TEKLA
A TRIMBLE COMPANY

Tekla Structures

Reinforcement Guide

Product version 21.0
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Contents

1 Reinforcement creation

Once you have created a model of concrete parts, you will need to reinforce the parts to gain higher strength for the parts.

In Tekla Structures, you can use different methods to create reinforcement.

You can manually create

- single reinforcing bars
- reinforcing bar groups

  For more automated reinforcing bar group creation you can also use **Shape Catalog** which contains predefined reinforcement shapes.
- reinforcement meshes

In addition, Tekla Structures contains various *reinforcement components*. We recommend that you use reinforcement components to create reinforcement whenever possible. They are adaptive, attached to a concrete part, and updated automatically if the dimensions of the reinforced part change, for example. Then create additional reinforcing bars using other tools. In many cases there is not one tool that does everything but you need to use several combinations of tools to get desired reinforcement results.

Reinforcement creation methods

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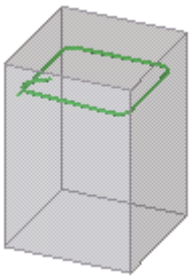
1.1 Creating a reinforcing bar

To create a reinforcing bar:

1. Click  or **Detailing** --> **Create Reinforcement** --> **Reinforcing Bar** .
2. Select the part to reinforce.
3. Pick the bar start point.
4. Pick the other bar reference points to set the bar shape.
5. Click the middle mouse button to finish picking.

   Tekla Structures attaches the bar to this part.



6. If you want to modify the reinforcement, do one of the following:
   - Use direct modification. Ensure that the **Direct modification** switch  is active.
   - Double-click the reinforcement to open the **Reinforcing Bar Properties** dialog box and modify the properties.

Reinforcing bar properties

Use the **Reinforcing Bar Properties** dialog box to view and modify the properties of reinforcing bars. The file name extension of the properties file is `.rbr`.

General tab

Option	Description	
Bar prefix and start number	Mark series of the reinforcing bar.	
Name	User-definable name of the bar. Tekla Structures uses bar names in reports and drawing lists, and to identify bars of the same type.	
Size	Diameter of the bar. Depending on the environment, the nominal diameter of the bar, or a mark that defines the diameter.	Size-grade-radius combinations are predefined in the reinforcing bar catalog. Click the **Select** button to open the **Select Reinforcing Bar** dialog box. The dialog box shows the available bars sizes for the chosen grade. You can also select whether the bar is a main bar or a stirrup or tie. The `rebar_database.inp` file contains the predefined reinforcing bar catalog entries.
Grade	Steel grade of the bar.	
Bending radius	Internal radius of the bends in the bar. You can enter a separate value for each bar bend. Separate the values with spaces. Bending radius complies with the design code you are using. Main bars, stirrups, ties, and hooks usually have their own minimum internal bending radii, which are proportional to the diameter of the reinforcing bar. The actual bending radius is normally chosen to suit the size of the mandrels on the bar-bending machine.	
Class	Used to group reinforcement. For example, you can display bars of different classes in different colors.	
Hooks Shape	Shape of the hook.	The `rebar_database.inp` file contains the predefined minimum bending radius and minimum hook length for all standard hooks. See Adding hooks to reinforcing bars on page 11.
Hooks Angle	Angle of a custom hook	
Hooks Radius	Internal bending radius of a standard hook or custom hook.	
Hooks Length	Length of the straight part of a standard or custom hook.	
Cover thickness on plane	Distances from the part surfaces to the bar on the same plane as the bar.	See Defining the reinforcement cover thickness on page 13.
Cover thickness from plane	Distance from the part surface to the bar, or bar end, perpendicular to the bar plane.	

Option	Description	
Start	Concrete cover thickness or leg length at the first end of the bar.	
End	Concrete cover thickness or leg length at the second end of the bar.	
User-defined attributes	You can create user-defined attributes to add information about reinforcement. Attributes can consist of numbers, text, or lists. You can use the values of user-defined attributes in reports and drawings. You can also change the name of the fields, and add new ones, by editing the `objects.inp` file. See Customizing user-defined attributes.	

See also Creating a reinforcing bar group on page 8

Creating a reinforcing bar group using Shape Catalog on page 18

Modifying the shape of a reinforcement using direct modification on page 57

1.2 Creating a reinforcing bar group

A reinforcing bar group includes several identical, or very similar, reinforcing bars. Tekla Structures always treats these bars as a group, modifies them in the same way, deletes them all at the same time, and so on. You first define the shape of a single bar, then the direction in which Tekla Structures distributes the bars.

If you do not want to manually define the bar shape, you can use **Shape Catalog** and its predefined reinforcement shapes instead.

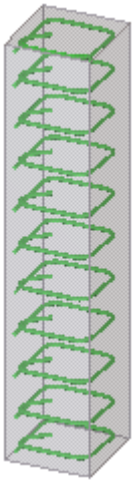
To create a reinforcing bar group:

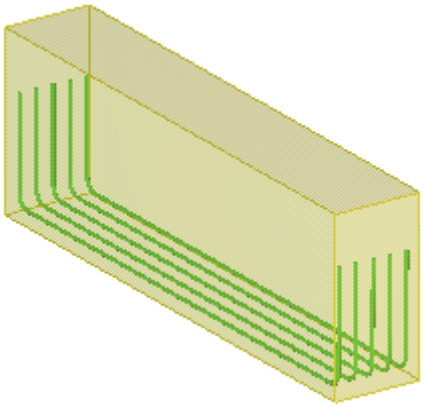
1. Click  or **Detailing** --> **Create Reinforcement** --> **Reinforcing Bar Group** .
2. Select the part to reinforce.

   Tekla Structures attaches the bar group to this part.
3. Pick the bar start point.
4. Pick the other bar reference points.

   These points define the plane of the first bar and the shape of a single bar in the group.
5. Click the middle mouse button to finish picking.
6. Pick the start point of the bar group.
7. Pick the end point of the bar group.

The start and end points indicate the distribution length and direction of the bars. Usually the distribution length of the bars is perpendicular to the plane so that the cover thickness on the sides can be defined.





8. If you want to modify the reinforcement, do one of the following:
   - Use direct modification. Ensure that the **Direct modification** switch  is active.
   - Double-click the reinforcement to open the **Reinforcing Bar Properties** dialog box and modify the properties.

Reinforcing bar group properties General tab

Use the **Reinforcing Bar Properties** dialog box to view and modify the properties of the reinforcing bar groups. The file name extension of the properties file is `.rbg`.

Option	Description
Bar prefix and start number	Mark series of the reinforcing bar.
Name	User-definable name of the bar. Tekla Structures uses bar names in reports and drawing lists, and to identify bars of the same type.

Option	Description	
Size	Diameter of the bar. Depending on the environment, the nominal diameter of the bar, or a mark that defines the diameter.	Size-grade-radius combinations are predefined in the reinforcing bar catalog. Click the **Select** button to open the **Select Reinforcing Bar** dialog box. The dialog box shows the available bars sizes for the chosen grade. You can also select whether the bar is a main bar or a stirrup or tie. The `rebar_database.inp` file contains the predefined reinforcing bar catalog entries.
Grade	Steel grade of the bar.	
Bending radius	Internal radius of the bends in the bar. You can enter a separate value for each bar bend. Separate the values with spaces. Bending radius complies with the design code you are using. Main bars, stirrups, ties, and hooks usually have their own minimum internal bending radii, which are proportional to the diameter of the reinforcing bar. The actual bending radius is normally chosen to suit the size of the mandrels on the bar-bending machine.	
Class	Used to group reinforcement. For example, you can display bars of different classes in different colors.	
Hooks Shape	Shape of the hook.	The `rebar_database.inp` file contains the predefined minimum bending radius and minimum hook length for all standard hooks. See Adding hooks to reinforcing bars on page 11.
Hooks Angle	Angle of a custom hook	
Hooks Radius	Internal bending radius of a standard hook or custom hook.	
Hooks Length	Length of the straight part of a standard or custom hook.	
Cover thickness on plane	Distances from the part surfaces to the bar on the same plane as the bar.	See Defining the reinforcement cover thickness on page 13.
Cover thickness from plane	Distance from the part surface to the bar, or bar end, perpendicular to the bar plane.	
Start	Concrete cover thickness or leg length at the first end of the bar.	
End	Concrete cover thickness or leg length at the second end of the bar.	
User-defined attributes	You can create user-defined attributes to add information about reinforcement. Attributes can consist of numbers, text, or lists.	

Option	Description
	You can use the values of user-defined attributes in reports and drawings. You can also change the name of the fields, and add new ones, by editing the `objects.inp` file. See Customizing user-defined attributes.

Group tab

Option	Description	
Creation method	How the bars are spaced.	See Spacing reinforcing bars in a group on page 14.
Number of reinforcing bars		
Target spacing value		
Exact spacing value		
Exact spacing values		
Reinforcing bar(s) not to be created to the group	Which bars are omitted from the group.	See Omitting reinforcing bars from a group on page 18.
Rebar group type	What is the type of the group.	See Creating a tapered or spiral reinforcing bar group on page 16.
Number of cross sections		

See also

Creating a reinforcing bar group using Shape Catalog on page 18

Creating a curved reinforcing bar group on page 27

Creating a circular reinforcing bar group on page 30

Creating a tapered or spiral reinforcing bar group on page 16

Modifying the shape of a reinforcement using direct modification on page 57

Adding hooks to reinforcing bars

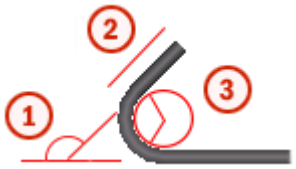
You can add hooks to the ends of reinforcing bars for anchoring purposes.

To add hooks to reinforcing bars, do one of the following:

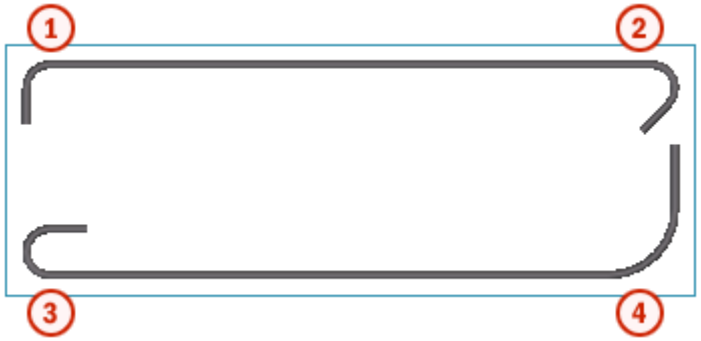
To	Do this
Add hooks using direct modification	1. Ensure that the **Direct modification** switch  is active. 2. Select a single reinforcing bar or a reinforcing bar group.

To	Do this
	3. Right-click the start or end point of the reinforcing bar  . A toolbar for hook properties appears. 4. Select the desired shape for the hook. 5. If you select **Custom hook**, enter the angle, radius, and length for the hook. Click  .
Add hooks using the **Reinforcing Bar Properties** dialog box	1. Select a single reinforcing bar or a reinforcing bar group. 2. Double-click the reinforcement to open the **Reinforcing Bar Properties** dialog box. 3. Select a hook type from the **Shape** list. 4. If you select **Custom hook**, enter the angle, radius and length for the hook. 5. Click **Modify**.

For custom hooks you need to enter the hook information:

Option	Description	
Angle	Enter a value between -180 and +180 degrees.	 1. Angle 2. Length 3. Radius
Radius	Enter the internal bending radius of the hook. Use the same radius for the hook and for the reinforcing bar. If the hook and the reinforcing bar have different radiuses, Tekla Structures does not recognize the shape of the bar.	
Length	Enter the length of the straight part. If the length is set to zero, no hooks are created.	

Hook examples



1. Standard 90-degree hook
2. Standard 135-degree hook
3. Standard 180-degree hook
4. Custom hook

If you select a standard hook, the **Angle**, **Radius**, and **Length** use predefined dimensions.

The `rebar_database.inp` file contains the predefined minimum bending radius and minimum hook length for all standard hooks.

See also Creating a reinforcing bar group on page 8

Creating a reinforcing bar group using Shape Catalog on page 18

Modifying the shape of a reinforcement using direct modification on page 57

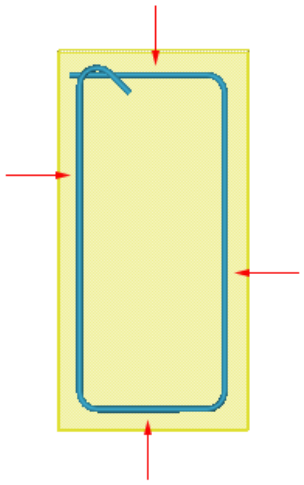
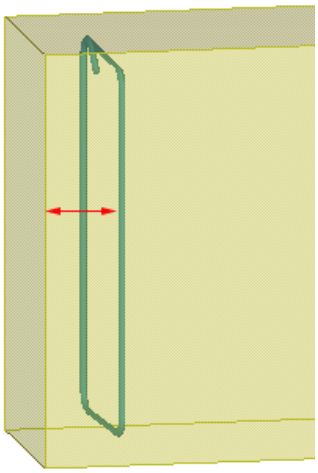
Defining the reinforcement cover thickness

Reinforcing bars need a concrete cover to protect them against harmful elements, such as the weather and fire. When you create single bars, Tekla Structures uses the thickness of concrete cover to determine the position of the bar.

To define the reinforcement cover thickness, do one of the following:

To	Do this
Change the cover thickness using the direct modification tools	Drag a line handle to the desired location. 
Change the cover thickness using the **Reinforcing Bar Properties** dialog box	1. Select a single reinforcing bar, a reinforcing bar group, or a mesh. 2. Double-click the reinforcement to open the **Reinforcing Bar Properties** dialog box. 3. Define the reinforcing bar cover thickness in the **Cover thickness** area. The cover thickness can be defined in three directions: • On plane, that is, the distance from beam's bottom, top, and side surfaces to the bar. You can enter several values. Enter the values in the order you pick the points to create the bar. If you enter less values than there are bar legs, Tekla Structures uses the last value for the remaining legs.

To	Do this
	• From plane, that is, the distance from the end surface of the beam to the bar. If the reinforcing bar is outside the part, enter a negative value in the **On Plane** and/or the **From Plane** boxes. • In the longitudinal direction of the bar, that is, start and end. To define the length of an ultimate leg of a bar, use the **Leg length** option and the **Snap to nearest points** switch. Then pick anywhere on a part edge or line to indicate the direction for the bar leg. 4. Click **Modify**.

On plane	From plane	Start and end
		

See also

Creating a reinforcing bar group on page 8

Creating a reinforcing bar group using Shape Catalog on page 18

Reinforcement modification on page 57

Spacing reinforcing bars in a group

There are several ways to distribute bars in a reinforcing bar group.

Use the **Creation method** list on the **Group** tab in the **Reinforcing Bar Properties** dialog box to define the bar spacings.

Option	Description	Example
Equal distribution by number of reinforcing bars	Enter the number of reinforcing bars. Tekla Structures divides the available distance by the number of bars. Enter the number of bars in the **Number of reinforcing bars** box.	
Equal distribution by target spacing value	Enter a spacing value. Tekla Structures aims the spacing value as close as possible to the value in the **Target spacing value** box.	
By exact spacing value with flexible first	Enter the spacing value in the **Exact spacing value** box. Creates fixed, regular spaces between the bars. The first space adjusts to even out the bar distribution. If the first space is less than 10% of the exact spacing value, Tekla Structures removes one bar.	
By exact spacing value with flexible last space	Enter the spacing value in the **Exact spacing value** box. Creates fixed, regular spaces between the bars. The last space adjusts to even out bar distribution.	
By exact spacing value with flexible middle space	Enter the spacing value in the **Exact spacing value** box. Creates fixed, regular spaces between the bars. The middle space adjusts to even out bar distribution. If there are an odd number of bars (two middle spaces), the other middle space adjusts to even out bar distribution.	
By exact spacing value with flexible first and last space	Enter the spacing value in the **Exact spacing value** box. Creates fixed, regular spaces between the bars. Both the first and last spaces adjust to even out bar distribution.	

Option	Description	Example
By exact spacings	Enter the spacing values manually in the **Exact spacing values** box. Use multiplication to repeat spacings, for example, `5*200` to create five spaces of `200`.	

See also

Creating a reinforcing bar group on page 8

Creating a reinforcing bar group using Shape Catalog on page 18

Modifying the shape of a reinforcement using direct modification on page 57

Creating a tapered or spiral reinforcing bar group

For rectangular concrete parts it is sufficient to pick two points to define the distribution area of the reinforcing bar group. If the part shape is not rectangular, an alternative shape can be selected.

Use the **Rebar group type** list on the **Group** tab in the **Reinforcing Bar Properties** dialog box to select and modify the reinforcing group types.

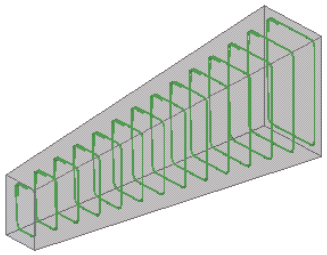
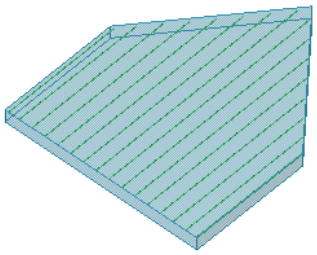
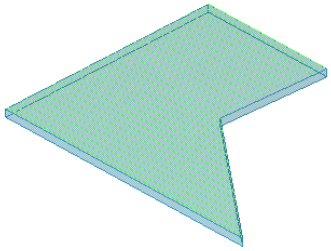
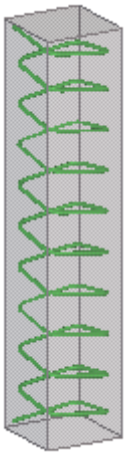
To create a tapered or spiral reinforcing bar group:

1. Click **Detailing** --> **Properties** --> **Reinforcement** --> **Reinforcing Bar Group...** .
2. Enter or modify the bar group properties.
3. On the **Group** tab, select an option from the **Bar group type** list.
4. Click **OK**.
5. Select the part to reinforce.

   Tekla Structures attaches the bar group to the part.
6. Pick points to define the shape of the bar at the first cross section.
7. Click the middle mouse button to finish picking.
8. For the second and subsequent cross sections, pick points to define the shape of the bar.
9. Click the middle mouse button to finish picking.

Reinforcing bar group types

Option	Description	Example
 Normal	Not tapered. Pick two points to define the distribution area of the bar group.	

Option	Description	Example
 Tapered	One bar dimension changes linearly in the group.	
 Tapered ridge	One bar dimension changes linearly in the group. The dimension is longest in the middle of the group.	
 Tapered curved	One bar dimension changes along a curve. The dimension is longest in the middle of the group.	
 Tapered N	One bar dimension changes linearly between N ridges. Enter the number of ridges in the **Number of cross sections** box.	
 Spiral	The reinforcing bars rise in a polygonal or circular shape along the longitudinal axis of the part.	

See also Creating a reinforcing bar group on page 8

Creating a reinforcing bar group using Shape Catalog on page 18

Reinforcing bar and bar group properties on page 50

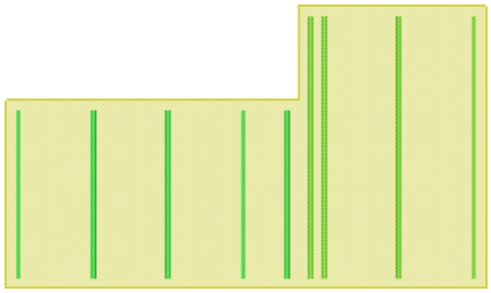
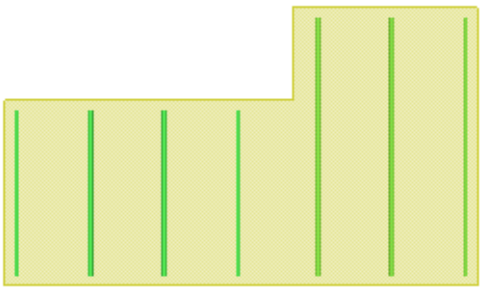
Modifying the shape of a reinforcement using direct modification on page 57

Omitting reinforcing bars from a group

You may occasionally need to omit specific reinforcing bars. For example, when several reinforced areas intersect, causing reinforcing bars to overlap, or when you want to start bar distribution at a specific distance from the end of a part.

Use the **Reinforcing bar(s) not to be created to the group** list on the **Group** tab in the **Reinforcing Bar Properties** dialog box to select which bars to omit.

For example:

Before omitting	After omitting
Two reinforcing bar groups have been added to a concrete beam: • one bar group with flexible last space • one bar group with flexible first space 	Two reinforcing bar groups after omitting: • one bar group with the last bar omitted • one bar group with the first bar omitted 

See also Creating a reinforcing bar group on page 8

Creating a reinforcing bar group using Shape Catalog on page 18

Modifying the shape of a reinforcement using direct modification on page 57

1.3 Creating a reinforcing bar group using Shape Catalog

A reinforcing bar group includes several identical, or very similar, reinforcing bars. You can create a reinforcing bar group by selecting a predefined reinforcement shape from **Reinforcing Bar Shape Catalog**. The predefined shapes in **Reinforcing Bar Shape Catalog** are based on the shapes that have been defined in **Rebar Shape Manager** and saved in the `RebarShapeRules.xml` file.

Reinforcing Bar Shape Catalog does not work with tapered reinforcing bar groups.

If you do not want to use the predefined shapes but want to manually define the bar shape, use the **Create Reinforcing Bar Group** command instead.

To create a reinforcing bar group using predefined reinforcement shapes:

1. Click **Detailing** --> **Create Reinforcement** --> **Shape Catalog** .
2. Select one of the predefined shapes from the tree view on the left.

   You can add frequently used shapes to the tree view, or delete the shapes that you do not need. See Adding more reinforcement shapes to the tree view in Shape Catalog on page 22.

   If you select an existing reinforcement in the model and click the **Get** button, the properties of that reinforcement are displayed in the **Reinforcing Bar Shape Catalog** dialog box.
3. If needed, modify the bar properties.

   Length of leg can be entered with or without parenthesis.

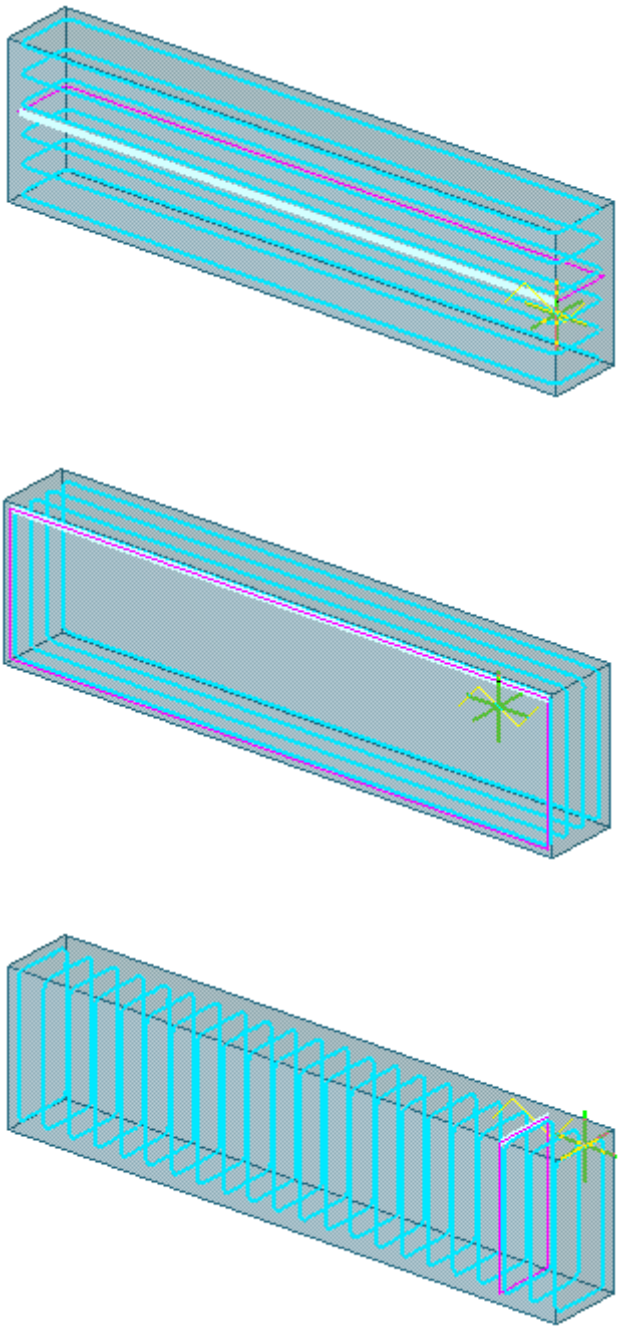
   - With parenthesis: the leg length is calculated automatically according to the object dimensions.
   - Without parenthesis: the exact value of the leg length is used.

     The hook properties are visible only if you have set the advanced option `XS_REBAR_RECOGNITION_HOOKS_CONSIDERATION` to `FALSE` in **Tools** --> **Options** --> **Advanced Options...** .

   For circular, polygonal and spiral reinforcement you can enter **Diameter** and **Overlap distance** instead of **Length of leg**.
4. If needed, set the reference point of the reinforcement to start, middle, or end by double-clicking the different legs or hooks in the preview of the shape.

   See Setting the reinforcement reference point in Shape Catalog on page 23.
5. Click **OK** to close the **Reinforcing Bar Shape Catalog** dialog box.
6. In the model, place the mouse pointer over a part face or edge.

A preview showing the placing and dimensions of the reinforcement is displayed.



7. Based on the preview, select a placing for the reinforcing bar group and click the left mouse button.

   Tekla Structures creates the reinforcement.

8. If you want to modify the reinforcement, do one of the following:

   - Use direct modification. Ensure that the **Direct modification** switch  is active.

- Double-click the reinforcement to open the **Reinforcing Bar Properties** dialog box and modify the properties.

Reinforcing bar group properties General tab

Use the **Reinforcing Bar Properties** dialog box to view and modify the properties of reinforcing bar groups. The file name extension of the properties file is `.rbg`.

Option	Description	
Bar prefix and start number	Mark series of the reinforcing bar.	
Name	User-definable name of the bar. Tekla Structures uses bar names in reports and drawing lists, and to identify bars of the same type.	
Size	Diameter of the bar. Depending on the environment, the nominal diameter of the bar, or a mark that defines the diameter.	Size-grade-radius combinations are predefined in the reinforcing bar catalog. Click the **Select** button to open the **Select Reinforcing Bar** dialog box. The dialog box shows the available bars sizes for the chosen grade. You can also select whether the bar is a main bar or a stirrup or tie. The `rebar_database.inp` file contains the predefined reinforcing bar catalog entries.
Grade	Steel grade of the bar.	
Bending radius	Internal radius of the bends in the bar. You can enter a separate value for each bar bend. Separate the values with spaces. Bending radius complies with the design code you are using. Main bars, stirrups, ties, and hooks usually have their own minimum internal bending radii, which are proportional to the diameter of the reinforcing bar. The actual bending radius is normally chosen to suit the size of the mandrels on the bar-bending machine.	
Class	Used to group reinforcement. For example, you can display bars of different classes in different colors.	
Hooks Shape	Shape of the hook.	The `rebar_database.inp` file contains the predefined minimum bending radius and minimum hook length for all standard hooks. See Adding hooks to reinforcing bars on page 11.
Hooks Angle	Angle of a custom hook	
Hooks Radius	Internal bending radius of a standard hook or custom hook.	
Hooks Length	Length of the straight part of a standard or custom hook.	

Option	Description	
Cover thickness on plane	Distances from the part surfaces to the bar on the same plane as the bar.	See Defining the reinforcement cover thickness on page 13.
Cover thickness from plane	Distance from the part surface to the bar, or bar end, perpendicular to the bar plane.	
Start	Concrete cover thickness or leg length at the first end of the bar.	
End	Concrete cover thickness or leg length at the second end of the bar.	
User-defined attributes	You can create user-defined attributes to add information about reinforcement. Attributes can consist of numbers, text, or lists. You can use the values of user-defined attributes in reports and drawings. You can also change the name of the fields, and add new ones, by editing the `objects.inp` file. See Customizing user-defined attributes.	

Group tab

Option	Description	
Creation method	How the bars are spaced.	See Spacing reinforcing bars in a group on page 14.
Number of reinforcing bars		
Target spacing value		
Exact spacing value		
Exact spacing values		
Reinforcing bar(s) not to be created to the group	Which bars are omitted from the group.	See Omitting reinforcing bars from a group on page 18.
Rebar group type	What is the type of the group.	See Creating a tapered or spiral reinforcing bar group on page 16.
Number of cross sections		

See also Creating a reinforcing bar group on page 8

Adding more reinforcement shapes to the tree view in Shape Catalog

You can modify the tree view in **Reinforcing Bar Shape Catalog** by adding frequently used shapes to the tree, or deleting the shapes that you do not need.

To add more reinforcement categories or shapes to the tree view in **Reinforcing Bar Shape Catalog**:

1. Click **Detailing** --> **Create Reinforcement** --> **Shape Catalog** .
2. Click **Organize catalog...**.
3. Create a new category folder by clicking  .
4. Drag and drop the selected shapes to the folder.

   If multiple shapes have the same shape code and you drag them to the categories, the shape codes get a suffix **(1)**, **(2)**, and so on. You can rename the shapes as you wish by right-clicking the shape and entering a new name or suffix, for example, **(a)**, **(b)**.

   When the shapes are listed in a report, they all get the same shape code.
5. Change the name of the folder, if needed.
6. Click **OK**.

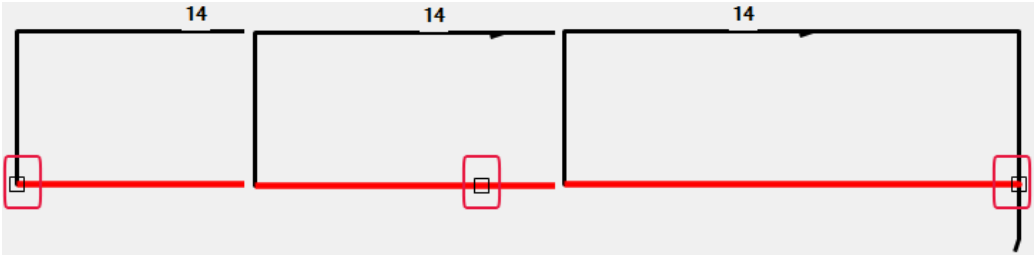
See also Creating a reinforcing bar group using Shape Catalog on page 18

Setting the reinforcement reference point in Shape Catalog

When you use **Reinforcing Bar Shape Catalog** and select a shape, you can set the reference point to the start, middle or end of the reinforcing bar leg. When you create the reinforcement in the model, you can move the reinforcement to a new location by dragging the reference point. This is useful, for example, when the reinforcing bar legs are of certain length and you want to aim the reference point, for example, to the middle of a part edge. You can also move the reference point of circular reinforcement shapes.

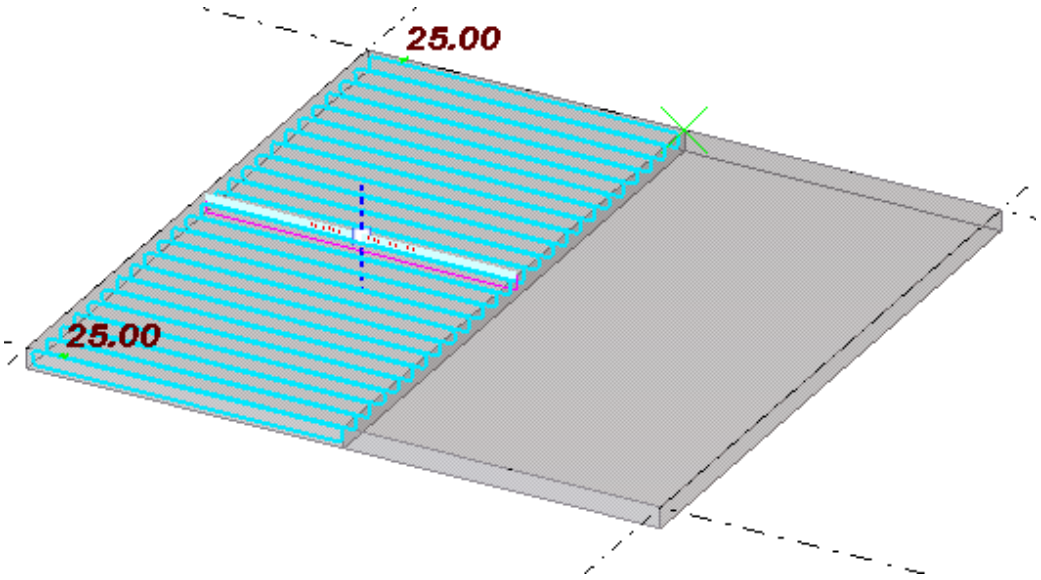
To set the reference point and move the reinforcement by dragging the reference point:

1. Click **Detailing** --> **Create Reinforcement** --> **Shape Catalog** .
2. Select a reinforcement shape.
3. Set the reference point to the desired location (start, middle, end) by double-clicking the position in the preview of the shape.

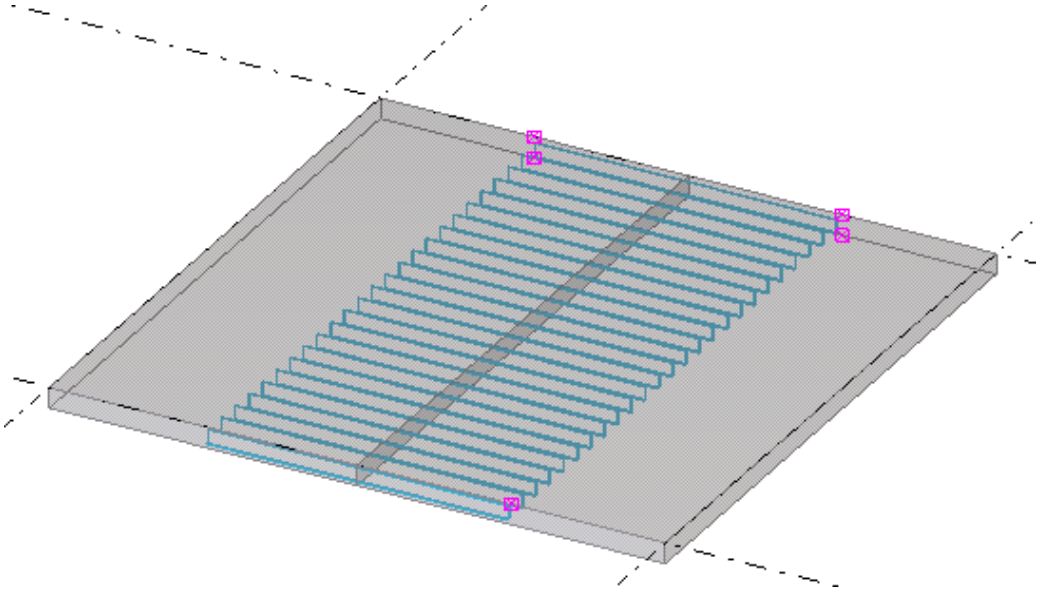


4. If needed, modify the bar properties.
5. Click **OK**.
6. In the model, place the mouse pointer over a part face or edge.
7. Based on the preview, select the desired placing and hold down the **Alt** key and click the left mouse button.

   The reference point is displayed.



8. Move the reinforcement to a new location by dragging the reference point.
9. Click the **Create** button on the floating toolbar to create the reinforcement.



For circular reinforcement you can set the reference point to the center line as follows:

a. Place the mouse pointer over a column edge to have the reinforcement oriented correctly.
b. Hold down the **Alt** key and click the left mouse button.
c. Drag the reference point and hold down the **Shift** key to snap to the center of column.
d. Click the **Create** button on the floating toolbar to create the reinforcement.

See also Creating a reinforcing bar group using Shape Catalog on page 18

Reinforcing pour objects using Shape Catalog

You can reinforce pour objects in pour views using **Reinforcing Bar Shape Catalog**.

Reinforcing Bar Shape Catalog is the only method to reinforce pour objects in pour views. If you want to use other reinforcement commands, such as **Create Reinforcing Bar Group**, or reinforcement components, you need to reinforce single parts in part views. All reinforcement are visible both in part views and in pour views.

When you reinforce pour objects:

- The reinforcement is attached to the reinforced part, not to the pour object.
- The reinforcement geometry is defined in accordance with the pour object geometry even though the reinforcement is attached to a part. For example, pour breaks can limit the length of reinforcing bars.
- In reports the reinforcement information is listed according to the part, not to the pour object.

Before you start, create concrete parts whose cast unit type is **Cast in place**. Tekla Structures automatically forms pour objects of them.

To reinforce pour objects:

1. Ensure that you are using a pour view. If not, click the **Pour representation** switch  to show the pour objects.

   By default, the pour objects are shown in pink.
2. If needed, create pour breaks by clicking any of the following buttons:

- **Create pour break using one point**

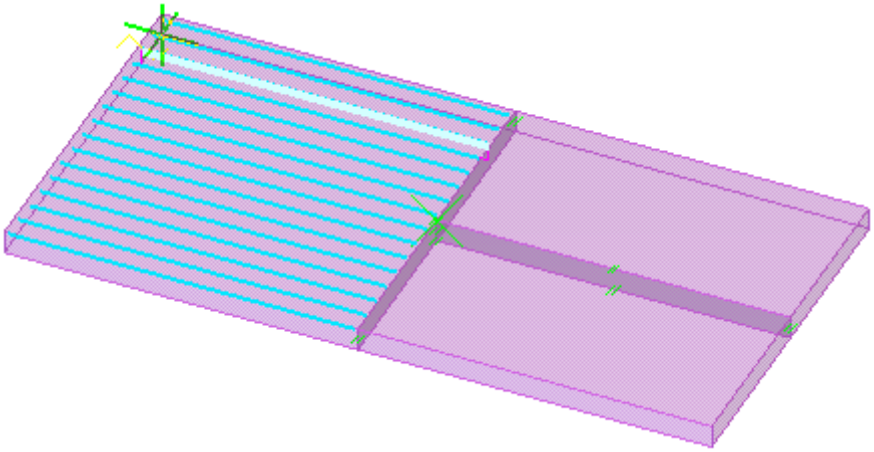
- **Create pour break using two points**

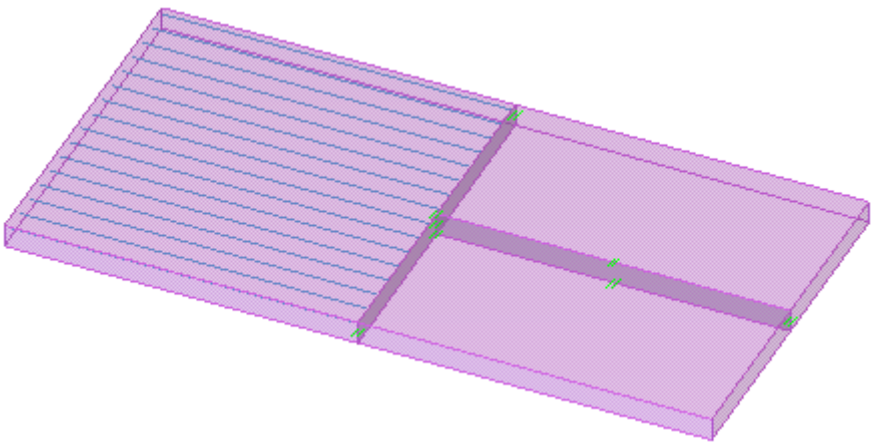
- **Create pour break using multiple points**

3. To insert a reinforcement to a pour object, click **Detailing** --> **Create Reinforcement** --> **Shape Catalog** .
4. In **Reinforcing Bar Shape Catalog**, select a shape from the tree view on the left and modify the properties, if needed.
5. Click **OK**.
6. In the model, place the mouse pointer over a face or an edge of a pour object.



7. Based on the preview, select a placing for the reinforcement and click the left mouse button to create the reinforcement.



See also Creating a reinforcing bar group using Shape Catalog on page 18

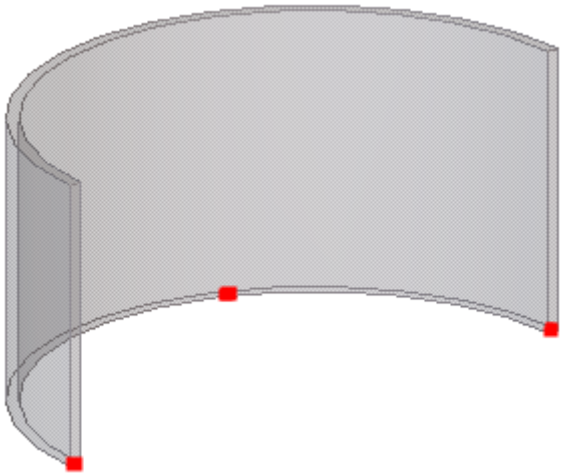
1.4 Creating a curved reinforcing bar group

You can reinforce curved segments in a concrete beam or a curved wall.

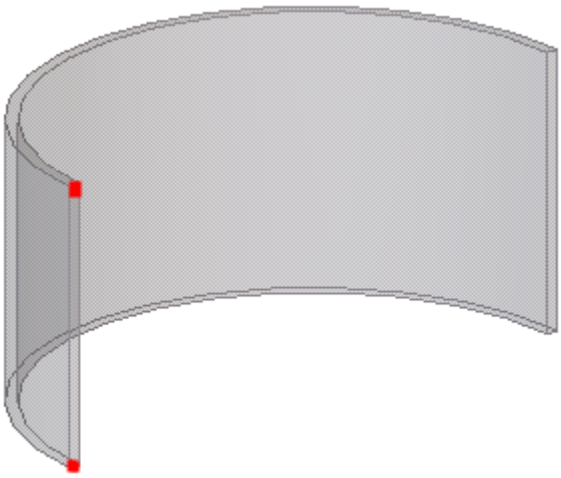
To create a group of curved reinforcing bars:

1. Click **Detailing** --> **Create Reinforcement** --> **Curved Reinforcing Bar Group** .
2. Select the part to reinforce.

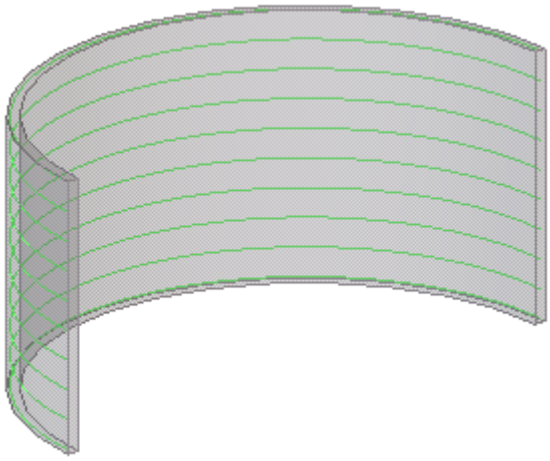
   Tekla Structures attaches the bar group to this part.
3. Pick three points on an arc to define the curve.



4. Pick two points to indicate the distribution direction of the bars.



Tekla Structures creates a group of curved reinforcing bars.



5. If you want to change the curved reinforcing bar group properties:
   a. Double-click the curved reinforcing bar group to open the **Reinforcing Bar Properties** dialog box.
   b. Modify the properties.
   c. Click **Modify**.

Curved reinforcing bar group properties

Use the **Reinforcing Bar Properties** dialog box to view and modify the properties of curved reinforcing bar groups. The file name extension of the properties file is `.rcu`.

General tab

Option	Description	
Bar prefix and start number	Mark series of the reinforcing bar.	
Name	User-definable name of the bar. Tekla Structures uses bar names in reports and drawing lists, and to identify bars of the same type.	
Size	Diameter of the bar. Depending on the environment, the nominal diameter of the bar, or a mark that defines the diameter.	Size-grade-radius combinations are predefined in the reinforcing bar catalog. Click the **Select** button to open the **Select Reinforcing Bar** dialog box. The dialog box shows the available bars sizes for the chosen grade. You can also select whether the bar is a main bar or a stirrup or tie. The `rebar_database.inp` file contains the predefined
Grade	Steel grade of the bar.	
Bending radius	Internal radius of the bends in the bar. You can enter a separate value for each bar bend. Separate the values with spaces. Bending radius complies with the design code you are using. Main bars, stirrups, ties, and hooks usually have	

Option	Description	
	their own minimum internal bending radii, which are proportional to the diameter of the reinforcing bar. The actual bending radius is normally chosen to suit the size of the mandrels on the bar-bending machine.	reinforcing bar catalog entries.
Class	Used to group reinforcement. For example, you can display bars of different classes in different colors.	
Hooks Shape	Shape of the hook.	The `rebar_database.inp` file contains the predefined minimum bending radius and minimum hook length for all standard hooks. See Adding hooks to reinforcing bars on page 11.
Hooks Angle	Angle of a custom hook	
Hooks Radius	Internal bending radius of a standard hook or custom hook.	
Hooks Length	Length of the straight part of a standard or custom hook.	
Cover thickness on plane	Distances from the part surfaces to the bar on the same plane as the bar.	See Defining the reinforcement cover thickness on page 13.
Cover thickness from plane	Distance from the part surface to the bar, or bar end, perpendicular to the bar plane.	
Start	Concrete cover thickness or leg length at the first end of the bar.	
End	Concrete cover thickness or leg length at the second end of the bar.	
User-defined attributes	You can create user-defined attributes to add information about reinforcement. Attributes can consist of numbers, text, or lists. You can use the values of user-defined attributes in reports and drawings. You can also change the name of the fields, and add new ones, by editing the `objects.inp` file. See Customizing user-defined attributes.	

Group tab

Option	Description	
Creation method	How the bars are spaced.	See Spacing reinforcing bars in a group on page 14.
Number of reinforcing bars		
Target spacing value		
Exact spacing value		

Option	Description	
Exact spacing values		
Reinforcing bar(s) not to be created to the group	Which bars are omitted from the group.	See Omitting reinforcing bars from a group on page 18.
Rebar group type	What is the type of the group.	See Creating a tapered or spiral reinforcing bar group on page 16.
Number of cross sections		

See also Creating a reinforcing bar group on page 8

Creating a reinforcing bar group using Shape Catalog on page 18

Creating a circular reinforcing bar group on page 30

Creating a tapered or spiral reinforcing bar group on page 16

Reinforcement modification on page 57

1.5 Creating a circular reinforcing bar group

You can reinforce round circular columns.

To create a circular reinforcing bar group:

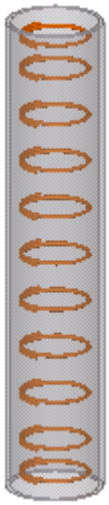
1. Click **Detailing** --> **Create Reinforcement** --> **Circular Reinforcing Bar Group** .
2. Select the part to reinforce.

   Tekla Structures attaches the bar group to this part.
3. Pick three points on the outer contour of the concrete part to define the circular bars.

The radius is automatically calculated from these three points.

4. Pick two points to indicate the distribution direction of the bars.

Tekla Structures creates a group of circular reinforcing bars.



If you want to modify the splice length of the round stirrups, enter negative values in the **Start** and **End** boxes in the **Reinforcing Bar Properties** dialog box.

5. If you want to change the circular reinforcing bar group properties:
   a. Double-click the circular reinforcing bar group to open the **Reinforcing Bar Properties** dialog box.
   b. Modify the properties.
   c. Click **Modify**.

Circular reinforcing bar group properties

Use the **Reinforcing Bar Properties** dialog box to view and modify the properties of circular reinforcing bar groups. The file name extension of the properties file is `.rci`.

General tab

Option	Description	
Bar prefix and start number	Mark series of the reinforcing bar.	
Name	User-definable name of the bar. Tekla Structures uses bar names in reports and drawing lists, and to identify bars of the same type.	
Size	Diameter of the bar. Depending on the environment, the nominal diameter of the bar, or a mark that defines the diameter.	Size-grade-radius combinations are predefined in the reinforcing bar catalog. Click the **Select** button to open the **Select Reinforcing Bar** dialog box. The dialog box shows the available bars sizes for the chosen grade.
Grade	Steel grade of the bar.	
Bending radius	Internal radius of the bends in the bar.	

Option	Description	
	You can enter a separate value for each bar bend. Separate the values with spaces. Bending radius complies with the design code you are using. Main bars, stirrups, ties, and hooks usually have their own minimum internal bending radii, which are proportional to the diameter of the reinforcing bar. The actual bending radius is normally chosen to suit the size of the mandrels on the bar-bending machine.	You can also select whether the bar is a main bar or a stirrup or tie. The `rebar_database.inp` file contains the predefined reinforcing bar catalog entries.
Class	Used to group reinforcement. For example, you can display bars of different classes in different colors.	
Hooks Shape	Shape of the hook.	The `rebar_database.inp` file contains the predefined minimum bending radius and minimum hook length for all standard hooks. See Adding hooks to reinforcing bars on page 11.
Hooks Angle	Angle of a custom hook	
Hooks Radius	Internal bending radius of a standard hook or custom hook.	
Hooks Length	Length of the straight part of a standard or custom hook.	
Cover thickness on plane	Distances from the part surfaces to the bar on the same plane as the bar.	See Defining the reinforcement cover thickness on page 13.
Cover thickness from plane	Distance from the part surface to the bar, or bar end, perpendicular to the bar plane.	
Start	Concrete cover thickness or leg length at the first end of the bar.	
End	Concrete cover thickness or leg length at the second end of the bar.	
User-defined attributes	You can create user-defined attributes to add information about reinforcement. Attributes can consist of numbers, text, or lists. You can use the values of user-defined attributes in reports and drawings. You can also change the name of the fields, and add new ones, by editing the `objects.inp` file. See Customizing user-defined attributes.	

Group tab

Option	Description	
Creation method	How the bars are spaced.	See Spacing reinforcing bars in a group on page 14.
Number of reinforcing bars		
Target spacing value		
Exact spacing value		
Exact spacing values		
Reinforcing bar(s) not to be created to the group	Which bars are omitted from the group.	See Omitting reinforcing bars from a group on page 18.
Rebar group type	What is the type of the group.	See Creating a tapered or spiral reinforcing bar group on page 16.
Number of cross sections		

See also

Creating a reinforcing bar group on page 8

Creating a reinforcing bar group using Shape Catalog on page 18

Creating a curved reinforcing bar group on page 27

Creating a tapered or spiral reinforcing bar group on page 16

Reinforcement modification on page 57

1.6 Creating a rectangular reinforcement mesh

You can create a reinforcement mesh that consists of two perpendicular bar groups. Tekla Structures treats mesh bars as one unit but distinguishes the main and crossing bars.

You cannot change the mesh type once the mesh has been created.

The reinforcement mesh can be rectangular, polygonal or bent.

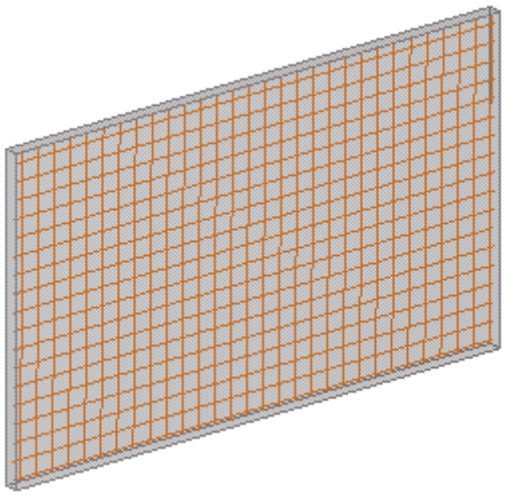
To create a rectangular mesh:

1. Click  or **Detailing** --> **Create Reinforcement** --> **Reinforcement Mesh** .
2. Select the part to reinforce.

   Tekla Structures attaches the mesh to this part.
3. Pick the start point of the mesh.
4. Pick a point to indicate the direction of the longitudinal bars.

5. Click the middle mouse button to finish picking.

   Tekla Structures creates the mesh parallel to the work plane, to the left of the points you picked.



6. If you want to modify the reinforcement mesh, do one of the following:

   - Use direct modification. Ensure that the **Direct modification** switch  is active.
   - Double-click the reinforcement to open the **Reinforcement Mesh Properties** dialog box and modify the properties.

Reinforcement mesh properties

Use the **Reinforcement Mesh Properties** dialog box to view and modify the properties of reinforcement meshes. The file name extension of a reinforcement mesh properties file is `.rbm`.

Option	Description
Mesh prefix and start number	Mark series of the mesh.
Name	User-definable name of the mesh. Tekla Structures uses mesh names in reports and drawing lists.
Mesh	Select a mesh from the mesh catalog. The properties of standard meshes are defined in the `mesh_database.inp` file. You can also use a customized mesh.
Grade	Steel grade of the bars in the mesh.
Class	Used to group reinforcement. For example, you can display bars of different classes in different colors.

Option	Description
Mesh type	Shape of the mesh. Select **Polygon**, **Rectangle**, or **Bent**. For bent meshes, enter the bending radius.
Bending radius	Internal radius of the bends in the bar.
Cross bar location	Define whether the crossing bars are located above or below the longitudinal bars.
Cut by father part cut	Define whether the polygon or part cuts in the part also cut the mesh.
Cover thickness on plane	Distance from the part surface to the main bars on the same plane as the bars.
Cover thickness from plane	Distance from the part surface to the bar, or bar end, perpendicular to the bar plane.
Start	Thickness of concrete cover or leg length from the mesh starting point.
End	Thickness of concrete cover or leg length at the end point of the bar. Used for bent meshes.
User-defined attributes	You can create user-defined attributes to add information about reinforcement. Attributes can consist of numbers, text, or lists. You can use the values of user-defined attributes in reports and drawings. You can also change the name of the fields, and add new ones, by editing the `objects.inp` file. See .
Hooks tab	See Adding hooks to reinforcing bars on page 11.

See also
Creating a polygonal reinforcement mesh on page 36
Creating a bent reinforcement mesh on page 39
Creating a customized reinforcement mesh on page 41
Modifying the shape of a reinforcement using direct modification on page 57

1.7 Creating a polygonal reinforcement mesh

You can create a reinforcement mesh that consists of two perpendicular bar groups. Tekla Structures treats mesh bars as one unit but distinguishes the main and crossing bars.

To create a polygonal mesh:

1. Double-click  or **Detailing** --> **Properties** --> **Reinforcement** --> **Reinforcement Mesh...** .

2. In the **Mesh type** list, select **Polygon**.

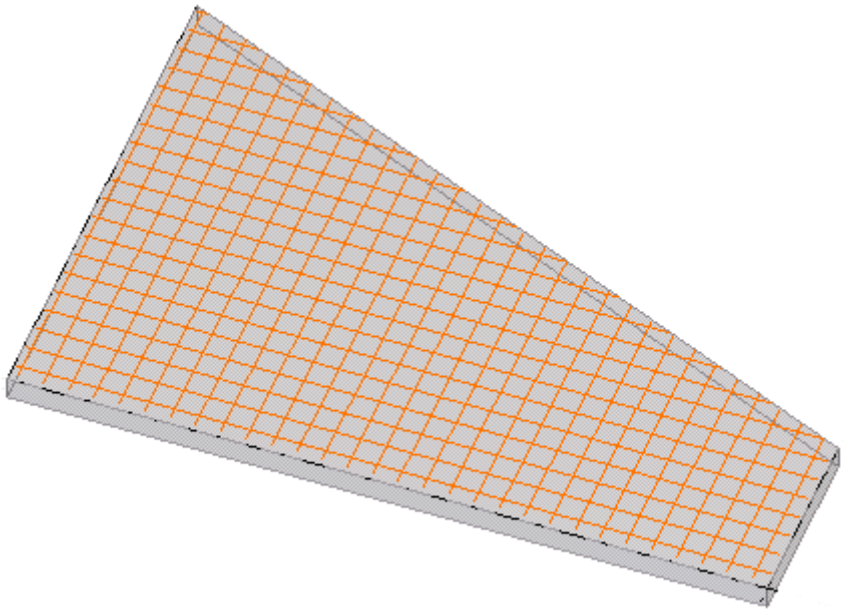
You cannot change the mesh type once the mesh has been created.

The reinforcement mesh can be polygonal, rectangular or bent.

3. Click **OK**.
4. Select the part to reinforce.

   Tekla Structures attaches the mesh to this part.
5. Pick the start point of the mesh.
6. Pick the corner points of the mesh.
7. Click the middle mouse button to finish picking.
8. Pick a point to indicate the direction of the longitudinal bars.

   Tekla Structures creates the mesh.



9. If you want to modify the reinforcement, do one of the following:

   - Use direct modification. Ensure that the **Direct modification** switch  is active.
   - Double-click the reinforcement to open the **Reinforcement Mesh Properties** dialog box and modify the properties.

Reinforcement mesh properties

Use the **Reinforcement Mesh Properties** dialog box to view and modify the properties of reinforcement meshes. The file name extension of a reinforcement mesh properties file is `.rbm`.

Option	Description
Mesh prefix and start number	Mark series of the mesh.
Name	User-definable name of the mesh. Tekla Structures uses mesh names in reports and drawing lists.
Mesh	Select a mesh from the mesh catalog. The properties of standard meshes are defined in the `mesh_database.inp` file. You can also use a customized mesh.
Grade	Steel grade of the bars in the mesh.
Class	Used to group reinforcement. For example, you can display bars of different classes in different colors.
Mesh type	Shape of the mesh. Select **Polygon**, **Rectangle**, or **Bent**. For bent meshes, enter the bending radius.
Bending radius	Internal radius of the bends in the bar.
Cross bar location	Define whether the crossing bars are located above or below the longitudinal bars.
Cut by father part cut	Define whether the polygon or part cuts in the part also cut the mesh.
Cover thickness on plane	Distance from the part surface to the main bars on the same plane as the bars.
Cover thickness from plane	Distance from the part surface to the bar, or bar end, perpendicular to the bar plane.
Start	Thickness of concrete cover or leg length from the mesh starting point.
End	Thickness of concrete cover or leg length at the end point of the bar. Used for bent meshes.
User-defined attributes	You can create user-defined attributes to add information about reinforcement. Attributes can consist of numbers, text, or lists. You can use the values of user-defined attributes in reports and drawings. You can also change the name of the fields, and add new ones, by editing the `objects.inp` file. See .
Hooks tab	See Adding hooks to reinforcing bars on page 11.

See also Creating a rectangular reinforcement mesh on page 34

Creating a bent reinforcement mesh on page 39

Creating a customized reinforcement mesh on page 41

Modifying the shape of a reinforcement using direct modification on page 57

1.8 Creating a bent reinforcement mesh

You can create a reinforcement mesh that consists of two perpendicular bar groups. Tekla Structures treats mesh bars as one unit but distinguishes the main and crossing bars.

To create a bent mesh:

1. Double-click  or **Detailing** --> **Properties** --> **Reinforcement** --> **Reinforcement Mesh...** .
2. In the **Mesh type** list, select **Bent**.

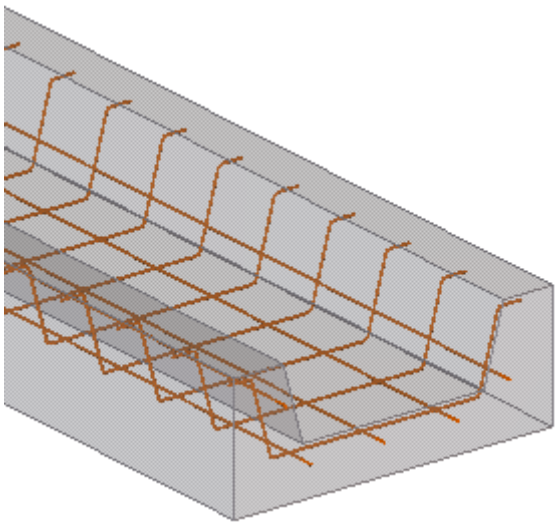
You cannot change the mesh type once the mesh has been created.

The reinforcement mesh can be bent, rectangular or polygonal.

3. Enter the bending radius.
4. Click **OK**.
5. Select the part to reinforce.

   Tekla Structures attaches the mesh to this part.
6. Pick points to indicate the bending shape of the crossing bars.
7. Click the middle mouse button to finish picking.
8. Pick two points to indicate the length and direction of the longitudinal bars.

Tekla Structures creates the mesh.



9. If you want to modify the reinforcement mesh, do one of the following:
   - Use direct modification. Ensure that the **Direct modification** switch  is active.
   - Double-click the reinforcement to open the **Reinforcement Mesh Propertis** dialog box and modify the properties.

Reinforcement mesh properties

Use the **Reinforcement Mesh Properties** dialog box to view and modify the properties of reinforcement meshes. The file name extension of a reinforcement mesh properties file is `.rbm`.

Option	Description
Mesh prefix and start number	Mark series of the mesh.
Name	User-definable name of the mesh. Tekla Structures uses mesh names in reports and drawing lists.
Mesh	Select a mesh from the mesh catalog. The properties of standard meshes are defined in the `mesh_database.inp` file. You can also use a customized mesh.
Grade	Steel grade of the bars in the mesh.
Class	Used to group reinforcement. For example, you can display bars of different classes in different colors.
Mesh type	Shape of the mesh. Select **Polygon**, **Rectangle**, or **Bent**. For bent meshes, enter the bending radius.

Option	Description
Bending radius	Internal radius of the bends in the bar.
Cross bar location	Define whether the crossing bars are located above or below the longitudinal bars.
Cut by father part cut	Define whether the polygon or part cuts in the part also cut the mesh.
Cover thickness on plane	Distance from the part surface to the main bars on the same plane as the bars.
Cover thickness from plane	Distance from the part surface to the bar, or bar end, perpendicular to the bar plane.
Start	Thickness of concrete cover or leg length from the mesh starting point.
End	Thickness of concrete cover or leg length at the end point of the bar. Used for bent meshes.
User-defined attributes	You can create user-defined attributes to add information about reinforcement. Attributes can consist of numbers, text, or lists. You can use the values of user-defined attributes in reports and drawings. You can also change the name of the fields, and add new ones, by editing the `objects.inp` file. See .
Hooks tab	See Adding hooks to reinforcing bars on page 11.

See also
Creating a polygonal reinforcement mesh on page 36
Creating a rectangular reinforcement mesh on page 34
Creating a customized reinforcement mesh on page 41
Modifying the shape of a reinforcement using direct modification on page 57

1.9 Creating a customized reinforcement mesh

You can create a customized reinforcement mesh that consists of two perpendicular bar groups.

To create a customized mesh:

1. Click **Detailing** --> **Properties** --> **Reinforcement** --> **Reinforcement mesh** .
2. Click the **Select** button next to the **Mesh** field to open the **Select Mesh** dialog box.
3. In the **Select Mesh** dialog box, select a standard mesh from the tree view to use it as a basis for the customized mesh.
4. Modify the mesh properties.

5. Enter a name for the mesh in the **Selected mesh** field.

   The default name is **Custom Mesh**.

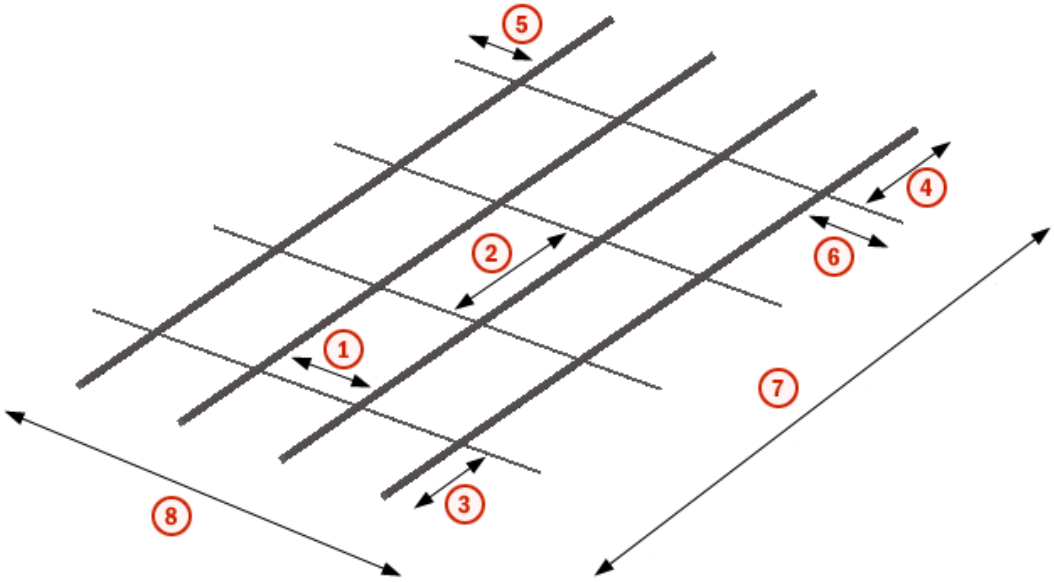
6. Click **OK** to close the **Select Mesh** dialog box and to save the properties.
7. To save customized mesh properties for later use, enter a name in the **Save as** box in the **Reinforcement Mesh Properties** dialog box and click the **Save as** button.

To use saved mesh properties in the **Reinforcement Mesh Properties** dialog box later, select the name of the mesh properties in the **Load** list and click the **Load** button.

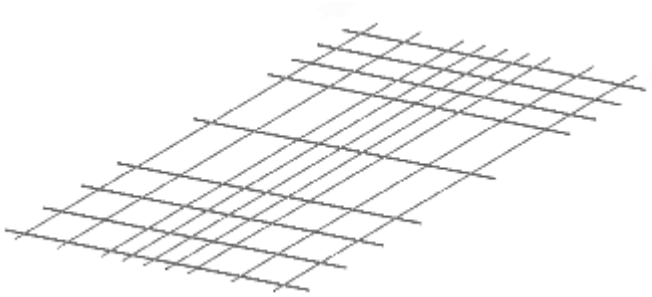
Custom reinforcement mesh properties

Use the **Select Mesh** dialog box to view and modify the properties of customized reinforcement meshes. The file name extension of a reinforcement mesh properties file is `.rbm`.

You can define the following properties for the customized reinforcement meshes:



1. Longitudinal distance
2. Cross distance
3. Longitudinal left overhang
4. Longitudinal right overhang
5. Cross left overhang
6. Cross right overhang
7. Length
8. Width

Option	Description
Spacing method	Define how the mesh bars are distributed. The options are: • **Same distance for all**: Use to create meshes with evenly-spaced bars. Tekla Structures distributes as many bars as possible for the length of **Length** or **Width**, using the **Distance(s)** and **Left overhang** values. The **Right overhang** is calculated automatically, and it cannot be zero. • **Multiple varying distances**: Use to create meshes with unevenly-spaced bars. Tekla Structures calculates the **Width** and **Length** based on the **Distance(s)**, the **Left overhang** and the **Right overhang** values. If you do not change any of the values, the spacing method changes back to **Same distance for all**.
Distance(s)	Spacing values of longitudinal or crossing bars. If you select the **Multiple varying distances** spacing method, enter all spacing values, separated by spaces. You can use multiplication to repeat spacing values. For example: `2*150 200 3*400 200 2*150` You can create meshes with unevenly-spaced bars. You can also define a different bar size or multiple different bar sizes for the longitudinal bars and the crossing bars. Multiple bar sizes enable pattern creation. For example, if you enter bar diameters 20 2*6 in the longitudinal direction, Tekla Structures creates a pattern with one size 20 bar and two size 6 bars. This pattern can be repeated in the mesh along the longitudinal direction. 
Left overhang	Extensions of crossing bars over the outermost longitudinal bars.
Right overhang	Extensions of longitudinal bars over the outermost crossing bars.

Option	Description
Diameter	Diameter or size of the longitudinal or crossing bars. You can define multiple diameters for the bars in both directions. Enter all the diameter values, separated by spaces. You can use multiplication to repeat diameter values. For example, `12 2*6` in longitudinal direction and `6 20 2*12` in crossing direction.
Width	Length of crossing bars.
Length	Length of longitudinal bars.
Grade	Steel grade of the bars in the mesh.

See also Creating a rectangular reinforcement mesh on page 34

Creating a polygonal reinforcement mesh on page 36

Creating a bent reinforcement mesh on page 39

Reinforcement mesh properties on page 53

Modifying the shape of a reinforcement using direct modification on page 57

1.10 Creating a reinforcement strand pattern

You can create prestressed straight or deflected strands for concrete parts.

To allow positioning of the strands, first create points to the part you are creating the strands for. Click **Modeling** --> **Add Points** --> **On Plane** to open the **Point Array** dialog box. Define the point coordinates.

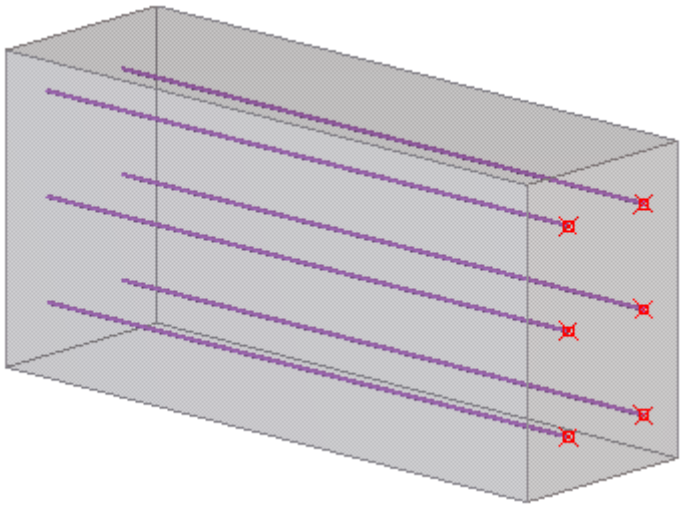
To create a strand pattern:

1. Click **Detailing** --> **Create Reinforcement** --> **Reinforcement Strand Pattern** .
2. Select the part you are creating strands for.
3. Pick each of the points that you are using to position the strands (for example, at the end of a part).

   The points you pick define the first cross section.
4. Click the middle mouse button to finish picking.
5. Pick points to position the strands.
   - If you create a single cross section, pick two points to define the length of the strands.
   - If you create two or more cross sections, for each cross section, pick points to indicate the strand positions. Pick the strand positions in the same order as for the first cross section.

6. Click the middle mouse button to finish picking.

   Tekla Structures creates the strands.

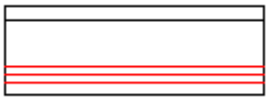
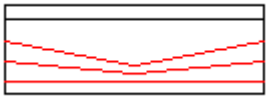
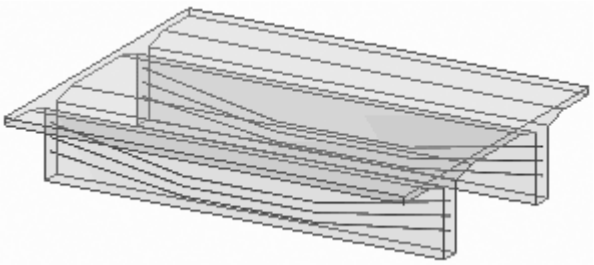


7. If you wan to change the strand properties:
   a. Double-click the strand pattern to open the **Strand Pattern Properties** dialog box.
   b. Modify the properties.
   c. Click **Modify**.

Reinforcement strand properties General tab

Use the **Strand Pattern Properties** dialog box to view and modify the properties of strands. The file name extension of the properties file is `.rbs`.

Option	Description
Strand prefix and start number	Mark series of the bar.
Name	User-definable name of the strand. Tekla Structures uses bar names in reports and drawing lists, and to identify strands of the same type.
Size	Diameter of the bar. Depending on the environment, the nominal diameter of the bar, or a mark that defines the diameter.
Grade	Steel grade of the bar.
Bending radius	Internal radius of the bends in the bar. You can enter a separate value for each bar bend. Separate the values with spaces.
Class	Used to group reinforcement. For example, you can display strands of different classes in different colors.

Option	Description
Pull per strand	Pre-stress load per strand (kN).
Number of cross sections	Number of cross sections of the strand pattern. • Number of profiles 1 = strand profile  • Number of profiles 2 = strand profile  • Number of profiles 3 = strand profile  • Number of profiles 4 = strand profile  
User-defined attributes...	You can create user-defined attributes to add information about reinforcement. Attributes can consist of numbers, text, or lists. You can use the values of user-defined attributes in reports and drawings. To create user-defined attributes, click the **User-defined attributes** button in the reinforcement properties dialog box. You can also change the name of the fields, and add new ones, by editing the `objects.inp` file. See .

See also Debonding reinforcement strands on page 47

Debonding reinforcement strands

To debond strands:

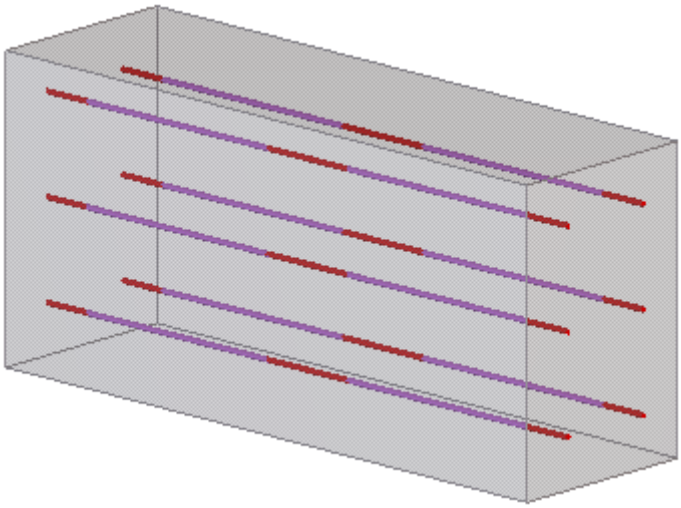
1. Click **Detailing** --> **Properties** --> **Reinforcement** --> **Strand Pattern...** .
2. On the **Debonding** tab, click the **Add** button to create a new row in the table.
3. Enter the strand numbers in the **Debonded strands** field.

   The strand number is the selection order number of the strand.

   - To set the same values for all the strands, enter all the strand numbers, separated by a space. For example, `1 2 3 4`.
   - To set separate values for each strand, click **Add** to add a new row, then enter the strand number in the **Debonded strands** field.
4. Define the debonded lengths.

   To set symmetrical lengths, select the **End lengths = start lengths** check box and only enter values in the **From start** or **Middle to start** fields.
5. Click **Modify**.

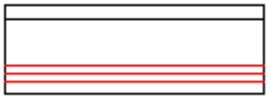
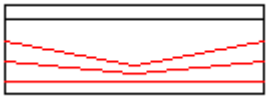
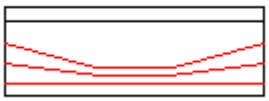
   Tekla Structures displays the debonded section of the strand in red.

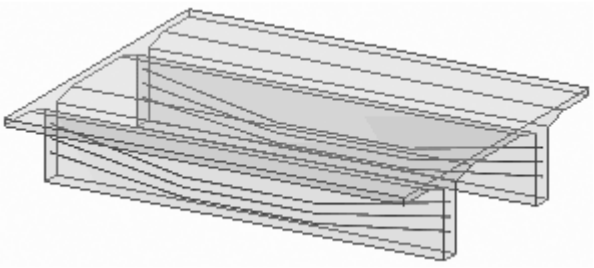


Reinforcement strand properties General tab

Use the **Strand Pattern Properties** dialog box to view and modify the properties of strands. The file name extension of the properties file is `.rbs`.

Option	Description
Strand prefix and start number	Mark series of the bar.

Option	Description
Name	User-definable name of the strand. Tekla Structures uses bar names in reports and drawing lists, and to identify strands of the same type.
Size	Diameter of the bar. Depending on the environment, the nominal diameter of the bar, or a mark that defines the diameter.
Grade	Steel grade of the bar.
Bending radius	Internal radius of the bends in the bar. You can enter a separate value for each bar bend. Separate the values with spaces.
Class	Used to group reinforcement. For example, you can display strands of different classes in different colors.
Pull per strand	Pre-stress load per strand (kN).
Number of cross sections	Number of cross sections of the strand pattern. • Number of profiles 1 = strand profile  • Number of profiles 2 = strand profile  • Number of profiles 3 = strand profile  • Number of profiles 4 = strand profile 

Option	Description
	
User-defined attributes...	You can create user-defined attributes to add information about reinforcement. Attributes can consist of numbers, text, or lists. You can use the values of user-defined attributes in reports and drawings. To create user-defined attributes, click the **User-defined attributes** button in the reinforcement properties dialog box. You can also change the name of the fields, and add new ones, by editing the `objects.inp` file. See .

Debonding tab

Option	Description
Debonded strands	Enter the strand number. The strand number is the selection order number of the strand.
From start **Middle to start** **Middle to end** **From end**	Enter the length of the debonding. If you select the **Symmetry** check box, values from **From start** and **From Middle to start** are copied to **From end** and **Middle to end**.
Symmetry	Define whether the end and start lengths are symmetrical.

See also Creating a reinforcement strand pattern on page 44

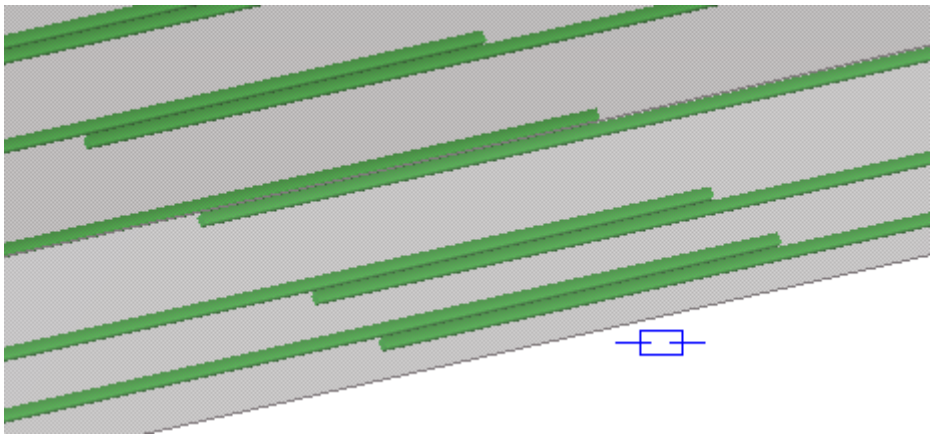
1.11 Creating a reinforcement splice

You can join reinforcing bars or reinforcing bar groups together with reinforcement splices. There can be a gap between the bars or groups.

To create a reinforcement splice:

1. Click **Detailing** --> **Create Reinforcement** --> **Reinforcement Splice** .
2. Select the first reinforcing bar or bar group.
3. Select the second reinforcing bar or bar group.

Tekla Structures creates the splice. The splices have blue splice symbols  in the model.



4. If you want to change the splice properties:
   a. Double-click the splice to open the **Reinforcement Splice Properties** dialog box.
   b. Modify the properties.
   c. Click **Modify**.

Splice properties Use the **Reinforcement Splice Properties** dialog box to view and modify the properties of splices. The file name extension of a saved splice properties file is `.rsp`.

Option	Description
Joint type	Splice type. **Lap left** creates the lap to the direction of the first reinforcing bar or bar group selected, **Lap right** to the direction of the second. **Lap both** centers the lap between the bars or bar groups.
Lap length	Length of the lap joint.
Offset	Offset of the splice center point from the point where the bars originally met.
Bar positions	Define whether the lapping bars are on top of each other or parallel to each other.

See also

Creating a reinforcing bar group on page 8

Creating a reinforcing bar group using Shape Catalog on page 18

Splitting and splicing reinforcement (AutomaticSplicingTool) on page 70

1.12 Reinforcing bar and bar group properties

Use the **Reinforcing Bar Properties** dialog box to view and modify the properties of reinforcing bars and reinforcing bar groups. The file name extension of the properties file is

- `.rbr` for bars
- `.rbg` for groups
- `.rci` for circular groups
- `.rcu` for curved groups

General tab Use the properties on the **General** tab to modify single reinforcing bars.

Option	Description	
Bar prefix and start number	Mark series of the reinforcing bar.	
Name	User-definable name of the bar. Tekla Structures uses bar names in reports and drawing lists, and to identify bars of the same type.	
Size	Diameter of the bar. Depending on the environment, the nominal diameter of the bar, or a mark that defines the diameter.	Size-grade-radius combinations are predefined in the reinforcing bar catalog. Click the **Select** button to open the **Select Reinforcing Bar** dialog box. The dialog box shows the available bars sizes for the chosen grade. You can also select whether the bar is a main bar or a stirrup or tie. The `rebar_database.inp` file contains the predefined reinforcing bar catalog entries.
Grade	Steel grade of the bar.	
Bending radius	Internal radius of the bends in the bar. You can enter a separate value for each bar bend. Separate the values with spaces. Bending radius complies with the design code you are using. Main bars, stirrups, ties, and hooks usually have their own minimum internal bending radii, which are proportional to the diameter of the reinforcing bar. The actual bending radius is normally chosen to suit the size of the mandrels on the bar-bending machine.	
Class	Used to group reinforcement. For example, you can display bars of different classes in different colors.	
Hooks Shape	Shape of the hook.	The `rebar_database.inp`
Hooks Angle	Angle of a custom hook	

Option	Description	
Hooks Radius	Internal bending radius of a standard hook or custom hook.	file contains the predefined minimum bending radius and minimum hook length for all standard hooks. See Adding hooks to reinforcing bars on page 11.
Hooks Length	Length of the straight part of a standard or custom hook.	
Cover thickness on plane	Distances from the part surfaces to the bar on the same plane as the bar.	See Defining the reinforcement cover thickness on page 13.
Cover thickness from plane	Distance from the part surface to the bar, or bar end, perpendicular to the bar plane.	
Start	Concrete cover thickness or leg length at the first end of the bar.	
End	Concrete cover thickness or leg length at the second end of the bar.	
User-defined attributes	You can create user-defined attributes to add information about reinforcement. Attributes can consist of numbers, text, or lists. You can use the values of user-defined attributes in reports and drawings. You can also change the name of the fields, and add new ones, by editing the `objects.inp` file. See Customizing user-defined attributes.	

Group tab Use the properties on the **Group** tab to modify

- reinforcing bar groups, including tapered groups
- curved reinforcing bar groups
- circular reinforcing bar groups.

Option	Description	
Creation method	How the bars are spaced.	See Spacing reinforcing bars in a group on page 14.
Number of reinforcing bars		
Target spacing value		
Exact spacing value		
Exact spacing values		
Reinforcing bar(s) not to be created to the group	Which bars are omitted from the group.	See Omitting reinforcing bars from a group on page 18.

Option	Description	
Rebar group type	What is the type of the group.	See Creating a tapered or spiral reinforcing bar group on page 16.
Number of cross sections		

See also Creating a reinforcing bar on page 6

Creating a reinforcing bar group on page 8

Creating a reinforcing bar group using Shape Catalog on page 18

Creating a tapered or spiral reinforcing bar group on page 16

Creating a curved reinforcing bar group on page 27

Creating a circular reinforcing bar group on page 30

1.13 Reinforcement mesh properties

Use the **Reinforcement Mesh Properties** dialog box to view and modify the properties of reinforcement meshes. The file name extension of a reinforcement mesh properties file is `.rbm`.

Option	Description
Mesh prefix and start number	Mark series of the mesh.
Name	User-definable name of the mesh. Tekla Structures uses mesh names in reports and drawing lists.
Mesh	Select a mesh from the mesh catalog. The properties of standard meshes are defined in the `mesh_database.inp` file. You can also use a customized mesh.
Grade	Steel grade of the bars in the mesh.
Class	Used to group reinforcement. For example, you can display bars of different classes in different colors.
Mesh type	Shape of the mesh. Select **Polygon**, **Rectangle**, or **Bent**. For bent meshes, enter the bending radius.
Bending radius	Internal radius of the bends in the bar.
Cross bar location	Define whether the crossing bars are located above or below the longitudinal bars.

Option	Description
Cut by father part cut	Define whether the polygon or part cuts in the part also cut the mesh.
Cover thickness on plane	Distance from the part surface to the main bars on the same plane as the bars.
Cover thickness from plane	Distance from the part surface to the bar, or bar end, perpendicular to the bar plane.
Start	Thickness of concrete cover or leg length from the mesh starting point.
End	Thickness of concrete cover or leg length at the end point of the bar. Used for bent meshes.
User-defined attributes	You can create user-defined attributes to add information about reinforcement. Attributes can consist of numbers, text, or lists. You can use the values of user-defined attributes in reports and drawings. You can also change the name of the fields, and add new ones, by editing the `objects.inp` file. See .
Hooks tab	See Adding hooks to reinforcing bars on page 11.

See also

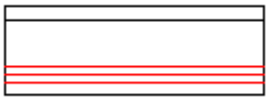
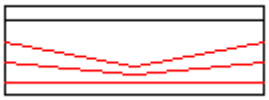
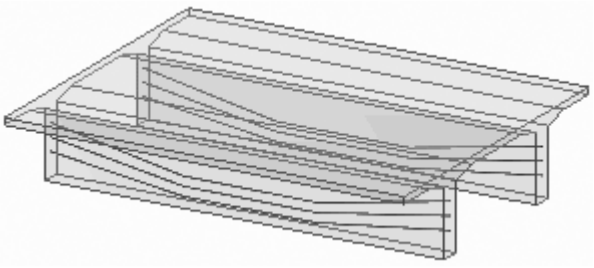
Creating a rectangular reinforcement mesh on page 34
Creating a polygonal reinforcement mesh on page 36
Creating a bent reinforcement mesh on page 39
Creating a customized reinforcement mesh on page 41

1.14 Reinforcement strand properties

Use the **Strand Pattern Properties** dialog box to view and modify the properties of strands. The file name extension of the properties file is `.rbs`.

General tab

Option	Description
Strand prefix and start number	Mark series of the bar.
Name	User-definable name of the strand. Tekla Structures uses bar names in reports and drawing lists, and to identify strands of the same type.
Size	Diameter of the bar. Depending on the environment, the nominal diameter of the bar, or a mark that defines the diameter.

Option	Description
Grade	Steel grade of the bar.
Bending radius	Internal radius of the bends in the bar. You can enter a separate value for each bar bend. Separate the values with spaces.
Class	Used to group reinforcement. For example, you can display strands of different classes in different colors.
Pull per strand	Pre-stress load per strand (kN).
Number of cross sections	Number of cross sections of the strand pattern. • Number of profiles 1 = strand profile  • Number of profiles 2 = strand profile  • Number of profiles 3 = strand profile  • Number of profiles 4 = strand profile  
User-defined attributes...	You can create user-defined attributes to add information about reinforcement. Attributes can consist of numbers, text, or lists.

Option	Description
	You can use the values of user-defined attributes in reports and drawings. To create user-defined attributes, click the **User-defined attributes** button in the reinforcement properties dialog box. You can also change the name of the fields, and add new ones, by editing the `objects.inp` file. See .

Debonding tab

Option	Description
Debonded strands	Enter the strand number. The strand number is the selection order number of the strand.
From start **Middle to start** **Middle to end** **From end**	Enter the length of the debonding. If you select the **Symmetry** check box, values from **From start** and **From Middle to start** are copied to **From end** and **Middle to end**.
Symmetry	Define whether the end and start lengths are symmetrical.

See also

Creating a reinforcement strand pattern on page 44

Debonding reinforcement strands on page 47

2 Reinforcement modification

Once you have created reinforcement to your model, you can modify, for example, the shape of the reinforcement. Tekla Structures includes several methods for the shape modification:

- You can use direct modification. See Modifying the shape of a reinforcement using direct modification on page 57.
- You can use handles. See Modifying the shape of a reinforcement using handles on page 61.
- You can use adaptivity. See Modifying the shape of a reinforcement using adaptivity on page 62.
- You can use points. See Modifying the shape of a reinforcement by adding points on page 63 and Modifying the shape of a reinforcement by removing points on page 64.

In addition, you can modify reinforcement by grouping, combining and splitting.

See also

Attaching a reinforcement to a concrete part on page 66

Ungrouping a reinforcement on page 67

Grouping reinforcement on page 68

Splitting a reinforcing bar group on page 69

Combining two reinforcing bars or reinforcing bar groups into one on page 70

Splitting and splicing reinforcement (AutomaticSplicingTool) on page 70

Assigning running numbers to reinforcement (RebarSeqNumbering) on page 72

Classifying reinforcement to layers (RebarClassificator) on page 72

How to calculate the reinforcing bar length on page 73

How to calculate the reinforcing bar leg length on page 76

2.1 Modifying the shape of a reinforcement using direct modification

You can modify reinforcement by using the direct modification. You can either modify the reinforcement simply by dragging handles, or select a command from a toolbar.

The direct modification does not work for the following reinforcement types:

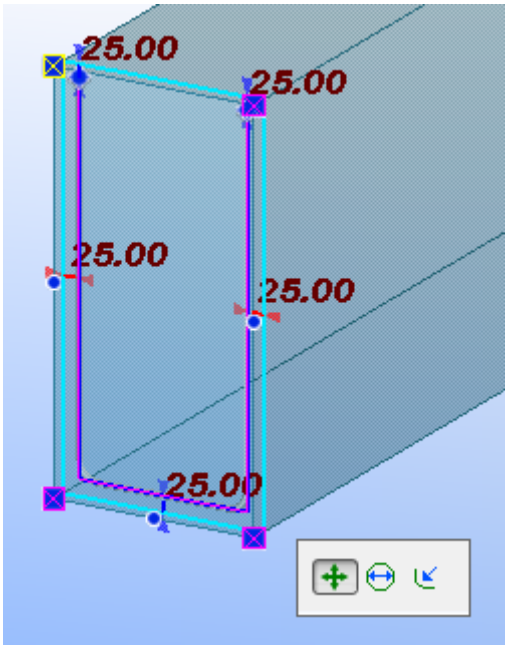
- circular and curved reinforcing bars
- reinforcement strand patterns
- detached reinforcing bars.

If you have created the reinforcement using a component, you need to explode the component before using the direct modification.

Before you start:

- Ensure that the **Direct modification** switch  is active.
- Select the reinforcement.

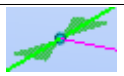
  Tekla Structures displays the handles that you can use to modify the reinforcement, and a toolbar where you can select the appropriate command. The available commands depend on the type of the reinforcement you are modifying.



- When you drag a handle, hold down the **Shift** key to use the snap switches. By default, the snap switches are off to make it easier to drag the handle to any location.

To modify single reinforcing bars, reinforcing bar groups, or reinforcement meshes:

To	Do this	Command available for
Change the cover thickness of a reinforcing bar	Drag a line handle to the desired location. 	Reinforcing bars, reinforcing bar groups, reinforcement meshes
Add polygon points to a reinforcing bar	Drag a midpoint handle to the desired location.	Reinforcing bars, reinforcing bar groups, polygonal and bent reinforcement meshes
Add points to the start or end of a reinforcing bar	1. Right-click the start or end reference point of the reinforcing bar. 2. Click the **Add new point** button on the toolbar. 3. Pick a location for the new start or end point.	Reinforcing bars, reinforcing bar groups
Remove points from a reinforcing bar	1. Select one or more reference points. 2. Press **Delete**.	Reinforcing bars, reinforcing bar groups, polygonal and bent reinforcement meshes
Add hooks	1. Right-click the start or end point of the reinforcing bar. A toolbar for hook properties appears. 2. Select the desired shape for the hook. 3. If you selected **Custom hook**, enter the angle, radius, and length for the hook and click .	Reinforcing bars, reinforcing bar groups
Change the bending radius of a reinforcing bar	1. Click the **Change bending radius** button on the toolbar. 2. Enter a value in the box next to the **Change bending radius** button and press **Enter**.	Reinforcing bars, reinforcing bar groups
Change the diameter of a reinforcing bar	1. Click the **Change diameter** button on the toolbar. 2. Select a value from the list next to the **Change diameter** button.	Reinforcing bars, reinforcing bar groups, reinforcement meshes
Modify the spacings by adjusting the range	1. Click the **Modify spacings** button on the toolbar.	Reinforcing bar groups, reinforcement meshes

To	Do this	Command available for
	2. Drag a handle  to the desired location.	
Modify the spacings by splitting the range in two	1. Click the **Modify spacings** button  on the toolbar. 2. Drag a midpoint handle  to the desired location and release the handle. Tekla Structures creates a new reinforcing bar and the range is split in two. The spacing in the two new ranges is as close as possible to the original spacing. 3. If needed, change the number of spaces or the spacing value. Right-click the midpoint handle and enter the desired values in the boxes that appear:  and click  .	Reinforcing bar groups, reinforcement meshes
Move, add, or remove reinforcement	1. Click the **Move, add, delete reinforcement** button  on the toolbar. Tekla Structures displays the line handles for each reinforcing bar. 2. Do one of the following: • To move a reinforcing bar, highlight it and drag it to the desired location. • To add a reinforcing bar between two reinforcing bars, click  . • To delete reinforcing bars, select them and press **Delete**.	Reinforcing bar groups, reinforcement meshes

See also Modifying the shape of a reinforcement using handles on page 61

Modifying the shape of a reinforcement using adaptivity on page 62

Modifying the shape of a reinforcement by adding points on page 63

Modifying the shape of a reinforcement by removing points on page 64

Checking the validity of reinforcement geometry on page 66

2.2 Modifying the shape of a reinforcement using handles

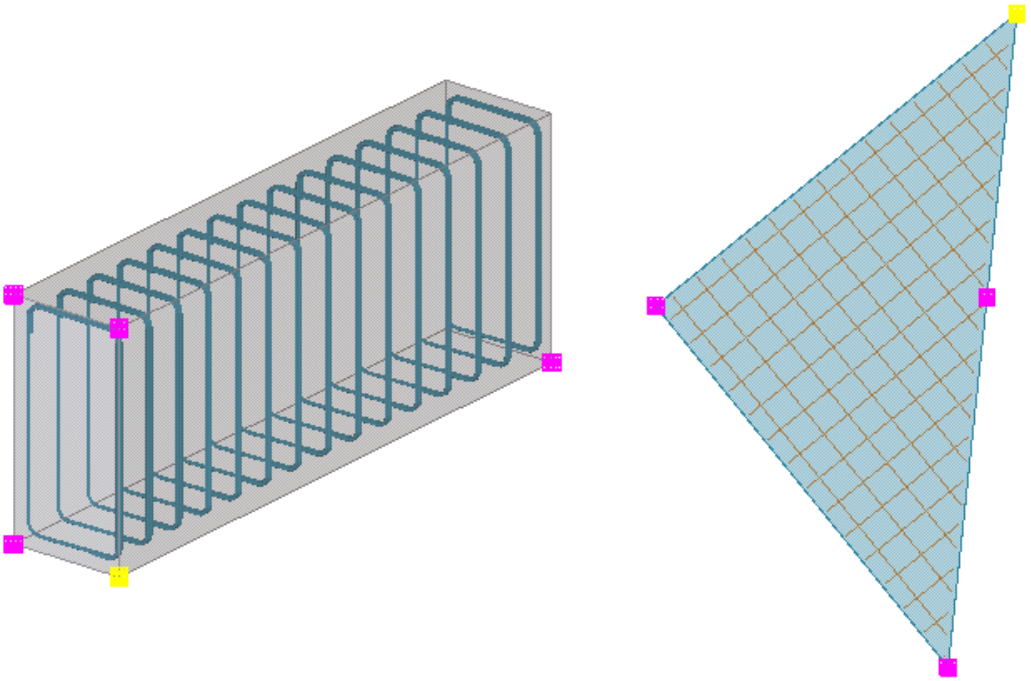
If you do not want to use direct modification to modify the reinforcement shape, you can use, for example, the reinforcement handles to modify the reinforcement shape.

If you want to use the reinforcement handles, ensure that the **Direct modification** switch  is not active. If the switch is active and direct modification is on, Tekla Structures displays direct modification handles for the reference points, ends, legs, and leg midpoints of the selected reinforcement. These handles are blue.

Tekla Structures uses handles to indicate:

- The ends and corners of a reinforcing bar.
- The distribution length of a bar group.
- The corners and main bar direction of a mesh.

When you select a reinforcement, Tekla Structures highlights the handles. The handle of the first end point is yellow, the rest are magenta.



To modify the reinforcement shape using handles:

1. Select the reinforcement.

   Tekla Structures highlights the handles.

2. Click one of the handles to select it.

3. Move the handle like any other object in Tekla Structures.

   For example, if **Drag and drop** is active, just drag the handle to a new position.

See also Checking the validity of reinforcement geometry on page 66

Modifying the shape of a reinforcement using direct modification on page 57

2.3 Modifying the shape of a reinforcement using adaptivity

Reinforcement follows the shape of the part also when the reinforcement handles are located on the face or edge of the part.

The following types of adaptivity are available:

- Fixed adaptivity: handles retain their absolute distances to the nearest part faces.
- Relative adaptivity: handles retain their relative distances to the nearest part faces in relation to the part's overall size.

To change the reinforcement adaptivity:

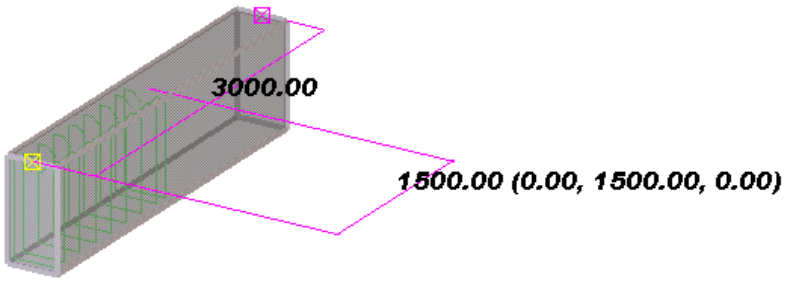
1. Select a reinforcement.
2. Right-click and select **Adaptivity** and then one of the adaptivity options from the pop-up menu.

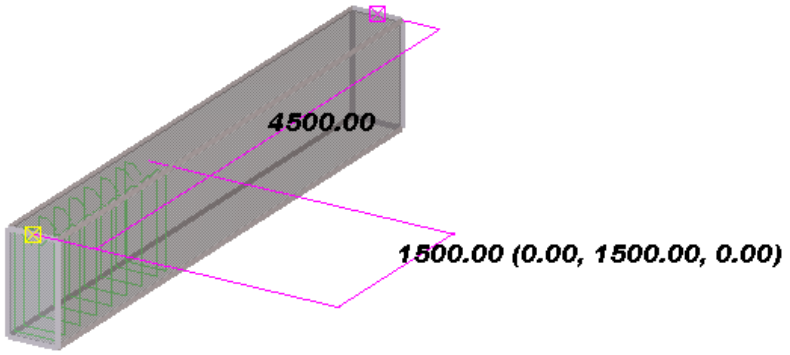
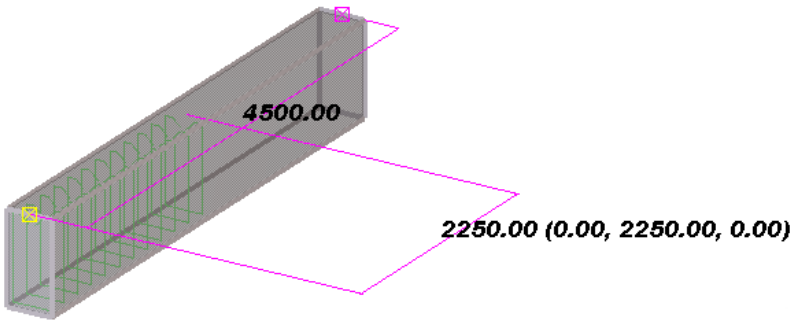
   When a part is modified, Tekla Structures handles the reinforcement according to the adaptivity selection.

To modify the general adaptivity settings, click **Tools** --> **Options** --> **Options...** --> **General** .

You can also modify the adaptivity settings for each part separately. These modifications override the general settings in the **Options** dialog box.

Adaptivity examples

Reinforcing bars in their original position	

Fixed adaptivity	
Relative adaptivity	

See also Checking the validity of reinforcement geometry on page 66

Modifying the shape of a reinforcement using direct modification on page 57

2.4 Modifying the shape of a reinforcement by adding points

You can modify the shape of a single reinforcing bar, a reinforcing bar group, or a reinforcement mesh by adding points to the reinforcement.

You cannot modify the shape of rectangular meshes by adding points.

To add points to a reinforcement, do one of the following:

To	Do this
Add points using direct modification	1. Ensure that the **Direct modification** switch  is active. 2. Select a single reinforcing bar, a reinforcing bar group, or a polygonal or bent mesh.

To	Do this
	3. Do one of the following: • Drag a midpoint handle to a new location. • Right-click the start or end reference point of the reinforcing bar, click the **Add new point** button, and then pick a location for the new reference point.
Add points using the **Modify Polygon Shape** command	1. Select a single reinforcing bar, a reinforcing bar group, or a bent mesh. 2. Click **Detailing** --> **Modify Polygon Shape** . 3. Pick the first existing polygon point (1). 4. Pick new points (2, 3). 5. Pick the second existing polygon point (4).  The new points are added to the reinforcement, and the shape of the reinforcement is modified. 

See also Checking the validity of reinforcement geometry on page 66

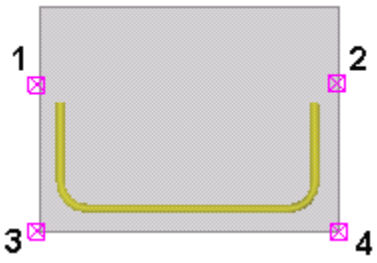
Modifying the shape of a reinforcement using direct modification on page 57

2.5 Modifying the shape of a reinforcement by removing points

You can modify the shape of a single reinforcing bar, reinforcing bar group, or a reinforcement mesh by removing points from the reinforcement.

You cannot modify the shape of rectangular meshes by removing points.

To remove points from a reinforcement, do one of the following:

To	Do this
Remove points using direct modification	1. Ensure that the **Direct modification** switch is active. 2. Select a single reinforcing bar, a reinforcing bar group, or a polygonal or bent mesh. 3. Select the reference points you want to remove. 4. Press **Delete**.
Remove points using the **Modify Polygon Shape** command	1. Select a single reinforcing bar, a reinforcing bar group, or a bent mesh. 2. Click **Detailing** --> **Modify Polygon Shape** . 3. Pick the first existing polygon point (1). 4. Pick the second existing polygon point (2). 5. Pick a point to be removed (3 or 4). The point to be removed needs to be in between the two previously picked (1) and (2) points.  The points are removed from the reinforcement, and the shape of the reinforcement is modified. 

See also Checking the validity of reinforcement geometry on page 66

Modifying the shape of a reinforcement using direct modification on page 57

2.6 Checking the validity of reinforcement geometry

Reinforcement creation or modification can result in invalid reinforcement geometry. For example, too big bending radius can cause invalid reinforcement geometry. If a model contains a reinforcement with invalid geometry, the reinforcement is not shown in the drawings. The reinforcement becomes visible and the drawings are updated when the geometry is corrected.

Reinforcement geometry validity check does not work with circular or curved reinforcing bar groups.

To check the validity of reinforcement geometry:

1. Click **Tools** --> **Diagnose & Repair Model** --> **Diagnose Model** .
2. Check the results.

   If there are inconsistencies in the geometry, Tekla Structures displays a warning message, and draws a thin line between the reinforcement handles to show the invalid geometry.

   You can correct the reinforcement geometry by selecting the line and modifying the reinforcement properties.

See also Modifying the shape of a reinforcement using direct modification on page 57

2.7 Attaching a reinforcement to a concrete part

When you create a reinforcement, Tekla Structures automatically attaches the reinforcement to the part for which you are creating the reinforcement. If needed, you can attach a reinforcement to a concrete part or cast unit also manually. The attached reinforcing bars follow the part or cast unit when it is moved, copied, or deleted.

You must attach reinforcement to a part or cast unit to have Tekla Structures merge automatic reinforcing bar marks in drawings.

To manually attach a reinforcement to a concrete part or cast unit:

1. Select the reinforcement to attach.
2. Click **Detailing** --> **Create Reinforcement** --> **Attach to Part** .

3. Select the part to attach the reinforcement to.

   The reinforcement is attached to the part.

Detaching a reinforcement from a concrete part

If needed, you can detach a reinforcement from a concrete part or cast unit.

To detach a reinforcement from a part:

1. Click **Detailing** --> **Create Reinforcement** --> **Detach from Part** .
2. Select the reinforcement to be detached.

   The reinforcement is detached from the part.

See also Reinforcement modification on page 57

2.8 Ungrouping a reinforcement

You can ungroup reinforcing bar groups and reinforcement meshes. Only reinforcement where each reinforcing bar is in one plane can be ungrouped.

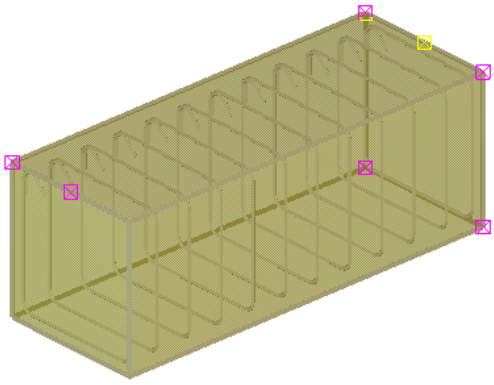
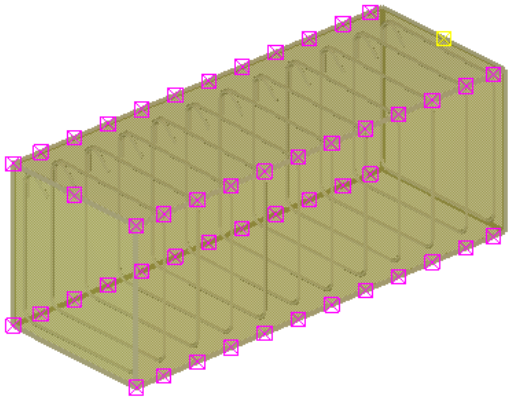
You cannot ungroup circular or curved reinforcing bar groups.

To ungroup a reinforcement:

1. Click **Detailing** --> **Create Reinforcement** --> **Ungroup** .
2. Select one of the reinforcing bars in a reinforcing bar group or in a reinforcement mesh.

   The reinforcing bar group is replaced with single reinforcing bars. The single bars get the same properties and offsets as the group.

   If you ungroup a reinforcement mesh, the offsets for single bars are zero.

Before ungrouping	After ungrouping
	

See also Reinforcement modification on page 57

Creating a reinforcing bar group on page 8

Creating a reinforcing bar group using Shape Catalog on page 18

Creating a rectangular reinforcement mesh on page 34

2.9 Grouping reinforcement

You can group single reinforcing bars and reinforcing bar groups. Only reinforcements where each reinforcing bar is in one plane can be grouped. All groups are created with exact spacings. Single reinforcing bars need to have the same bending shape.

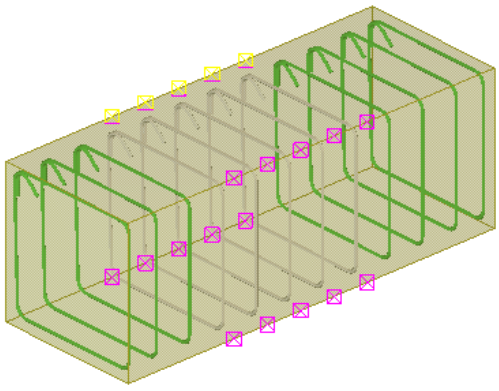
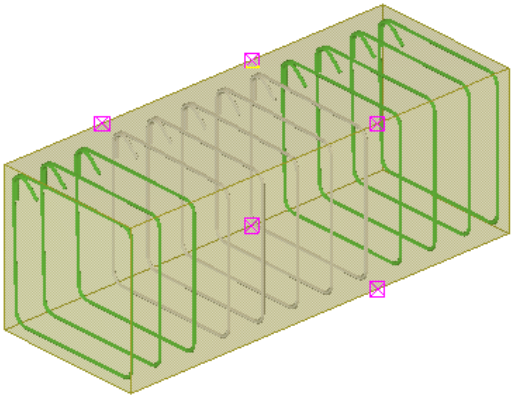
You cannot create circular or curved reinforcing bar groups by grouping.

To group single reinforcing bars or reinforcing bar groups:

1. Click **Detailing** --> **Create Reinforcement** --> **Group** .
2. Select all the reinforcing bars or reinforcing bar groups that you want to group.
3. Click the middle mouse button.
4. Select one reinforcing bar or reinforcing bar group to copy the properties from.

   The new group gets the same properties as the selected reinforcing bar.

The reinforcing bar or reinforcing bar group that you copy the properties from is also added to the group. This means, for example, that you cannot copy properties from a separate reinforcing bar group which you do not want to include in your new reinforcing bar group.

Before grouping	After grouping
	

See also Reinforcement modification on page 57

Creating a reinforcing bar group on page 8

Creating a reinforcing bar group using Shape Catalog on page 18

Creating a reinforcing bar on page 6

2.10 Splitting a reinforcing bar group

You can split normal and tapered reinforcing bar groups into two groups. You can also split single reinforcing bars into two.

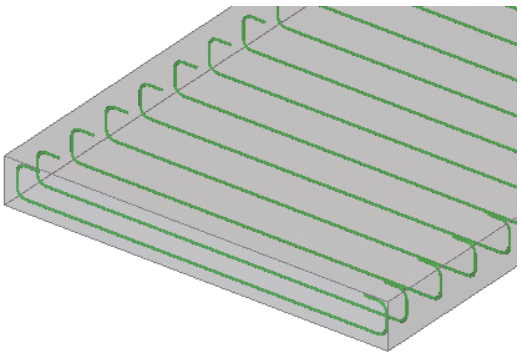
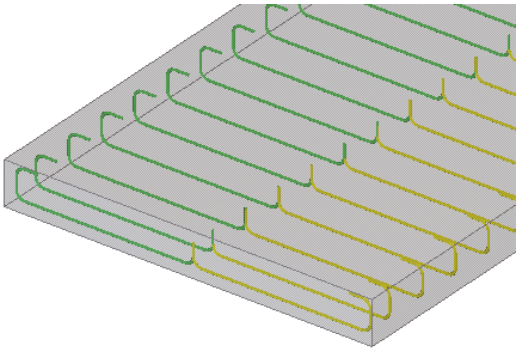
To split a reinforcing bar group:

1. Click **Edit** --> **Split** .
2. Select a reinforcing bar group.
3. Pick two points to indicate where to split the group.

   Tekla Structures splits the reinforcing bar group.

You cannot split reinforcing bar groups diagonally.

Once split, each new reinforcing bar group retains the properties of the original group. For example, if the bars in the original group had hooks at both ends, bars in the new groups also have hooks at both ends. Modify the properties of the new groups, if needed.

Before splitting	After splitting
	

See also Creating a reinforcing bar group on page 8

Creating a reinforcing bar group using Shape Catalog on page 18

Creating a reinforcing bar on page 6

Modifying the shape of a reinforcement using direct modification on page 57

2.11 Combining two reinforcing bars or reinforcing bar groups into one

You can combine two single reinforcing bars or reinforcing bar groups into one. Reinforcing bars can be combined if their end points are connected, or the bars are parallel and close to each other. However, in certain cases it is possible to combine bars or groups that are not connected nor parallel. The combined reinforcement gets the same properties as the bar selected first.

You cannot combine **Tapered N** reinforcing bar groups.

To combine two single reinforcing bars or two reinforcing bar groups into one:

1. Click **Edit** --> **Combine** .
2. Select the first single bar or bar group to be combined.
3. Select the second single bar or bar group to be combined.

   Tekla Structures combines the reinforcing bar groups or bars into one.

See also

Creating a reinforcing bar group on page 8

Creating a reinforcing bar group using Shape Catalog on page 18

Creating a reinforcing bar on page 6

Reinforcement modification on page 57

2.12 Splitting and splicing reinforcement (AutomaticSplicingTool)

You can split long reinforcing bars and bar groups that exceed the stock length, and create splices in split locations.

Use the `AutomaticSplicingTool` macro to split and splice reinforcement that exceeds the stock length. You can first check the length of the reinforcing bars in the model according to the manufacturer. You can then define the portion of the reinforcement to be split and spliced in the same cross section, and the location, symmetry, type, and length of the splices.

To split and splice reinforcement:

1. In the model, click **Tools** --> **Macros** .
2. In the **Macros** dialog box:
   a. Select `AutomaticSplicingTool`.
   b. Click **Run** to start the macro.

3. In the **Automatic Splicing Tool** dialog box:

   a. Select the manufacturer of the reinforcement.

      The maximum bar lengths and lap lengths are then listed by the grade and size of the bar.

      If needed, you can define the length information in the `AutomaticSplicingTool_Manufacturers.dat` file. You can copy the default file from `..\ProgramData\Tekla Structures\<version>\environments\common\system` , edit it, and save it to your project or firm folder.

   b. For the bar grades and sizes that are not listed in the `AutomaticSplicingTool_Manufacturers.dat` file, use the **Maximum length for unspecified stock** box to define the maximum reinforcing bar length after which the bars are split and spliced.

   c. To check if the length of the reinforcing bars exceeds the maximum length, click one of the buttons next to **Perform check to**:

      - To check all reinforcement in the model, click **All**.
      - To check specific reinforcement, select the reinforcement in the model using the **Select objects in components** switch  , and then click **Selected**.

      Tekla Structures lists the reinforcing bars that are longer than the maximum length under **Longer rebars** on the right side of the dialog box.

      When you select a row in the **Longer rebars** list, Tekla Structures highlights the corresponding reinforcement in the model.

   d. Define which proportion of the reinforcement can be spliced in the same cross section.

   e. Define the symmetry that is applied when the reinforcing bars are spliced.

   f. Define the offset of the splice center point.

   g. Define the minimum longitudinal distance between two parallel bar splices.

   h. Select the splice type.

      You can create lap splices, coupler splices, or welded splices.

   i. For lap splices, define the default lap length in relation to the nominal bar diameter.

      This value will be used if there is no lap length defined for a bar grade and size in the `AutomaticSplicingTool_Manufacturers.dat` file.

   j. For lap slices, define whether the lapping bars are on top of each other or parallel to each other.

   k. To split and splice reinforcement, click one of the buttons next to **Perform split and splice to**:

      - To splice all reinforcement in the model, click **All**.

- To splice specific reinforcement, select the reinforcement in the **Longer rebars** list, or in the model using the **Select objects in components** switch  , and then click **Selected**.

See also Creating a reinforcement splice on page 49

2.13 Assigning running numbers to reinforcement (RebarSeqNumbering)

You can assign running numbers to reinforcement in cast units. You can then use the running numbers in addition to or instead of the position numbers in reinforcement marks and tables in drawings, and in reports.

Use the `RebarSeqNumbering` macro to assign cast unit specific running numbers (1, 2, 3...) to the reinforcement in the model. Running numbers are unique inside each cast unit. The macro does the following:

1. Updates the position numbers of the modified model objects using the **Drawings & Reports** --> **Numbering** --> **Number Modified Objects** command.
2. Assigns running numbers to the reinforcing bars, reinforcing bar groups, and reinforcement meshes in the model.
3. Saves a running number as the user-defined attribute **Rebar sequence number** (`REBAR_SEQ_NO`) of each bar, group, or mesh.

To assign running numbers to reinforcement:

1. In the model, click **Tools** --> **Macros...** .
2. In the **Macros** dialog box, select `RebarSeqNumbering`.
3. Click **Run** to start the macro.
4. To show the running numbers in drawings and reports, use the user-defined attribute `REBAR_SEQ_NO`.

2.14 Classifying reinforcement to layers (RebarClassificator)

To be able to show in drawings what is the order of different reinforcement layers near a surface of a concrete part, you need to classify reinforcement in the model.

Use the `RebarClassificator` macro to classify the reinforcing bars and reinforcement meshes by their order of depth in concrete slabs and panels. The reinforcing bars and meshes get an attribute indicating the layer where they are placed inside the concrete part.

To classify reinforcing bars and reinforcement meshes:

1. In the model, click **Tools** --> **Macros...** .
2. In the **Macros** dialog box:
   a. Select `RebarClassificator`.
   b. Click **Run** to start the macro.
3. In the **Rebar Classificator** dialog box:
   a. Enter the prefixes that you want to use for the reinforcement layers near the top, bottom, front, and back surfaces of the concrete parts.
   b. Select whether you want to classify **All objects** or **Selected objects**.

      If you select **Selected objects**, select the reinforcement or the concrete parts containing the reinforcement that you want to classify.
   c. Click **Preview** to view the properties of the reinforcement in each layer.

      The layers are named using the relevant surface prefix and numbered starting from the surface.
   d. If you do not want to classify a reinforcement, select it from the list and click **Delete item**.
   e. To save the classification attributes of the reinforcement, do one of the following:
      - Click **Modify** to also keep the **Rebar Classificator** dialog box open.
      - Click **OK** to also close the **Rebar Classificator** dialog box.
4. In a drawing, run the `RebarLayeringMarker` macro to create layer-specific markers for reinforcement.

2.15 How to calculate the reinforcing bar length

You have three options how to calculate the reinforcing bar length in Tekla Structures:

- Along center line, which is the default method
- As a sum of leg lengths
- Using a formula

Along center line

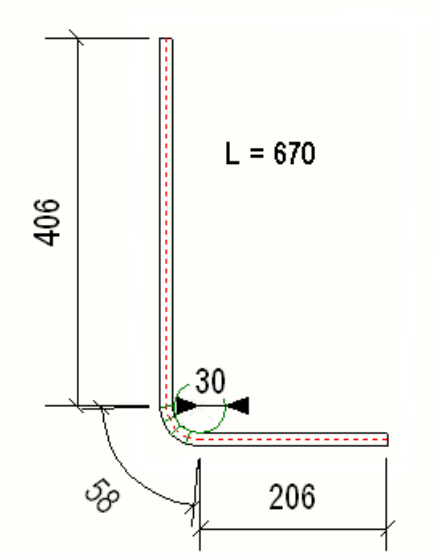
The center line length calculation is used by default when `XS_USE_USER_DEFINED_REBAR_LENGTH_AND_WEIGHT` is set to `FALSE` in **Tools** --> **Options** --> **Advanced Options...** ..

Center line length calculation uses the actual reinforcing bar diameter by default.

In the example below, the center line length is calculated as follows: `450 - (30 + 14) + 2*3.14*(30+14/2)*1/4 + 250 - (30 + 14) = 670.1`

where

- 30 = bending radius
- 14 = actual diameter (12 is nominal)

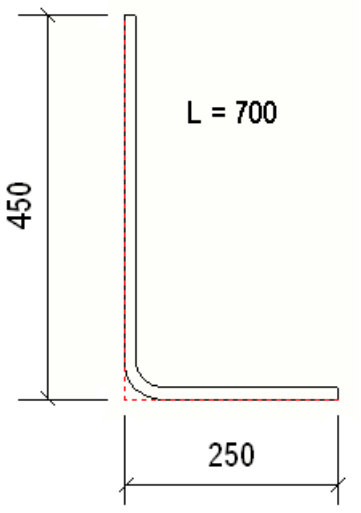


Sum of leg lengths (SLL)

The sum of leg length calculation is based on the dimensions of the straight legs and it does not take the bending radius into account.

This calculation is used when XS_USE_USER_DEFINED_REBAR_LENGTH_AND_WEIGHT and XS_USE_USER_DEFINED_REBARSHAPERULES are set to TRUE in **Tools** --> **Options** --> **Advanced Options...** ..

In the example below, the reinforcing bar length is 450 + 250 = 700



If the length value is shown as zero in reports and inquiries, you need to define the length in **Rebar Shape Manager** for each shape.

To define the length in **Rebar Shape Manager**:

1. In **Bending schedule fields**, right-click in the **L** cell and select **SLL (Sum of leg lengths)** from the pop-up menu.
2. Click **Update**.
3. Click **Save**.

Using a formula

You can also use a formula in **Rebar Shape Manager** to calculate the reinforcing bar total length.

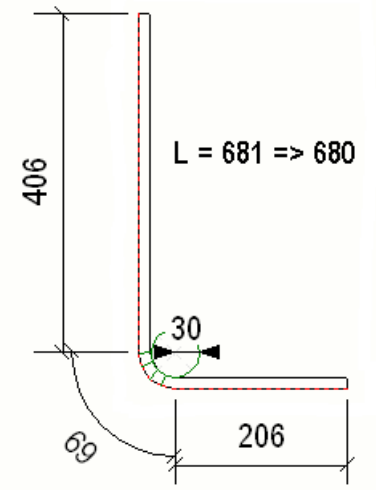
You need to set `XS_USE_USER_DEFINED_REBAR_LENGTH_AND_WEIGHT` and `XS_USE_USER_DEFINED_REBARSHAPERULES` to `TRUE` **Tools** --> **Options** --> **Advanced Options...** .

For example, to take the bending radius into account and to calculate the length along the reinforcing bar outer surface, do the following:

1. In **Bending schedule fields**, right-click in the **L** cell and select **(formula)** from the pop-up menu.
2. Enter the following formula for the length calculation: `S1 + S2 + 2*3.14*(RS + DIA)*1/4`

where

- `S1` = straight leg length 1 (`406`)
- `S2` = straight leg length 2 (`206`)
- `RS` = rounding radius (`30`)
- `DIA` = actual diameter (`14`)



Accuracy

The accuracy of reinforcing bar length is defined in the `rebar_config.inp` file. The values can vary in each environment.

For example, the values shown below are from a `rebar_config.inp` file. In the default environment the file is located in `..\ProgramData\Tekla Structures\<version>\Environments\default\system\` folder.

The following settings define the accuracy and rounding for the leg lengths:

- `ScheduleDimensionRoundingAccuracy=1.0`
- `ScheduleDimensionRoundingDirection="DOWN"`

The following settings define the accuracy and rounding for the total reinforcing bar length:

- `ScheduleTotalLengthRoundingAccuracy=10.0`
- `ScheduleTotalLengthRoundingDirection="DOWN"`

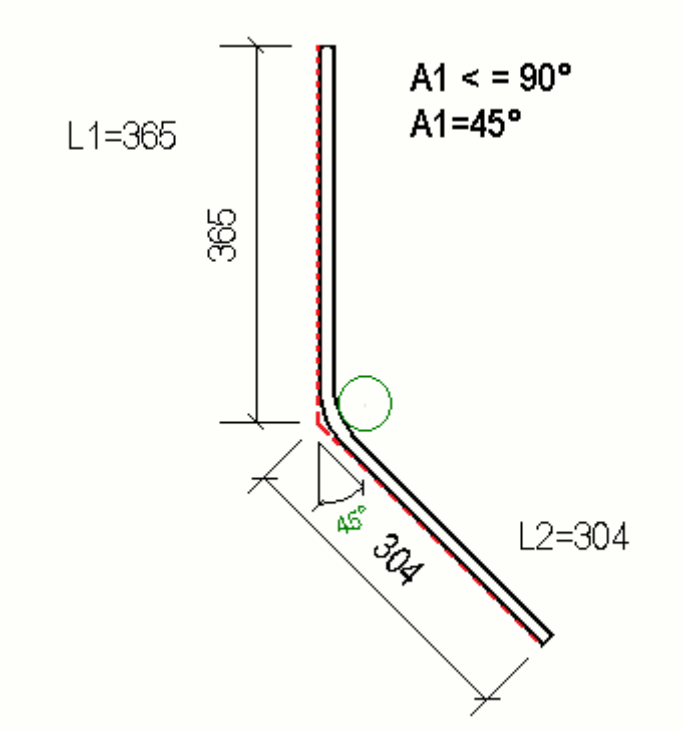
Note that also `XS_USE_ONLY_NOMINAL_REBAR_DIAMETER` affects the reinforcing bar length calculation.

See also Rebar Shape Manager in reinforcement shape recognition on page 78

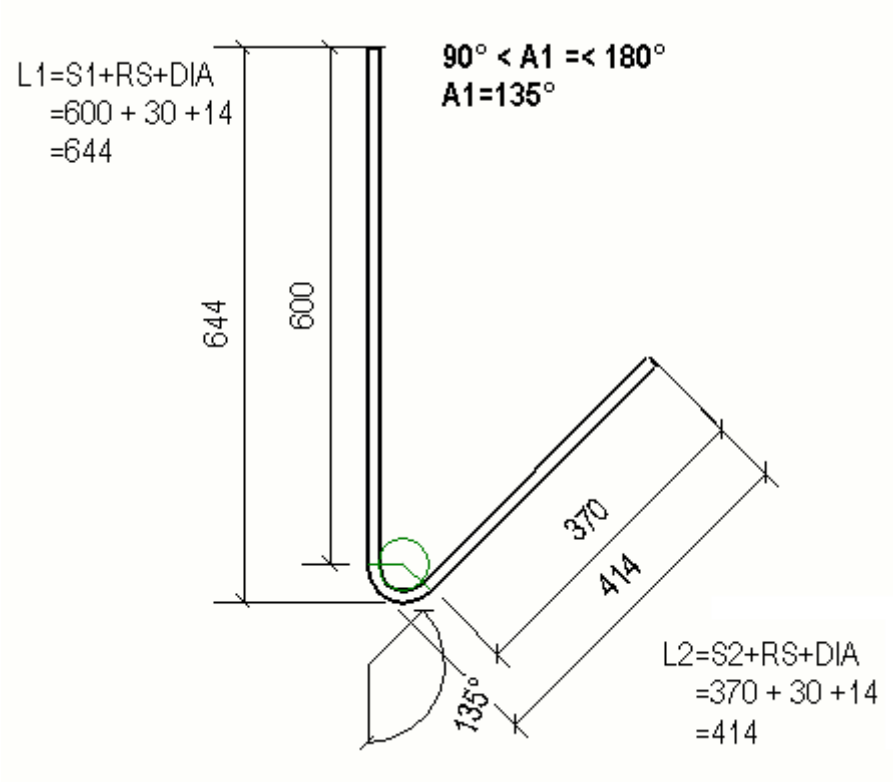
2.16 How to calculate the reinforcing bar leg length

How the reinforcing bar leg length is calculated depends on the angle between the bar legs.

- When the angle is <= 90°, the length is measured to the extension of a leg along the outer edge



- When the angle is > 90 ° and <= 180 °, the tangential length is used



The leg lengths are calculated using **Rebar Shape Manager**, where

- `S1` = straight portion of a bar for the first segment
- `S2` = straight portion of a bar for the second segment
- `A1` = bending angle measured between the extension of the first leg and the second leg. The angle is 0° if the second segment continues to the same direction as the first segment (the bar is straight)
- `L1` = leg length for the first reinforcing bar segment
- `L2` = leg length for the second reinforcing bar segment
- `RS` = bending radius
- `DIA` = actual diameter of the reinforcing bar

See also Rebar Shape Manager in reinforcement shape recognition on page 78

Reinforcing bar and bar group properties on page 50

3 Reinforcement shape recognition

Tekla Structures recognizes different reinforcing bar bending shapes and assigns shape codes to them. Tekla Structures then uses the shape and dimension information in bending schedules, pull-out pictures, templates and reports.

Tekla Structures includes two methods for shape recognition:

- User-defined bending shape definitions.

  These definitions are created with **Rebar Shape Manager** and saved in the `RebarShapeRules.xml` file.

  The file is located in `..\ProgramData\Tekla Structures\<version>\environments\<environment>\system` folder.

- Tekla Structures internal, hard-coded bending type definitions.

  These internal bending types of reinforcing bars are mapped to area-specific reinforcing bar bending type codes in the `rebar_schedule_config.inp` file.

  The file is located in `..\ProgramData\Tekla Structures\<version>\environments\common\system` folder.

See also Rebar Shape Manager in reinforcement shape recognition on page 78

Hard-coded bending type identifiers in reinforcement shape recognition on page 88

Reinforcement in templates on page 111

3.1 Rebar Shape Manager in reinforcement shape recognition

You can define your own bar bending shapes and assign shape codes with **Rebar Shape Manager**, and thus increase the amount of recognized bar shapes. User-defined bending shapes are useful when Tekla Structures does not recognize the bending shape and assigns the `UNKNOWN` bending type to the shape.

With **Rebar Shape Manager** you can

- customize the existing bending shapes and create new bending shapes
- establish your own rules for defining the bending shapes

- customize your own dimension mappings that are used in templates and reports
- import and export user-defined bending shapes
- use user-defined bending shapes in bending schedules and pull-out pictures

Rebar Shape Manager is a tool for recognizing reinforcing bar shapes. You cannot control the reinforcing bar creation properties, such as cover thickness, reinforcing bar grade, or size, with this tool.

The tool is meant for users who need to customize the bending shapes based on company or project requirements.

See also
Defining reinforcing bar bending shapes in Rebar Shape Manager on page 79
Adding new bending shape rules manually in Rebar Shape Manager on page 81
Defining content for templates and reports in Rebar Shape Manager on page 85
Tips for reinforcement shape recognition in Rebar Shape Manager on page 87

Defining reinforcing bar bending shapes in Rebar Shape Manager

When you define your own reinforcing bar bending shapes and shape codes in **Rebar Shape Manager**, an `.xml` file called `RebarShapeRules.xml` is created in the current model folder.

In addition, Tekla Structures installation contains by default another `.xml` file called `RebarShapeRules.xml`. This file contains the most typical bending shapes in your environment, and it is located in the `..\ProgramData\Tekla Structures\<version>\environments\<environment>\system` folder.

When you define new shapes, the shapes in the default `RebarShapeRules.xml` rule file can be appended to your own shapes. Tekla Structures reads valid `RebarShapeRules.xml` rule files in the model, project, firm, and system folders in that order, and merges the files. When the shape codes and report field values are applied, Tekla Structures uses the first matching shape in a `RebarShapeRules.xml` file which is found first based on the search order. All the found bending shapes are displayed in **Rebar Shape Manager**.

To define your own reinforcing bar bending shapes in **Rebar Shape Manager**:

1. Select reinforcing bars in the model.
2. Click **Tools** --> **Rebar Shape Manager...** .

   Rebar Shape Manager opens, and lists the selected reinforcing bars in the **Model rebars** list.

   Alternatively, you can first open **Rebar Shape Manager** and then select reinforcing bars in the model. Click **Get selected** to add the reinforcing bars to the **Model rebars** list.

- The **Model rebars** list shows the ID and the shape code of the selected reinforcing bars.
- The **Shape catalog** list shows the shapes that exist in the default `RebarShapeRules.xml` rule file.

3. Select one unknown shape from the **Model rebars** list.
4. To define the needed information for a bending shape, do the following:

To define	Do this
Shape code	Enter a shape code for an unknown shape. Note that multiple reinforcement shapes that are variants of the same shape can have the same **Shape code** but different **Bending shape rules**.
Bending shape rules	Add or delete a bending shape rule by clicking the **Add** and **Delete** buttons on the right. Use the **Reset** button to restore the original values.
Check hooks	Select the check box if you want to define different shape codes or bending schedule fields for two bars that otherwise have exactly the same geometry, but one bar has hooks and the other one does not. If you select the check box, hooks are considered as hooks. If you clear the check box, hooks are considered as normal legs. Note that the **Check hooks** option works independently from the advanced option `XS_REBAR_RECOGNITION_HOOKS_CONSIDERATION` in **Tools** --> **Options** --> **Advanced Options...** , and it allows bars that have different hooks to have different shape code or schedule fields regardless of the value of the advanced option.
Update	Update the existing shape code definition of the selected reinforcing bar. You can update the definition if you have modified the shape code, bending shape rules or the contents of bending schedule fields.
Bending schedule fields	Define the content for a bending schedule. Right-click a field to select a bending shape property or to enter a formula. The names of the **Bending schedule fields** (**A**, **B**, and so on) are used in templates and reports. To make sure that old reports also work correctly, we recommend that you use the same `DIM_XX` fields as in the `rebar_schedule_config.inp` file.
Schedule fields...	Click the **Schedule fields...** button to add, remove or change the order of the available schedule fields. If needed, you can reset the schedule fields to original defaults. If you change the set of available schedule fields and update an existing shape, the old schedule fields which do not exist anymore will be cleared. Therefore we recommend that you do not to remove any of the default

To define	Do this
	schedule fields unless you are sure they have not been used in any of the existing shapes. You can change the names of the existing schedule fields or, if you add new fields, give names to them. To use the fields in templates and reports, use the `DIM_XX` or `ANG_xx` fields, and replace `xx` with the schedule field name.

5. When you have finished defining the new shape, click **Add** to add the bending shape definition to the `RebarShapeRules.xml` file.

   To enable the **Add** button you need to change the bending shape rule, enter a shape code or select the **Check hooks** check box.

6. Click **Save** to save the `RebarShapeRules.xml` file.

   By default, the file is located in the current model folder.

   When you create, for example, a bending schedule, Tekla Structures uses the updated bending shape information, recognizes the added bending shape and assigns a correct shape code to it.

Rebar Shape Manager is able to recognize bending shapes regardless of the modeling direction of the bars. This means that the modeling direction has no effect on the shape definition and the shape code.

When defining the bending shapes, the start or the end of modeling direction is always sorted based first on bending angles, then on twist angles, and finally on leg lengths. However, bending radius is not taken into account in the sorting. This means that radius 1 may not always be less than radius 2 or vice versa.

See also Rebar Shape Manager in reinforcement shape recognition on page 78

Adding new bending shape rules manually in Rebar Shape Manager

In some cases, the bending shape rules that **Rebar Shape Manager** defines automatically are not sufficient to distinguish certain bending shapes. If needed, you can manually add new bending shape rules for reinforcing bars in **Rebar Shape Manager**.

To manually define a rule for a reinforcing bar bending shape:

1. In **Rebar Shape Manager** click **Add** next to the **Bending shape rules list**.
2. In the **New bending rule** dialog box, select the options from the lists to define the new rule.

   The content of the lists depends on the shape and the bending of the reinforcing bar.

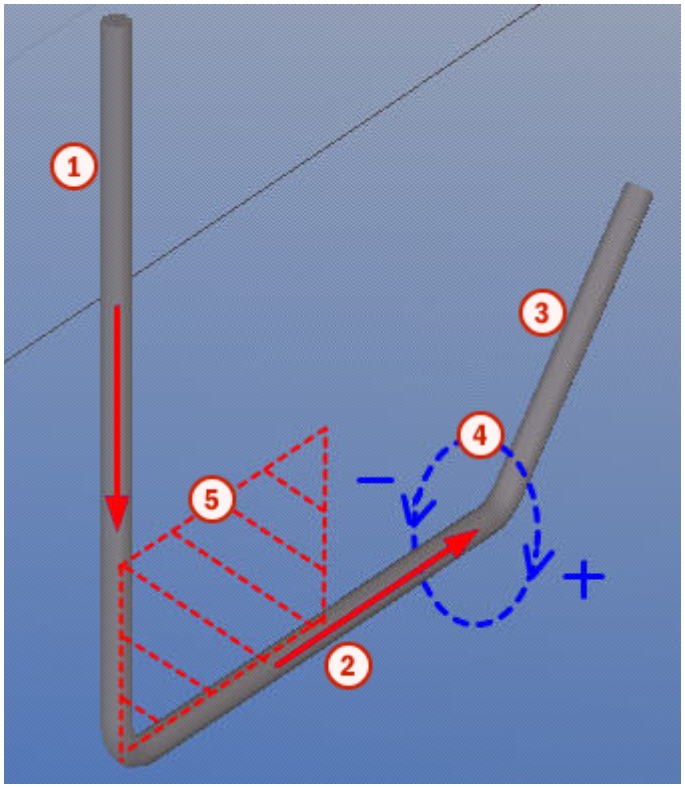
3. Click **OK** to add the new rule to the **Bending shape rules list**.

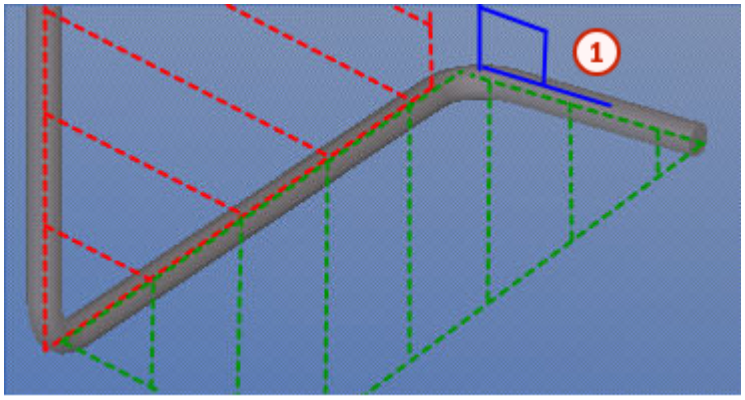
   The **OK** button is enabled only when the rule is valid.

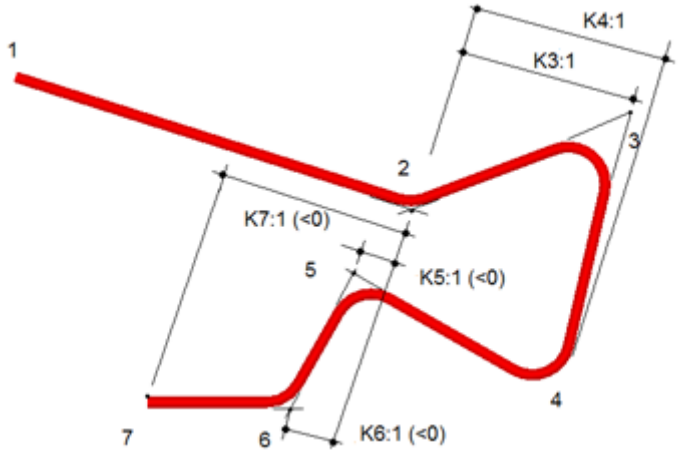
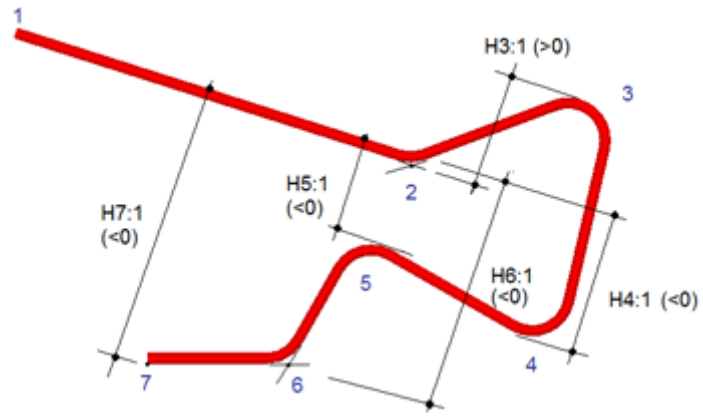
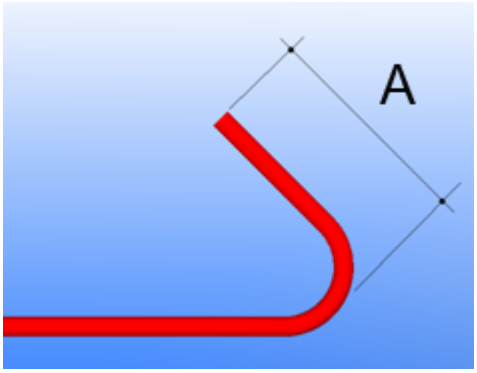
Bending shape rule settings

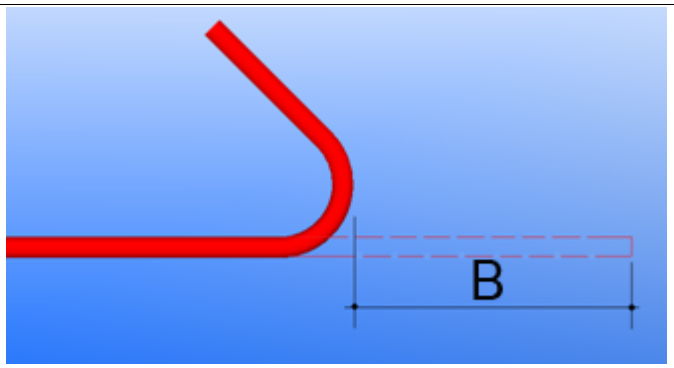
All the rule options are available in the **New bending rule** dialog box, even though only certain selections are valid, depending on the type of the conditions used. The left and right condition of a rule need to be of the same type. The values in the parentheses are the values that were used to create the bar shape.

Use the **New bending rule** dialog box in **Rebar Shape Manager** to manually define rules for reinforcing bar bending shapes.

Option	Description
Angle (A)	Bending angle between the legs. Bending angle is always between 0 and +180 degrees. The angle cannot be negative.
Twist angle (T)	Rotation angle of a plane that has been created by two bars of consecutive lengths. The plane is rotated around the axis of the last bar creating the plane. For bars where all the legs lie in the same plane, the twist angle is either 0 degrees or +180 degrees. If the bar twists out of the plane, i.e. the bar is in 3D, the twist angle is between -180 and +180 degrees.  1. Leg1

Option	Description
	2. Leg 2 3. Leg 3 4. Twist angle direction 5. Plane created by legs 1 and 2
Twist angle example	The twist angle between two planes is +90 degrees. The planes are created by legs 1 and 2, and legs 2 and 3.  1. Twist angle: +90 degrees
Radius (R), (RX)	Bending radius of the bending. `(RX) Radius *` is the value of the bending radius when all the bendings have equal radius. Otherwise the value is zero (0). `Radius * = Radius 1` ensures that all the bendings have been created using the same radius.
Straight length (S)	Straight length between the start and the end of adjacent bendings. The rule is generated only when there is no straight part, for example, `Straight length 2 = 0`.
Leg length (L)	Length of the leg.
Leg (V)	Leg direction as a vector value.
Leg distance from leg (D)	Similar to **Point/arc distance off from leg (H)**. The difference is that **Point/arc distance off from leg (H)** considers the bending radius, whereas **Leg distance from leg (D)** is measured from the sharp corner. When the legs are parallel, both **Leg distance from leg (D)** and **Point/arc distance off from leg (H)** give the same result.
Point/arc distance along leg (K)	Distance parallel to a leg from outer edge to outer edge, or tangential to the bending. The distances are positive or negative depending on the leg direction. Example:

Option	Description
	
Point/arc distance off from leg (H)	Distance perpendicular to a leg from outer edge to outer edge, or tangential to the bending. The distances are positive or negative depending on the leg direction. Example: 
SHA **SHR** **SHS** **SHLA** **SHLB** **EHA** **EHR** **EHS**	Start and end hook properties. Use method A or B for the hook length calculation: 

Option	Description
EHLA **EHLB**	
Standard radius (RS)	Standard minimum bending radius. The bending radius depends on the size and the grade of the bar.
Bar diameter (DIA), (DIAX)	Diameter of the reinforcing bar.
Center line length (CLL)	Leg length according to the center line.
Sum of leg lengths (SLL)	Sum of all leg lengths.
Weight per length (WPL)	Weight per leg length.
Reversed	Reversed reinforcing bar. You can use **Reversed** to have additional bending shape rules and/or formulas for the schedule fields. When used in a rule, you can have separate definitions in shape code and/or schedule fields for reinforcing bars that have different modeling order of the points. When used as a part of a formula, you can eliminate the automatic normalization of the modeling order of the points. For example, a formula `if (REVERSED) then L2 else L3 endif` forces the content of the field to show the desired leg length depending on the order of the points or legs.
Constant angle	Constant value of the angle. Enter the value in the rightmost box.
Constant radius	Constant value of the radius. Enter the value in the rightmost box.

See also Rebar Shape Manager in reinforcement shape recognition on page 78

Defining content for templates and reports in Rebar Shape Manager

Use the **Bending schedule fields** in **Rebar Shape Manager** to define the content for templates and reports. Each of the **Bending schedule fields** can contain a shape property or a formula.

When you right-click in a **Bending schedule fields** cell, you can:

- Select a shape property from the list. The content of the list depends on the reinforcing bar geometry.
- Select the **(empty)** option to clear the content of the current cell.
- Select the **(formula)** option to enter a formula. The variables in the formula can either be the shape properties visible in the pop-up menu, or direct references to other non-empty bending schedule field cells.

  You can use the same functions in the formulas as in custom components:

  - Mathematical functions
  - Statistical functions
  - String operation
  - Trigonometric functions

    When you map angles and trigonometric functions in the **Schedule field formula** dialog box, enter the functions (sin, cos, tan) in small letters, for example `sin(A1)`. Capital letters are not recognized, and a blank space will appear in reports.

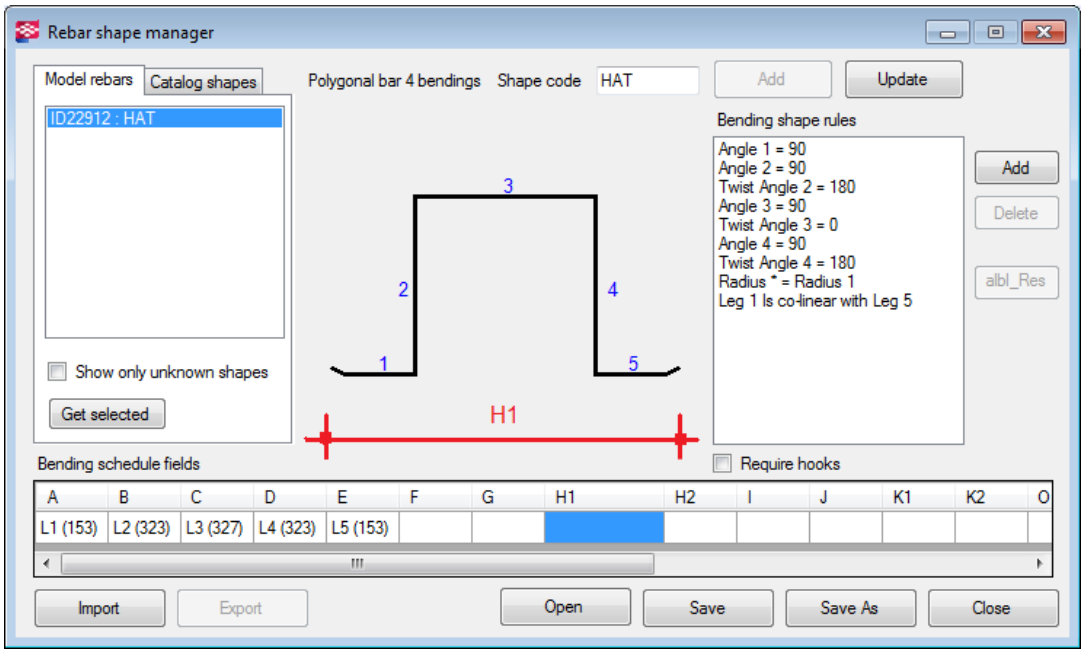
  If you have angles in a formula, the formula needs to be in radians. For example, if you want to subtract 180 degrees from angle A1, enter `A1-PI` in capital letters. If you enter `A1-180` or `A1-pi`, the formula does not work.

Bending schedule fields cell shows the result of a valid formula. If the formula is not valid, a question mark and text describing the error is shown.

Use the fields **S**, **T**, **U** or **V** to report angles. If you do not use these fields, you need to override the default unit settings in the **Template Editor**.

Example Formula is `L1+L3+L5-2*DIA`

- `L1`, `L3` and `L5` are the leg lengths measured from outer edge to outer edge
- `H1` is the total width
- to achieve `H1`: `L1+L3+L5 minus 2*bar diameter`



See also Rebar Shape Manager in reinforcement shape recognition on page 78

Tips for reinforcement shape recognition in Rebar Shape Manager

The reinforcing bar shape recognition is based on each shape's bending shape rules. The shapes and their rules are listed in the `RebarShapeRules.xml` file, located in the `..\ProgramData\Tekla Structures\<version>\environments\<environment>\system` folder by default. Sometimes a shape matches the rules of two shapes, and Tekla Structures does not recognize the reinforcing bar shape as expected.

The most convenient way to ensure that a shape is recognized correctly is to modify the shape definition by adding more rules to the shape in **Rebar Shape Manager**.

However, if necessary, you can manually modify the `RebarShapeRules.xml` file and thus affect the shape recognition. When Tekla Structures recognizes the shape, the order of the shapes in the `RebarShapeRules.xml` is important:

- The first shape that matches the rules is the one that Tekla Structures recognizes as the shape. If you need to change the order of the shapes to change how Tekla Structures recognizes the shape, you can do it by manually modifying the `RebarShapeRules.xml` file. If you modify the file and change the order of the shapes, make sure that the structure of the file stays valid.
- You can divide the shape definitions in several `RebarShapeRules.xml` files and different folders. Tekla Structures searches the `RebarShapeRules.xml` file in the model, project, firm, and system folders in that order, and merges the files. Tekla

Structures uses the first matching shape in the first `RebarShapeRules.xml` file which is found based on the search order.

See also Rebar Shape Manager in reinforcement shape recognition on page 78

3.2 Hard-coded bending type identifiers in reinforcement shape recognition

Tekla Structures recognizes different reinforcing bar bending shapes and assigns bending type identifiers to them.

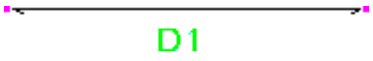
The bending type identifiers in the table below are internal, hard-coded types of Tekla Structures. The leg dimensions (`D1`, `D2`, and so on) and bending angles (`A1`, `A2`, and so on) of reinforcing bars are Tekla Structures internal dimensions and angles. You can map the Tekla Structures internal bending types, for example, to country- or project-specific bending types, and the Tekla Structures internal dimensions and angles to specific template attributes. You can do this in the `rebar_schedule_config.inp` file.

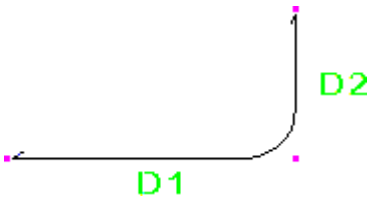
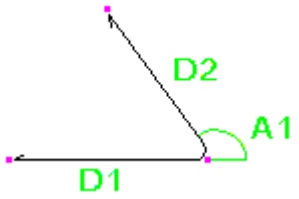
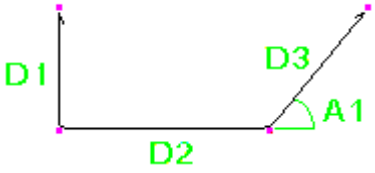
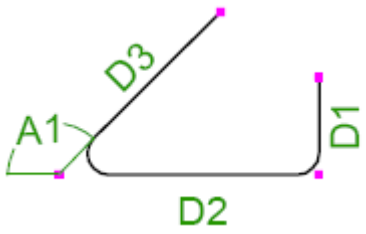
Reinforcing bar bending dimensions are calculated so that the leg dimensions (`D1`, `D2`, and so on) follow the outer edge, or the edge extension, of the reinforcing bar. The total length is calculated according to the center line of the reinforcing bar.

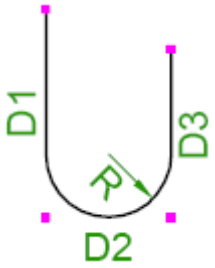
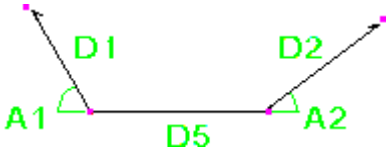
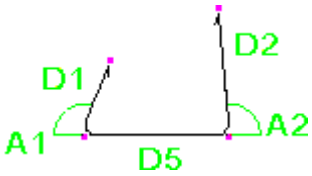
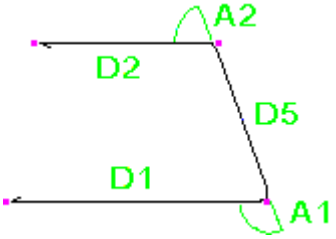
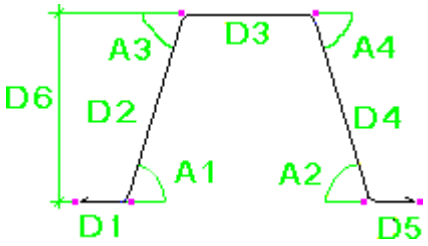
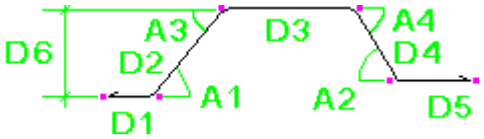
If Tekla Structures does not recognize the shape of a reinforcing bar, it assigns the `UNKNOWN` bending type to it.

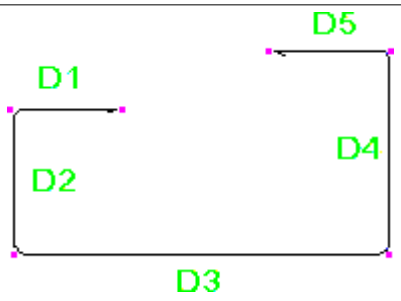
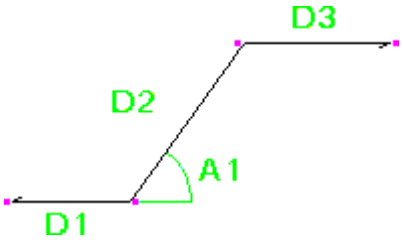
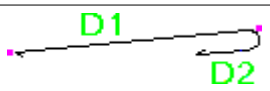
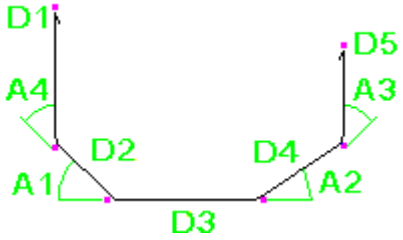
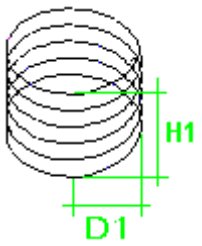
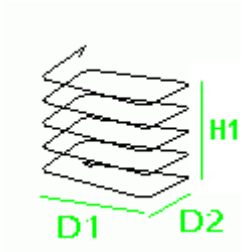
The magenta points in the images in the table below represent the points you pick in the model when you create reinforcing bars.

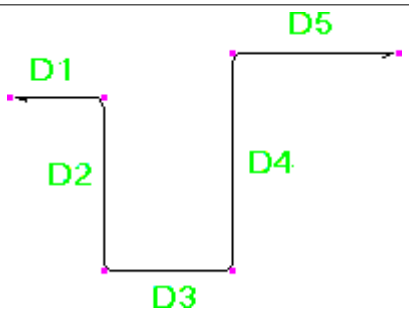
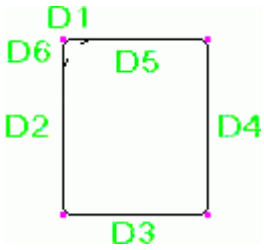
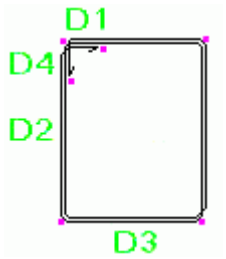
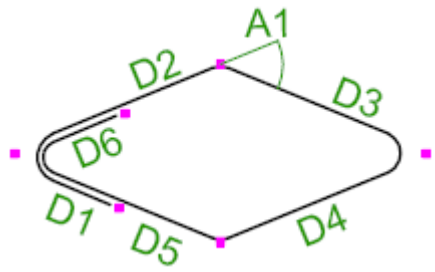
If you want to customize the hard-coded bending shapes or define new bending shapes, use **Rebar Shape Catalog**. See Defining reinforcing bar bending shapes in Rebar Shape Manager on page 79.

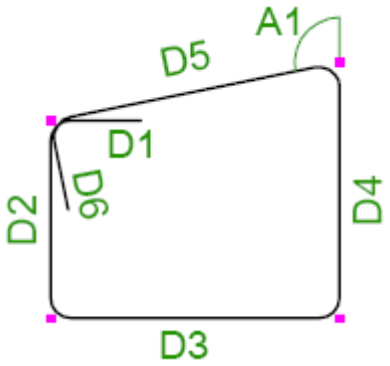
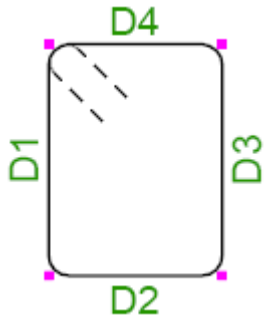
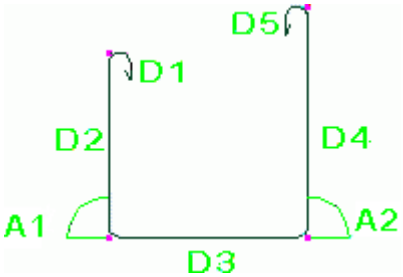
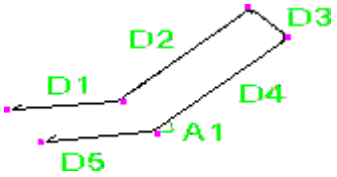
Bending type identifier	Bending shape
1	
2_1	 Requires standard bending radius.

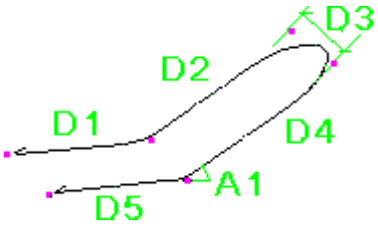
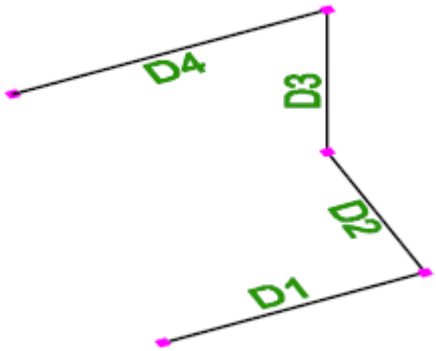
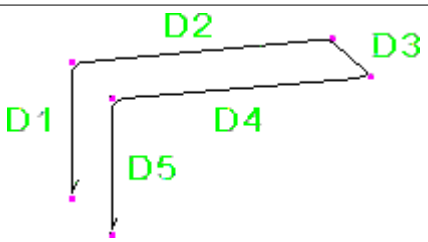
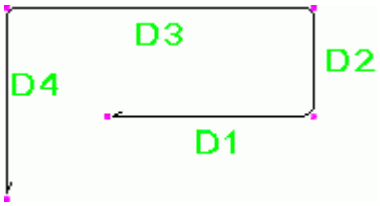
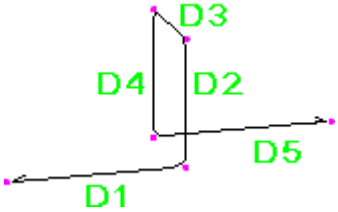
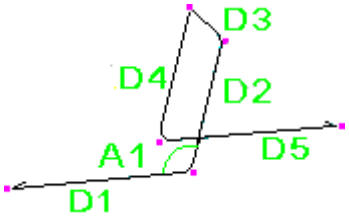
Bending type identifier	Bending shape
2_2	 Non-standard bending radius.
3_1	
3_2	
4	
4_2	
4_3	

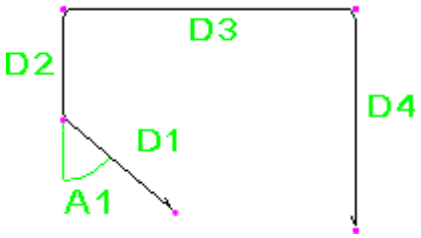
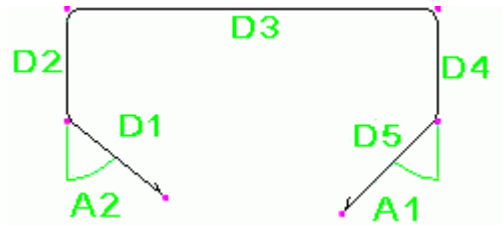
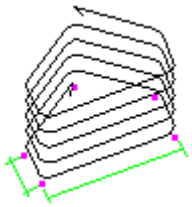
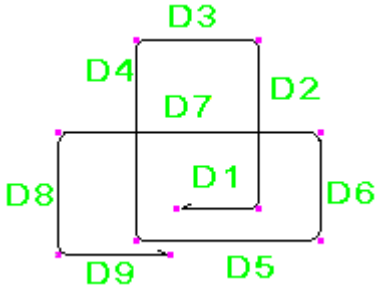
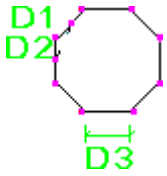
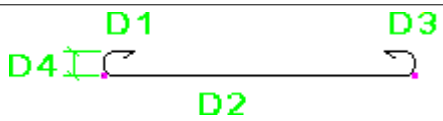
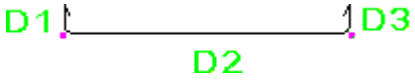
Bending type identifier	Bending shape
4_4	
5_1	
5_2	
5_3	
6_1	
6_2	

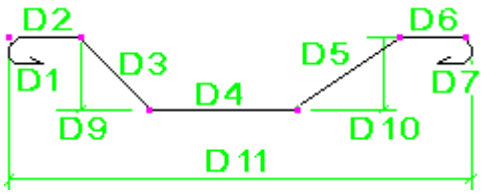
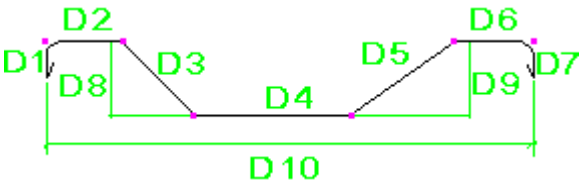
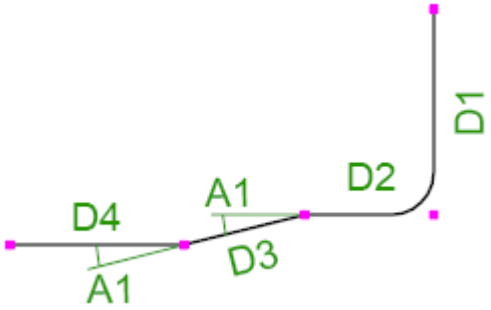
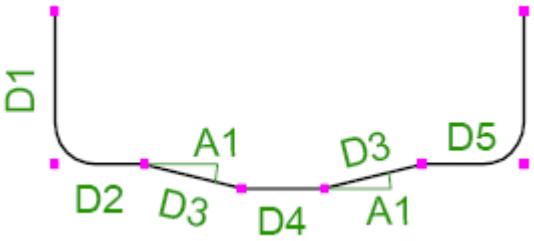
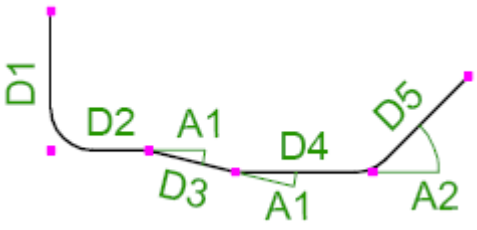
Bending type identifier	Bending shape
7	
8	
9	 Requires 180 degree hook.
10	
11	 D1 = Radius from center of circle to the center line of reinforcing bar.
12	

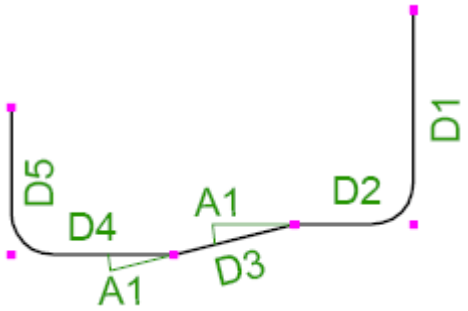
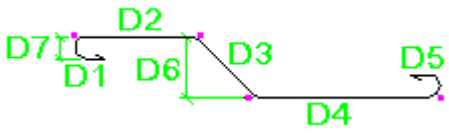
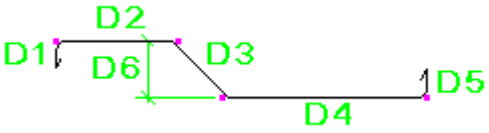
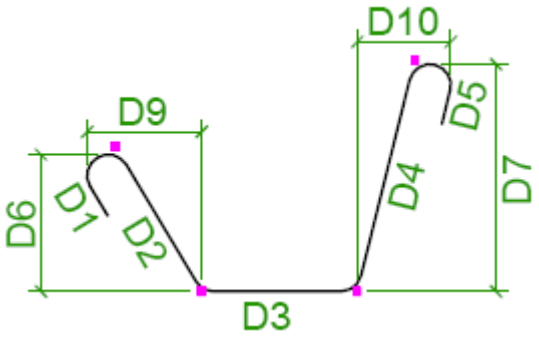
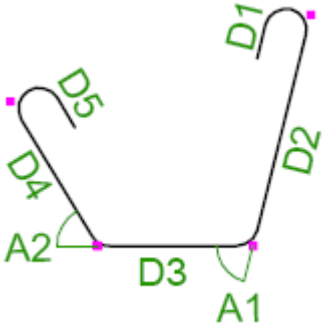
Bending type identifier	Bending shape
13	 Can also be modeled using hooks at both ends (i.e. model D1 and D5 using 90 degree hooks).
14	 Requires 90 degree hooks at both ends.
14_2	
14_3	

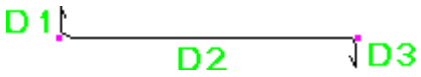
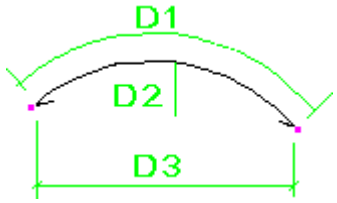
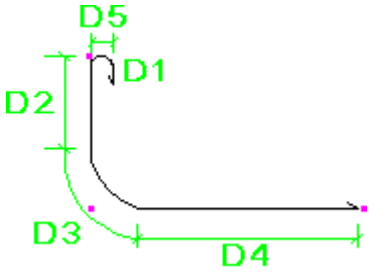
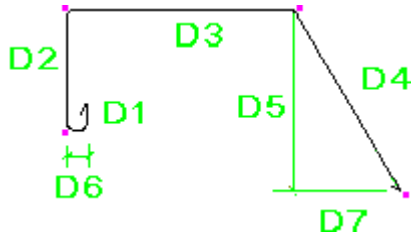
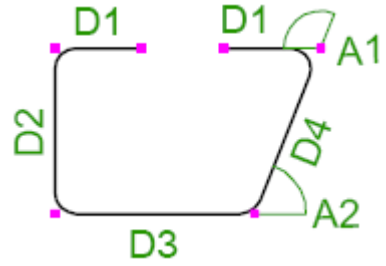
Bending type identifier	Bending shape
14_4	 Requires 90 degree hooks at both ends.
14_5	 Recognized when the start point and end point are in the same location and no hooks are used. If `XS_REBAR_RECOGNITION_HOOKS_CONSIDERATION` is set to `FALSE`, reinforcing bars with hooks (types 14 and 48) are recognized as 14_5.
15	 Requires hooks at both ends.
16_1	

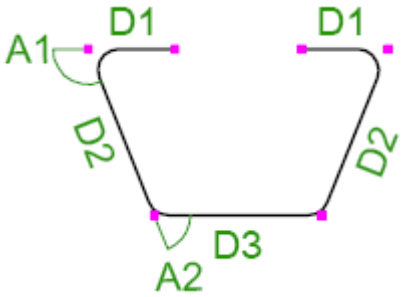
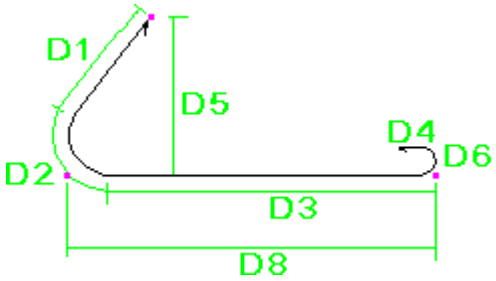
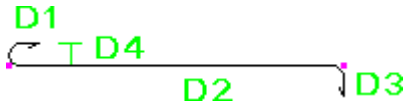
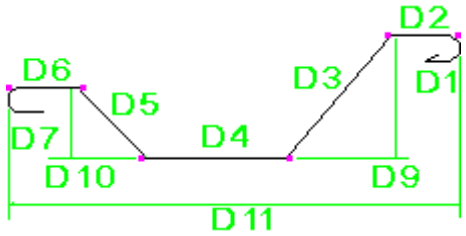
Bending type identifier	Bending shape
16_2	
17	
18	
19	
20_1	
20_2	

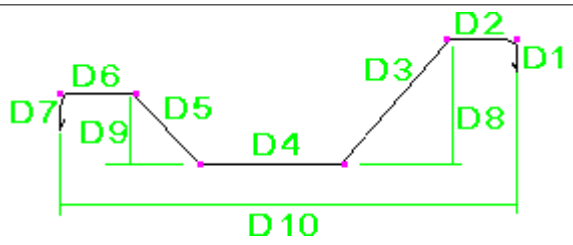
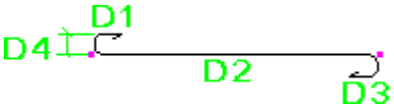
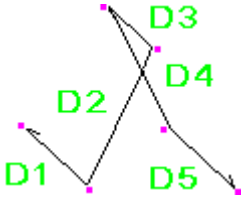
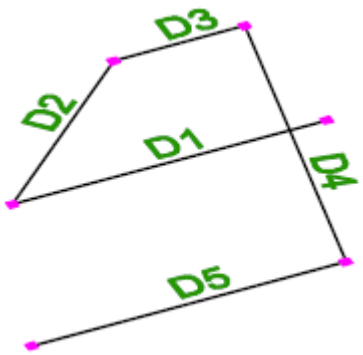
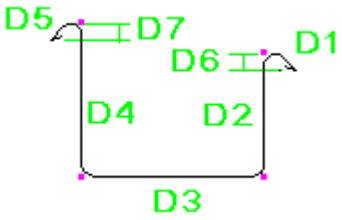
Bending type identifier	Bending shape
21	
22	
23	
24	
25	
26	 Requires 180 degree hooks at both ends.
27	 Requires 90 degree hooks at both ends.

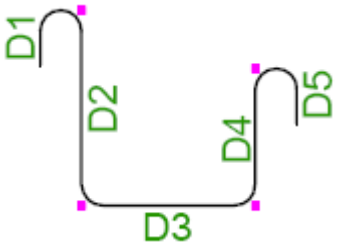
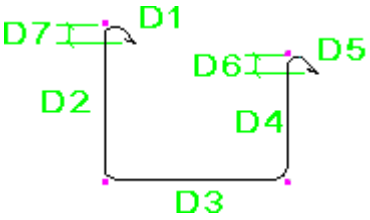
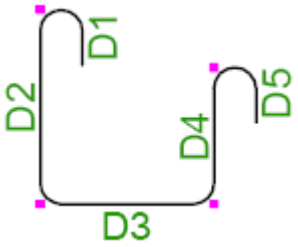
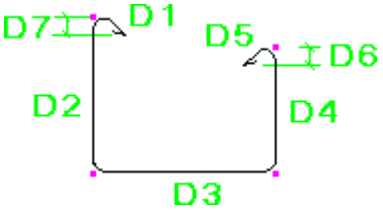
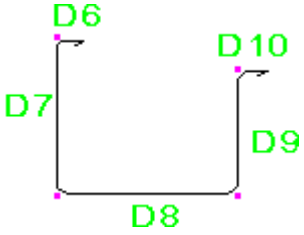
Bending type identifier	Bending shape
28	 Requires 180 degree hooks at both ends.
29	 Requires 90 degree hooks at both ends.
29_2	
29_3	
29_4	

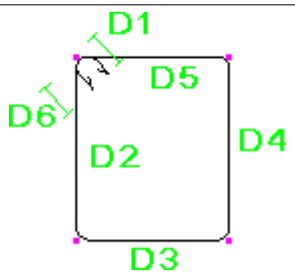
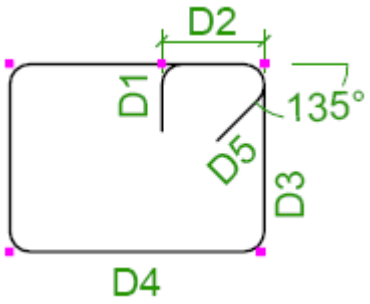
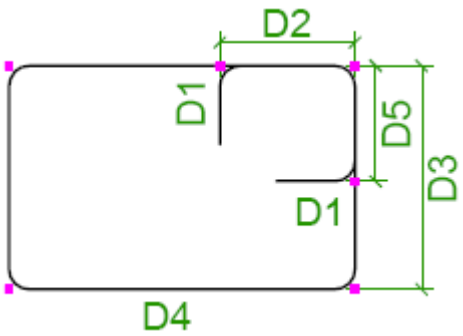
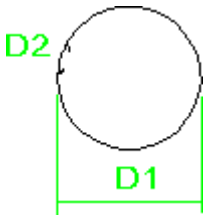
Bending type identifier	Bending shape
29_5	
30	 Requires 180 degree hooks at both ends.
31	 Requires 90 degree hooks at both ends.
32	 Requires 180 degree hooks at both ends.
32_2	

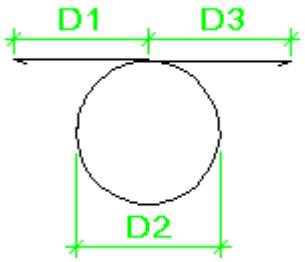
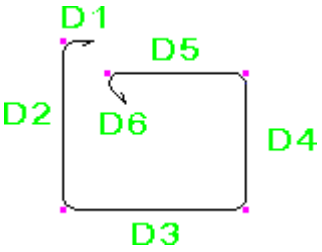
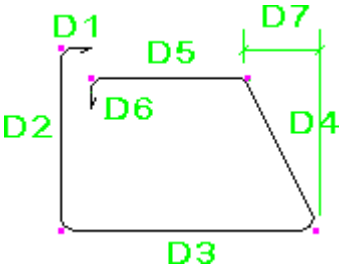
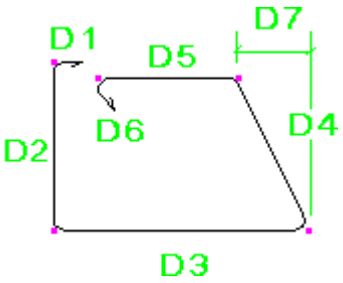
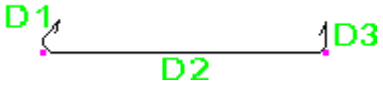
Bending type identifier	Bending shape
33	 Requires 90 degree hooks at both ends.
34	
35	 Requires 180 degree hook.
36	 Requires 180 degree hook.
36_2	 Can also be modeled using hooks at both ends.

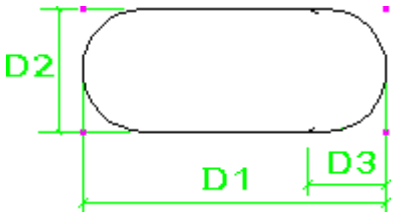
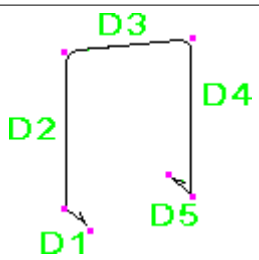
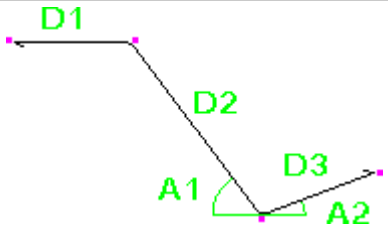
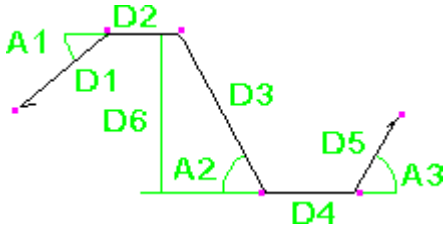
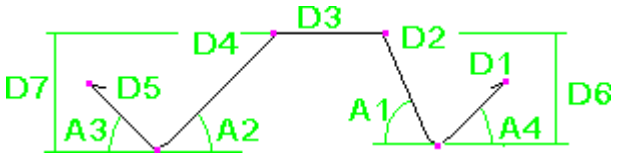
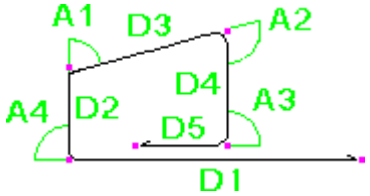
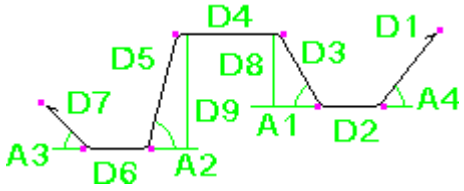
Bending type identifier	Bending shape
36_3	 Can also be modeled using hooks at both ends.
37	 Requires 180 degree hook.
38	 Requires 180 degree hook at one end and 90 degree hook at the other end.
38_2	
39	
40	 Requires 180 degree hooks at both ends.

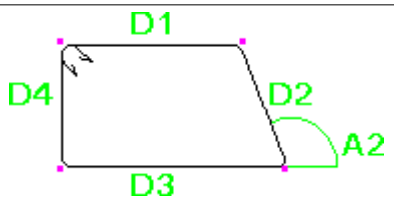
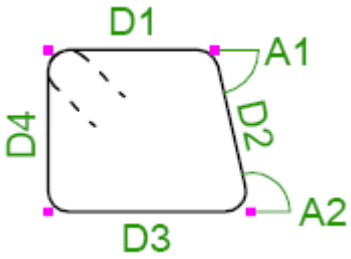
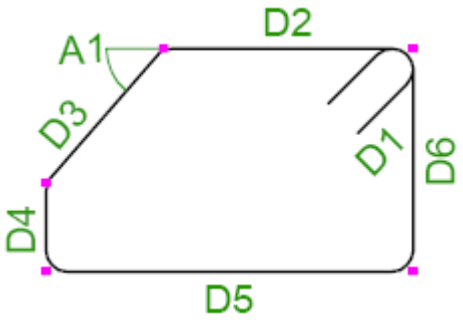
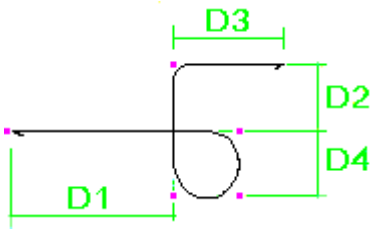
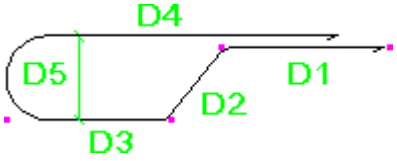
Bending type identifier	Bending shape
41	 Requires 90 degree hooks at both ends.
42	 Requires 180 degree hooks at both ends.
43	
43_2	
44	 Requires hooks at both ends.

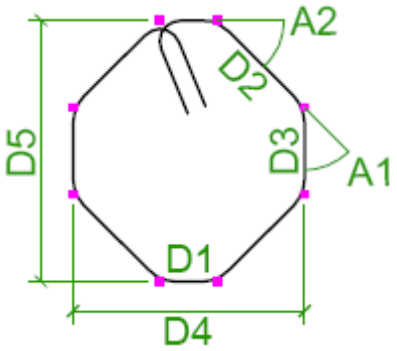
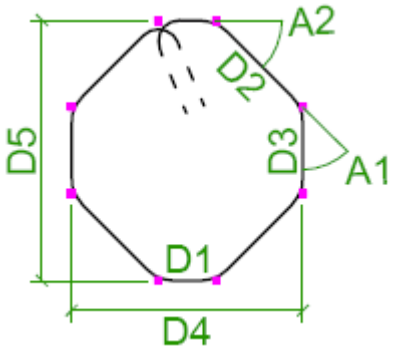
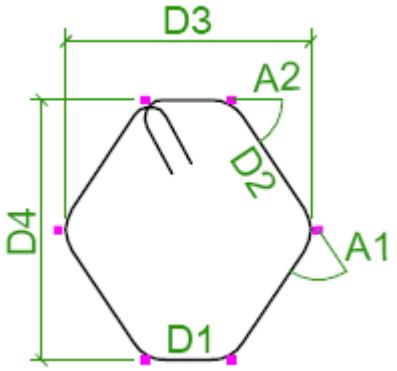
Bending type identifier	Bending shape
44_2	 Requires 180 degree hooks at both ends.
45	 Requires hooks at both ends.
45_2	 Requires 180 hooks at both ends.
46	 Requires hooks at both ends.
47	 Requires 90 degree hooks at both ends.

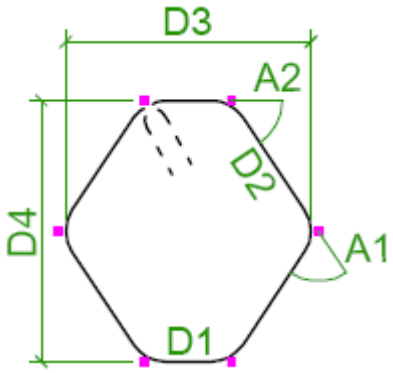
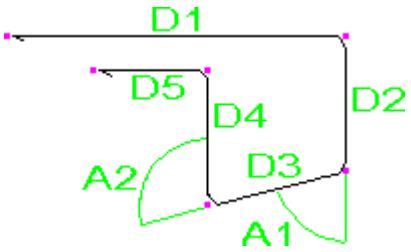
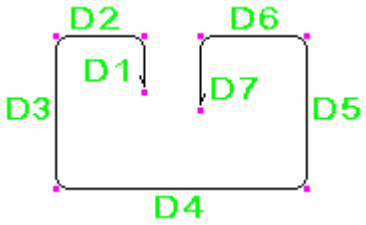
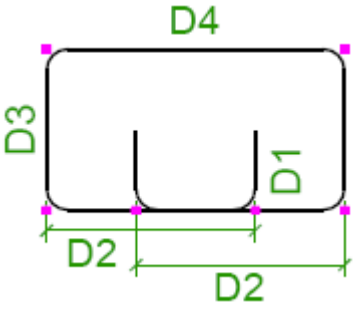
Bending type identifier	Bending shape
48	 Requires hooks at both ends.
48_2	 Requires hooks at both ends.
48_3	
49	 D1 = Reinforcing bar center line diameter.

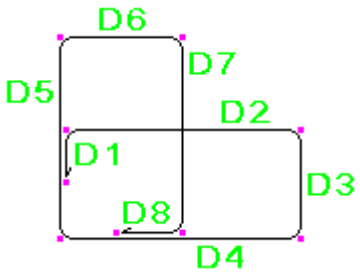
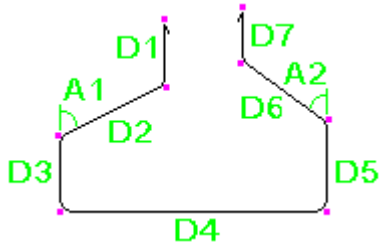
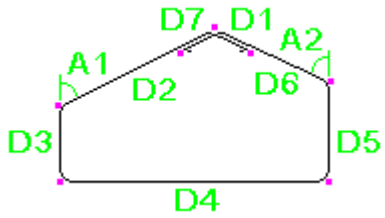
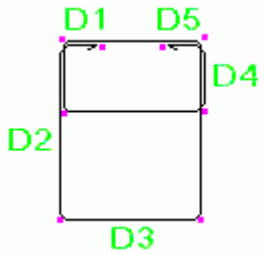
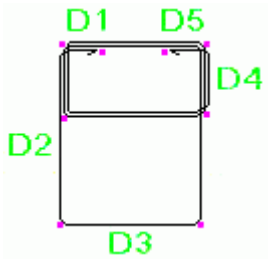
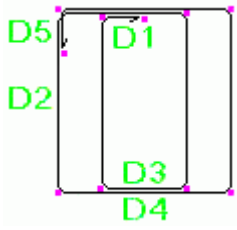
Bending type identifier	Bending shape
49_2	
50	 Requires hooks at both ends.
51	 Requires 90 degree hooks at both ends.
52	 Requires hooks at both ends.
53	 Requires hooks at both ends.

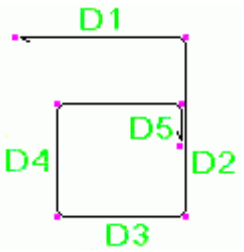
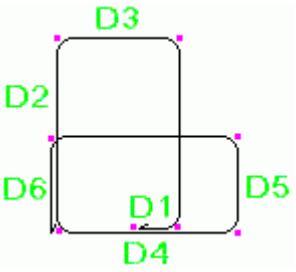
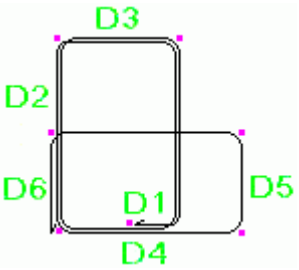
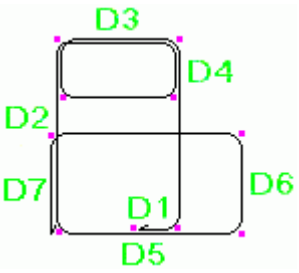
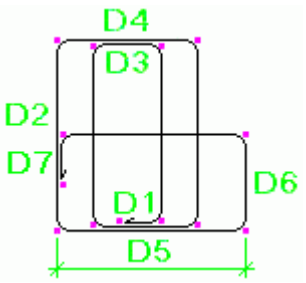
Bending type identifier	Bending shape
54	 Requires hooks at both ends.
55	
56	
57	
58	
59	
60	

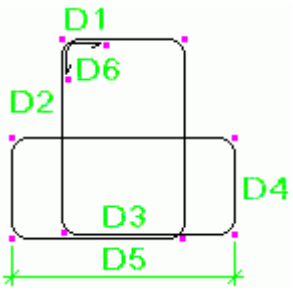
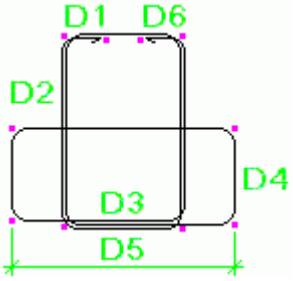
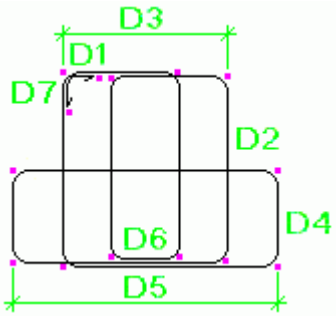
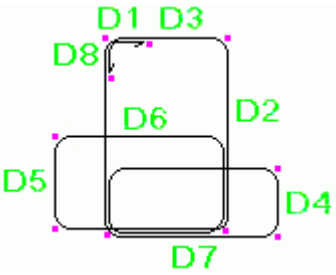
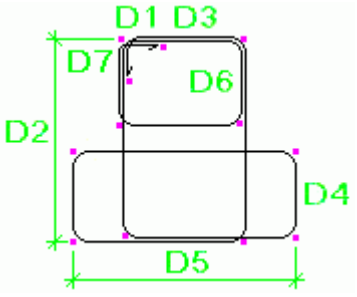
Bending type identifier	Bending shape
61	 Requires hooks at both ends.
61_2	 Recognized if `XS_REBAR_RECOGNITION_HOOKS_CONSIDERATION` is set to `FALSE`.
61_3	 Requires hooks at both ends.
62	 Requires hook.
63	 Requires hook.

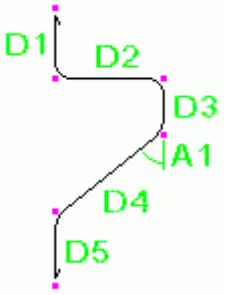
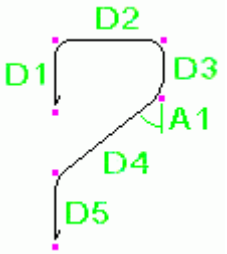
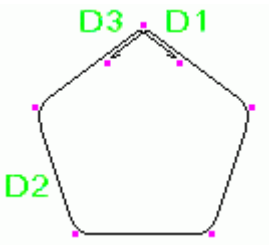
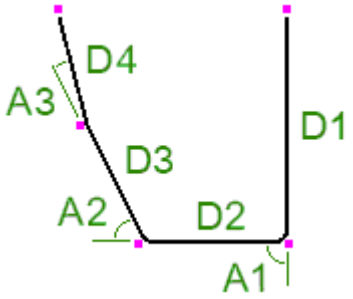
Bending type identifier	Bending shape
64	 Requires hooks at both ends.
64_2	 Recognized if `XS_REBAR_RECOGNITION_HOOKS_CONSIDERATION` is set to `FALSE`.
65	 Requires hooks at both ends.

Bending type identifier	Bending shape
65_2	 Recognized if `XS_REBAR_RECOGNITION_HOOKS_CONSIDERATION` is set to `FALSE`.
66	
67	
67_2	

Bending type identifier	Bending shape
68	
69_1	
69_2	
70_1	
70_2	
71	

Bending type identifier	Bending shape
72	
73_1	
73_2	
73_3	
74	

Bending type identifier	Bending shape
75_1	
75_2	
76	
77	
78	

Bending type identifier	Bending shape
79_1	
79_2	
80	
UNKNOWN	For example: 

See also Reinforcement in templates on page 111

Reinforcement shape recognition on page 78

3.3 Reinforcement in templates

Sometimes you need to localize reinforcing bar bending types or to create templates for reinforcing bar bending schedules.

If you want to customize the hard-coded bending shapes or define new bending shapes, use **Rebar Shape Catalog**. See Defining reinforcing bar bending shapes in Rebar Shape Manager on page 79.

Reinforcement templates

You can show dimensions, bending angles, and bending types of reinforcing bars in drawings and reports by including reinforcement-specific attributes, such as `DIM_A`, `ANG_S`, `SHAPE`, and `SHAPE_INTERNAL`, in template fields. For more information on creating templates, see the Template Editor (TplEd) help.

Mapping dimensions

Use the `rebar_schedule_config.inp` file in the `..\ProgramData\Tekla Structures\<version>\environments\<environment>\system` folder to map

- Tekla Structures internal reinforcing bar dimensions and angles with specific template attributes
- Tekla Structures internal reinforcing bar bending types with specific bending types

These mappings are environment-specific by default. You can modify them to suit your company or project needs.

You can use equations, functions, and `if` statements to calculate the dimensions and angles you need to show.

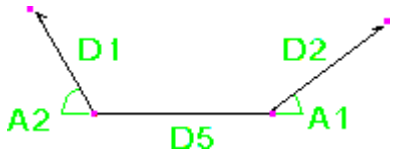
Use any standard text editor (for example, Microsoft Notepad) to edit the `rebar_schedule_config.inp` file.

Examples

The following example of the `rebar_schedule_config.inp` file maps the internal bending type `5_1` to the bending type identifier `E`, and the leg dimensions and bending angles to specific template attributes.

rebar_schedule_config.inp

```
BEND_TYPE_5_1[1]="E"
BEND_TYPE_5_1[2]="DIM_A=D1"
BEND_TYPE_5_1[3]="DIM_B=D5"
BEND_TYPE_5_1[4]="DIM_C=D2"
BEND_TYPE_5_1[5]="DIM_TD=TD"
BEND_TYPE_5_1[6]="ANG_U=A1"
BEND_TYPE_5_1[7]="ANG_V=A2"
```



With this mapping, the internal bending type `6_2` becomes `XY`, and the template attributes `DIM_B` and `DIM_C` will show the horizontal and vertical dimensions of the second leg `D2`, and `DIM_E` and `DIM_F` the horizontal and vertical dimensions of the fourth leg `D4`.

rebar_schedule_config.inp

```
BEND_TYPE_6_2[1]="XY"
BEND_TYPE_6_2[2]="DIM_A=D1"
BEND_TYPE_6_2[3]="DIM_B=D2*COS(A2*PI/180)"
BEND_TYPE_6_2[4]="DIM_C=D2*SIN(A2*PI/180)"
BEND_TYPE_6_2[5]="DIM_D=D3"
BEND_TYPE_6_2[6]="DIM_E=D4*COS(A1*PI/180)"
BEND_TYPE_6_2[7]="DIM_F=D4*SIN(A1*PI/180)"
BEND_TYPE_6_2[8]="DIM_G=D5"
BEND_TYPE_6_2[9]="DIM_TD=TD"
```

The following example maps the internal bending type `4` to the bending type identifier A **if** the dimensions `D1` and `D3` are the same. Otherwise it maps `4` to `B`.

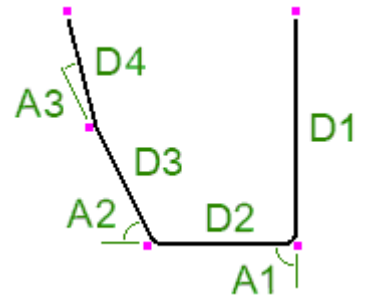
rebar_schedule_config.inp

```
BEND_TYPE_4[1]=if (D1==D3) then ("A") else ("B") endif
BEND_TYPE_4[2]="DIM_A=D1"
BEND_TYPE_4[3]="DIM_B=D2"
BEND_TYPE_4[4]="DIM_C=D3"
BEND_TYPE_4[5]="DIM_TD=TD"
```

If Tekla Structures does not recognize a reinforcing bar bending shape, it uses the internal bending type `UNKNOWN` for it. In the `rebar_schedule_config.inp` file you can also define how unknown bending types appear in drawings and reports. For example, you may just want to use the bending type identifier `???`, and list all leg dimensions and bending angles.

rebar_schedule_config.inp

```
BEND_TYPE_UNKNOWN[1]="???"
BEND_TYPE_UNKNOWN[2]="DIM_A=D1"
BEND_TYPE_UNKNOWN[3]="DIM_B=D2"
BEND_TYPE_UNKNOWN[4]="DIM_C=D3"
BEND_TYPE_UNKNOWN[5]="DIM_D=D4"
BEND_TYPE_UNKNOWN[6]="DIM_E=D5"
BEND_TYPE_UNKNOWN[7]="DIM_F=D6"
BEND_TYPE_UNKNOWN[8]="ANG_S=A1"
BEND_TYPE_UNKNOWN[9]="ANG_T=A2"
BEND_TYPE_UNKNOWN[10]="ANG_U=A3"
BEND_TYPE_UNKNOWN[11]="ANG_V=A4"
BEND_TYPE_UNKNOWN[12]="DIM_TD=TD"
```



No.	Grade	Size	Mark	Length	Type	A	B	C	D	E	F	S	T	U	V	TD
1	A615-40	#4	R/5	1930	???	740	420	430	380			90	65	15		76

See also Hard-coded bending type identifiers in reinforcement shape recognition on page 88

Reinforcement shape recognition on page 78

4 Disclaimer

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