width, thickness, reference line width
`\csHRSRoundBar`, `\csHRSCHS`	radius, thickness or line width
`\csHRSRHS`	depth, width, thickness, root radius
`\csHRSSHS`	width, thickness, root radius

13 Current Limitations

- The `dimensions=true` feature is currently a mix of section-specific legends for channel and zee commands and the older generic overlay for other families. It is not yet a standard-based engineering dimensioning system.

- RC cross-sections are schematic. Stirrups are drawn around the outside edge of the longitudinal bar envelope, but beam elevations, column elevations, slab/wall detailing, and reinforcement spacing along member length remain future work.
- The `simplified` and `detailed` mode contract is defined first for CFS channel, stiffened-channel, zee, and sigma inputs. Detailed rolled-radius behavior is still future work.
- Generated figures are schematic cross-section sketches. They are not section-property calculators and do not validate engineering dimensions.