

CULVERT - A Quick Tutorial

After starting the program select the first option on the main program menu by clicking the button to the left of the description line (*Start a new job*).

Select the project type and click OK. A job identification panel will be displayed. Fill in the required fields (*Project Title* is mandatory) then click *OK*.

A default structure layout (usually a crown unit) will be loaded and displayed together with the following model data: Job identification information; design data; geometry and fill data; loading data. If a summary layout is preferred select: *Settings / Session options / Short input list*.

Options in the main (top) menu have been arranged in the approximate order in which model data is expected to be entered and results interrogated. Click in turn on each of the following menu options and enter data as appropriate.

File:

This option allows job data to be saved, retrieved and printed. A summary report is particularly useful, since it displays all key model and design data.

Jobident:

This option allows job identification information to be entered and edited.

Model:

This option allows you to select the design standard (i.e., the relevant design code), the type of design (single, external, internal unit or all three), the type of live load wheel distribution (overlapping cones or Boussinesque) and the type of unit (crown, crown and base, inverted U, box, pinned). If sway is to be allowed check the tick box and enter the % sway to be applied. (A lateral support will be inserted into the structural model in the plane of the top slab if there is no sway).

The major difference between the two design codes relates to their treatment of horizontal earth pressure. If the *AUSTROADS 1992* option has been selected as the design code then hydrostatic horizontal earth pressures are used. If *AS1597.2* is selected the horizontal earth pressures must be explicitly defined. If a single unit is designed earth pressure is applied to both sides, for an external unit earth pressure is applied to one side only and for an internal unit earth pressure is ignored.

Dimensions:

This option allows the geometry of the unit to be defined (width, height etc). Both fillets and leg haunches are catered for. If you have the demo version of the program the dialog box corresponding to this option cannot be accessed.

Section:

Results of the analysis are given at defined points, or nodes, around the structure. This option allows the number of nodes along the legs, base and top slab to be defined. One can also specify the sections at which a detailed design, or a critical shear check, are to be performed.

Material:

This option allows concrete and steel reinforcement properties to be specified.

Reinforcement:

This option allows the number of bars, bar diameter and bar spacing to be calculated or defined at each design section and for both faces of the culvert unit. An option is also available to automatically adjust the number of bars to meet the minimum necessary design rules.

Fill:

This option allows a range of parameters to be specified for the fill viz: material properties, earth pressure coefficients, construction layer information (if any), multiple fill depth analysis, and ground and installation types. Note that if the design code is AS1597.2 the horizontal earth pressures for each construction layer must be specified. This is done during the « Analysis » stage. If you have the demo version of the program the dialog box corresponding to this option cannot be accessed.

Loadings:

This option (and its associated menu of sub-options) allows general vehicle, surcharge and test loads to be specified and provides access to the vehicle editor. Data required will depend on the type of unit chosen. For example, if the Australian Bridge Code is selected, the general vehicle & surcharge loads dialog boxes will include fields for design lanes, lateral compaction, fill depth, cone spread factor, live load surcharge information and vehicle data.

Impact:

This option allows impact factors (DLA) to be specified for a range of moving vehicle loadings – standard code vehicles, HLPs, user, rail etc. Factors may also need to be provided for distributed lane loads. For moving vehicle loads the calculation of the final impact factor is based on a single common relationship viz : $I = I_{max} - a*(H - b)$ where ***I_{max}*** is the maximum allowable factor, ***H*** is the fill height and ***a***, ***b*** are impact factors corresponding to the relevant design code.

Analysis:

This option allows the selection of an analysis type (serviceability or ultimate) and the subsequent analysis of an individual load case, load combination or group of load combinations. The results can be viewed in either graphical or report form. Graphical displays of bending moments, shear forces, Moment/ Shear ratios and axial forces can be superimposed onto one another and selectively included or excluded from the diagram. Values will only be displayed/tabulated for those sections selected for design. Results can be viewed in either detailed or summary form.

Design:

This option allows the unit to be checked for a range of actions against the provisions of the selected design code - bending moment, shear, cracking, fatigue and reinforcement stresses. Note that the check will only be performed at nominated design sections. A dialog box will pop-up that allows the load cases and corresponding load factors for the required combination to be entered (the limit state, serviceability or ultimate, must be selected from the « Analysis » menu option). Up to 10 different load combination sets can be generated and stored for future reference.

Drafting:

This option is only available for crown units.

Settings:

This option allows various attributes used in the graphical display to be set and saved for future use. Attributes that can be customised include: background colours; line styles (viz line colour and line width up to a maximum of 34 line styles); drawing styles (for drawing model outlines, displaying text and results, shear and moment diagrams etc); and a number of session options (detailed or summarised display of model data).