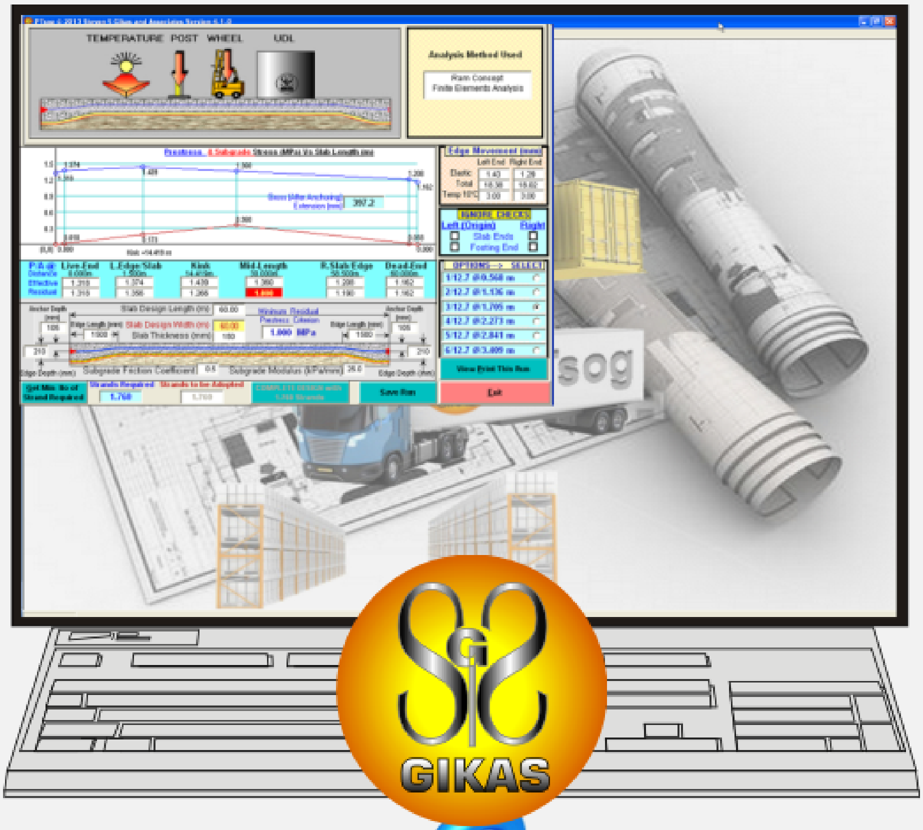

PTsog

by

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No representations or warranties with respect to the contents hereof are made, and any implied warranties or fitness for any particular purpose is specifically disclaimed.

Although care has been taken in developing and testing the program described herein, it is possible that errors and inadequacies may emerge as it used in new applications. It is the responsibility of the user to ensure that the input data is appropriate, and to check and exercise his/hers own judgment in applying the results.

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Table of Contents

1. INTRODUCTION

PTsog is a Windows standalone program that designs Post-Tensioned and Reinforced Slabs-On-Grade (SOG)

Type of Designs:

- Warehouse Slabs-On-Grade
- Industrial Pavements
- Container Pavements
- Airport Pavements

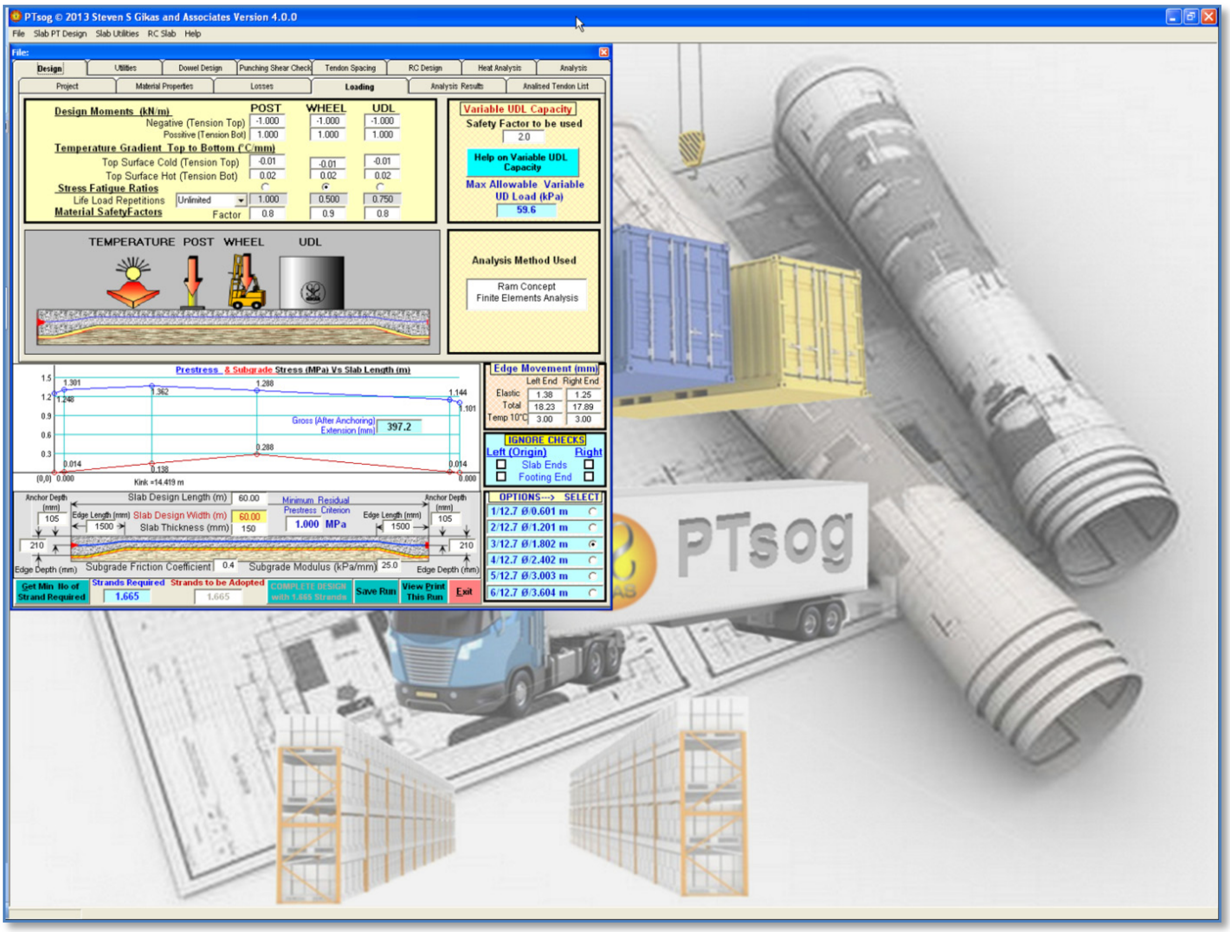


Figure 1: The PTsog Program

2. DESIGN THEORY for the Slab-On-Grade (SOG)

Three design criteria for prestressed SOG are normally considered

Criterion 1

The effect of

- Loads (post, wheel)
- Subgrade reaction
- Subgrade friction
- Temperature
- Shrinkage
- Creep

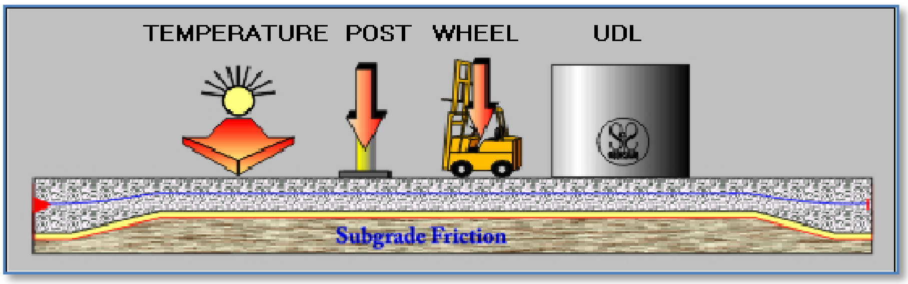


Figure 2: Loading

Are all considered and sufficient prestress is applied to keep the concrete tensile stresses to the allowable limit.

The relationship for a safe performance is as follows

$$f_t + f_p \geq f_{\Delta t} + f_F + f_L \quad \text{----------- (1)}$$

Where:

f_t = Concrete Flexural Strength
f_p = effective prestress at the slab critical point
$f_{\Delta t}$ = temperature gradient stress
f_F = Subgrade friction at slab critical point
f_L = Load tensile stress at slab critical point
N = Life Load Repetitions

Criterion 2

A minimum residual compression level, in the concrete is maintained after all losses.

Criterion 3

Fatigue strength, or strength under repetitive loading is satisfied

Strength under repetitive loading is measured in terms of Stress Ratio **(SR)**. The Stress Ratio is a measure of net working tensile stress to the net cracking stress

$$SR = \frac{Net\ Working\ Tensile\ Stress}{Net\ Cracking\ Stress} \quad \text{--------- (2)}$$

$$SR = \frac{f_{\Delta t} + f_L - f_p + f_F}{f_t + f_p - f_F} \quad \text{--------- (3)}$$

The allowable Stress Ratio (SR_{All}) is defined as

$$SR_{All} = 0.73 - \left(0.0846\left(\frac{Ln(N)}{Ln(10)} - 3\right)\right) \quad \text{--------- (4)}$$

The Stress Ratio calculated (Equation 3) must be equal or less than the allowable (Equation 4)
It should be noted that, the inverse of the SR is equal to the Safety Factor

3. SLAB DESIGN

3.1. Slab Design – Dialogue Window

The Slab Design Dialogue Window is displayed as shown in **Figure 3**.

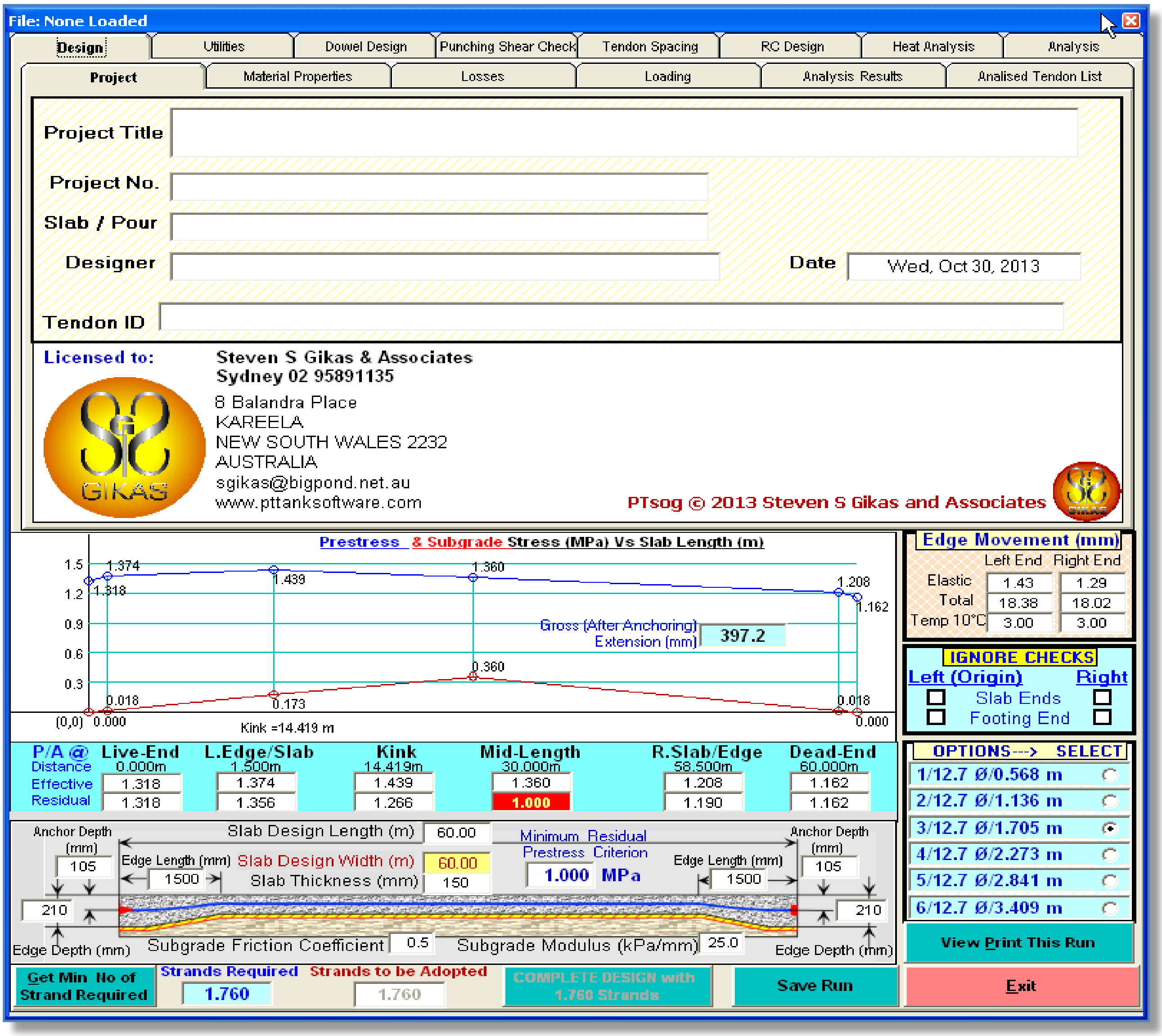


Figure 3: Slab Design Dialogue Window

Dialogue Window is divided into several Primary Tabs, as Shown in **Figure 4**. These are:

- Design
- Utilities
- Dowel Design
- Punching Shear Check
- Tendon Spacing
- RC Design
- Heat Analysis (Not available for this version)
- Analysis (Not available for this version)

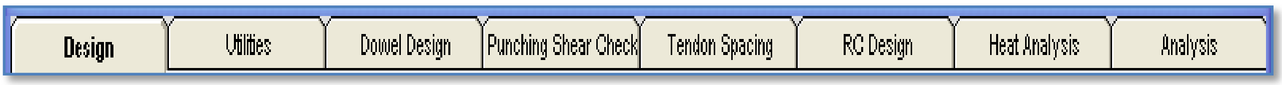


Figure 4: Primary Control Tabs

3.2. The Design (Primary Tab)

The Design Primary Tab, as shown in **Figure 5,** is sub-divided into Six Tabs.
These are:

- Geometry and Subgrade
- Slab Material Properties (Tab 1)
- Tendon Losses (Tab 2)
- Loading (Tab 3)
- Loading Analysis Results (Tab 4)
- Edge Bars and Utilities (Tab 5)
- Analysed Tendon List

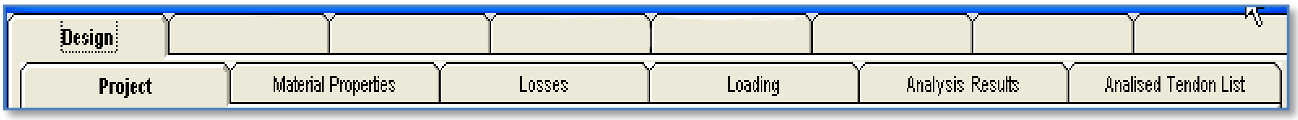


Figure 3: Design Tab

3.2.1. Geometry, Subgrade and Prestress Level

This Part of the Design Tab, as shown in **Figure 4**

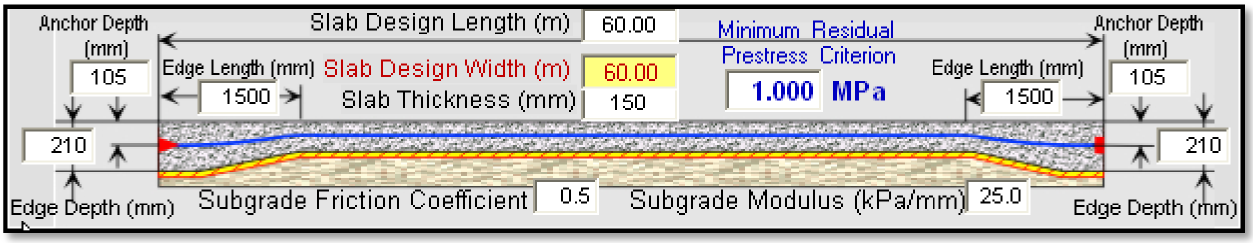


Figure 4: Geometry, Subgrade and Prestress Level Input

The user required input or confirm the:

- **<u>The Slab Geometry</u>**
  - Design Length (Length of Tendon-Default of 60m)
  - Design Width (With of slab to place and space the tendons-Default 60m)
  - Slab Thickness(Default 150mm)
    There is a practical minimum to the thickness of a prestressed slab on grade, which depends on the size of the prestressing hardware to be used. Given that generally the anchorages are cast into the edge thickening, 130 mm is normally considered to be the minimum achievable slab thickness
- **<u>Edge Geometry</u>**
  - Depth of Edge. (Default 1.4xSlab Depth)
    Normally proportioned as 1.4 x the Slab Depth
  - Length of Edge
    Normally proportioned with
    Level Length of 0.5m to 1.0m
    Inclined Length of 0.8m to 1.0m
  - Tendon Anchor Location from top of Slab
    Normally located at Mid-Edge Depth

- **Minimum Residual Prestress** (Default 1.000 MPa)
  The level of prestress to be present at the critical section (normally mid-length) of the slab, after all losses, and subgrade friction, is normally proportioned to be not less than 1.0 MPa. In order to improve the waterproofing properties of the slab, a level of 2.0 MPa may be more appropriate.

- **Subgrade Friction Coefficient** (Default 0.50)
  The subgrade friction is the restrained offered by the subgrade when the slab is contracting due to climatic variations, shrinkage and prestressing. Values for the friction coefficient may vary from 0.2 to 2 or more.
  Important to note, that the subgrade friction is caused by the self-weight of the slab. On the very rare occasion that static superimposed loads are great in number and magnitude, their inclusion in the friction loss calculations may be warranted.
  The most practical method of base treatment is to use 25mm to 50mm san layer, covered by two layers of membrane. This is placed between the subgrade and the concrete slab. For this arrangement a coefficient of subgrade friction of 0.5 is generally adopted.
  Where an accurate assessment is critical, the subgrade friction should be experimentally determined and then confirmed in the field.

3.2.2. Project

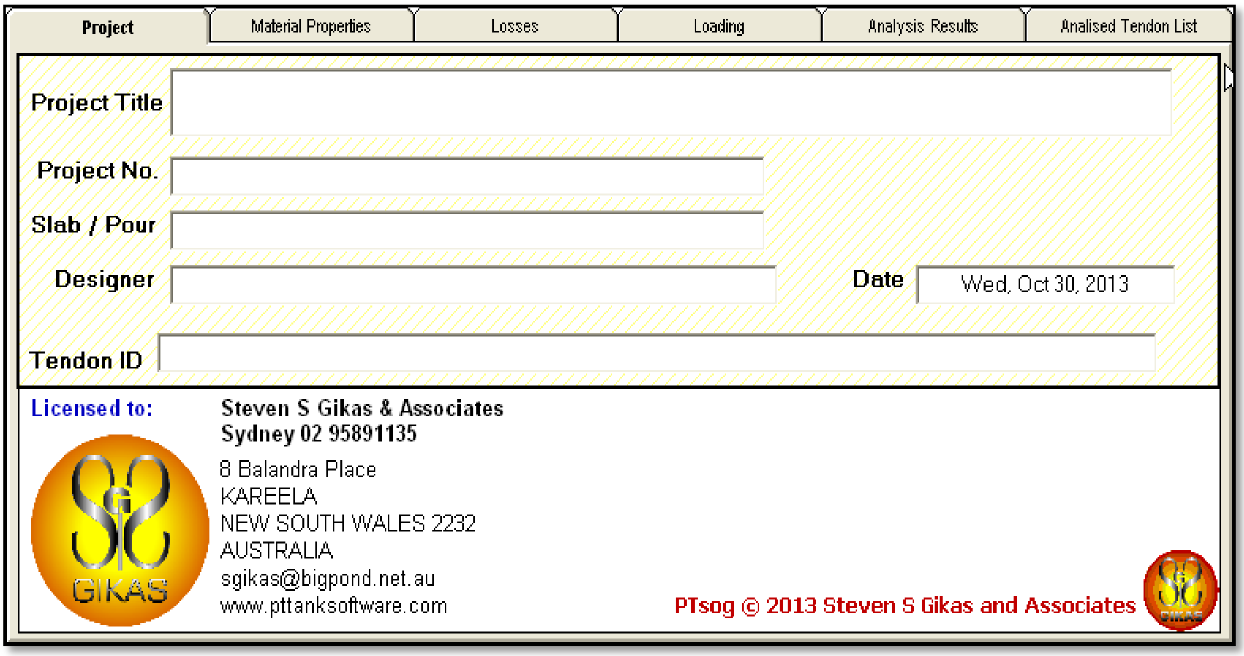


Figure 5: Project Tab

The project Tab displays the License detail, as shown in **Figure 5**
User needs to complete all the fields, especially when saving the design.

3.2.3. Slab Material Properties

PTsog displays default values for all material properties, as shown in **Figure 6.**

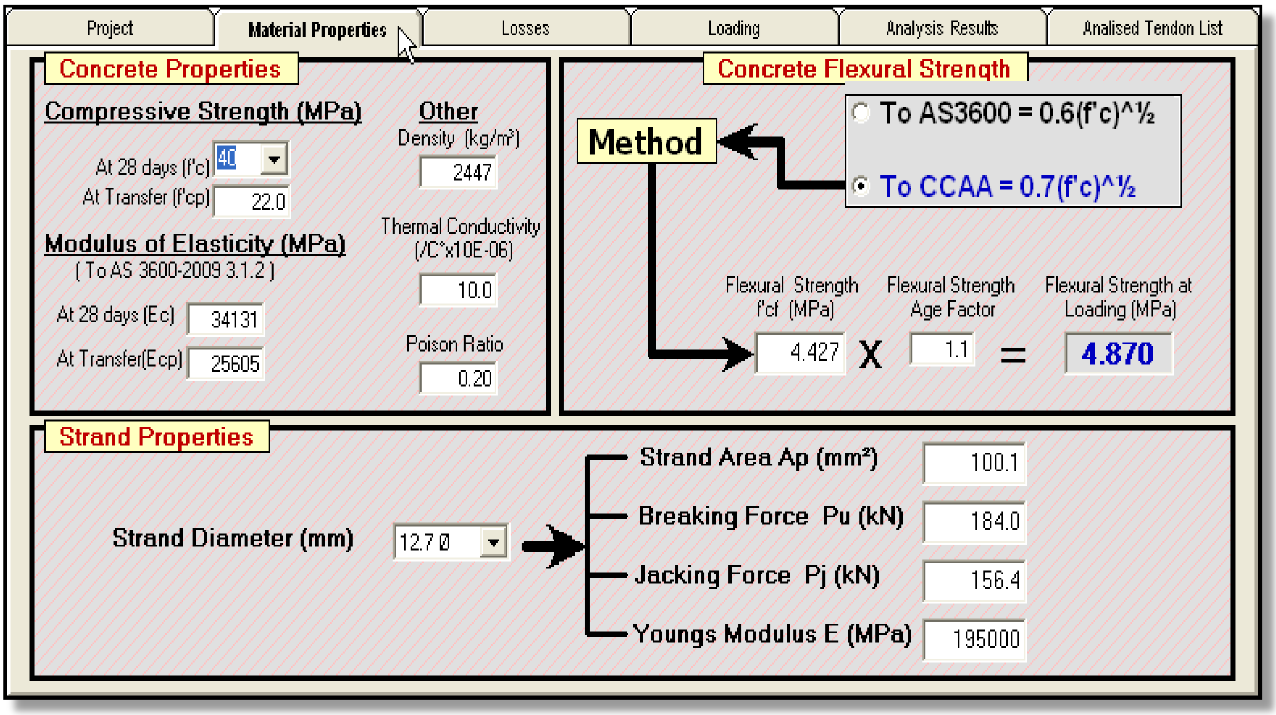


Figure 6: Slab Design – Material Properties

User needs to confirm/amend the:

- **Concrete Properties**
  - Compressive Strength
    - At 28 days (Default 40 MPa)
    - At Transfer this is when tendons are stressed (Default 22 MPa)
      This is specified by the PT system used, and normally is
      - 22 MPa for 12.7mm Strands
      - 25 MPa for 15.2mm Strands
  - Density
  - Modulus of Elasticity
    - At 28 days
    - At 2Transfer

    The Values are automatically generated by PTsog, as a function of Concrete strength and density, in accordance with AS3600.
    The user can overwrite these values
  - Thermal Conductivity (Default 10)
  - Poison Ratio (Default 0.2)

- **Concrete Flexural Strength** (Default 4.427 MPa)

  There are three options (criterions) that can be used to define the Concrete Flexural Strength, as shown in **Figure 7**.
  - To AS3600 which gives a value of $0.6(fc)^{1/2}$
  - To Cement and Concrete Association of Australia, Floor and Pavements Which gives a value of $0.7(fc)^{1/2}$
  - User Defined, by entering the required value at the Flexural Strength Field

- **Flexural Strength Age Factor** (Default 1.10)

  This is the Concrete Flexural Strength that PTsog uses to design the Slab. It should be the value at the time of slab loading, which normally is taken as 90 days

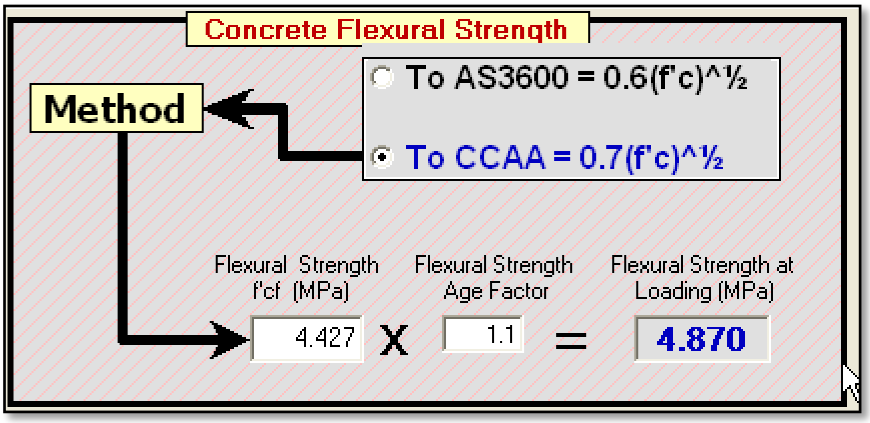


Figure 7: Flexural Strength – Material Properties

- **Strand Properties**

  User selects the strand size to be used in the design, as shown in **Figure 8**
  - Strand Diameter (Default 12.7mm)
    Options are 12.7mm and 15.2mm
  - Associated Strand Properties
    - Area
    - Breaking Force
    - Jacking Force
    - Young's Modulus

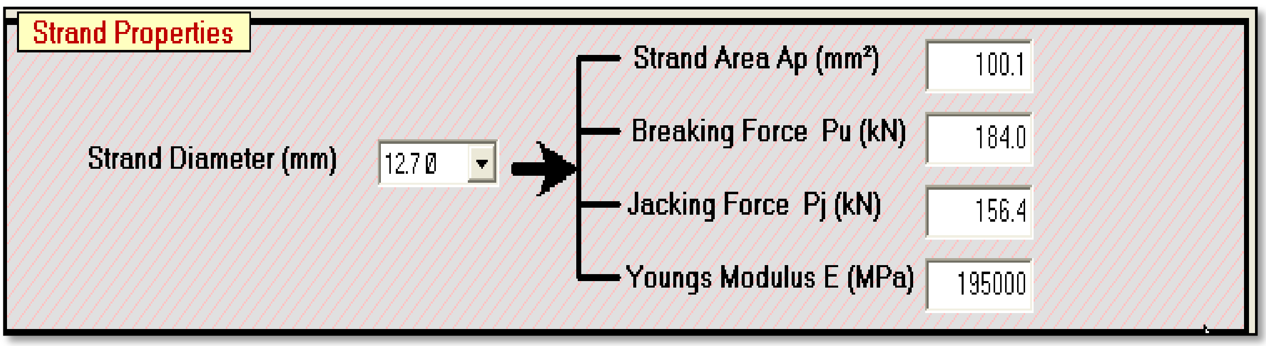


Figure 8: Strand – Material Properties

3.2.4. Tendon Losses

Here is where PTsog evaluates the Slab:

- Tendon Force Profile
- Tendon Extension (After Anchoring)

The Force Profile is evaluated taking into account all the Tendon Losses, which are:

- **Immediate** Loss of Prestress due to:
  - Elastic deformation of concrete
  - Friction along duct
  - Anchoring
- **Time-Dependent** Loss of Prestress due to:
  - Shrinkage of Concrete
  - Creep of Concrete
  - Tendon Relaxation

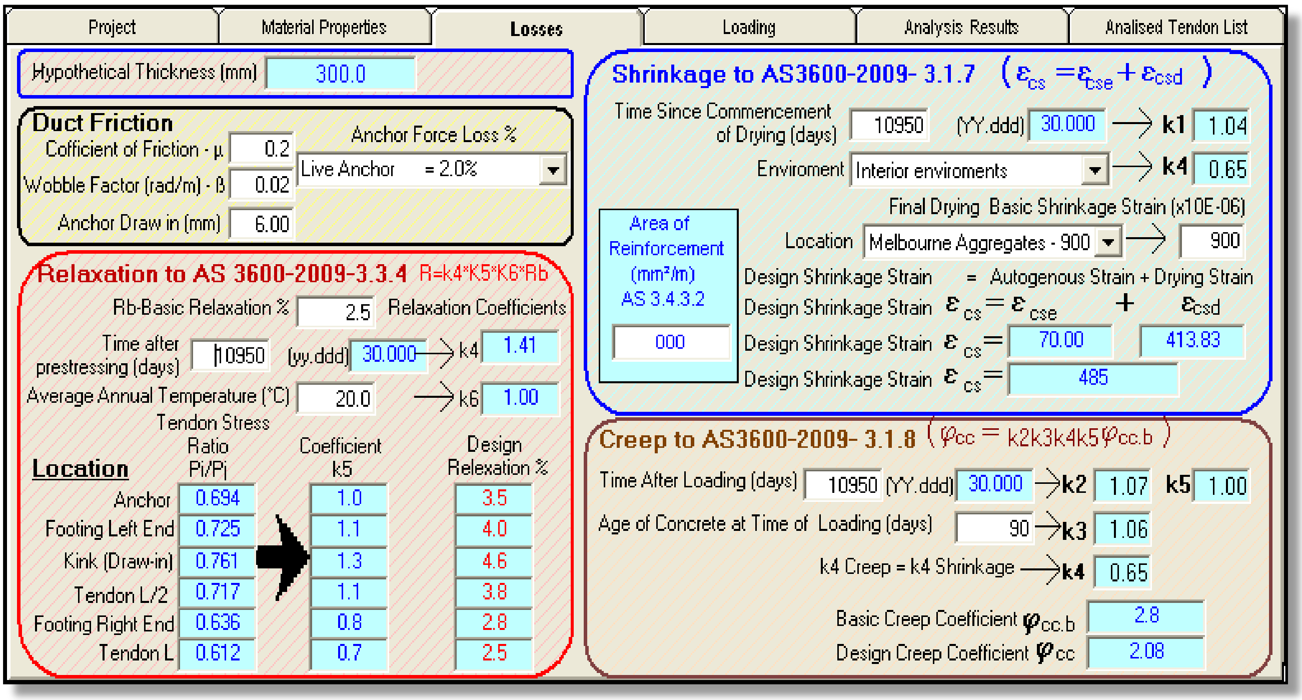


Figure 9: Slab Design – Tendon Losses

PTsog performs the Loss Analysis using:

- The loss values as defined in AS 3600-2009, Section 3.4, assuming
  - For the Time-Dependent Losses
    - Age of Concrete as (30 years x 365) 10950 days
    - Age of concrete at time of loading as 90 days
    - Basic Tendon Relaxation of 2.5
- Default Tendon values for
  - Coefficient of friction
  - Wobble Factor
  - Draw-in
  - Anchor Force Loss %

User needs to confirm these loss parameters and make sure the Tendon related values, are applicable to the Prestress System used.

3.2.5. Tank Slab Loading

This is where user enters all loadings, as applicable to the top and bottom of slab
Applied Loads can be:

- Post, Wheel or UDL
  These are added in the form of Moments kNm/m
  Also required are the associated values for:
  - Stress Fatigue Ratios
    This is evaluated from the Total (Life) Load Repetitions
    Default Values:
    - Post 1 for No Repetitions
    - Wheel 0.5 for Unlimited Repetitions
    - UDL 0.75 for 580 Repetitions

    PTsog evaluates the **Fatigue Factor** based on the user selected Life Load Repetitions
  - Material Safety Factors
    Reference: Cement and Concrete Association of Australia
    Industrial Pavements
- Temperature Gradient (Default 0.02 °C/mm for tension bottom)
  Uniform temperature changes produce stresses, only because of frictional restraint. As a result of temperature gradient within the slab, the slab tends to warp, thereby resulting in longitudinal and transverse stresses.
  Common Values for industrial floors are:
  - For Internal Environments 0.02 °C/mm
  - For External Environments 0.04 °C/mm

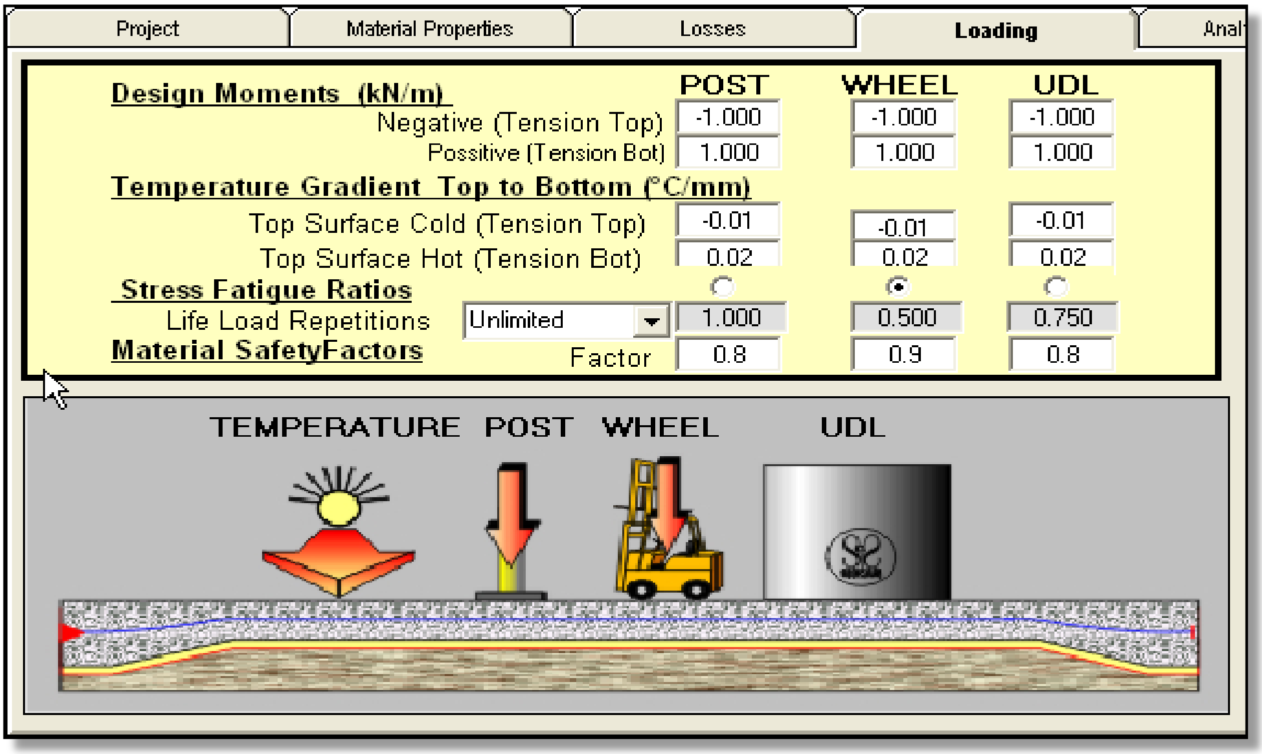


Figure 10: Tank Slab Loading

3.3. The Slab Design

PTsog designs the slab, satisfying the three criteria described in **Section 2 of this Manual**.

The design of the slab is in two steps. These are:

- Determining The Minimum Number of Strands required
- Completing Design, using the determined strand or the user modified number of strands

3.3.1. Determining Number of Strands

PTtank evaluates and displays the minimum required number of strands when user presses the

Command Button,

The required number of strand is displayed as shown in **Figure 11**, and the user has the option to:

- Accept and continue with finalizing design
- Increase number and finalize design

Figure 11: Slab Design – Strands required and Used

3.3.2. Complete Design using Number of Strands

PTtank completes the Slab Design, using the **Strands to be Used** value, when user presses the

Command Button

Note: The **COMPLETE DESIGN** Command button contains the number of strands used

3.3.3. Slab Design Results

On completion of the Slab Design, PTsog displays and plots:

- Analysis Results at each critical section, in Tabulated Form
- **Tendon/Subgrade Stress Profile** Plot
- Slab Edge Movements
- Tendon Design Options
- No of Tendons and Tendon spacing for the specified slab width

3.3.3.1. Slab Design – Analysis Results

PTsog Tabulates the Controlling Location and condition as shown in **Figure 12**

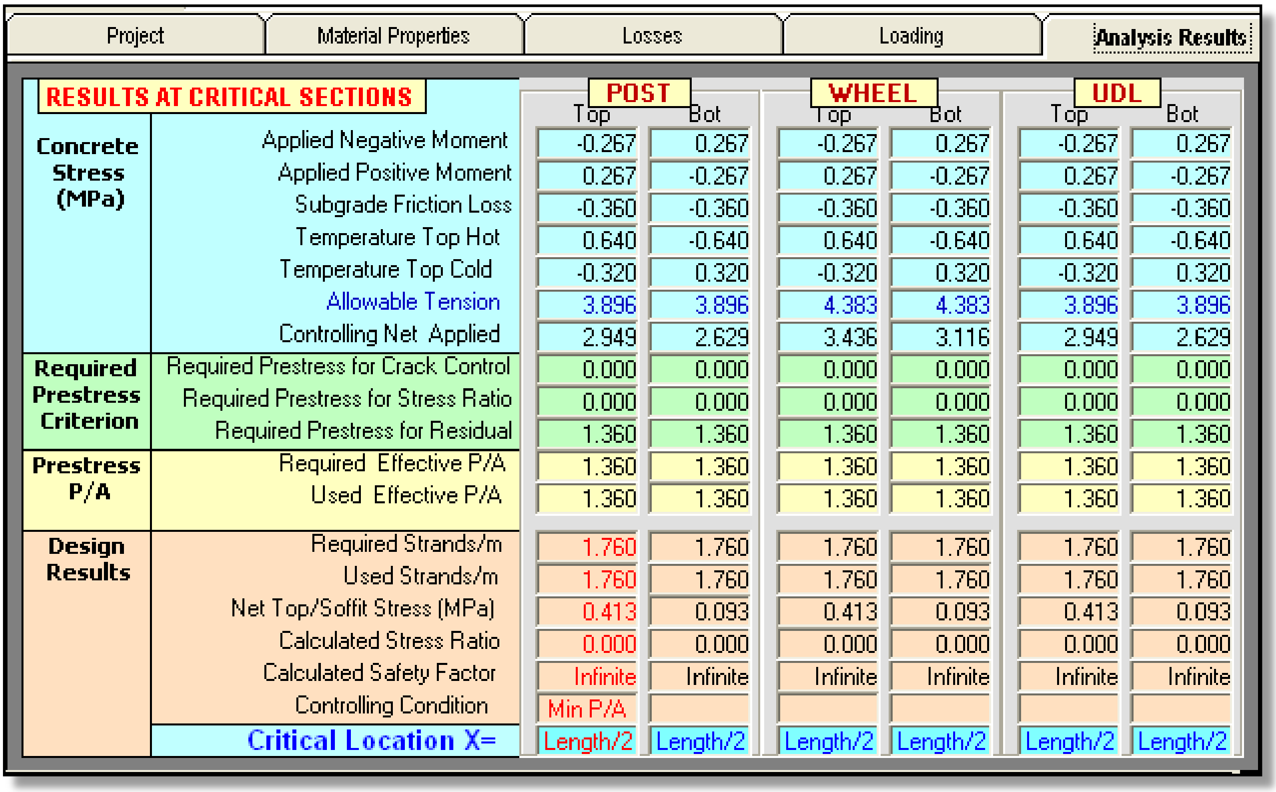
- Post
- Wheel
- UDL

For Slab Top and Bottom

Figure 12 shows:

- The Controlling Criterion (Residual Prestress in this example)
- Critical Location (At Slab mid-length for this example)

This is expected as there is no Post, or Wheel loads



Project | Material Properties | Losses | Loading | Analysis Results

RESULTS AT CRITICAL SECTIONS		POST Top	POST Bot	WHEEL Top	WHEEL Bot	UDL Top	UDL Bot
Concrete Stress (MPa)	Applied Negative Moment	-0.267	0.267	-0.267	0.267	-0.267	0.267
	Applied Positive Moment	0.267	-0.267	0.267	-0.267	0.267	-0.267
	Subgrade Friction Loss	-0.360	-0.360	-0.360	-0.360	-0.360	-0.360
	Temperature Top Hot	0.640	-0.640	0.640	-0.640	0.640	-0.640
	Temperature Top Cold	-0.320	0.320	-0.320	0.320	-0.320	0.320
	Allowable Tension	3.896	3.896	4.383	4.383	3.896	3.896
	Controlling Net Applied	2.949	2.629	3.436	3.116	2.949	2.629
Required Prestress Criterion	Required Prestress for Crack Control	0.000	0.000	0.000	0.000	0.000	0.000
	Required Prestress for Stress Ratio	0.000	0.000	0.000	0.000	0.000	0.000
	Required Prestress for Residual	1.360	1.360	1.360	1.360	1.360	1.360
Prestress P/A	Required Effective P/A	1.360	1.360	1.360	1.360	1.360	1.360
	Used Effective P/A	1.360	1.360	1.360	1.360	1.360	1.360
Design Results	Required Strands/m	1.760	1.760	1.760	1.760	1.760	1.760
	Used Strands/m	1.760	1.760	1.760	1.760	1.760	1.760
	Net Top/Soffit Stress (MPa)	0.413	0.093	0.413	0.093	0.413	0.093
	Calculated Stress Ratio	0.000	0.000	0.000	0.000	0.000	0.000
	Calculated Safety Factor	Infinite	Infinite	Infinite	Infinite	Infinite	Infinite
	Controlling Condition	Min P/A					
	Critical Location X=	Length/2	Length/2	Length/2	Length/2	Length/2	Length/2

Figure 12: Slab Design – Analysis Results

The controlling Location and Condition are tabulated **in red**

3.3.3.2. Slab Design – Tendon/Subgrade Friction Plot

PTsog plots as shown in **Figure 13**, the:

- Tendon and Subgrade Friction Stress as a function of Slab Length
- Values at all critical points
- Tendon Extension (After Anchoring)

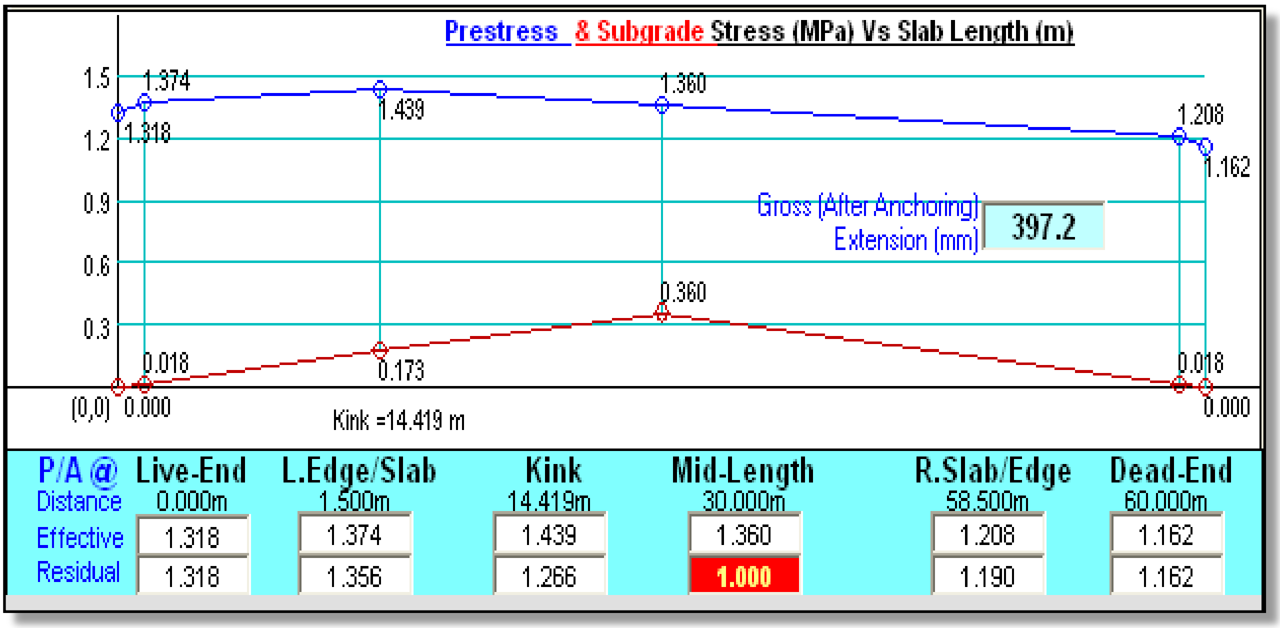


Figure 13: Slab Design – Tendon/Subgrade Friction Stress Vs Slab Length

The Lengths (m) and associated stresses (MPa) are plotted and tabulated.
These are:

- Beginning of Slab (Live End)
- Left Edge/Slab transition
- Tendon Force Kink (due to Anchor Draw in or Anchoring)
- Mid-Slab Length
- Right Edge/Slab transition
- Slab Length

The Blue Line represents the Tendon Stress Profile in MPa
The Red Line represents the Subgrade Stress Profile in MPa
The controlling P/A is **highlited**

3.3.3.3. Slab Design – Edge Movement

PTsog evaluates and displays as shown in **Figure 14**, the Movement of the Slab Ends
The Movements are:

- Elastic
- Temperature
- Total

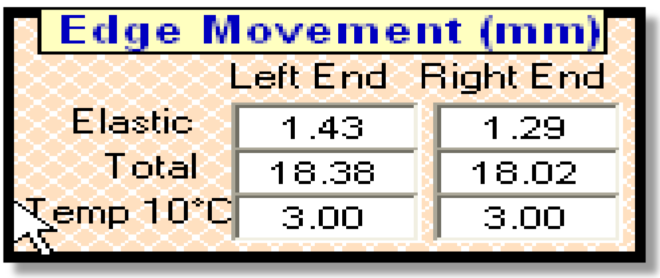


Figure 14: Slab Design – Edge Movements

The movements are particularly important, for pavement design, in the design of

- Movement Joints
- Dowels

3.3.3.4. Slab Design – Tendons Spacing Option

PTsog displays the Tendon Design options and makes an educated guess at the selection, as shown in **Figures 15**

The options are based on

- Strand Properties defined by user
- The number of strand used in the design

The PTsog selected option
- **12.7mm Strand**
- **3-stand Tendon**
- **at 1.705m spacing**

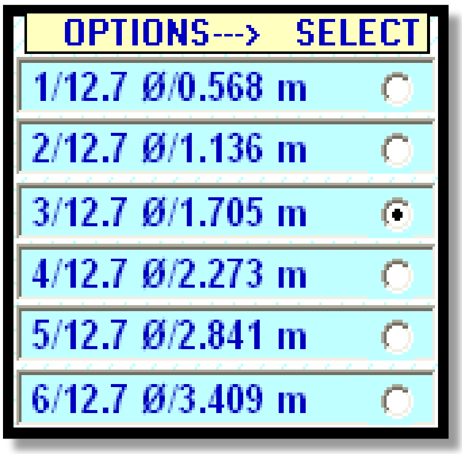


Figure 15: PTsog Option

User can make his own selection

As shown in Figure 16
- **12.7mm Strand**
- **4-stand Tendon**
- **at 2.273m spacing**

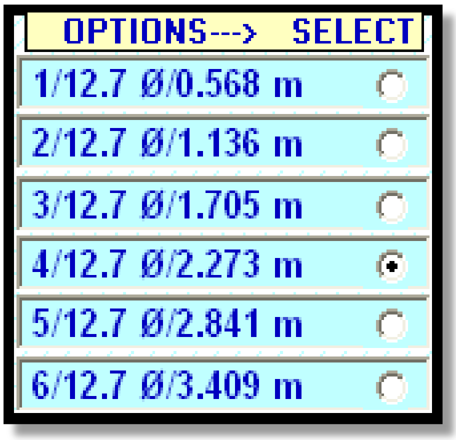


Figure 16: User Option

The Selected option defines the spacing to be used to calculate the

- Number of Tendons
- Tendon Spacing

For the full Slab With, while maintaining the design P/A (prestress)

3.3.3.5. Slab Design - Slab Width and Tendon Spacing

PTsog calculates the spacing based on the specified option **(Figures 15 and 16**)
The Design window can be accessed by selecting the Tendon Spacing Tab as shown in **Figure 17**

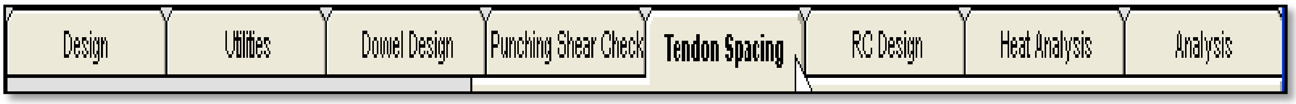


Figure17: The Tendon

Pressing the **Tendon Spacing Tab** brings up the Default Spacing Window as shown in **Figure 18**

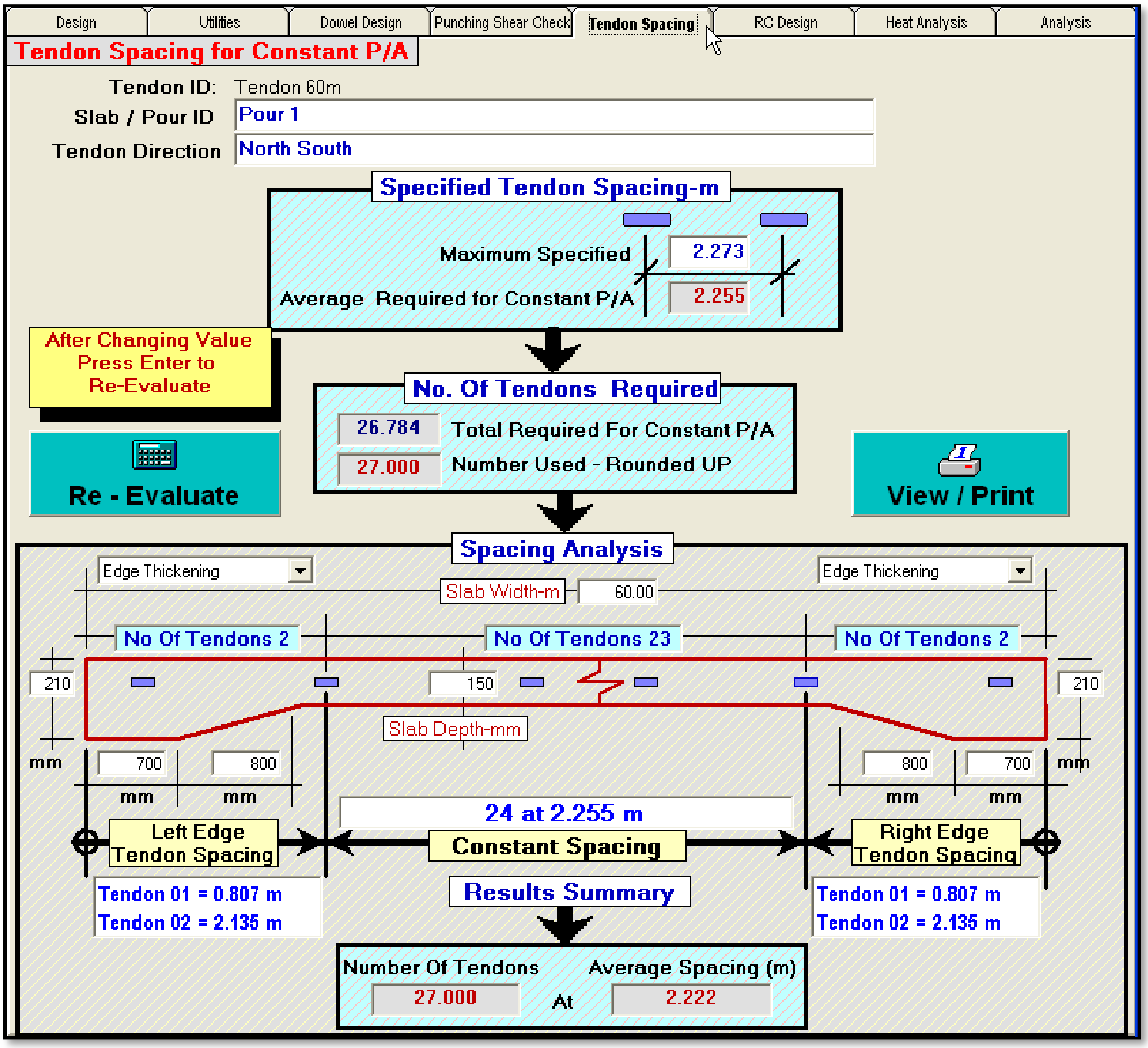


Figure18: Spacing Window with Defaults

The default window assumes the width of slab (secondary direction) has the same edge conditions as the main direction. Based on this, the specified spacing, PTsog calculates

- The number of tendons
- Actual Spacing at Ends
- Spacing internally
- Total number of tendons
- Average spacing

The user can modify the edge conditions and re-evaluate, as shown in Figure 19

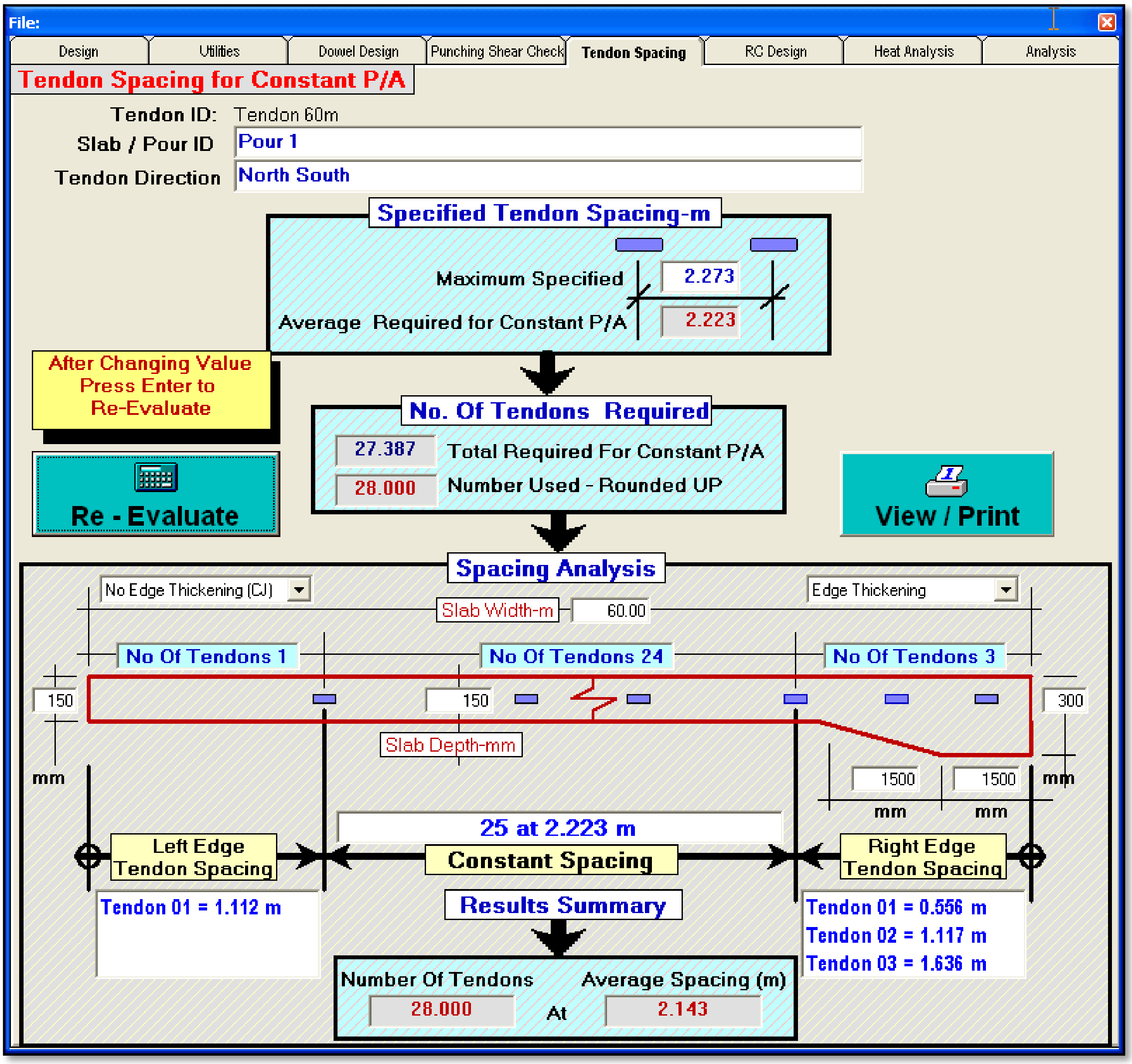


Figure19: Spacing Window with User amendments

As seen in **Figure 19**, the

- Left Edge has no edge thickening
- The Right Edge has been made wider and deeper

User can Print/ View this analysis by pressing the **View/Print** command button

3.4. Loading and Saving Design Files

PTsog allows user to save each and every completed Tendon Run to a disk file.
The user can:

- Save to a New File
- Load and Append to Existing File

The file status is always shown on top of the Window, as shown in **Figures 20 and 21**.

Figure 20: File Status - Loaded (current) File displayed

Figure 20 shows a File has been Loaded or Saved

Figure 21: File Status – No File Loaded or Saved

Figure 21 shows No file has been Loaded or Nothing Saved

3.4.1. Saving the Current Run

When a design has been completed user can save save/append this run by pressing the 

Command Button.

To save a run, the Tendon must have an ID, refer **Figure 5**. If no ID has been entered, the Run cannot be saved.

PTsog lets user know, by displaying an error message as shown in **Figure 22**.

Figure 22: User Warning – Tendon ID required

If a file has not been loaded or this is the first run to be saved, PTsog displays the Save dialogue Window as shown in **Figure 23**.

User enters the file name, or selects an existing file to be overwritten.

The default file extension is **.sog**

Pressing the Save buttons the New File is saved containing the current run.

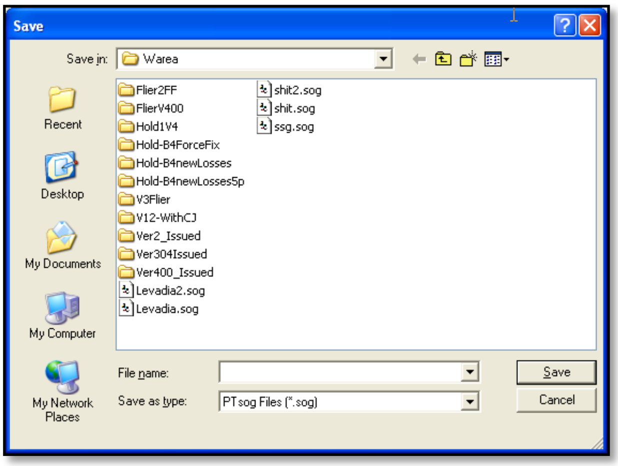
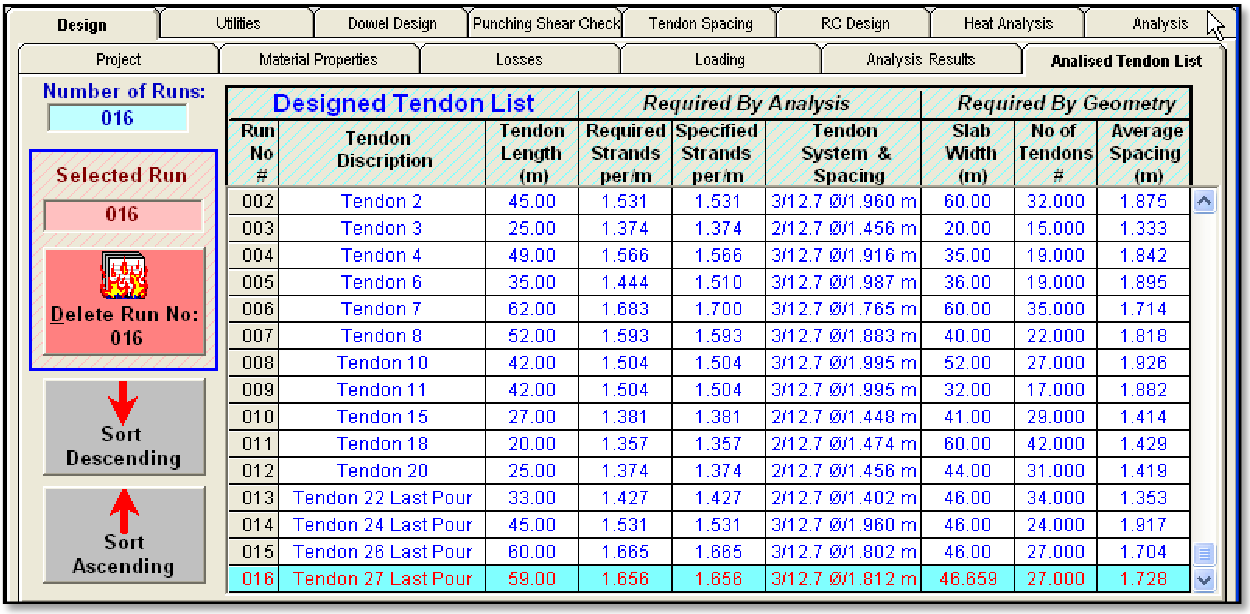


Figure 23: Save Dialogue Window

3.4.2. Analysed Tendon List

When a run is saved it automatically gets added to the **Analysed Tendon List**
When a file is loaded, all Runs contained are displayed in the **Analysed Tendon List**, as shown in **Figure 24**



Designed Tendon List			Required By Analysis			Required By Geometry		
Run No #	Tendon Discription	Tendon Length (m)	Required Strands per/m	Specified Strands per/m	Tendon System & Spacing	Slab Width (m)	No of Tendons #	Average Spacing (m)
002	Tendon 2	45.00	1.531	1.531	3/12.7 Ø/1.960 m	60.00	32.000	1.875
003	Tendon 3	25.00	1.374	1.374	2/12.7 Ø/1.456 m	20.00	15.000	1.333
004	Tendon 4	49.00	1.566	1.566	3/12.7 Ø/1.916 m	35.00	19.000	1.842
005	Tendon 6	35.00	1.444	1.510	3/12.7 Ø/1.987 m	36.00	19.000	1.895
006	Tendon 7	62.00	1.683	1.700	3/12.7 Ø/1.765 m	60.00	35.000	1.714
007	Tendon 8	52.00	1.593	1.593	3/12.7 Ø/1.883 m	40.00	22.000	1.818
008	Tendon 10	42.00	1.504	1.504	3/12.7 Ø/1.995 m	52.00	27.000	1.926
009	Tendon 11	42.00	1.504	1.504	3/12.7 Ø/1.995 m	32.00	17.000	1.882
010	Tendon 15	27.00	1.381	1.381	2/12.7 Ø/1.448 m	41.00	29.000	1.414
011	Tendon 18	20.00	1.357	1.357	2/12.7 Ø/1.474 m	60.00	42.000	1.429
012	Tendon 20	25.00	1.374	1.374	2/12.7 Ø/1.456 m	44.00	31.000	1.419
013	Tendon 22 Last Pour	33.00	1.427	1.427	2/12.7 Ø/1.402 m	46.00	34.000	1.353
014	Tendon 24 Last Pour	45.00	1.531	1.531	3/12.7 Ø/1.960 m	46.00	24.000	1.917
015	Tendon 26 Last Pour	60.00	1.665	1.665	3/12.7 Ø/1.802 m	46.00	27.000	1.704
016	Tendon 27 Last Pour	59.00	1.656	1.656	3/12.7 Ø/1.812 m	46.659	27.000	1.728

Figure 24: Analysed Tendon List

The **Analysed Tendon List** displays the

- Design Summary Table, which include
  - Tendon Run Number
  - Tendon Description (ID)
  - Design Requirement
    - Strands/meter
    - Specified Strand/meter
    - Selected System and Spacing
  - Geometry Requirement
    - Slab Width
    - Number of Tendons used
    - Average Spacing
- Number of Tendon Runs
- The Selected Run (Highlighted)
- Three Command Buttons, which are
  - Delete (Selected Run)
    - Pressing this button, deletes/purges the selected run permanently fro list and file.
  - Sort Descending
    - Pressing this button, displays list in descending order, based on Tendon ID
  - Sort Ascending
    - Pressing this button, displays list in ascending order, based on Tendon ID

Selecting a Run from the List is done by simply clicking on that Run (anywhere along the row). This highlights the whole row and fills all the tabs with the Input and Results for this run.

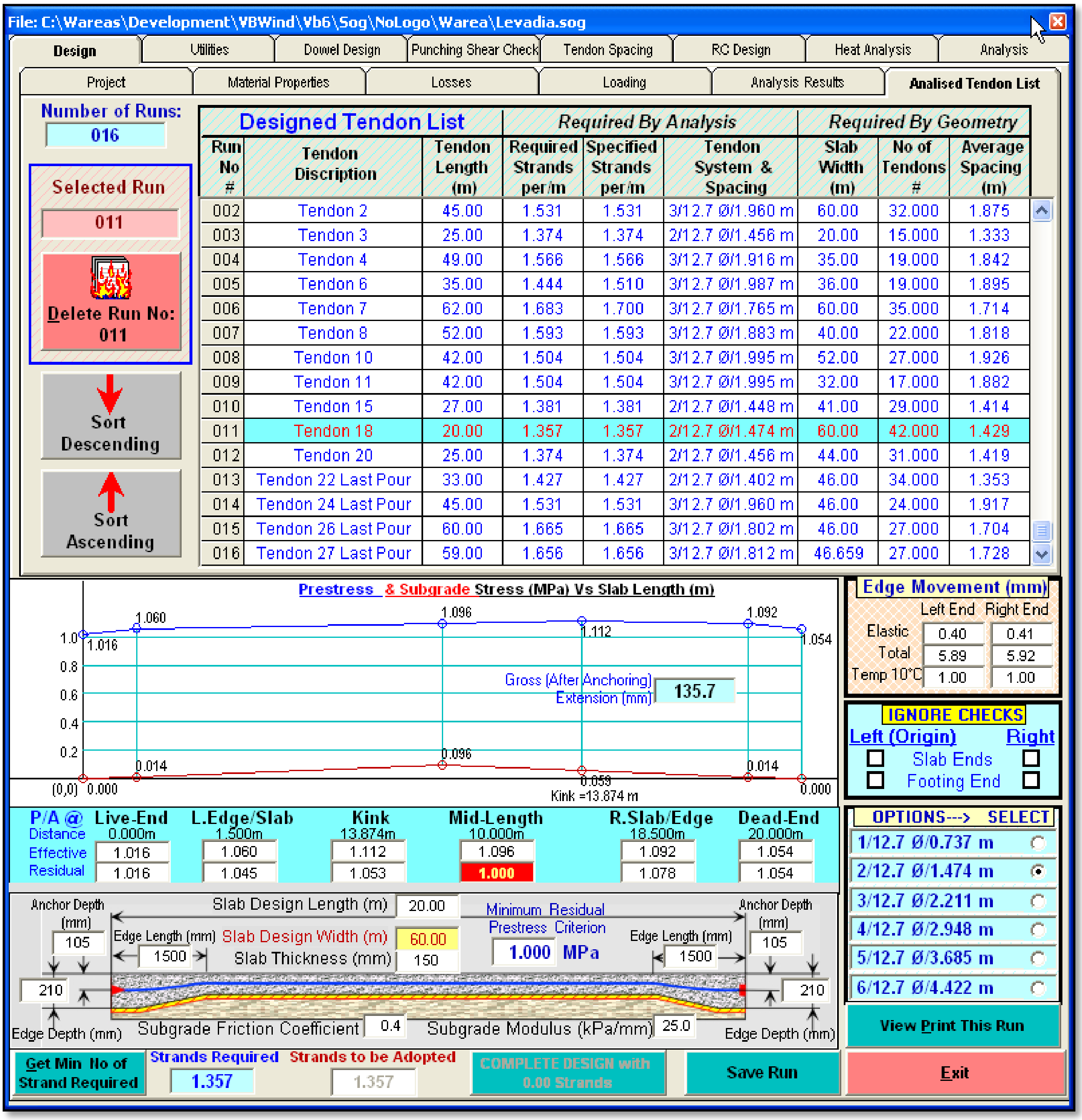


Figure 25: Selected Run No: 011

Figure 25, shows the user has selected Run No. 011

Note the Delete button contains this Number. Pressing it will permanently delete this run

4. DOWEL DESIGN

PTsog does a detail Dowel Design based on (TR34)

Technical Report No 34 Third Edition UK

Concrete Industrial Ground Floors

A guide to design and construction

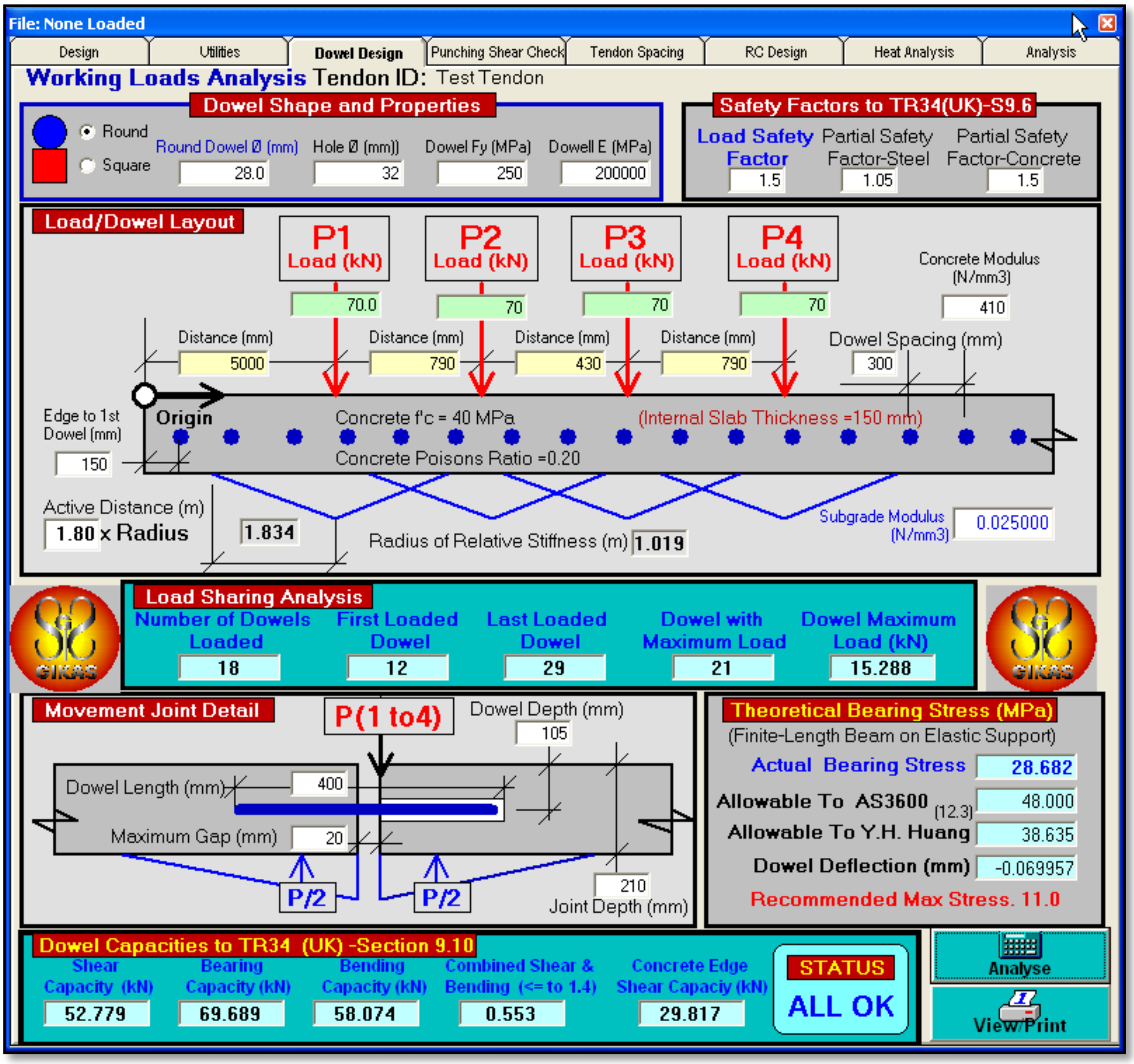


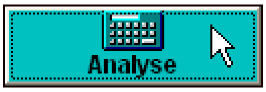
Figure 26: Dowel Design

PTsog, displays the Recommended/Default values (User can amend as required)

- Dowel size and associated properties
- Default Safety Factors

User needs to enter/confirm the:

- Loading as applicable (**Figure 26** shows Typical Warehouse Storage Loading)
- Slab/Edge Depth (**Figure 26** shows a depth of 210)
- Dowel Spacing (**Figure 26** shows a spacing of 300)
- Edge to First Dowel distance (Normally half the dowel spacing)
- Dowel Depth (normally mid slab depth)
- Dowel Overall Length
- Concrete and Subgrade Modulus
- Expected maximum gap opening (obtained from PTsog edge movements)

Once all Dowel Input is completed, pressing the  command button allows PTsog to do the Analysis Check.

The first part of the Dowel Analysis process is the **Load Sharing Analysis** as shown in **Figure 27**

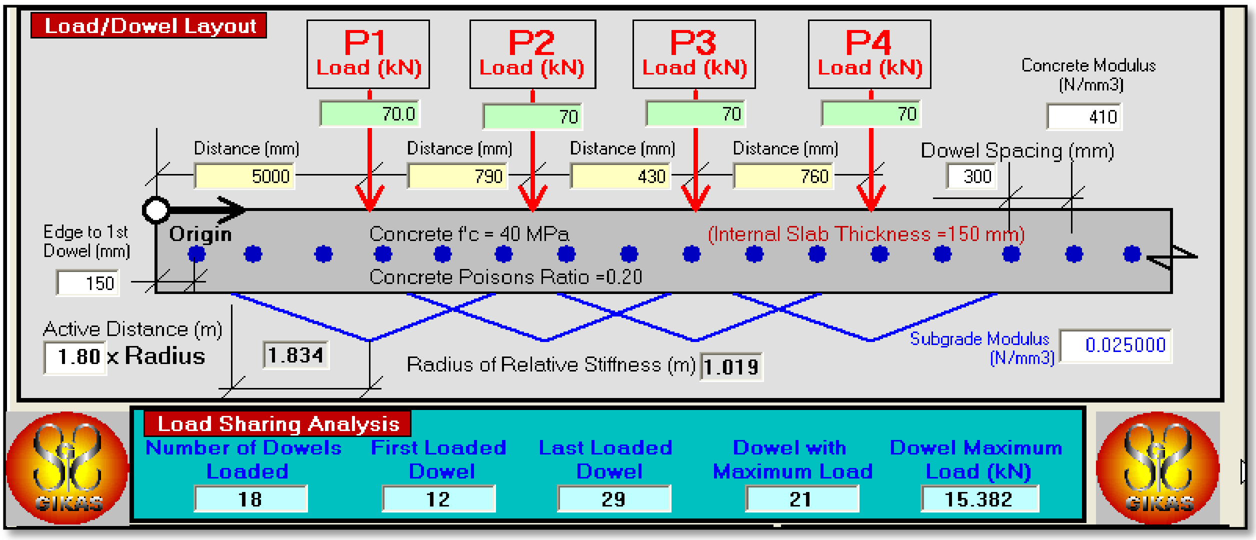


Figure 26: Load Sharing Analysis

PTsog evaluates, for the Loading specified, the:

- Number of Dowels Loaded (For example shown 18 Dowels)
- First Dowel Loaded (For example shown 12th Dowel)
- Last Dowel Loaded (For example shown 29th Dowel)
- The Dowel with Maximum Load (For example shown 21st Dowel)
- The Dowel Maximum Load (For example shown 15.382 kN)

PTsog then performs a Finite-Length Beam on Elastic Support analysis, and displays, as shown in **Figure 27**, the

- Actual Bearing Stress
- Allowable Stress to AS3600
- Allowable Stress to Y.H.Huang
- Dowel Deflection in mm

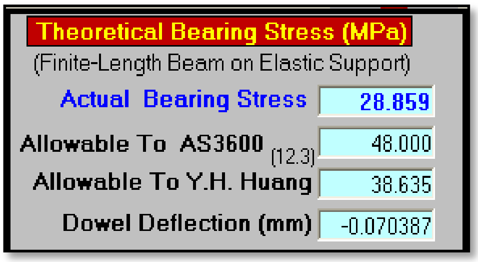


Figure 27: Bearing Stresses

The Final phase of the Dowel design is the Dowel Capacities based on TR34, as shown on **Figure 28**

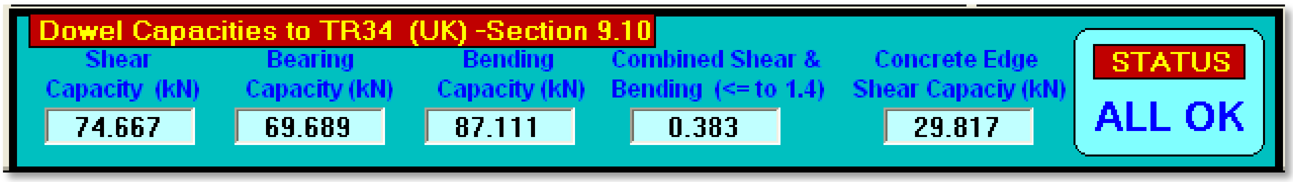


Figure 28: Dowel Capacities

PTsog, displays the Capacity for

- Shear
- Bearing
- Bending
- Combined
- Edge Shear

And finally the Design Check **STATUS**, (For Example **ALL OK**)

5. PUNCHING SHEAR

PTsog performs a Punching Shear Check to AS3600, as shown in **Figure 29**

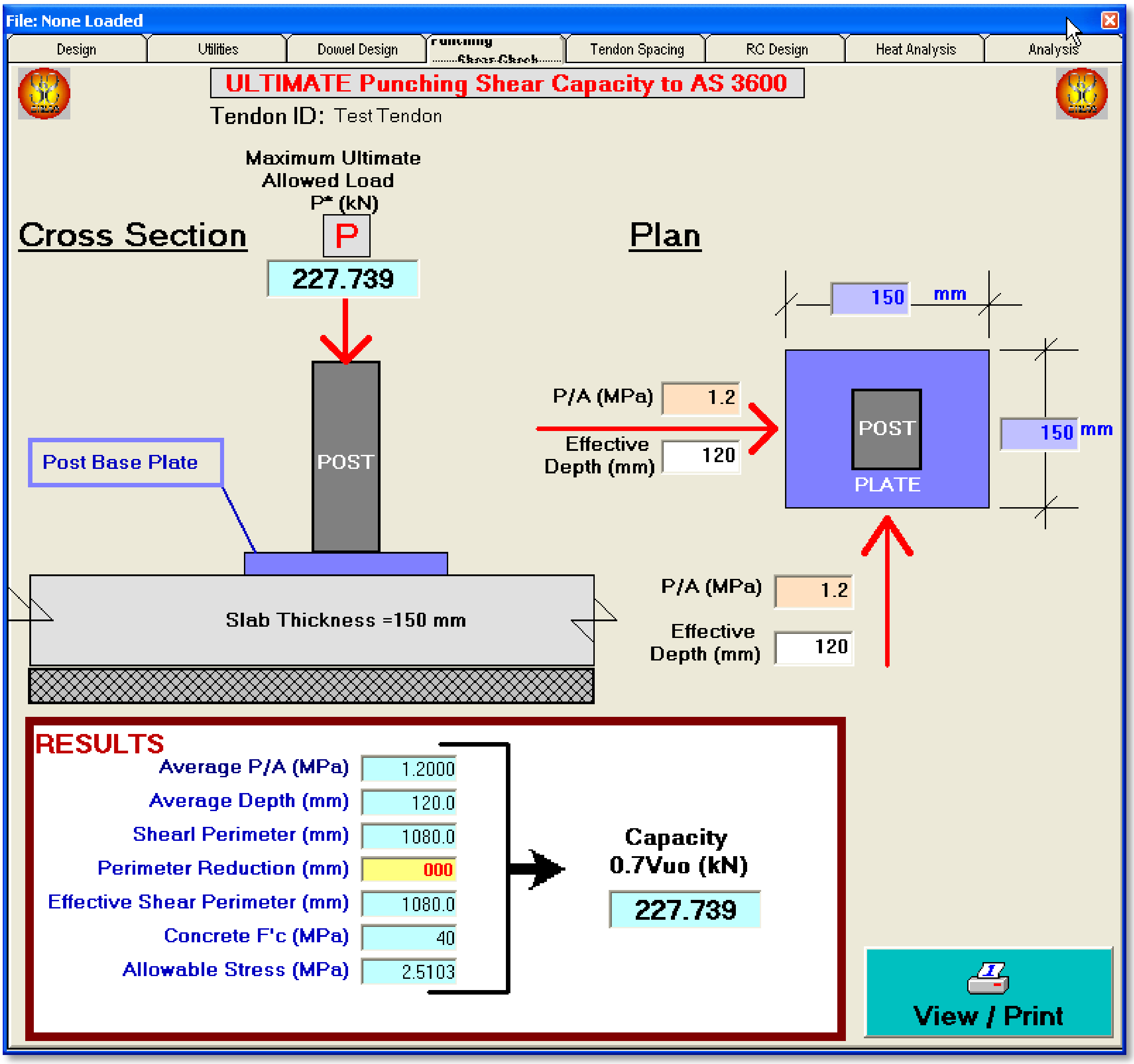


Figure 29: Punching Shear Check

User needs to confirm/edit the

- Base Plate Dimensions (For example **150**mm x **150**mm)
- P/A in Both Directions
  PTsog uses as defaults the specified minimum residual (For example shown 1.2 MPa)
- Effective Depth Both Directions
  PTsog used 0.8D as default for both directions (For the example shown, 120mm)
- Shear Perimeter Reduction, in case of holes in the vicinity (Default is zero)

Based on the above PTsog calculates the Ultimate Shear Capacity
In example shown (Figure 29) capacity is **227.739 kN**
User need to ensure **<u>Applied Point Load < Capacity</u>**

6. RC SLAB DESIGN

PTsog performs an equivalent Reinforced Only Design, as shown in **Figure 30**

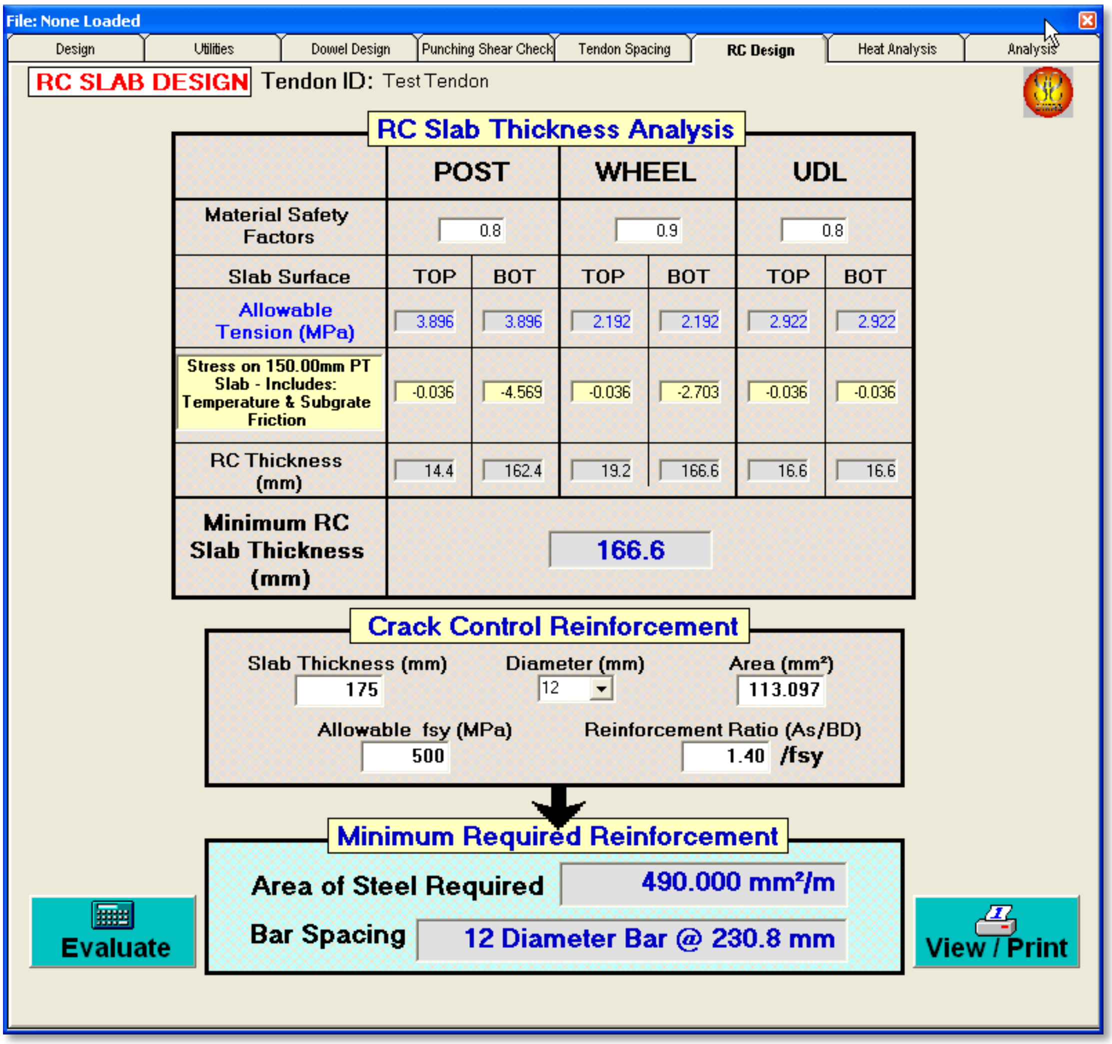


Figure 30: RC Design

To perform the RC design a couple of items need to be addressed

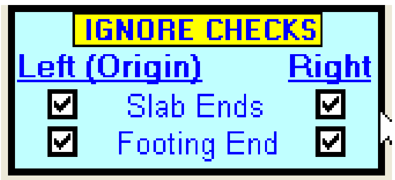


Figure 31: Ignore Edge Checks

- Slab Length
  The PT Slab Length needs to be reduced to the RC Length
  Say 7m
- The Temperature Loading, due to the short length, can be reduced or zeroed
- The Design Checks for Slab and Footing End, must be switched off to force check at mid-slab length

PTsog evaluates the minimum slab depth required to satisfy the allowable stress criterion.
User needs to confirm/amend

- Slab Depth (Round up from evaluated minimum)
  In Example Shown increased from 166.6min to 175mm
- The Reinforcement Size
- Allowable Steel Yield Stress (fy)
- Reinforcement Ratio required (Default 1.4/fsy)

PTsog completes RC Design by evaluating the minimum required reinforcement

7. UTILITIES

PTsog makes available a Utility Page, as shown in **Figure 32**

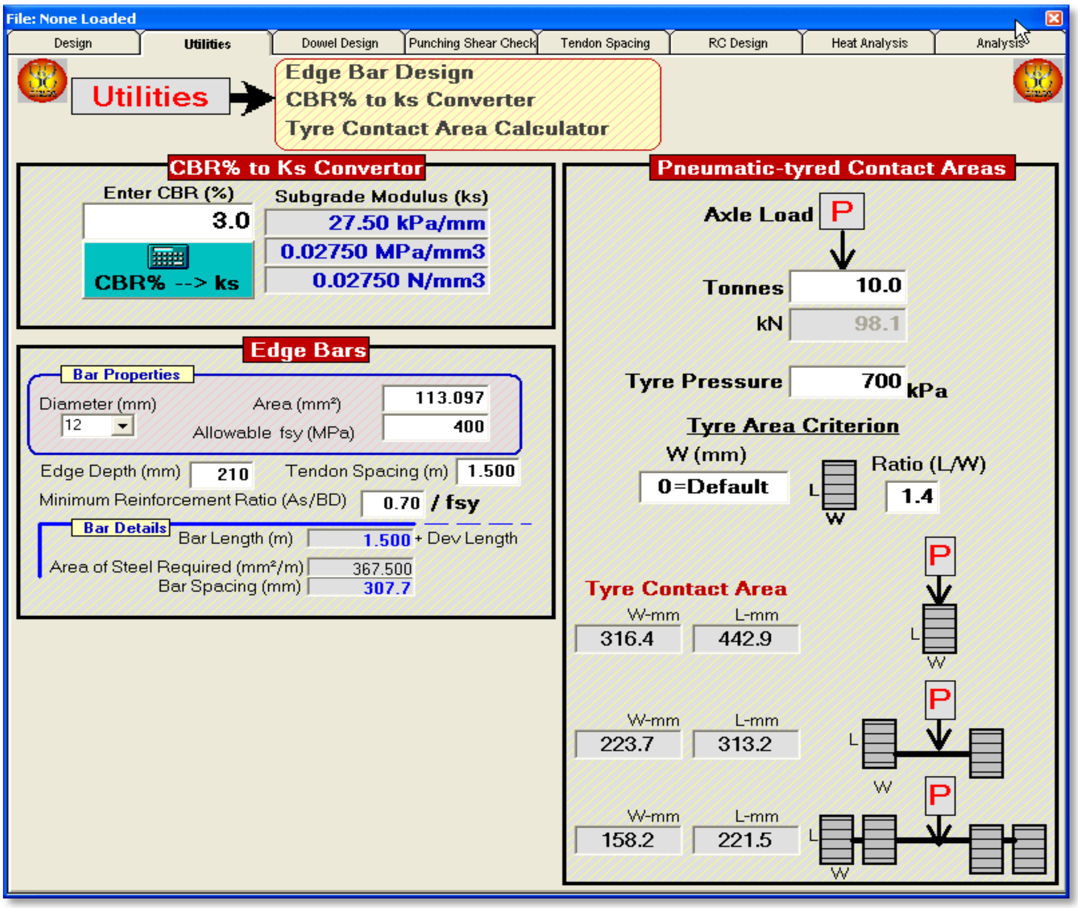


Figure 32: Utilities

The Utilities available are:

- **CBR% to ks Converter.**
  This is useful when a CBR value is given by Geotechnical engineer and the equivalent ks is required to be entered in the FE analysis
- **Pneumatic Tyre Contact Pressures**
  This calculates the pressure and applied pressure, for entry into FE Analysis, based on
  - Axle Load
  - Tyre Are Criterion, which can be
    - Ratio of W/L
    - Specified W
- **Edge Bars Design**
  PTsog evaluates the minimum
  - Bar spacing
  - Straight Edge Bar Length

  Based on
  - Bar Diameter
  - Minimum Reinforcement Ratio
  - Tendon Spacing
    The tendon spacing using the ***Dispersion angle of prestres*** , as defined in AS3600 (30^o either side of tendon centre-line)

8. PRINT

PTsog allows user to View and Print the:

- PT Slab Design (**Figure 33**)
- Dowel Design (**Figure 34**)
- Punching Shear Check (**Figure 35**)
- Tendon Spacing (**Figure 36**)
- Equivalent RC Design (**Figure 37**)

This is done by pressing the **View / Print** Command Button at each of the above individual windows. This brings up the associated page to be printed

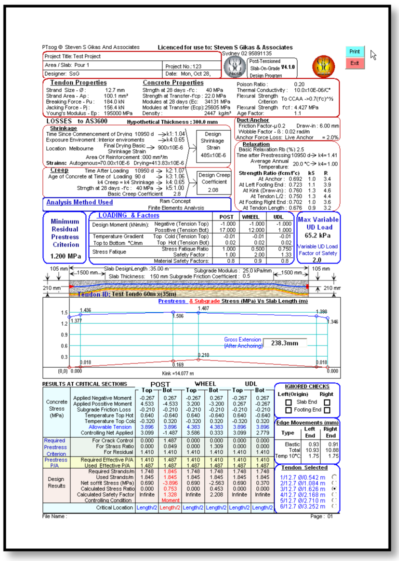


Figure 33: PT Slab Design

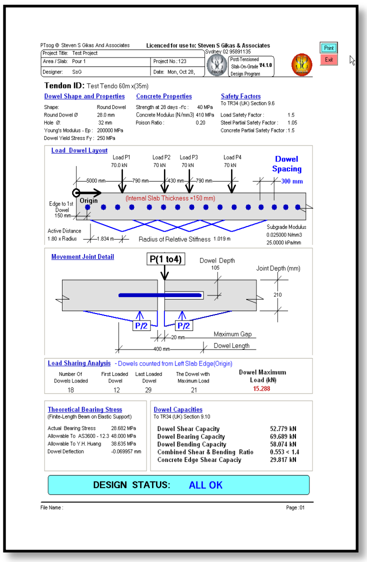


Figure 34: Dowel Design

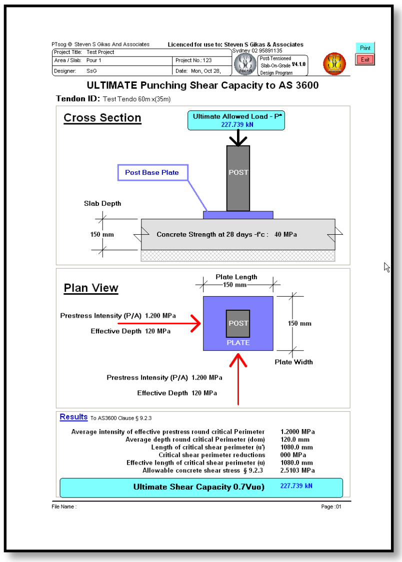


Figure 35: Punching Shear

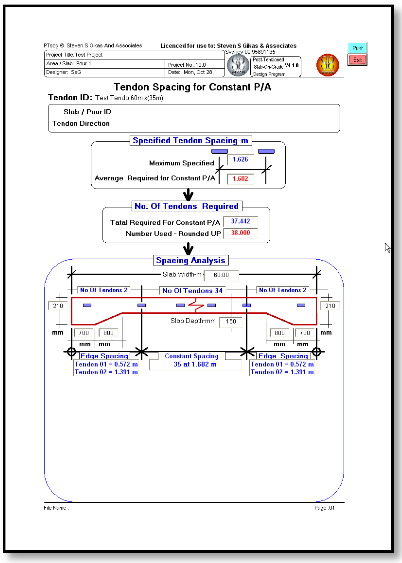


Figure 36: Tendon Spacing

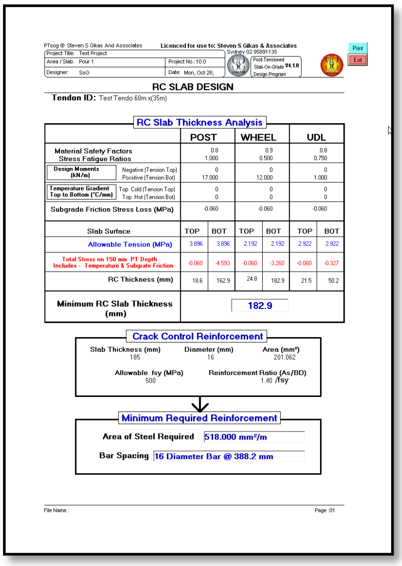
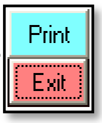


Figure 37: RC Slab Design

PTsog produces an output of the displayed pages (based on the defined printer).

This is done by pressing the 

Print button at each page