ACES V7.5
MAJOR NEW FEATURES

1. Auto Generation of Austroads Load Envelopes

❑ **Auto-Generation of Austroads Load Cases:** After a load case is created and the "*Code Lds*" button is clicked a dialog box is displayed that will allow you to either auto-generate the full design envelopes for the SM1600 Austroads loadings or to manually create envelopes of individual SM1600 vehicle and lane loadings.

If you select the first option ACES will automatically generate all SM vehicle and lane loads then create the combinations (envelopes) that will allow you to extract the maximum and minimum design values for a selected range of members. Note that if you select this option you will not be able to add any other vehicle load cases to the model. The second option will only allow you to select individual S/M1600 vehicles and/or lane loads and generate design envelopes for them (as per the current version of the program).

❑ **Example of Auto-generated Load Cases:** For a two lane bridge the following is a sample of some of the load cases that will be automatically created:

[1] M1600 moving in lane 1
[2] M1600 moving in lane 2
[3] M1600 Lane Ld: -6kN/m in Divn 1 Lane 1 Span 1
[4] M1600 Lane Ld: -6kN/m in Divn 2 Lane 1 Span 1
[5] M1600 Lane Ld: -6kN/m in Divn 3 Lane 1 Span 1
[6] M1600 Lane Ld: -6kN/m in Divn 1 Lane 1 Span 2
[7] ....etc.....

Lane Load is applied as a series of discreet UDLs based on a division equal to one-third the span length. In generating a Lane Load envelope ACES patterns the appropriate load cases to obtain the maximum and minimum forces.

❑ **Example of Auto-generated Envelopes:** For a two lane bridge the following is a sample of some of the envelopes that will be created:

[1] M16 vehicle moving in lane 1 (inc DLA of 1.4)
[2] M16 vehicle moving in lane 2 (inc DLA of 1.4)
[3] M16 Lane Load in lane 1
[4] M16 Lane Load in lane 2
[5] 1.4M16L1 + 1.12M16L2 + 1.0LL1 + 0.8LL2
[6] 1.12M16L1 + 1.4M16L2 + 0.8LL1 + 1.0LL2
[7] S16 vehicle moving in lane 1
[8] .... etc ....
[..] Envelope of all of the above M1600 envelopes
[..] Envelope of all of the above S1600 envelopes
[..] Envelope of all of the above MS1600 envelopes

2. Enveloping Results & Exporting to EXCEL

❑ **"DesgnVals" button:** This button is in the Left Hand Results menu. It enables maximum and minimum values, or the maximum design values of one force vector with the corresponding values of the others, to be displayed, printed or exported directly into EXCEL.

When clicked a dialog box will open. This will allow you to select the type of report required (maximum/ minimum or maximum plus corresponding values) and whether you wish to: view and print the report only; view, print and export the report to EXCEL, or export the report directly to EXCEL.

The report will be generated for the currently selected member range and envelope. An example report is shown below:

	A	B	C	D	E	F	G	H	I	J	K
1	ACES7.500 _____										
2	19-Jun-17										
3	--										
4											
5	A suitable project title										
6	A suitable job description										
7	Your name or initials										
8	Units : kN	m									
9	--										
10	Envelope of all of the above SM1600 envelopes										
11	Max & min My and corresponding vectors at start and end of member										
12	Memb	Start	Env	Vcor	Tcor	Momnt	End	Env	Vcor	Tcor	Momnt
13	No.	Node	No.	kN	kNm	kNm	Node	No.	kN	kNm	kNm
14	19	2	23	23.9	-4.8	1.9	20	17	2.4	0.9	2.1
15	19	2	23	94.5	14.3	-18.4	20	17	-130.8	-10.4	-135.5
16	20	20	17	106.7	29.9	118.3	21	23	3.2	2.1	5.6
17	20	20	23	-3.2	-2.1	-1.9	21	17	-127	-29.8	-264.6
18	21	21	17	105.9	46.9	257	22	23	3.5	3.3	9.4
19	21	21	23	-3.5	-3.3	-5.4	22	17	-105.9	-46.9	-379.2
20	22	22	17	71.1	60.8	377.9	23	23	3.9	4.5	13.9
21	22	22	23	-3.9	-4.5	-9.4	23	17	-110.2	-62.7	-498.7

❑ **Auto-loading reports into EXCEL:**

To read reports directly into EXCEL an additional path specification needs to be inserted into the *Aces.sys* file (to identify the location of EXCEL). If the path is already specified but EXCEL does not open check that the path spec is correct. The *Aces.sys* file is located in the same folder as the main program executable (*Aces.exe* or *Aces6.exe*). Below is an example of an *Aces.sys* file with the path specification highlighted:

> *ACES SYSTEM CONFIGURATION FILES*
> ---
> *This configuration table enables logical drives and DOS paths to be*
> *allocated to all files used by the ACES system. Modify only the*
> *values appearing to the RIGHT of the COMMA (no blanks are allowed)*
> ---
> *Path for SYSTEM & PROGRAM files, .*
> *Path for VEHICLE files, .\vehicles*
> *Path for TEMPORARY files, .\tempdata*
> *Path for RESULTS & OUTPUT files, .\outpdata*
> *Path for USER MODEL files, .\userdata*
> *Path and name of HTML browser, C:\Program Files\Internet Explorer\iexplore.exe*
> *Path and name of CBM module, .\aces-beam.exe*
> *Path for licence file ACES.VSN, .*
> *Path and name of EXCEL file, C:\Program Files (x86)\Microsoft Office\Office12\EXCEL.EXE*

3. Other Enhancements

❑ **Auto-Generating Lane Geometry:** An option has been provided to automatically generate the lane geometry via an "*Auto-set all lanes*" option in the lane creation dialog box. By entering the appropriate parameters (number of lanes, lane width, lane separation distance etc) the system will generate the final geometry of all lanes.

Each lane will begin at the correct location on the far left abutment and end on the far right abutment (if the extension is zero), including appropriate allowance for skew. Otherwise the lane will end beyond that point by the extension amount. Note that all start and end X and Y coordinates can still be manually adjusted by selecting the individual lane buttons.

❑ **Hide/Show Values button in LH Results menu:**

This button enables values to be either displayed or hidden from diagrams. It acts as a one-click toggle. In the "*Hide Vals*" mode all results except the maximum positive and negative values are hidden.

❑ **Member Releases:**

Member releases can now be added and deleted to all members of a particular property type or to selected lines of members. It is available through the top structure menu ("*Structure/End Releases/Apply release to all members of the same type*") or the left hand "*Releases*" option. If a member already has releases they will first be removed before the new release set is applied. Note that the operation only applies to active members in the model. Members can be excluded by de-activating them before using this option.

❑ **Display of Member Numbers:**

The user can select to display member numbers for either the currently selected range of members or for all members in the model.

❑ **Additional Design Properties Dialog Box:**

Access to this dialog box is now possible for all section types. Fields will be left blank or zero if data is not available. (Note that all parameters will be automatically transferred into the PSC design module. If any value is zero the user will have to enter it within the PSC module). A sketch of the section will be displayed if it has been selected from the SECPROPS.TXT database file.

❑ **Pasting Nodes, Members & Elements using NOTEPAD:**

This feature has been implemented to make it easier to more quickly paste and/or merge large numbers of nodes, members and elements into the model (the previous system had size limitations).

❑ **Reading .INP files (V7.510)**:

An option has been provided to create a model by reading one or two "INP" files created using older versions of ACES. If two .INP files are specified ACES will merge them into a single ".ACE" model file.

❑ **Relocation of RH Menu:**

All options in the right-hand menu have been moved to the top icon line. A description of what the icon buttons do is shown in a yellow "balloon" when the cursor hovers over each icon.

❑ **Display of Results in the Base-line Option:**

An option has been implemented that enables the user to left-click on any line of members in the baseline display mode and get an immediate display of the current results diagram (without having to go through the range-selection process). The previous diagram is first cleared before the new diagram is displayed.

❑ **Enhanced Material Properties Dialog Box:**

The previous non-editable dialog box for selecting standard '*E*' values has been replaced with a fully editable table. Both default and current material properties can be set by the user including the material type (*concrete, steel, timber* etc), *E, Density, Poissons Ratio, Temp Coefficient* and a description of the property type.

These values can all be saved to a defaults file and reloaded for future jobs. Note that the fields for '*Category*', '*Type*' and '*Description*' are stored with 10, 10 and 45 characters respectively (including blank characters).

If the material properties dialog box is to be accessed in the PSC Module all of the "*Type*" descriptors within a "*Concrete*" category in the table must be of the form "*fc = xx*".

The PSC module will interpret the grade as "***xx***". Therefore if new concrete types are added a value for the grade must follow an "=" sign. The actual text used before the "=" sign does not matter. For example the type string could be "*Gr = 55*" – the PSC module will assume a grade value of 55.

If there is no "=" in the type descriptor, or the text following the "=" is not a valid number, a value of zero for the concrete grade will be returned to the PSC module and the values for ***f'cg*** or ***f'cs*** will not be updated on the properties tabs.

❑ **Batch Analysis of '.INP' and '.ACE' files:**

When run in batch mode ACES will now perform the analysis of model data stored in either "*.INP*" or "*.ACE*" format. The program will auto-detect the format by searching for the extension "*.INP*" in the batch file specification.

EXAMPLE: The following two specifications will produce the same results providing the .INP and .ACE files contain the same model data:

Aces7535.EXE 'F:\\mrwa\\bridge-12.inp' -s
Aces7535.EXE 'F:\\mrwa\\bridge-12.ace' -s

Note that whenever ACES analyses a model created within the graphical interface it first creates a file called ACES.INP and saves it to the ..*OUTPDATA* folder. This file contains all of the information necessary for an analytical solution. Although ACES also creates a detailed ".ACE" model file the format of this file is more complex than that of the ".INP" file and is therefore harder to create manually.

❑ **Converting model dimensions to new units:**

A feature has been added to enable model dimensions to be converted from one set of units to another (e.g. feet to metres). It can be accessed via "*Structure/Other options*" or "*Edit/Convert geometry units*" in the Main (top) menu.

❑ **Moving blocks of members & nodes:**

The "*Structure / Members*" drop-down menu has been changed to allow rectangular and fenced members and their nodes to be moved by relative amounts. This feature is also available via the "*Edit*" option on the main (top) menu line.

4. Model Geometry - Exporting to EXCEL & Converting Dimensions

❑ Options have been included on the *File* and *Structures* pop-down menus and on the "*View Table"* form to export the model geometry to EXCEL. All member numbers, node co-ordinates, member types and support types are included in the download.

❑ An option has been provided to convert model dimensions to new units. It allows the dimensions of a structural model created in one set of units (e.g., feet) to be converted into another (e.g. metres). This can be accessed via "*View*" and "*Structure/Other options*".

5. Auto Analysis of Multiple Load Cases

❑ This feature is only available for either continuous line beam or grillage models.

❑ In the case of **line beams** up to 900 vehicle load cases are allowed. Vehicle and axle load data must be saved to a CSV in a specific format. The feature analyses each load case in turn, extracts the maximum +ve and -ve moments and shears and writes the results to both a text file and a CSV file that is automatically exported to EXCEL.

❑ For **grillage** models an unlimited number of patch, member and moving vehicle load cases are allowed. Vehicle, member and patch load data are read from a text-based load case file that must be organised in accordance with a specific format (described in the ACES Help system). During the analysis the system will generate a CSV results file for every load case and, in the case of moving vehicle loads, for every position of the vehicle, or vehicles, in the load case. Envelopes are automatically generated for moving vehicle load cases.

Results include maximum & minimum moments, shears, torsions and reactions for every member (or specified range of members) and include the vehicle position at which the maxima occurs and values of the other results vectors corresponding to the maximas.

Two example load case files called "*MLAF-Load-Case-File-Example.doc*" and "*MLAF-Load-Case-File-Example.txt*" can be downloaded, viewed and edited and can be used as a template when creating a job file. Both example files are identical but saved in two different formats (WORD and text form).

6. SECPROPS Module

❑ **Super-T sections**   A template has been implemented for Super-T / T-Roff sections. All dimensions can be edited, enabling properties for this type of section to be quickly determined. Most design properties required by the PSC module are also calculated.

7. ILB Module

❑ **Line Colours dialog:** The current colours for each structural element and result value have been rationalised and now displayed as a colour block on the dialog box. These colours can be saved for future use by clicking the "*Save Settings*" button at the bottom of colours dialog box.

❑ **Model Size:** The maximum number of nodes in the structural model has now been increased from 999 to 2000.

❑ **Saving Output Results:** When using the "*Save Model*" option ILB will save data to 4 files with the extensions *.ILB, .ACE. OUT* and *.ILO* with the selected file name as the root. (The file with the extension *.ILO* is a copy of *ACLAUNCH.OUT* which contains a summary of both the structural input data as well as the results values.

❑ **Spring Constants:** Spring constants have now been implemented for the main supports as well as the stressing bed and intermediate supports. This can be done via the "*Loadings and supports*" button on the "*Model Data*" frame. (The default for new jobs is 0.0)

❑ **Concurrent Reactions:** The tabulated results displayed after clicking "*View Tabulated Results*" (as well as in file *ACLAUNCH.OUT*) now includes a list of the concurrent support reactions for each launch position. Only non-zero reactions are displayed.

8. PSC Module (V3.210)

❑ Upgraded to Section 8 of the AS5100 (2017) concrete design code.

❑ Inclusion of additional sectional dimensions for designing more complex Super-T sections (such as T-Roff's).

❑ Inclusion of an option to read design moments directly from a currently active ACES model.

❑ Inclusion of an expanded range of design forces in the SLS and ULS checks (secondary prestress, differential shrinkage, residual creep, differential settlement, hot plus cold top differential temperatures and user transient effects).

❑ Provision for manual entry of PS losses (final total loss or intermediate losses).

❑ Primary differential shrinkage stresses can either be entered manually or calculated by the PSC module using the AS5100 (2017) methodology (V3.210).

❑ Allowance for hot and cold top temperature stresses for SLS checks.

❑ Provision for checking up to six SLS load combinations of the full range of design forces.

❑ Provision for checking up to six ULS moment load combinations of the full range of design forces.

❑ Inclusion of both a tabular and graphical summary report for all design checks - this allows the overall design to be quickly reviewed.