

ACES V7.0

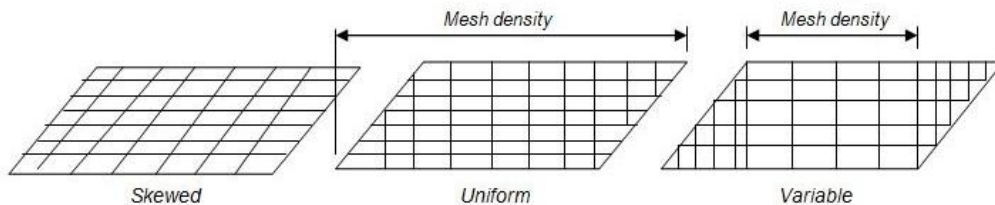
MAJOR NEW FEATURES

1. GENERAL SYSTEM CHANGES

- **WINDOWS 7:** The program has been compiled to run under the WINDOWS 7 Professional (64 Bit) operating system. However, the same version will also run under Win7 (32 Bit), VISATA and XP. It is significantly faster on all platforms. Changes were also made to the licence file (**Aces.vsn**) to provide clearer licensing information. (Implemented in V 7.1).
- **WINDOWS 8:** WIN8 may object to writing data to files with the extension **".scr"** (assuming them to be screensavers) and also to files without extensions (in particular the 'PARAMS' file). All scratch files names were therefore changed from ***.scr** to ***.txt** and 'PARAMS' to 'PARAMS.TXT' in Version 7.200.

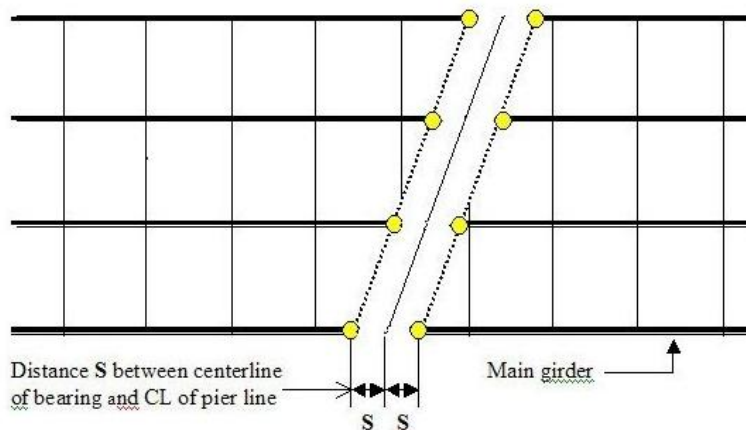
2. GRILLAGE TEMPLATES - Skewed Grillages Type 2, 3

- **'Variable' Mesh Type:** This additional grillage layout type was added to the existing two types (*Skewed* and *Uniform*). When the mesh is created the transverse member densities in the skew regions are different to those in the main body of the span (defined as that area lying between the internal span apexes). The mesh densities in the skew regions of each span are based on the number of longitudinal girders in the model. The density in the body of the span is specified by the *Mesh Density* parameter.



Variable Mesh Type: For each span in the structure the program calculates the length between the internal apex points then divides this distance into a uniform grillage mesh, where the mesh spacing is given by: $Length / Mesh\ density$

- **'Offset for Internal Supports':** This option enable supports to be generated at a defined offset '**S**' from the internal span end nodes. If a value is entered into this field ACES will create a series of new spans offset from the internal lines of support by that amount. The "old" supports and former connecting members between them are deleted.



3. Curved Decks and Lanes

- ❑ **Wizard for Defining Circular Paths & Lanes:** A wizard has been provided to assist in creating lanes and vehicle travel paths that lie on curved decks. Both can be lengthened by a specified amount to ensure the rear axle of the vehicle moves completely off the structure. The wizard uses the curve radius entered in the model template and requires an offset of the bottom edge of the lane/travel path from the bottom edge of the deck.
- ❑ **Templates with a Radius Parameter:** The span lengths are now measured along the deck centreline and all templates with this parameter now clearly indicate this. The convention for locating the radius has been standardized so that its location is the same whether the deck is turning right or left.

If the deck width is specified as an overall width (for the two slab types and the two box girder types) then changing the cantilever widths will not change the radius location. If the deck width is calculated from the girder spacing and cantilever widths, (for the grillage type and the two slab/grillage types), then the cantilevers are relevant. Thus changing the specified cantilever widths does change the radius location (relative to the girders).

4. Modelling

- ❑ **Conversion of Members to FE Shell Elements:** A feature under "*Structure/Other options*" has now been provided to "*Convert members to a 3D mesh*". This option can only be used in 3D models and in structures where the members are "I" sections. An example would be a case where a slab+grillage model template is used to generate a 2D deck mesh in which the main girders are steel "I" girders supporting a reinforced concrete deck.

In this case the top and bottom flanges and the web plates of the girder are replaced with FE thin shell elements located along the centrelines of the webs and flanges. Supports at the ends of a member are moved to the bottom flange and the converted members are deleted. Three new element property types are created, one each for the web and top and bottom flanges. Connection to the deck is modelled using elements the same as for the web – 'rigid links' are not used. If the model is initially generated as a 2D mesh it will be automatically converted to 3D.

5. STAGE CONSTRUCTION

Options were provided that enable stage construction analysis to be more easily performed. They included changes to the following menus and dialog boxes:

- ❑ **"Analyse / Analysis Type" dialog box:** Radio buttons were added to the bottom of this dialog box to allow the exclusion of de-activated members/elements from the analysis. The exclusion is performed by multiplying the **E** value of de-activated members by a suitably small factor nominated by the user (the default value is .001) and by setting the corresponding density to zero. Member and element loads on de-activated members are also excluded from the analysis.
- ❑ **"Analyse" - Main menu option:** Two items were added to this menu - "*Include all members/elements in the analysis*" and "*Exclude de-activated members/elements from the analysis*". Note that the modification of **E** and density is only performed just prior to the analysis and is temporary – the original (actual) properties assigned to suppressed members/elements are always retained and will be used in the analysis once the members/elements have been re-activated.
- ❑ **"Activate / De-Activate" menu options:** A new top menu option was created to allow nodes, members and elements to be selectively de-activated. The suppression (de-activation) features were removed from the "*Activate*" menu option.

- ❑ **Analysis Message:** If the analysis option is clicked and members/elements have been deactivated (suppressed) ACES will display a warning message to this effect. Member and element loads on de-activated members are not included in the analysis.
- ❑ **Loading model files with de-activated members/elements:** When loading model files with de-activated members/elements the program will display a warning message that parts of the model have been de-activated.

6. LOADINGS & ENVELOPES

- ❑ **Floating Load Case List:**

A floating load case list has been implemented when both defining load cases as well as interrogating and displaying the results for load cases. They are slightly different because the first deals only with the basic loadings while the second must deal with the expanded list if the load case represents moving vehicle loads. The two lists cannot co-exist and they are self-cancelled when appropriate or can be cancelled manually using the 'X' in the header.

Note that the envelope floating list only requires up to 20 entries, but the load case floating lists need to be able to handle up to 99 basic entries and 1000's in the case of results.

If the number to display is greater than a preset limit (20 basic load cases and 40 results load cases) "*Browse up*" and "*Browse down*" buttons are provided on the dialog boxes to scroll through the list. For the basic load cases, the browse buttons shift the list by one entry, whereas for the results cases, the browse buttons move the list by 26 entries (ie 2/3) because the list is generally much longer. The load currently selected from the floating list is always underlined in the list, even if the browse buttons cause the currently selected load to move on/off the list. Note that the underlining only occurs if the load is selected from the floating list – the underlining will disappear if the user selects a load using the "*Lcase*" option on the left menu.

- ❑ **Inserting Load Cases:** The load case creation dialog box has been redesigned to allow a new load case to be either added to the end of an existing list or inserted into a spot within the list.
- ❑ **Auto-Generating MS1600 Vehicle Load Cases:** The wizard for auto-generating code vehicle loads has been expanded. In a multi-lane deck model the program now gives the user an option to automatically create a series of MS1600 code vehicle load cases in which each load case consists of one vehicle moving in one individual lane. Both DLA and lane reduction factors can be specified to the vehicles if required.
- ❑ **Automatically Creating Moving Vehicle Envelopes:** An option has been provided to automatically create envelopes from all defined vehicle load cases and insert them into the envelope list. The load case description is used as the envelope name and the envelope factor on the vehicle(s) is set to 1.
- ❑ **MS1600 Lane Load Wizard:** This has been expanded with an option to create a series of MS1600 lane load cases in which each load case consists of a single patch load equal in length to one third of the span applied to each lane in each span. Application of lane load reduction factors has also been made optional.
- ❑ **Auto-enveloping of Vehicle Loads Created Manually:** If a moving vehicle load case is created manually (rather than by going through the code load options) a message box will be displayed asking the user if they would like an envelope of this load case to be automatically generated during the analysis (as currently happens for the code load option).
- ❑ **Variable Axle Width :**

The a new frame has been added to the vehicle path form called "*Variable axle width data*". It contains the following parameters:

- *Axle number to be varied*
- *Number of increments*
- *Increment amount (m)*

When populated with values ACES will create a load case in which all vehicles in the load case make multiple passes over the designated path. In each pass the spacing between the designated axle and the next in line is incremented by the specified amount. This action is performed for the specified number of increments. Note that all three fields must be populated with values in order for this routine to be activated. The frame is displayed only for the path of the **first** vehicle in the group - it is omitted from the path dialogs of the second and subsequent vehicles.

This feature can be used where there are multiple vehicles in a single load case. However, the axle number to be varied is the same for all vehicles in the load case. If the specified variable axle on a particular vehicle does not exist, the axle configuration for that vehicle will remain the same throughout all iterations.

- ❑ **Floating Envelope List:** A new "ENV" option and icon have been provided that allows all currently defined envelopes to be listed in a "floating" window when interrogating results. The diagram for any envelope can then be quickly displayed just by clicking on its entry in the list. The envelope list can also be activated via a tick-box on the envelope selection dialog box.
- ❑ **Enveloping & Summing Cumulative Envelopes:** Cumulative envelopes can now be summed and enveloped with each other or with non-cumulative envelopes.
- ❑ **Retaining Summed & Enveloped Envelopes:** Envelopes that have been summed or enveloped are retained in the envelope list. They are now identified with the prefixes: *[C] Cumulative envelope; [E] Envelope of envelopes; [S] Sum of envelopes*
- ❑ **Factors in "Envelope of Envelopes" and "Sum of Envelopes":** These dialog boxes have been enhanced to allow multiplication factors to be specified for the envelopes selected for summing or enveloping.
- ❑ **Hydrostatic member loads:**

An option has been provided in the member load pull-down menu to apply hydrostatic member loads (useful if applying loads to members that represent walls retaining water and/or soil). The option is accessed by clicking "*Loads/Apply Static Loads/Add hydrostatic loads (Rect. block of members)*" then dragging a rectangular fence line around the members to which the loads are to be applied and specifying:

 - *the grade line (kN/m);*
 - *distance of the free surface from the origin;*
 - *direction of load (X,Y,Z); and*
 - *the notional 'depth' axis (X,Y,Z). This is used in conjunction with the grade line to calculate the load value.*

The loads are added as member trapezoidal loads relative to the local axes. Note the free surface point is specified as a distance to the origin rather than to an existing node.

7. OTHER CHANGES

- ❑ **Right-Click on a member - Member Release:** Options have been provided in the pop-up right-click menu to add or delete moment releases at either end of the selected member.
- ❑ **Adding Nodes:** If a new node is created using the "Add node" option and it falls on an existing member an option is now given for that member to be divided at that point. If the member is not divided the node will be left in an unconnected state.
- ❑ **Member Force Options** dialog box: A feature has been included on this dialog box that allows both the vehicle and vector diagrams to be displayed concurrently - but only if an individual loading (using the 'LCase' button) is selected. The option cannot be used for combinations or envelopes. The feature is activated via a tick box called: "*Display both vehicle & vector diagrams*".
- ❑ **Reports / Moments & shears / Sort by loadings:** When selected this option now brings up a dialog box that gives the user three member/node range options to report on:
 - All members in the current range

- At specified nodes
- At specified members

Note that for the second option the results are given at the start or end of all members ending at the designated node(s).

8. MME MODULE

- **Envelope of envelopes function:** Both normal and cumulative (polarised) envelope types can be mixed when creating an envelope of envelopes. Envelopes of envelopes will be saved with the job and can be recalled later. They can also be transferred into the PSC module. (V7.2)
- **Loading existing envelopes from model files:** When adding ACES model files into the MME file list the module now searches each file for any envelopes that may have already been created and optionally loads them into the MME envelope list. A dialog box allows the required envelopes to be selected. Each envelope in the file being added is associated with its corresponding file number.

9. PSC MODULE

- **Enhancements:**
 - Multiple sections (i.e., the entire girder) can now be designed
 - Variable section properties along the girder (i.e., every section can be different)
 - Design forces can be imported from ACES models and other sources (e.g., EXCEL)
 - Ultimate Moment check can optionally be performed using strain-compatibility analysis
 - Comprehensive shear and shear plus torsion checks
 - Serviceability crack check to AS5100 using strain-compatibility analysis
 - Graphical display of a range of results along the girder
 - Ability to save and retrieve strand segment and passive reinforcement profiles
 - Fully annotated reports that include the design methodology
 - Customisable output reports, design methodologies and default parameters settings
 - Display and print to scale the Super-T cross-section