
RED HEAD
truspec
ANCHOR DESIGN SOFTWARE
RED HEAD
C6+
RED HEAD
EPCON S7
RED HEAD
EPCON G5

HELP GUIDE

In the event of any inconsistency between the description of functions in this guide and the software, the software takes precedence.

CONTENTS

Chapter 1
Applications

RED HEAD TRUSPEC asks you to select the application for your design calculations from the APPLICATIONS tab:

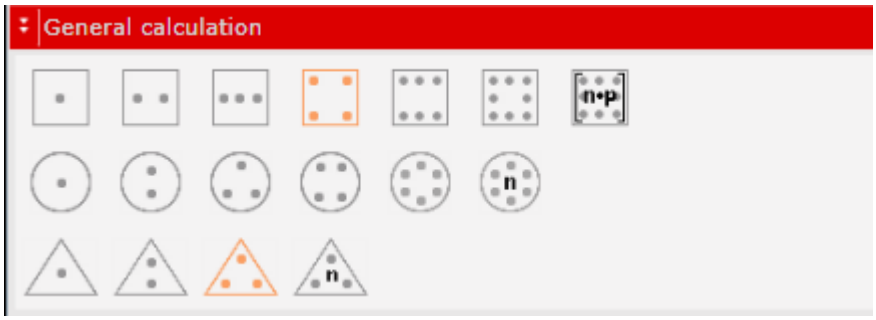
You can select one of the following applications:

- Predefined general calculations
- General calculations in free design mode
- Bracket
- Safety barrier
- Lighting column
- Joist hanger

General calculations

Several predefined models can be selected by choosing the shape of the base plate (rectangular, triangular or circular) and the number of anchors (1, 2, 4, 6, or 8).

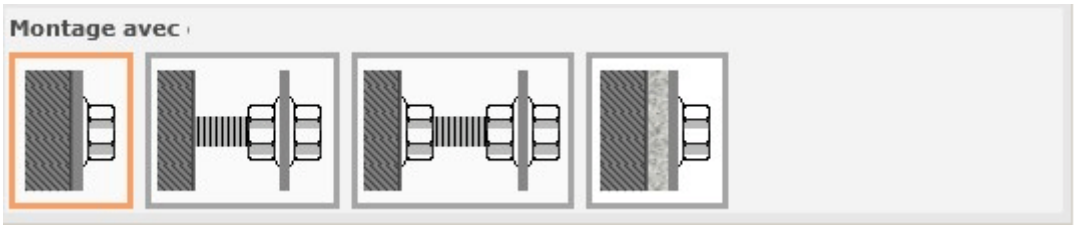
If the application does not correspond to one of the predefined models available, free design mode may be selected.



Click on the icon corresponding to your application, the corresponding 2D and 3D views are displayed on the right of the screen.

The following can also be defined:

- the profile from the profile library;
- the type of stand-off in relation to the surface of the concrete:



By default, the base plate is flush against the surface of the concrete.

Three alternative mounting configurations with spacing are are available for selection. They can be selected by clicking on the icon corresponding to the application:

- Mounting with spacing, without nut against the concrete
- Mounting with spacing, with nut against the concrete
- Mounting with spacing on an intermediate layer of resurfacing.

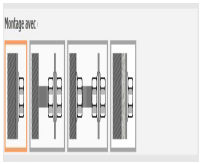
Stand-off parameters

Stand-off takes into account the lever effect caused by shear loads.

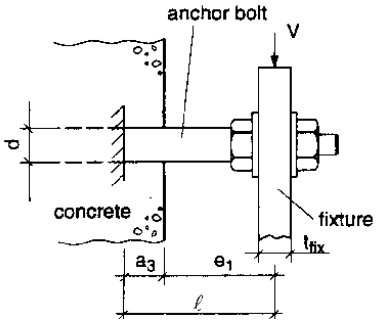
There are 4 available configurations:

1. Mounting without spacing if the following conditions are met: the part to be fixed is fixed directly on the concrete without an intermediate layer or with a resurfacing layer (compressive strength≥ 30 N/mm²) of thickness ≤ d/2. In this configuration, select the following icon:

2. Mounting with spacing, without nut against the concrete. In this configuration, select the following icon:

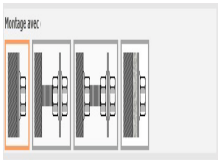


In this case, the length of the lever arm is calculated as follows:

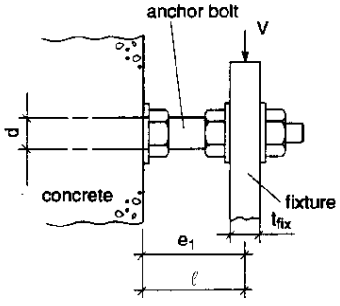


a3 = 0.5.d

3. Mounting with spacing and nut against the concrete. In this configuration, select the following icon:



In this configuration, the length of the lever arm is calculated as follows:



4. Mounting with spacing on an intermediate layer of resurfacing. In this configuration, select the following icon:

If selected, dimension and restraint level detail must be entered in the DIMENSIONS tab.:

Length of the lever arm: L. This is the distance between the part to be attached and the surface of the concrete.

Degree of anchor restraint: α_M. The value of this parameter is between 1 and 2.

If the part to be fixed can turn freely, there is no restraint: $\alpha_M = 1$.

If the part to be attached cannot turn (=guided), and the diameter of the hole is less than the values shown in the table below, it can be considered that there is restraint: $\alpha_M = 2$.

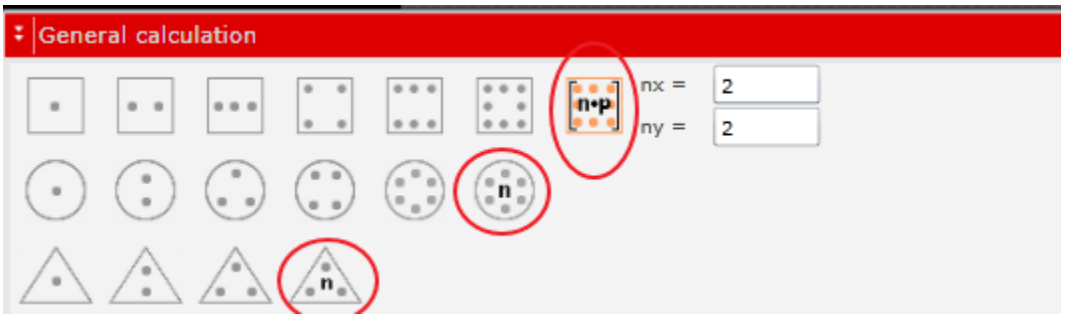
External diameter of anchor (in.)	1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/4
Admitted diameter of part to be attached (in.)	0.375	0.5	0.6875	0.8125	0.9375	1,0625	1.1875	1,4375

The compressive strength of the resurfacing grout to verify whether or not the intermediate layer causes a lever effect.

General calculations – free design mode

Free design mode enables the user to select a number of anchors, and define positions freely on the base plate.

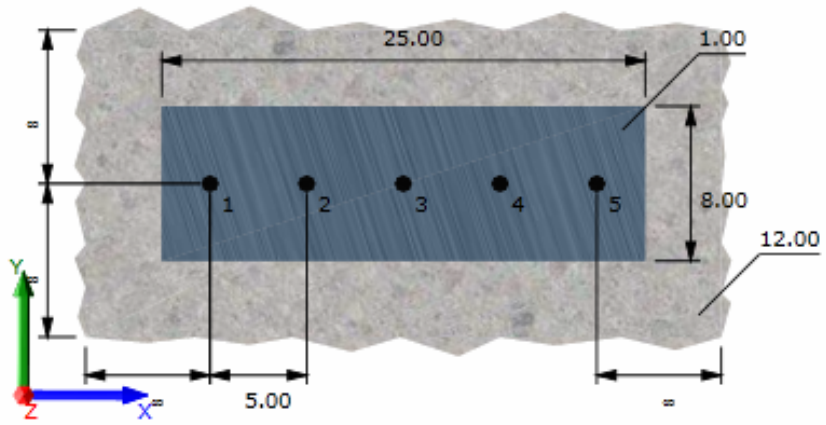
Free design mode is accessed by clicking on the following icons:



Once the icon is selected, number of anchors required may be entered. The corresponding 2D and 3D views are displayed on the right of the screen.

The user can define the position from the Dimensions tab (Geometry - Free design).

Example: 5 anchors in line



Bracket attachment

The bracket attachment model is used when the loads are transmitted to the base plate by lever arm effect. The software is used to calculate the loads applied to the base plate, directly from the dimensions of the application.

Several predefined models can be selected by choosing the number of anchors (1, 2, 4, 6, or 8).

If the application does not correspond to one of the predefined models available, free design mode.may be selected (icon market with ‘n’)

As the icon corresponding to the application is selected, the corresponding 2D and 3D views are displayed on the right of the screen.

The following may also be defined:

- the profile from the profile library;

Safety Barrier

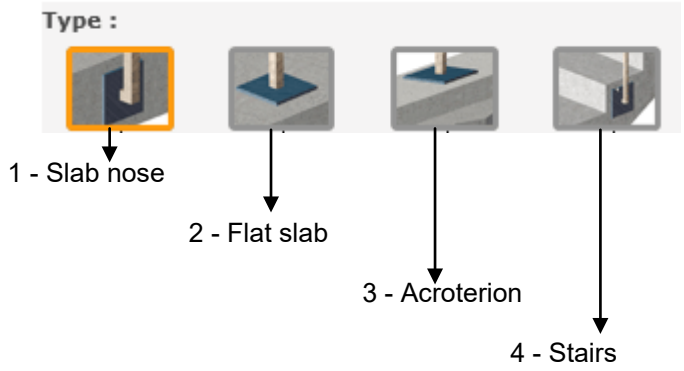
The Safety barrier attachment model allows:

- dimensioning of the attachment depends on type of safety barrier, its geometry and location.
- verification of the profile section.

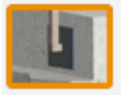
Several predefined base plate models can be selected by selecting the type of safety barrier, the shape of the base plate, and the number of fixings (1, 2 or 4 fixings).

SAFETY BARRIER types: mounting on slab nose, flat slab, acroterion, stairways

Click on the icon corresponding to the type of Safety barrier in the application, the corresponding 2D and 3D views are displayed on the right of the screen.



For each of these types, several mounting and base plate shape configurations may be selected:

Type of application	Type of mounting	Predefined base plate models
1 - Slab nose	 Slab nose mounting	
	 Mounting on slab nose with corner base plate	
2 - Flat slab	 Flat slab mounting	
3 - Acroterion	 Flat slab mounting on acroterion	
	 Slab nose mounting outside acroterion	
	 Slab nose mounting inside acroterion	
	 Mounting on slab nose of a corner base plate outside acroterion	
	 Mounting on slab nose of an angle base plate inside acroterion	
4 - Stairs	 Flat slab mounting on stair	
	 Slab nose mounting on stair	
	 Mounting of a corner base plate on slab nose on stair	

Lighting column

The lighting column attachment model allows the attachments to be dimensioned according to:

- The shape of the base plate (rectangular or circular);
- The number of fixings and its geometry;
- The bending moment at the base, and the lateral load induced by wind pressures;

The predefined models can be selected by choosing the shape of the base plate:

- Rectangular plate with 4 attachments;
- Circular plate with N attachments..

Fabricated bracket

The fabricated bracket model allows the attachments to be dimensioned according to:

- The number of anchors (2, 4 or 6 fixings) and structural geometry;
- Shear loads and lateral loads.

Several predefined models can be selected by selecting the number of attachments:

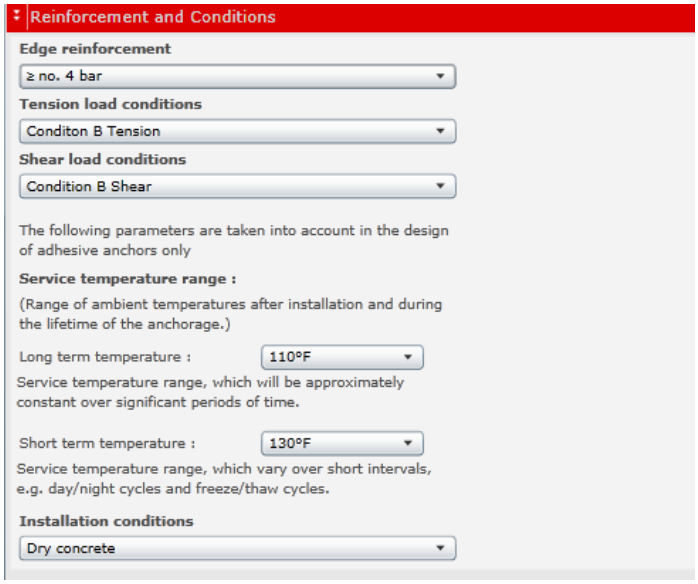
Chapter 2
Base material

Base material conditions are defined in the MATERIAL tab:

Define the substrate material from the Concrete section:

- Compressive strength of concrete
- Cracked / uncracked concrete
- Substrate material thickness

Define the reinforcement and environment conditions:

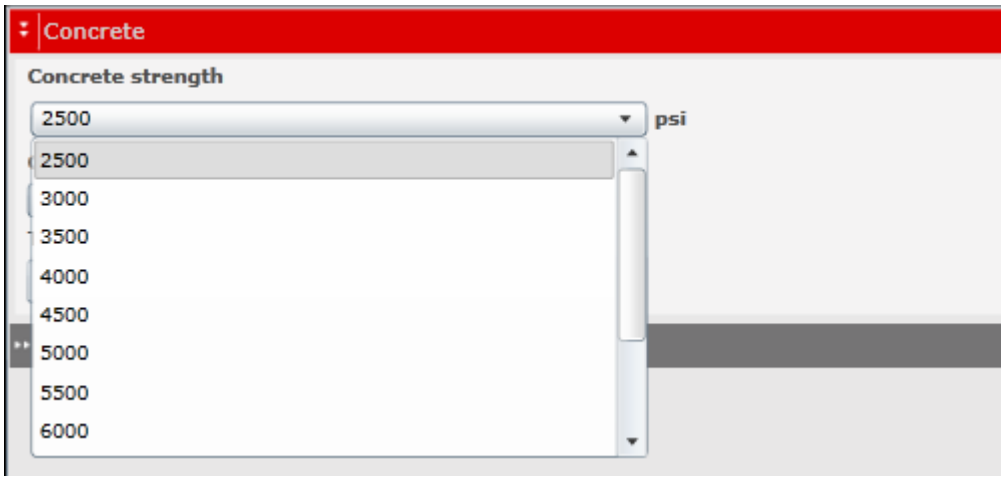


- Substrate reinforcement
- Temperature of material
- Installation conditions

Compressive strength of concrete

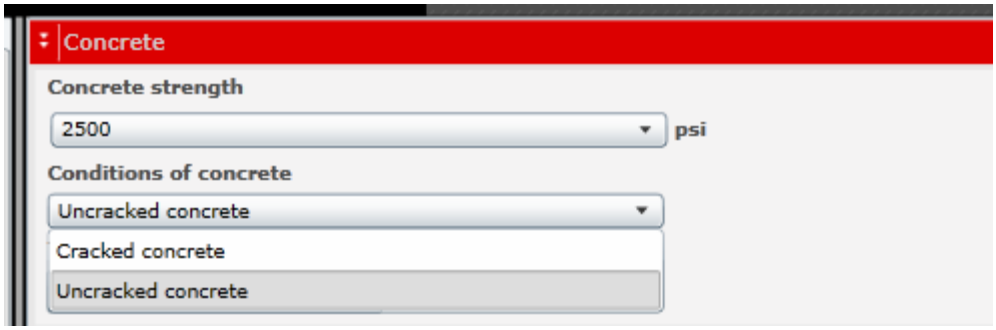
The Calculation method uses concrete with a minimum of 2500 psi to 6000 psi which is also based on the characteristic cylinder strength (f'c).

Select the concrete compressive strength from its application in the Concrete strength dropdown menu in the Concrete section:



Cracked / noncracked concrete

Select whether the anchoring zone is cracked or noncracked concrete in the Conditions of Concrete dropdown in the Concrete section.



Thickness of base material

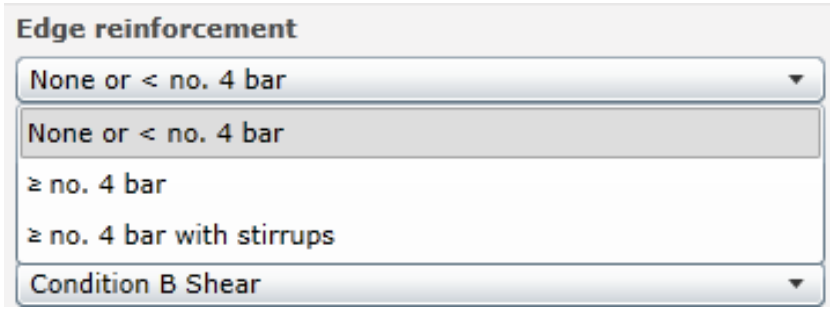
Enter the substrate thickness in the “Thickness of Concrete” Concrete menu of the Material tab. RED HEAD TRUSPEC will check that the substrate thickness is greater than the minimum thickness required for anchoring. In addition, this data is used to determine the characteristic slab edge shear failure resistance

Concrete reinforcement and conditions

The types of concrete reinforcement in the anchoring zone must be defined via the Reinforcement and Conditions menu of the MATERIAL tab.

- Concrete reinforcement
- Concrete edge reinforcement
- Tension Load Conditions
- Shear Load Conditions
- Service Temperature Ranges

Concrete edge reinforcement



Choose one of the following assumptions:

- None or ≤ no.4 bar
- ≥ no. 4 bar
- ≥ no. 4 bar with stirrups

Tension load conditions

- Select tensile condition A or B and the corresponding factor will be applied to the concrete breakout/pullout strength

Shear load conditions

- Select shear condition A or B and the corresponding factor will be applied to the pryout strength.

Service temperature range

The service temperature range is taken into account for dimensioning of adhesive anchors only. It corresponds to the exposure temperature after installation and during the anchor lifetime

For ACI 318 design methods, to determine the temperature range, the user must define two temperature levels:

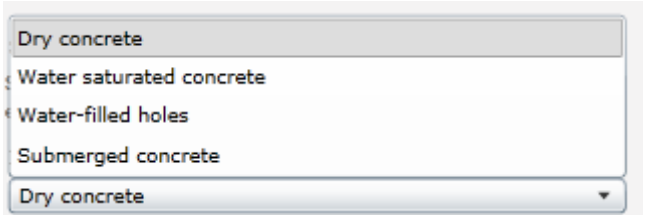
Long term temperature: representing the constant or quasi-constant temperature over long periods of time, such as those observed inside cold rooms or in the vicinity of heating installations.

Short term temperature: representing the maximum temperature in the operating temperature range varying over short periods, such as diurnal/nocturnal cycles.

Installation conditions

The installation conditions are taken into account for dimensioning of adhesive anchors only.

The installation conditions provide a check that these conditions are correct for the attachment area of use, and dimension the attachment for these conditions.



The installation conditions are determined from the conditions of implementation in the substrate material: the user must select the following options:

- Installation in dry concrete (default option);
- Installation in water saturated concrete;
- Installation in a water-filled hole.
- Installation in submerged concrete

Chapter 3
Profile

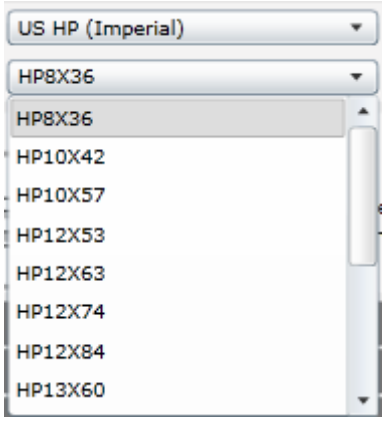
The information concerning the profile is defined via the APPLICATIONS tab:

- Profile library
- Profile position

Profile library

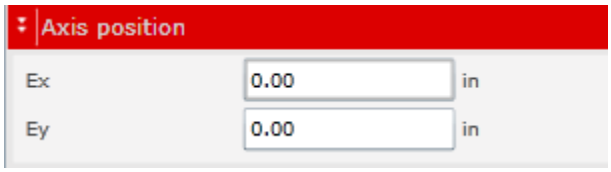
The user has access to a library of of AISC standardized profiles in the APPLICATIONS tab and profile family section.

Once the user has selected the base plate type and plate material, profile type and dimensions can be chosen from the dropdown menus.



Profile position

The profile position can be defined with the help of Ex, Ey and angle parameters via the DIMENSIONS tab – Axis position section. By default, the profile is positioned at the center of the base plate, corresponding to Ex = 0 in., Ey = 0 in., angle = 0°.



Chapter 4
Dimensions

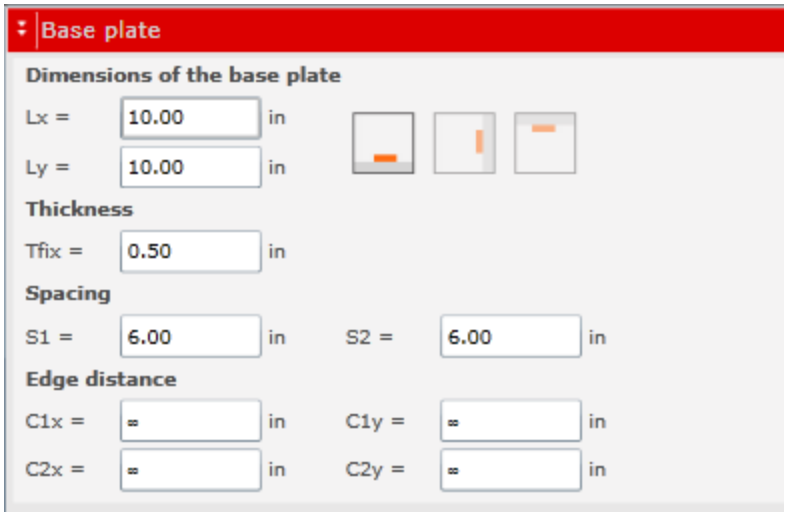
The information concerning Dimensions is defined via the DIMENSIONS tab:

- Predefined general calculations – Geometry
- General calculations – Free design mode – Geometry
- Bracket – Dimensions
- Safety barrier – Dimensions
- Lighting columns – Geometry
- Fabricated Bracket – Geometry
- Slotted holes (Dimensions tab)

Predefined general calculations – Geometry

To define the geometry of the base plate, enter the following information:

- Base plate dimensions
- Thickness of part to be anchored:
- Spacing between anchors;
- Slab edge distances



Parameters defining the base plate	Rectangular base plate	Circular base plate	Triangular base plate
			
Base plate dimensions	Lx: dimension along X axis Ly: dimension along Y axis	Lx: plate diameter	Lx: triangle base dimension Ly: triangle height dimension
The thickness of the part to be attached	Tfix: thickness of the part to be attached, entered by the user. A calculation module is available to verify that the base plate has sufficient rigidity. See verification of base plate rigidity		
Centre distances between anchors	S1: spacing between anchors along X axis S2: spacing between anchors along Y axis	D: fixing distribution diameter	S: Spacing between anchors (equilateral distribution)
Slab edge distances	C1x: distance of anchor closest to left concrete edge C2x: distance of anchor closest to right concrete edge C1y: distance of anchor closest to bottom concrete edge C2y: distance of anchor closest to top concrete edge If the distance is not entered, no concrete edge influence will be taken into account. The ∞ symbol is displayed in the entry field and on the 2D diagram. If you want to ignore a concrete edge, enter a space and the ∞ sign will reappear.		

General calculations – Free design mode – Geometry

General calculations for free design mode are available.

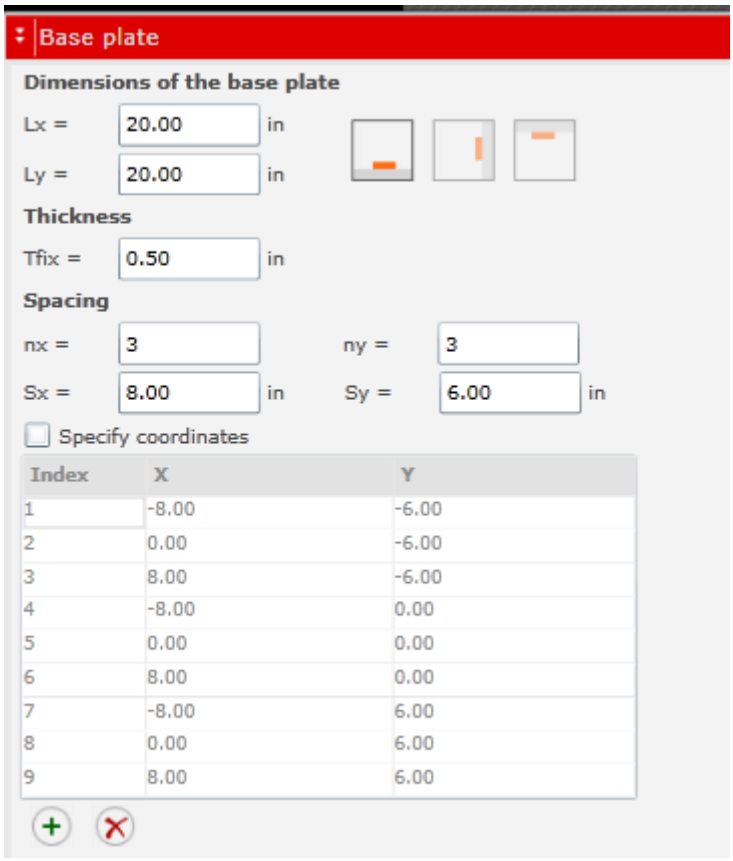
To define the geometry of the base plate, enter the following information:

- Number of anchors;
- Base plate dimensions
- Thickness of part to be attached:
- Spacing between anchors or anchor coordinates;
- Slab edge distances

Parameters defining the base plate	Rectangular base plate	Circular base plate	Triangular base plate
			
Number of anchors	Nx: number of anchors along X axis Ny: number of anchors along Y axis **Example:** 5 anchors in line along X: nx = 5; ny = 1	N: number of anchors distributed over a circle	N: Number of anchors
Base plate dimensions	Lx: dimension along X axis Ly: dimension along Y axis	Lx: plate diameter	Lx: triangle base dimension Ly: triangle height dimension
The thickness of the part to be attached	Tfix: thickness of the part to be attached, entered by the user. A calculation module is available to verify that the base plate has sufficient rigidity. See verification of base plate rigidity		
Centre distances between anchors	Sx: spacing of anchor distribution along X axis Sy: spacing of anchor distribution along Y axis	D: fixing distribution diameter	S: Spacing between anchors (equilateral distribution)
Slab edge distances	C1x: distance of anchor closest to left concrete edge C2x: distance of anchor closest to right concrete edge C1y: distance of anchor closest to bottom concrete edge C2y: distance of anchor closest to top concrete edge If the distance is not entered, no concrete edge influence will be taken into account. The ∞ symbol is displayed in the entry field and on the 2D diagram. If you want to ignore a concrete edge, enter a space and the ∞ sign will reappear.		

Modification of anchor coordinates

Free Design mode allows the user to define the coordinates of anchors, by clicking on the “Specify coordinates” checkbox:



Once the checkbox has been activated, automatic anchor distribution is inactive, and the user can:

- modify anchor coordinates (x,y)
- add anchors by clicking on the icon
- delete anchors by clicking on the icon

To reactivate the initial automatic anchor distribution function, the “Specify coordinates” checkbox must be deactivated, but the coordinates entered will be lost.

Bracket – Dimensions

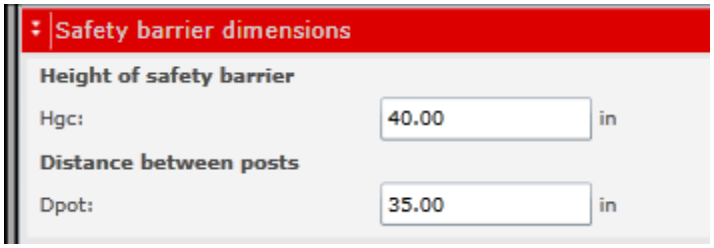
The plate dimensions for a bracket application are identical to the Predefined general calculations case, and to the General calculation in free design mode.

Safety barrier– Dimensions

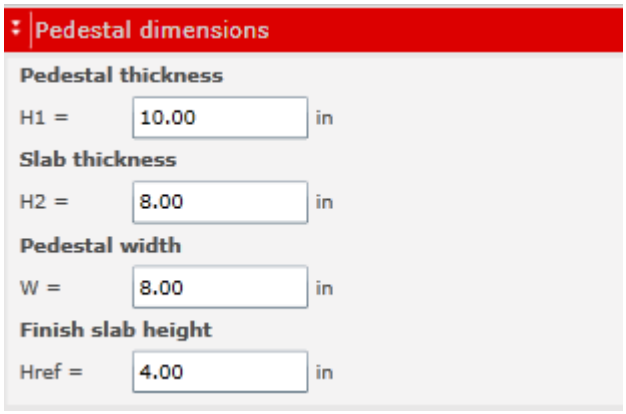
Safety barrier dimensions

The safety barrier dimensions are used to determine the value of loads from:

- the distance between posts Dpot and the safety barrier height Hgc.



- the dimension of the acroterion if applicable:
  - H1: height of acroterion
  - H2: thickness of slab under acroterion
  - W: width of acroterion



- the dimensions of stairways if applicable:
- Hst: height of step
- Lst: depth of step
- Tst: stringer height

NB: the ratio between the distance between posts (Dpot) and the depth of step (Lst) must be a whole number.

Safety barrier base plate dimensions

- Flat slab mounting (1 slab edge in front of SAFETY BARRIER)

Dimensions:	Rectangular base plate	Circular base plate
Flat slab mounting (1 slab edge in front of SAFETY BARRIER)		
Base plate dimensions	Lx: dimension along X axis Ly: dimension along Y axis	Lx: plate diameter
Position of base plate and fixings	S1: spacing between anchors along X axis S2: spacing between anchors along Y axis Dy: distance of the bottom anchors in relation to bottom of base plate C1y: slab edge distance between anchor and slab nose	

- Flat slab mounting on acroterion

Dimensions:	Rectangular base plate	Circular base plate
Flat slab mounting on acroterion		
Base plate dimensions	Lx: dimension along X axis Ly: dimension along Y axis	Lx: plate diameter
Position of base plate and fixings	Dpp: distance from edge of base plate in relation to inside edge of slab S1: spacing between anchors along X axis S2: spacing between anchors along Y axis Dy: distance of the bottom anchors in relation to bottom of base plate	

- Flat slab mounting on stairway

Dimensions:	Rectangular base plate	Circular base plate
Flat slab mounting on stairway		
Base plate dimensions	Lx: dimension along X axis Ly: dimension along Y axis	Lx: plate diameter
Position of base plate and fixings	S1: spacing between anchors along X axis S2: spacing between anchors along Y axis Dy: distance of the bottom anchors in relation to bottom of base plate C1x: slab edge distance between anchor and step nose C1y: slab edge distance between anchor and left edge of step	

- Slab nose mounting (type slab nose, acroterion or stairway):

Dimensions:	Rectangular base plate	Circular base plate	Corner base plate
Slab nose mounting (type slab nose, acroterion or stairway):			
Base plate dimensions	Lx: dimension along X axis Ly: dimension along Y axis	Lx: plate diameter	Lx: dimension along X axis Ly: dimension of vertical base plate along Y axis Lyh: dimension of horizontal base plate along Y axis
Position of base plate and fixings	Dpp: distance from top of base plate in relation to top of slab S1: spacing between anchors along X axis S2: spacing between anchors along Y axis Dy: distance of the bottom anchors in relation to bottom of base plate		S1: spacing between anchors along X axis Dy: distance of the bottom anchors in relation to bottom of base plate Dpl: distance from edge of base plate to step nose

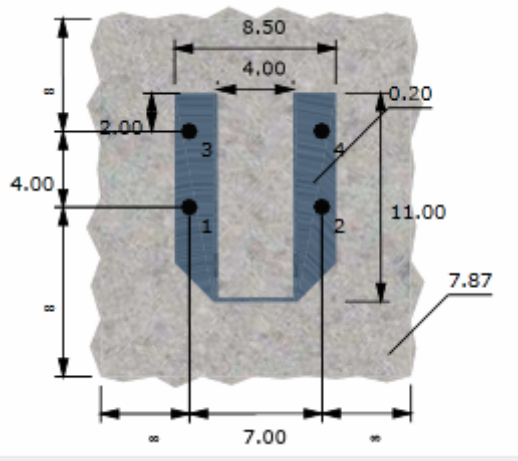
Lighting columns – Geometry

Base plate dimensions for a lighting column are identical to the Predefined general calculations.

Joist hangers – Geometry

Fabricated bracket dimensions are used to determine the value of stresses from:

Parameters defining the base plate	Joist hanger
	
Fabricated bracket dimensions	Lx: external dimension of hanger along axis X Ly: external dimension of hanger along axis Y Lz: hanger depth dimension
The thickness of the part to be attached	Tfix: thickness of Fabricated bracket entered by the user. NB: the calculation is performed on the basis of assumption of a rigid joist hanger, dimensioned to take loads.
Position of anchors	Dy: position of top anchors in relation to top edge of base plate S1: spacing between anchors along X axis S2: spacing between anchors along Y axis
Slab edge distances	C1x: distance of anchor closest to left concrete edge C2x: distance of anchor closest to right concrete edge C1y: distance of anchor closest to bottom concrete edge C2y: distance of anchor closest to top concrete edge If the distance is not entered, no concrete edge influence will be taken into account. The ∞ symbol is displayed in the entry field and on the 2D diagram. If you want to ignore a concrete edge, enter a space and the ∞ sign will reappear.



Slotted holes

If anchoring the plate close to slab edges, slotted holes in the direction of the shear load may be defined in the DIMENSIONS tab.

These configurations are only available for the case of predefined general calculations for rectangular plates with 2 or 4 anchors.

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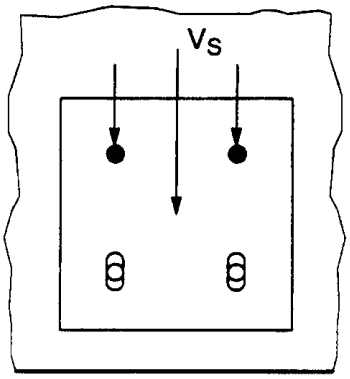
This layout may offer advantages, as the slotted holes prevent the plugs from absorbing the shear load.



Chapter 5
Loads

The information concerning Loads is defined via the LOADS tab:

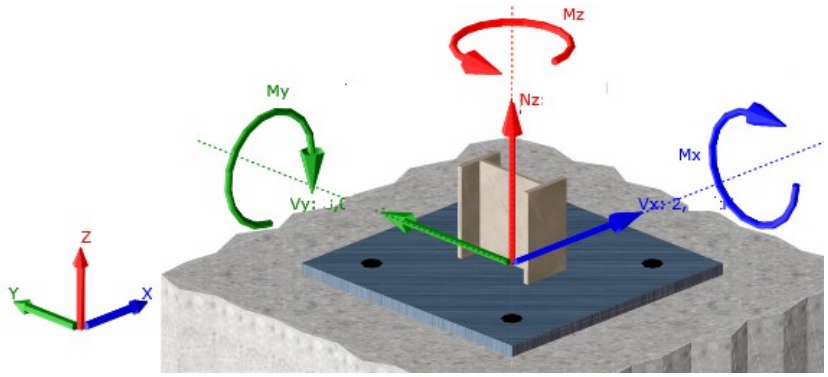
- General calculations – Loads
- Bracket – Loads
- Safety barriers – Loads
- Lighting columns – Loads
- Joist hangers – Loads

General calculations – Loads

The General calculations application loads are defined on the basis of a torsor (x,y,z).

The LOADS are defined in the torsor (x,y,z):

- Tensile force Nz
- Shear force Vx
- Shear force Vy
- Torque Mz
- Bending moment Mx
- Bending moment My

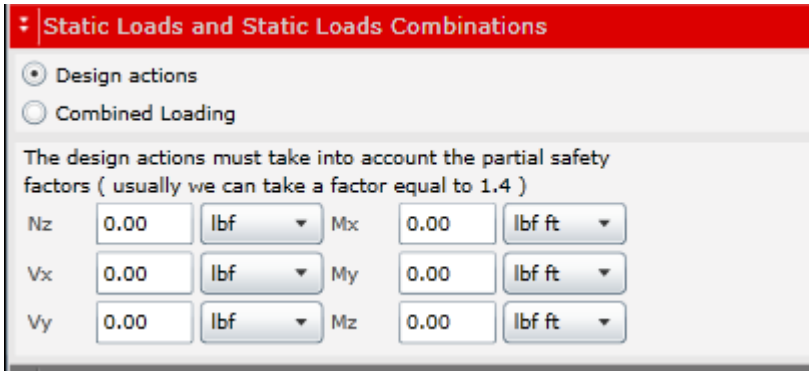


The software offers two entry modes:

- Design loading
- Combined loading

Design loading

Using the design loading method for enter loads, values must be entered at ultimate limit state (i.e., assigned their partial safety factor).



The units can be changed at the time of entry, or from options.

Combined loading

Using the combined loading method for entering loads, the following information must be provided:

- The values of actions that have not yet been multiplied by the safety factors:
- Permanent loads G and safety factor (default value 1.35);
- The variable loads Q and the partial safety factor (default value: 1.5);
- The temporary loads A and the partial safety factor (default value: 1.75).

For each action, the software will calculate the combination of loads corresponding to the ultimate limit state, displayed in the last column of the entry table.

The units can be changed at the time of entry, or from options.

Static Loads and Static Loads Combinations

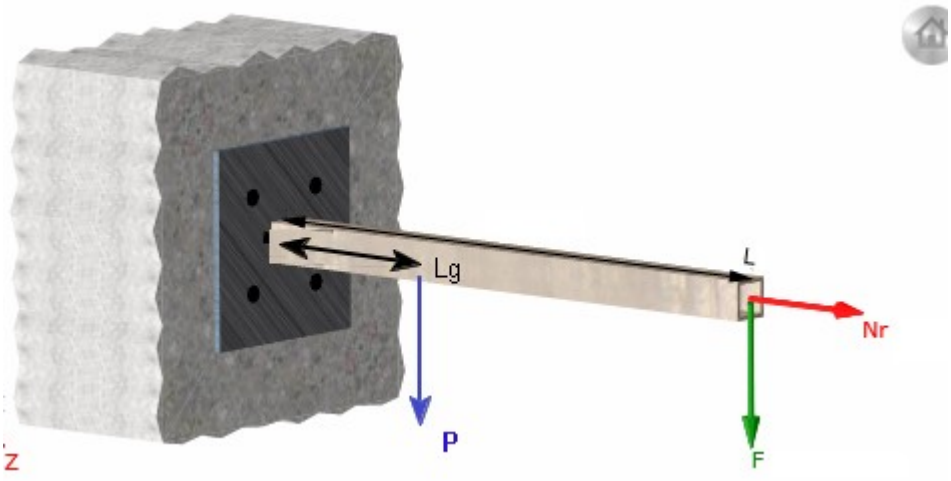
Design actions

Combined Loading

lbf / lbf ft	Dead Load, D	Live Load, L	Accidental action A	Ultimate loads
Partial safety factor	1.35	1.5	1.75	
Nz	0.00	0.00	0.00	0.00
Vx	0.00	0.00	0.00	0.00
Vy	0.00	0.00	0.00	0.00
Mx	0.00	0.00	0.00	0.00
My	0.00	0.00	0.00	0.00
Mz	0.00	0.00	0.00	0.00

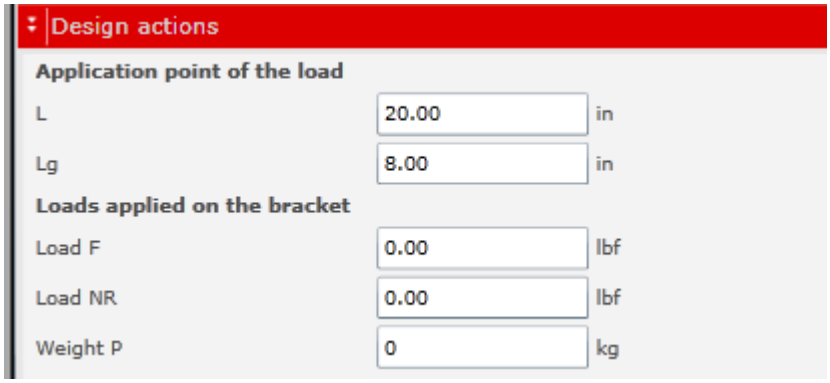
Bracket – Loads

In the case of brackets, the parameters used to define the forces acting at the centre of the plate are as follows:



- The force application point:

  - L: distance from application point of load F
  - Lg: distance from application point of dead weight of bracket
- The values of loads applied on the bracket: these loads must be given without application of the partial safety factor. The software takes the safety factor entered by the user into account in the calculation.
  - Vertical load F applied at distance L;
  - Tensile load NR applied in profile axis;
  - The weight of the bracket applied at distance Lg.



Safety barrier – Loads

The loads applied to the safety barrier are defined according to the safety barrier geometry and the establishment in which it is installed.

The loads applied may be in two directions, outwards from the safety barrier, and also inwards.

From the LOADS tab, indicate:

- the establishment type, to determine the outward load to be considered;
- the inward load: by default the value taken into account is 0.4 kN/ml.

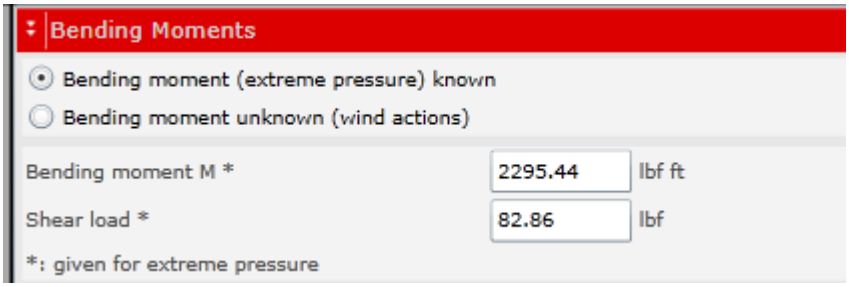
This may be modified by selecting “other case”.

Lighting column – Loads

- The loads applied to the lighting column can be defined in two ways in the LOADS tab:
- From the bending moment value at the base, known to the user (at ultimate limit state for extreme wind pressure);
- From the geometry of the lighting column and the wind pressures, used to define the bending moment at the base.

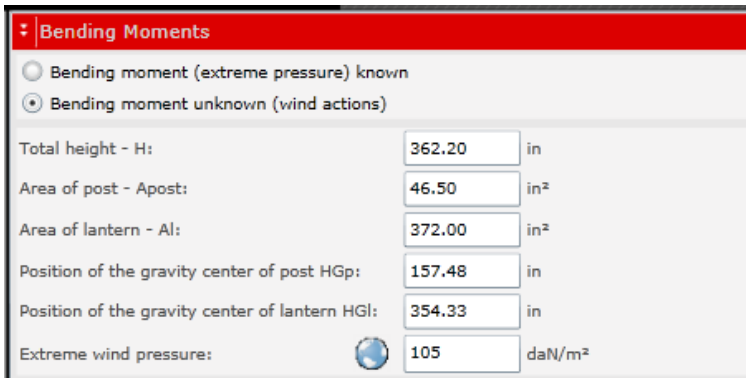
Bending moment at base known to the user

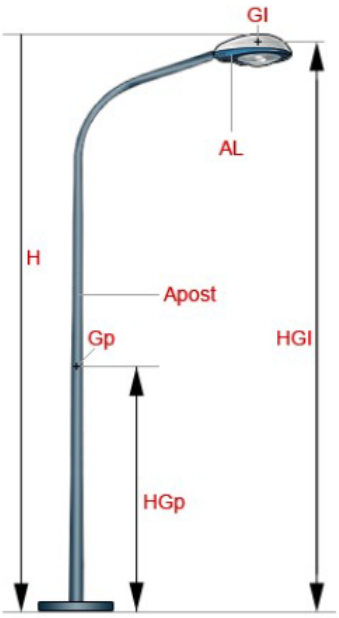
If the user knows the bending moment at the base for extreme wind pressure, the first option should be selected, and value of the bending moment directly together with the shear stress value should be entered.



Bending moment determined from lighting column geometry

If the user does not know the bending moment, the dimensions of the lighting column and the extreme wind pressure should be entered:

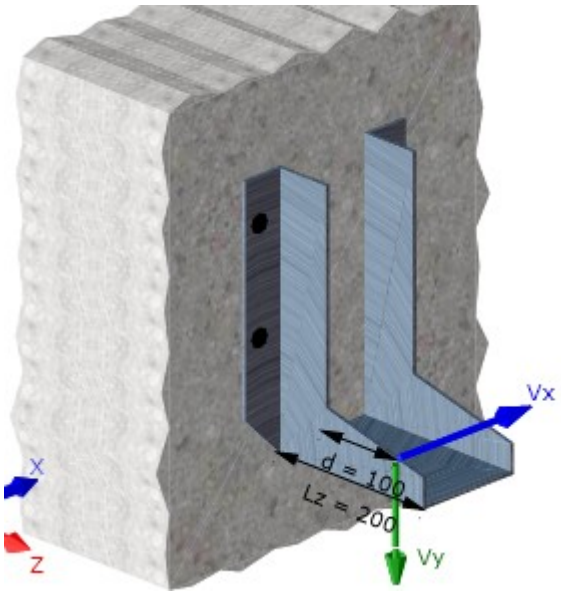




Fabricated bracket – loads

The loads applied to the Fabricated bracket are as follows:

- Shear load Vy
- Lateral load Vx
- The distance d from the point of load application (this value d may be taken as half of the dimension Lz)



Chapter 6
Calculation method / Safety concept

The information concerning Loads is defined via the LOADS tab:

- Determination of loads on the base plate
- ACI-318 Design Method
- Determination of minimum base plate thickness

Determination of loads on the base plate

Based on the principle that bending moments and normal forces are balanced by tension in certain attachments and compression on a section of the concrete surface, RED HEAD TRUSPEC calculates the position of the neutral axis and the loads on the anchors under tension, in such a way that the deformations and loads on the attachments and the concrete are zero along this line (Navier – Bernouilli assumptions).

The neutral axis marks the compressed zone of the concrete, and the loads are calculated on the anchors located outside the compressed zone of the concrete.

Navier – Bernouilli assumptions

The deformation of anchors under tension and concrete under maximum compression are proportional to their distances in relation to the neutral axis:

$$\frac{\varepsilon_{ti}}{d_{ti}} = \frac{\varepsilon_b}{d_b}$$

Elastic behaviour

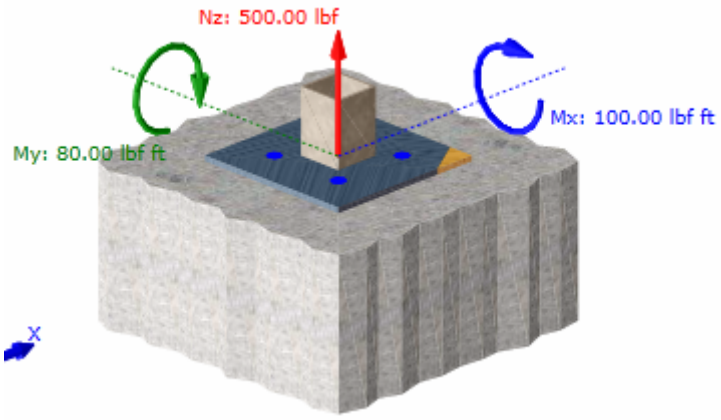
The loads on anchors under tension and concrete under maximum compression are proportional to their deformation:

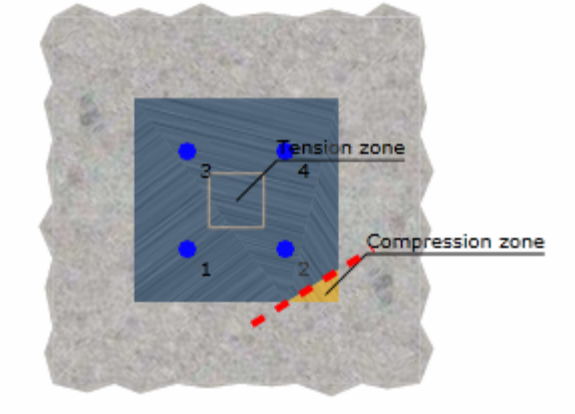
$$\frac{F_{ti}}{A_0} = E_t.\varepsilon_{ti} \text{ and } p_m = E_b.\varepsilon_b$$

Eb: Young's modulus – concrete 30000 N/mm²

Et: Young's modulus – metal 210,000 N/mm² (30.5 x 106 ksi)

This concept is based on the assumption that the base plate is rigid. To check this, the software allows you to check that the thickness of the base plate specified by the user satisfies this assumption. See Chapter: Determination of base plate minimum thickness section





The loads at each anchor point are displayed on the results page, in the loads section

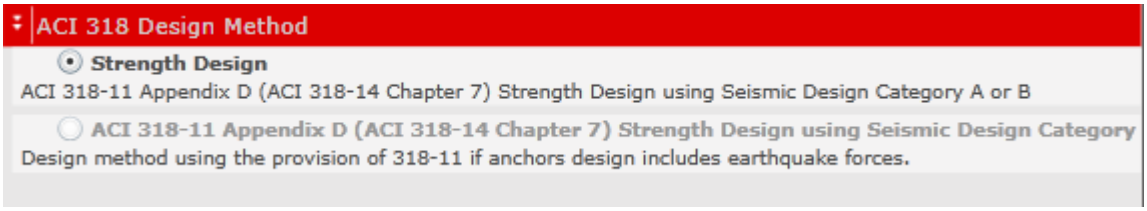
Loads

Loads on anchors:

Anchor	Tensile	Shear[x]	Shear[y]
1	138.64	0.00	0.00
2	64.76	0.00	0.00
3	256.33	0.00	0.00
4	182.45	0.00	0.00

ACI-318 Design Method

The software is based on the American Concrete Institute standard ACI 318-11 Appendix D and ACI 318-14:

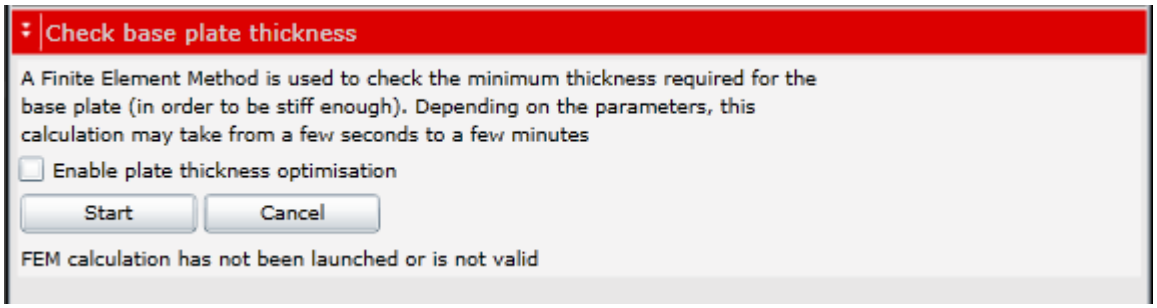


- Strength Design using Seismic Design Category A or B for static or quasi-static loads.
- Strength Design using Seismic Design Category C, D, E or F if anchors design includes earthquake forces.

Determination of minimum base plate thickness

Using the base plate thickness verification RED HEAD TRUSPEC provides verification on the minimum thickness of the base plate (i.e. verification of the calculation assumption of the baseplate rigidity).

To check base plate thickness the user may click on the icon “Check of base plate thickness” in the CALCULATE tab, which will enable the following prompt:



The user may run the calculation simply to check that the thickness is sufficient, or run the optimization program in order to determine the minimum thickness guaranteeing the rigidity of the base plate.

The results displayed give information on the following parameters:

- Maximum displacement of the base plate;
- Relative displacement representing mid span deflection;
- Von Mises stress Chapter 7

Chapter 7
Calculation result

Results screen

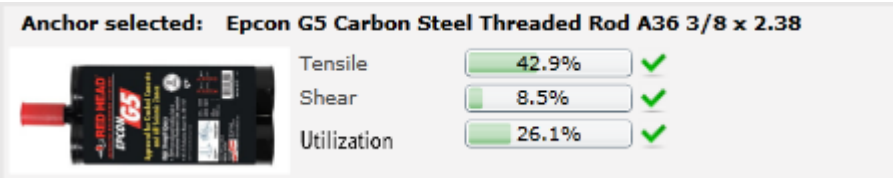
Once the data has been entered, the user obtains the calculation results for all fixings by clicking on the CALCULATE tab.

The listed anchors displayed are marked with a symbol showing:

- ✔ That the anchor is suitable for the application
- ✘ That the anchor is not suitable for the application, but could be made suitable by modifying a parameter
- ⊘ That the anchor is not suitable for the application (concrete cracking status, substrate thickness, spacing or slab edge distance less than minimum recommended values, etc.)

The result display gives access to several levels of information for the selected anchor:

Result summary containing the following information:



- % tensile resistance
- % shear resistance
- % combined tensile and shear resistance

If the anchor is not suitable and is marked with a symbol ✘ or ⊘ icons identifying the errors concerned:

	Distance from edge of base plate too low (non-compliant base plate factor)
	Slab edge distance too low (less than Cmin)
	Spacing too low (less than Smin)
	Concrete thickness too tin (less than Hmin)
	Thickness of part to be attached too large (higher than Tfix)
	Error message related to incorrect field of application (non-cracked concrete only, no fire performance, no seismic performance, etc.)

Result of loads per anchor

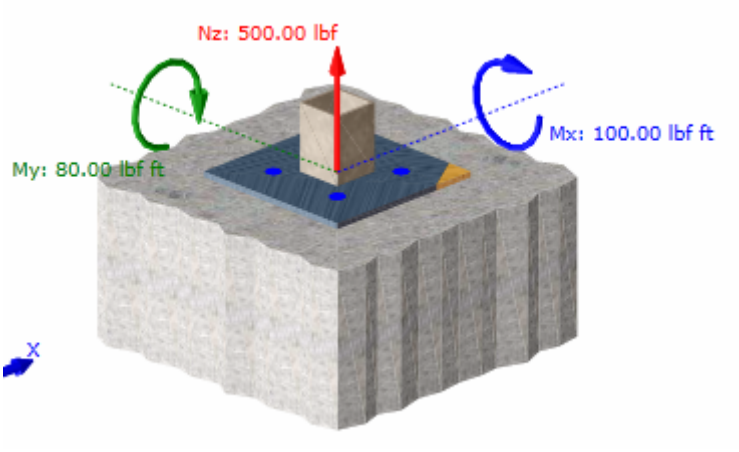
The Loads menu in the CALCULATE tab gives access to a breakdown of stresses on each anchor.

Loads

Loads on anchors:

Anchor	Tensile	Shear[x]	Shear[y]
1	138.64	0.00	0.00
2	64.76	0.00	0.00
3	256.33	0.00	0.00
4	182.45	0.00	0.00

The 2D view shows the position of the neutral axis from which the tensile and compression forces have been calculated:



Resistance calculation result

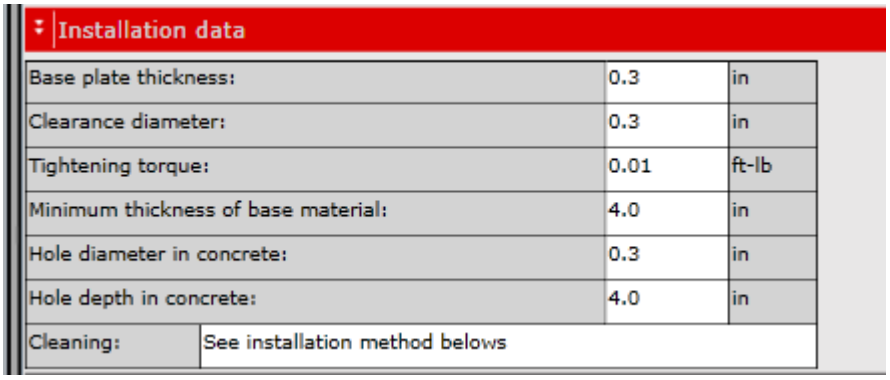
The Calculation Result menu in the CALCULATE tab indicates the resistance at ultimate limit state for each type of failure, together with the value of the coefficient βrepresenting the ratio between resistance and stress. For a fixing to be acceptable, the coefficient βmust be less than 1.

Results of design according to ACI 318-11 (ACI 318-14) and AC308

Tension		lbf	β_N=
Concrete breakout strength	$\varnothing_{Ncbg}$	7954	0.25
Steel strength	$\varnothing_{Nsa}$	3375	0.15
Pullout strength	$\varnothing_{Npg}$	4658	0.43
Shear		**lbf**	**β_V=**
Concrete breakout strength	$\varnothing_{Vcbg}$	***	***
Pryout strength	$\varnothing_{Vcpg}$	11857	0.04
Steel strength	$\varnothing_{Vsa}$	1462	0.09
Interaction equation	$\beta_N^{5/3} + \beta_V^{5/3} =$		**0.26**

Installation data and method

The Installation Data menu in the CALCULATE tab displays the data required for anchor installation:



Installation data

Base plate thickness:	0.3	in
Clearance diameter:	0.3	in
Tightening torque:	0.01	ft-lb
Minimum thickness of base material:	4.0	in
Hole diameter in concrete:	0.3	in
Hole depth in concrete:	4.0	in
Cleaning:	See installation method belows	

The Installation Method section displays the installation method in the form of an animation showing the steps to be performed.

ICC-ES Evaluation Report

The ICC-ES Evaluation report menu is used to download the ESR for the selected anchor

ICC EVALUATION SERVICE

Most Widely Accepted and Trusted

ICC-ES Evaluation Report

ESR-3614*

Reissued August 2014

This report is subject to renewal August 2015.

www.icc-es.org | (800) 423-6587 | (562) 699-0543 *A Subsidiary of the International Code Council®*

DIVISION: 03 00 00—CONCRETE
Section: 03 16 00—Concrete Anchors

DIVISION: 05 00 00—METALS
Section: 05 05 19—Post-Installed Concrete Anchors

REPORT HOLDER:

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CHIRNSIDE PARK
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AUSTRALIA
+61 3 9727 6180
www.itwcs.com.au

EVALUATION SUBJECT:

RED 502 ADHESIVE ANCHORS FOR CRACKED AND UNCRACKED CONCRETE

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2012, 2009, 2006 and 2003 *International Building Code®* (IBC)
- 2012, 2009, 2006 and 2003 *International Residential Code®* (IRC)

Property evaluated:

Structural

2.0 USES

The Red 502 Adhesive Anchors are used to resist static, wind or earthquake (Seismic Design Categories A through F) tension and shear loads in cracked and uncracked, normal-weight concrete having a specified compressive strength, f'_c, of 2,500 psi to 6,500 psi (17.2 MPa to 59.9 MPa).

The anchors anchors comply with anchors as described in Section 1909 of the 2012 IBC and are an alternative to cast-in-place anchors described in Section 1908 of the 2012 IBC, Sections 1912 and 1913 of the 2009 and 2006 IBC, and Sections 1912 and 1913 of the 2003 IBC. The anchors may also be used where an engineered design is submitted in accordance with Section R301.1.3 of the IRC.

3.0 DESCRIPTION

3.1 General:

The Red 502 Anchor System is comprised of the following:

- Red 502 adhesive packaged in cartridges
- Adhesive mixing and dispensing equipment
- Equipment for cleaning holes and injecting adhesive

The Red 502 adhesive is used with continuously threaded steel rods or deformed steel reinforcing bars. Installation information, guidelines and parameters are shown in Tables 1, 15, 16, and 19 of this report.

The manufacturer's printed installation instructions (MPII), included with each adhesive cartridge unit, are shown in Figure 3 of this report.

3.2 Materials:

3.2.1 Red 502 Adhesive: The Red 502 adhesive is a two-component (resin and hardener) epoxy-based adhesive, supplied in dual chamber cartridges requiring mixing and dispensing equipment. The adhesive is in a ratio by volume when dispensed through the system static mixing nozzle. The Red 502 is available in 250 mL (9 fl. oz.), 400 mL (14 fl. oz.), 600 mL (21 fl. oz.) and 1500 mL (51 fl. oz.) cartridges. The shelf life of the Red 502 is two years, when stored in the manufacturer's unopened containers at temperatures between 50°F (10 °C) and 77°F (25 °C).

3.2.2 Dispensing Equipment: The Red 502 adhesive must be dispensed using pneumatic or manual actuated dispensing tools listed in Table 17 of this report.

3.2.3 Hole Preparation Equipment: The holes must be cleaned with hole-cleaning brushes and air nozzles. The brush must be the appropriate size brush shown in Tables 15 and 16 of this report, and the air nozzle must be equipped with an extension capable of reaching the bottom of the drilled hole and having an inside bore diameter of not less than $\frac{1}{2}$ inch (8 mm). The holes must be prepared in accordance with the installation instructions shown in Figure 3 of this report.

3.2.4 Steel Anchor Elements:

3.2.4.1 Threaded Steel Rod: Threaded anchor rods must be clean, continuously threaded rods (all-thread) in diameters and types as described in Tables 2 and 4 of this report. Steel design information for the common grades of threaded rod is provided in Tables 2 and 4. Carbon steel threaded rods may be furnished with a zinc electroplated coating or hot-dipped galvanized, or may be uncoated. Threaded steel rods must be straight and free of indentations or other defects along their length.

3.2.4.2 Steel Reinforcing Bars: Steel reinforcing bars must be deformed bars (rebar). Tables 3 and 4 summarize

*Revised January 2015

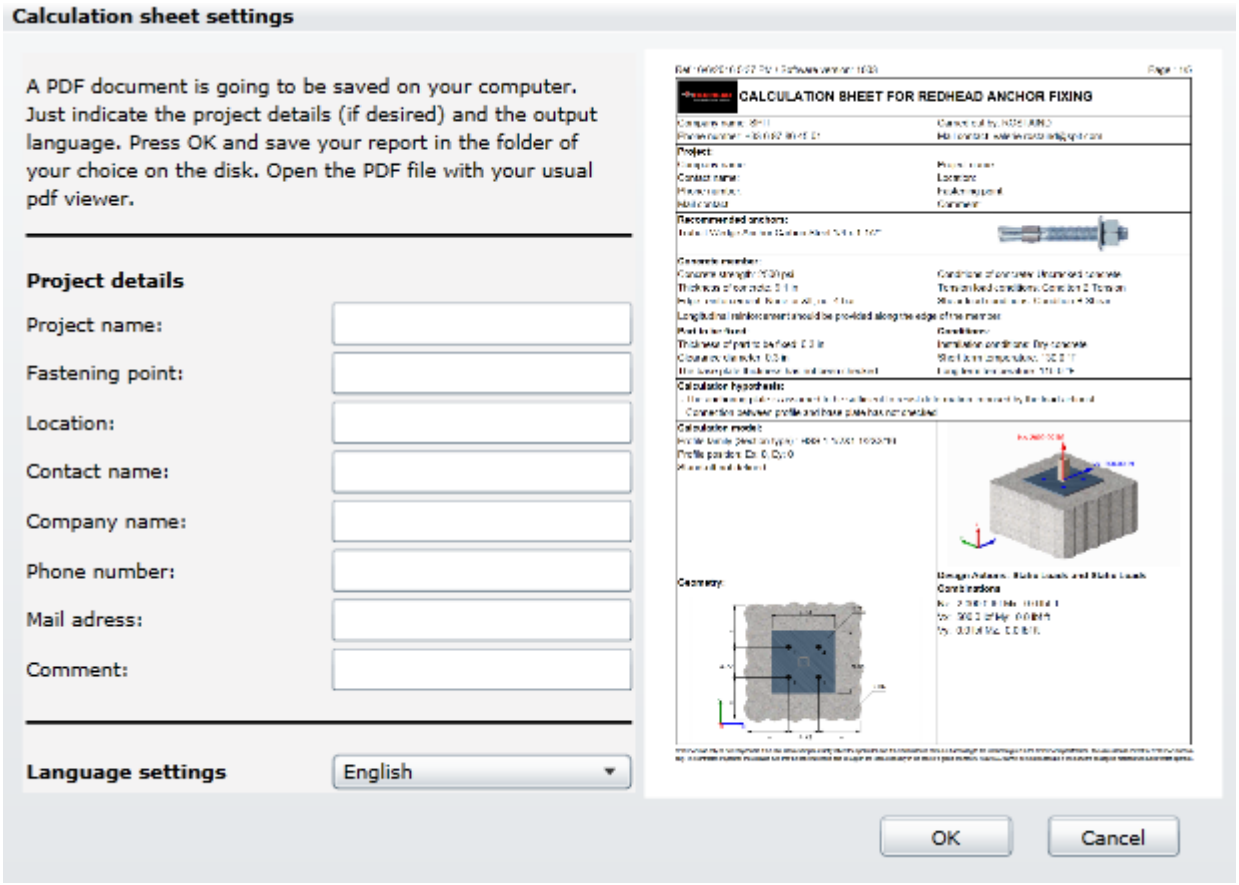
ICC-ES Evaluation Report

Design calculation note

To edit the design calculation report for the selected anchor, click on the icon  in the central toolbar. Only an anchor that meets the defined assumptions gives access to the Design calculation report edit function.

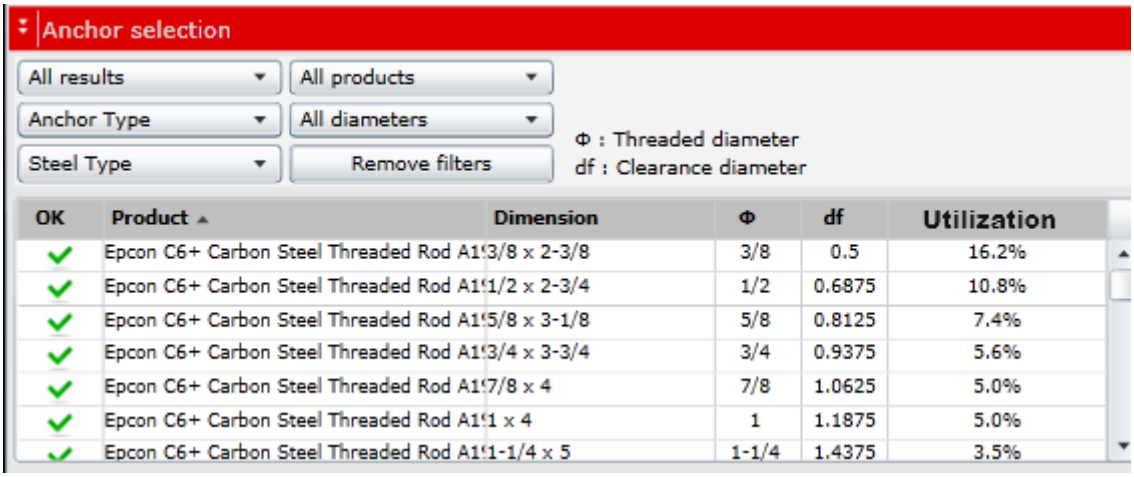
The user may then:

- Enter information concerning the project to be included in the calculation report.
- Confirm the formatting window to save the PDF file on your computer (see §Confidentiality)
- Once the PDF file has been saved on your computer, it can be opened, printed, or emailed as an attachment.



Fixing selection filter

Filters allow fast selection of the most suitable anchor depending on your constraints:

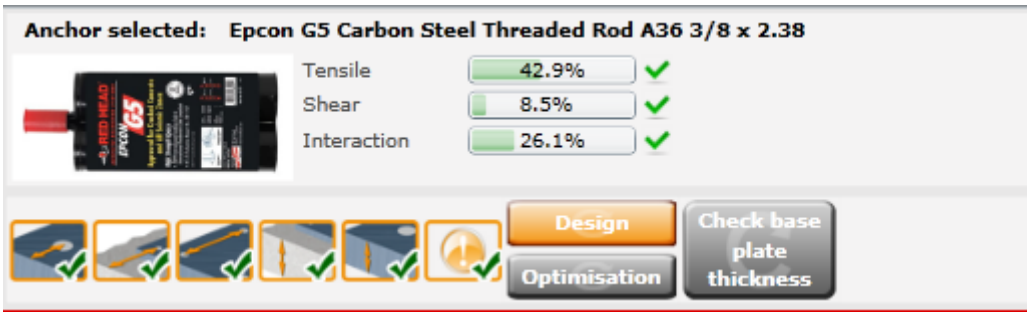


Filters can be used to sort the anchor selection list displayed:

- All results: Anchors OK or Anchors NOK
- Type: Mechanical, chemical
- Material: Galvanized steel, stainless steel
- Product description
- Diameter

Chapter 8
Optimization program

TRUSPEC offers two optimization modes to help the user find and optimize a solution:

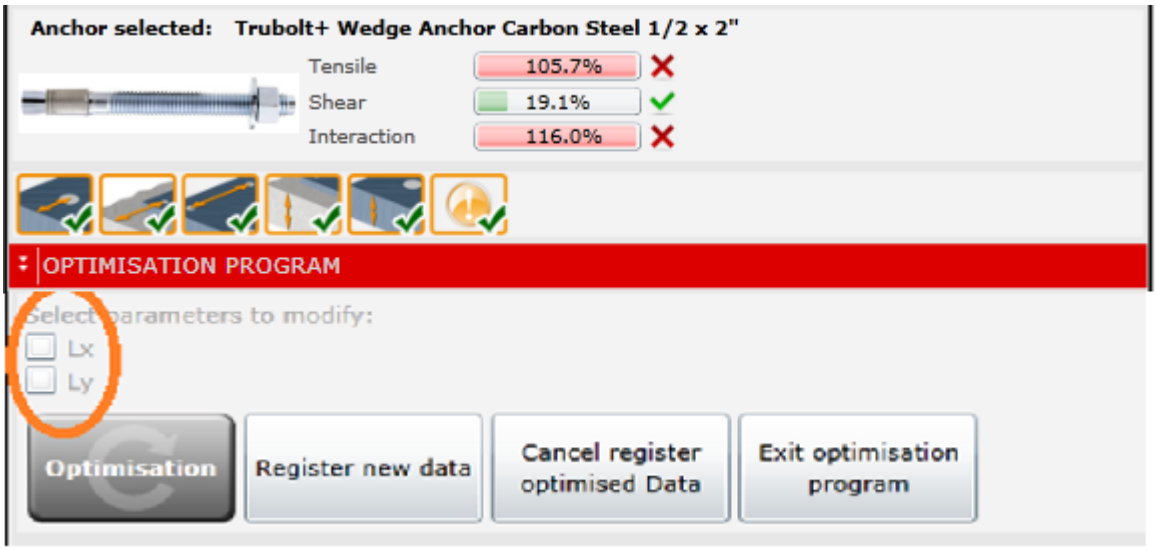


- OPTIMIZATION mode
- DESIGN CALCULATION mode

Optimization mode

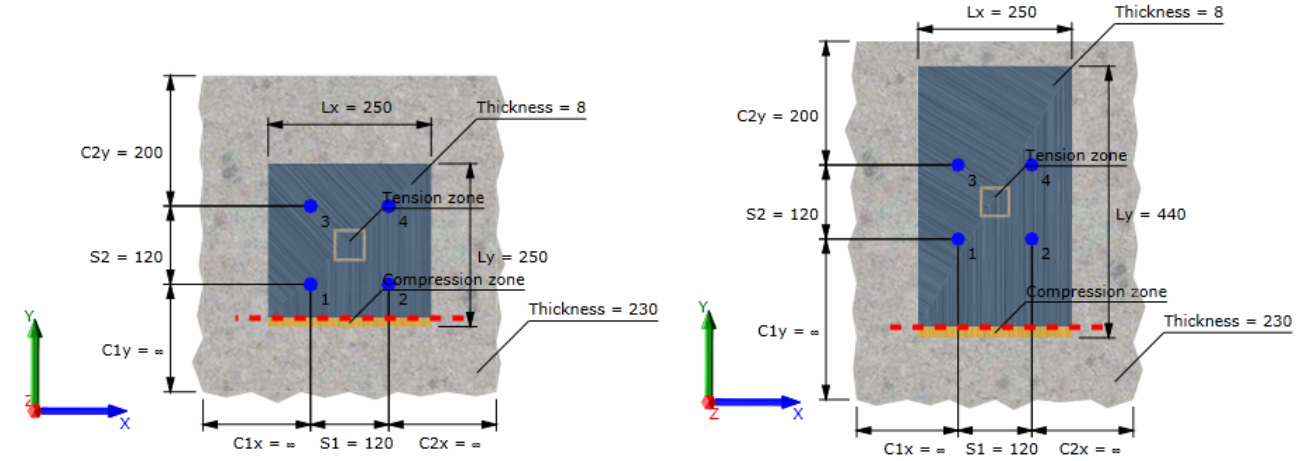
Optimization mode is accessible for each anchor for which a result has not been found.

Once you click on the Optimization button, TRUSPEC asks you to select the dimensions to be modified:



Once the parameters to be modified have been entered, click on Optimization so that RED HEAD TRUSPEC can optimize these values to find a solution for the selected anchor.

The screen on the right will display two 2D views: Initial situation and optimized situation:

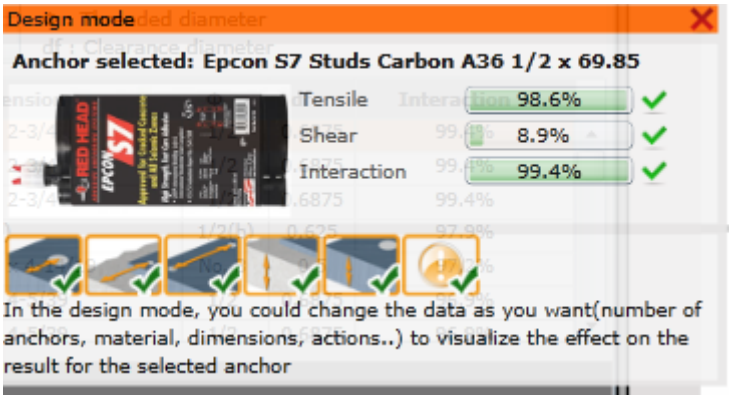


If the optimized data is acceptable, it can be saved by clicking on the button.

Design Calculation mode

In the CALCULATE tab, in Design Calculation mode, the user can choose an anchor and modify all the parameters in order to see the impact on the calculation result in real-time.

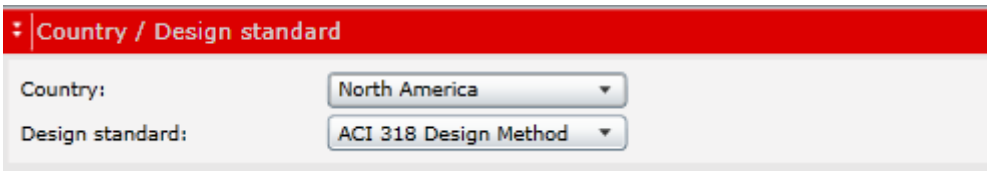
A window then opens, showing the result summary. Updated results will be displayed every time parameters are modified.



To exit design calculation mode, simply close the window by clicking on the red “x” at the top right.

Chapter 9
Options / User profile

Country / Design Standard

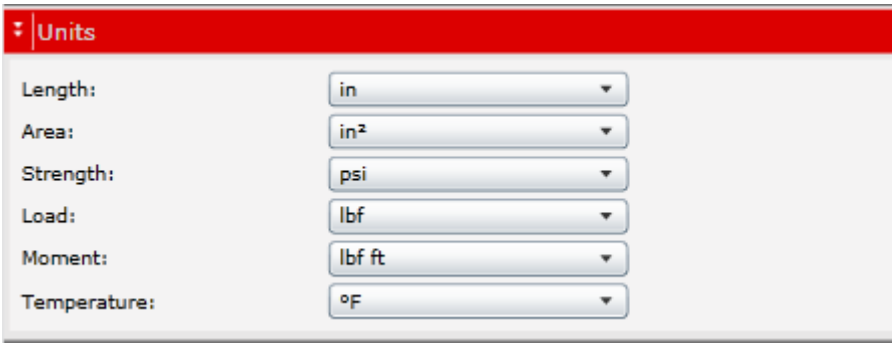


RED HEAD TRUSPEC is designed for use in North America. For users designing outside of North America, please contact technical support for further information.

Language

Red Head is offered in English (default language) as well as French and Spanish.

Units

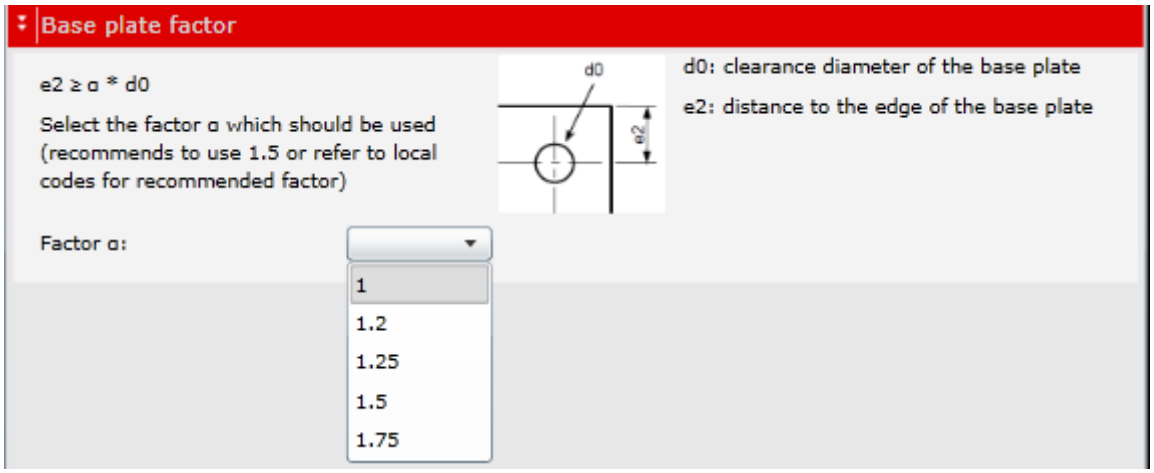


Users can choose units of the following unit parameters:

- Length: in (inches) or mm (SI)
- Surface: in² or mm², cm² (SI)
- Resistance: Psi or N/mm² (SI)
- Force: lbf or N, daN, kN (SI)
- Moment: lbf ft or Nm, daNm, kNm (SI)
- Temperature: °F or °C (SI)

Base plate factor

The user may define the base plate factor αrequired. We recommend to use a coefficient α = 1,5.

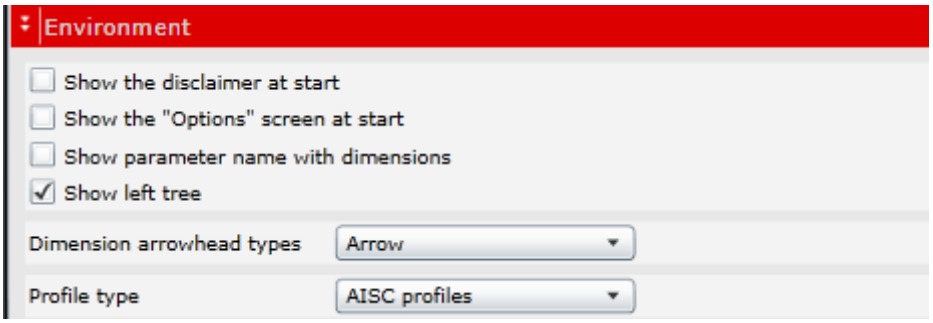


User profile

The user’s details can be entered in the user profile. This information will be included in the design calculation report, so there is no need to re- enter it systematically.

Environment

The Options > Environment menu can be used to define the working environment to suit the user.



Chapter 10
Confidentiality – Internet connection

Use of RED HEAD TRUSPEC via an internet connection is completely secure. RED HEAD provides access to a dedicated server, and guarantees:

- That all the data entered by the user remains in local mode on the user's computer;
- That no information concerning the user's business or contacts is used or saved on the TRUSPEC server;
- The design calculation note is saved on the user's computer.

Chapter 11
Installation guide – System configuration

The minimum configuration described below allows full use of T TRUSPEC.

Hardware

- Windows: 1.6-gigahertz (GHz) or higher processor
- Macintosh (Intel based): Intel Core Duo 1.83-gigahertz (GHz) or higher processor
- 512Mb RAM
- High speed Internet connection (min. 1Mb/s)
- Free space on hard disk: Min. 50 Mb
- Minimum display resolution 1280 x 800.

Software

To use the online version, check the compatibility between the operating system and the Web browser:

Web browser / Operating system	Internet Explorer 11	Internet Explorer 10	Internet Explorer 9	Internet Explorer 8	Internet Explorer 7	Internet Explorer 6	Firefox 12+	Safari 4+	Chrome supported up to version 41 (3)
Windows 10 (2)	✓(1)	–	–	–	–	–	✓	–	✓
Windows 8.1 Desktop	✓(1)	–	–	–	–	–	✓	–	✓
Windows 8 Desktop	–	✓(1)	–	–	–	–	✓	–	✓
Windows Server 2012 R2	✓(1)	–	–	–	–	–	✓	–	✓
Windows Server 2012	–	✓(1)	–	–	–	–	✓	–	✓
Windows 7	–	–	✓(1)	✓(1)	–	–	✓	–	✓
Windows 7 SP1	✓(1)	✓(1)	✓(1)	✓(1)	–	–	✓	–	✓
Windows Server 2008 SP2	–	–	✓	✓	✓	–	✓	–	✓
Windows Server 2008 R2 SP1	✓(1)	–	✓(1)	✓(1)	–	–	✓	–	✓
Windows Vista SP2	–	–	✓	✓	✓	–	✓	–	✓
Windows Server 2003 SP2, Windows XP SP3	–	–	–	✓	✓	–	✓	–	✓
Macintosh OS 10.5.7+ (Intel-based)	–	–	–	–	–	–	✓	✓	–

(1) the Internet Explorer 64-bit version does not allow use of the online TRUSPEC application. If the 64-bit version is used, we invite you to run the 32-bit version of Internet Explorer to use TRUSPEC, or contact technical support to install an offline version on your computer.

(2) Silverlight is not available in the Microsoft Edge browser, but is supported in Internet Explorer.

(3) With Chrome version 45 or higher Chrome no longer supports NPAPI plugins (like Silverlight, Java, Silverlight, QuickTime, Flash …)

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Concrete Anchoring Solutions