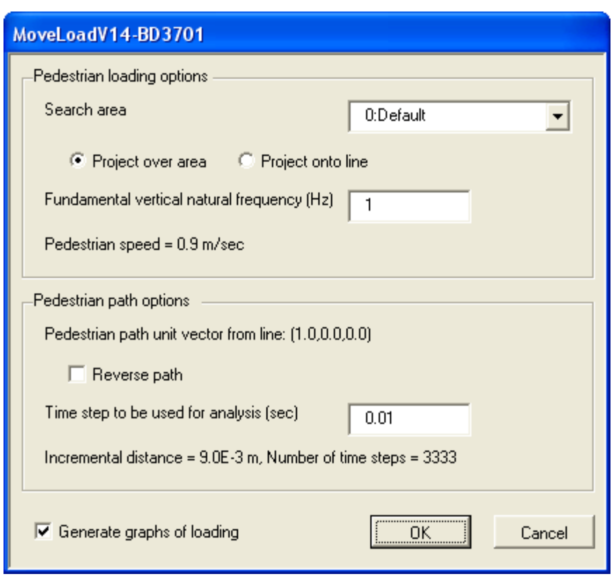
Vertical Pedestrian Loading to BD37/01 for LUSAS V15

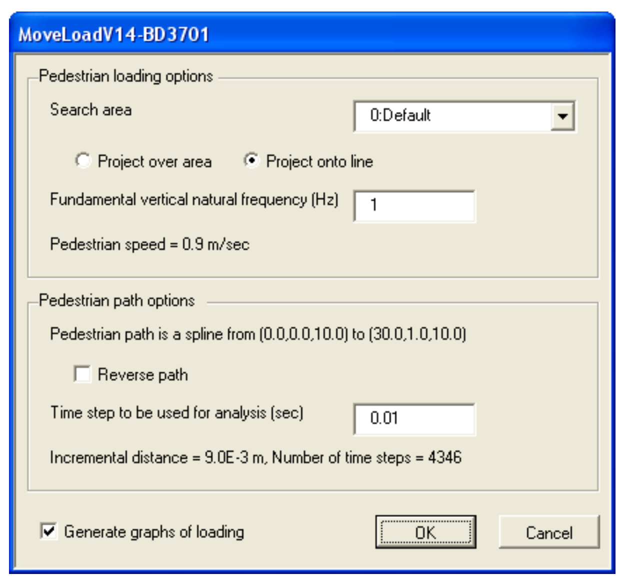
The **MoveLoadV15-BD3701.tfm** scriptable dialog provides the ability to apply vertical oscillating pedestrian loading to a structural model in accordance with BD37/01. The use of scriptable dialogs to create custom applications has been demonstrated at past LUSAS Special Interest Groups with the implementation of the pedestrian loading covered for V13.3 and higher in 2002. Due to popular demand, this pedestrian loading has been provided in the accompanying TFM for LUSAS V15 and the source code can be viewed in any text editor. While the underlying functionality is identical there are a couple of minor changes to the usage of the dialog which will be covered below.

In order to use the dialog, a straight line, arc or spline must first be selected in the model which will represent the path of the pedestrian movement (NOTE: There is no need to select a point for this version as the dialog will automatically find a supported feature for the dummy load applied to ensure all time steps are tabulated in the data file). The scriptable dialog can be run from LUSAS Modeller by clicking on the **Run Script** toolbar button or through the **File>Script>Run Script...** menu item. Select the **MoveLoadV15-BD3701.tfm** scriptable dialog from its current location and click **OK**.

NOTE: The pedestrian loading dialog sets up a dynamic analysis to analyse the behaviour of the current structure to the moving and pulsating pedestrian load. The units of the model must therefore be in SI units (N,m,kg,s,C). The user must also ensure any Rayleigh damping parameters are set in the material properties to correctly represent the damping behaviour of the materials / structure.

The front-end of the BD37/01 pedestrian loading dialog is similar to the previous version and is shown in the following figure for a straight line path (left image) and a spline path (right image).





In the V15 implementation a new analysis (named Moving Load Analysis) will be created to contain the loadcases for the moving load. The existing analyses in the model will be unaffected.

The search areas will be listed in the combobox with the default (all model) set initially. These search areas should be used for targeting the loading, especially if the load is to be projected onto beam elements.

The **Project over area** and **Project onto line** options allow control over the load projection method. If the default **Project over area** is used then the load projection will apply to surfaces in the model. The **Project onto line** option allows the projection of the load onto simplified beam models. As noted above, search areas must be used for these types of models to ensure the pedestrian loading is projected correctly onto the model.

The **Fundamental vertical natural frequency** (in Hz) governs the speed of the pedestrian movement in accordance with BD37/01 where

Pedestrian speed $v_t = 0.9f_o$ (in m/s)

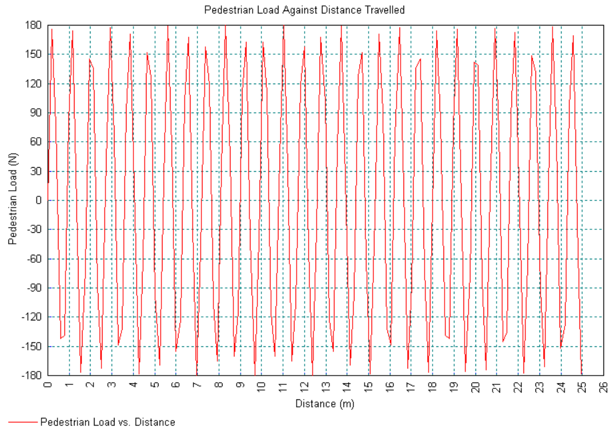
This frequency should be determined from an eigenvalue analysis on the structure.

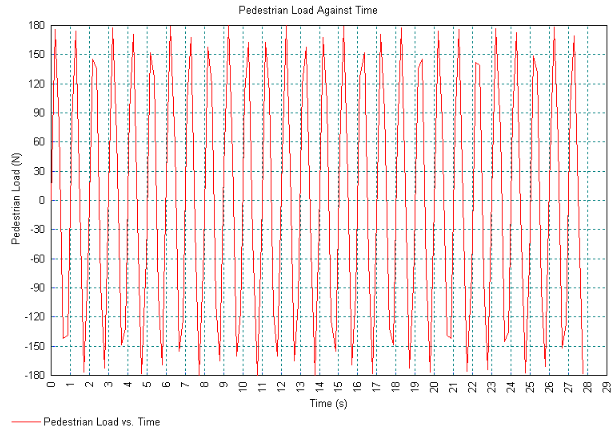
The pedestrian path options control the direction of the pedestrian movement and the time step / incremental distance for each stage of the analysis. By default the pedestrian will move in the direction of the line definition in the model which is indicated by the direction unit vector in the dialog for a straight line or the start and end coordinates for an arc or spline. If the opposite direction is required then the movement can be reversed using the **Reverse path** option in the dialog.

The time step that is to be used for the dynamic analysis should be specified in the dialog. By default this is 0.01 seconds but it is up to the user to ensure that the time step is sufficiently small to capture the dynamic response of the structure.

NOTE: For analyses that have over 1000 time steps the analysis may need to be broken up into a restart analysis with 1000 time steps per data file – refer to the LUSAS Solver Reference Manual on the Restart Facilities. Alternatively, the master index tables can be adjusted for LUSAS Modeller and Solver to allow more time steps to be solved. For more information on either method please contact the LUSAS Customer Support Department.

Selecting the **Generate Graphs** option before clicking the **OK** button will generate two LUSAS graphs showing the loading applied to the model. The first graph will plot the variation of pedestrian load versus distance along the path and the second will plot the variation of pedestrian load versus time. These two graphs can be printed and / or included in any report for the analysis. They are also very useful to ensure that a good representation of the loading has been achieved in the analysis. If the graphs do not look like sine curves and are uneven or very spiky then the time step may be too large for the analysis as indicated in the following figures.





C:\LUSAS142\Projects\BeamModel-ZUp.mdl Units: N,m,kg,s,C