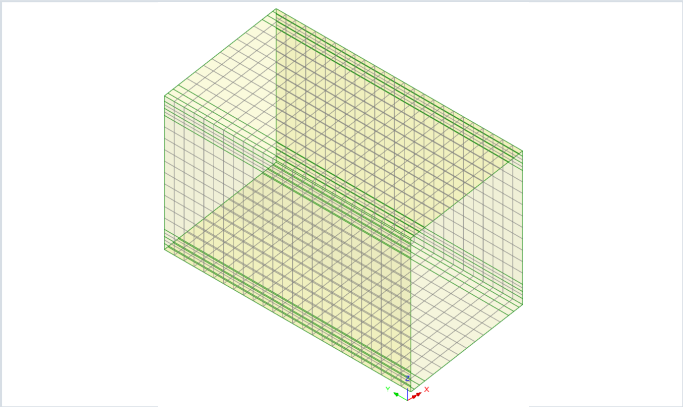
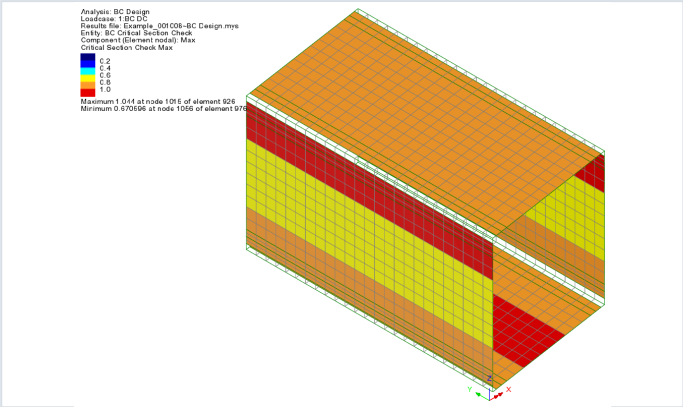
LUSAS EXTENSION MODULE

Box Culvert Wizard

One set of input: from the 3D shell model to design checks, reinforcement refinement and the report



3D shell model created from dialog input



Utilisation contours by design zone. Red is above 1.0

Repetitive box culvert design work in one LUSAS menu

A box culvert has a simple shape, but ground springs, earth pressure combinations, moving loads and reinforcement checks for each member mean a lot of repeated work. Box Culvert Wizard puts this work in menu order. Enter the geometry, ground, materials, loads, vehicles and design conditions in one dialog to create the 3D shell model and the load calculations, then follow the menu through to the reinforcement checks and the Excel report.

Define	Model	Ground	Vehicles	Combinations	Check, refine	Report

Key features

Automatic 3D shell model

Mesh, thickness, materials, ground springs and permanent loads in one step

Compression-only ground

Finds lift-off under permanent loads and linearizes the ground for design

Automatic vehicle loading

AASHTO LRFD, KDS, Eurocode and JTG vehicles, moving load analyses and envelopes

Governing vehicle positions

Keeps only the positions that reach a chosen share, to shorten design checks

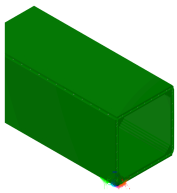
Two levels of design check

Quick check at design sections, and LUSAS RC Slab/Wall at every node

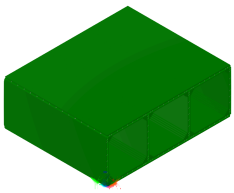
Excel report and calculations

Zone utilisations, contour pictures, quantities and a load workbook with visible formulas

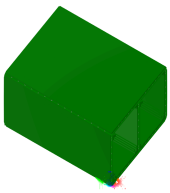
Supported shapes



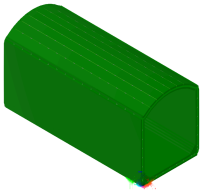
Single cell, haunches



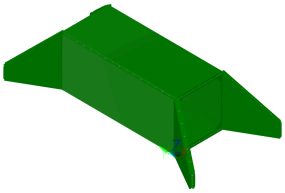
Multi-cell



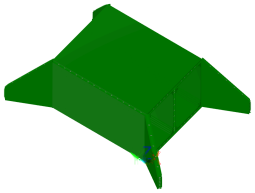
Skew



Arched top slab



Wing walls



Skew multi-cell with wing walls

Reinforcement refinement

From the LUSAS design check of all surfaces, it finds the lightest reinforcement table that meets your utilisation limit.

1. Check all surfaces
RC Slab/Wall checks every node of the design members to the code

›

2. Adjust the bars
Zone utilisations set the diameter and spacing of the continuous bars

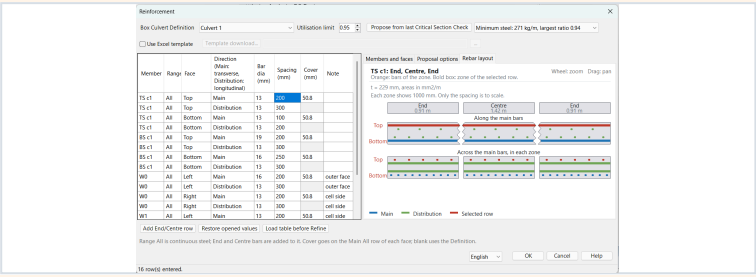
›

3. Recalculate
LUSAS recalculates, up to 8 rounds, with no new analysis

›

Best table
Keeps the table with the least steel among those within the limit

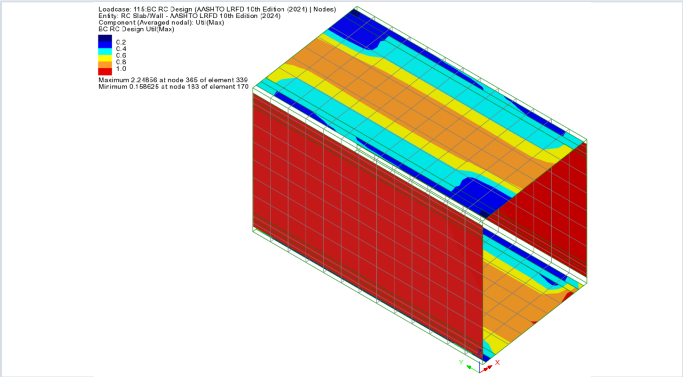
- **Your utilisation limit:** 0.50~1.00
- **Traceable:** steel mass and utilisation logged for each round
- **Reversible:** the previous table is saved and can be restored
- **By member:** only the members in the design case change
- **Minimum bar proposals:** compare three options from the saved section forces to choose the starting bars



Bar options and rebar layout. New bars are checked at once with the saved section forces

One picture for the whole structure

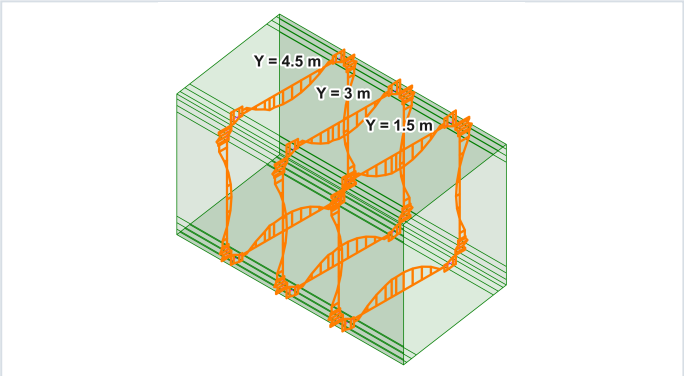
After LUSAS RC Slab/Wall has checked every node, one Util(Max) contour shows the design check result for the whole structure. You can see at once where it falls short.



Largest utilisation at every node. Red is above 1.0: an example before the bars are changed

Sliced force diagrams

Cut the 3D shell at any distance and show the BMD, SFD and AFD of the slabs and walls like a frame. Compare several positions at once and save pictures.



BMD at three distances. LUSAS also shows the values

Compared with usual methods

Usual method	Box Culvert Wizard
2D frames simplify skew, wing walls and transverse behaviour	**3D shell model represents skew and wing walls directly**
Model, springs and loads built by hand in general FE software	**Dialog input creates everything up to the combinations**
User repeatedly judges ground tension removal	**One menu finds lift-off and linearizes the ground**
Moving load results sorted by hand for each section	**Zone forces and governing positions sorted automatically**
Everything sorted again, by trial, each time the bars change	**Quick re-check from saved forces; refinement runs the trials**

Supported design codes

Item	Code
Vehicle loads, load combinations	AASHTO LRFD, KDS, Eurocode (EN 1991-2, EN 1990), JTG D60
All surfaces (RC Slab/Wall)	AASHTO LRFD 10th Edition, EN 1992-1-1, JTG 3362-2018
Design sections (Critical Section Check)	AASHTO LRFD resistance

Conditions LUSAS 24.0. RC Slab/Wall needs the RC Slab Design option. With KDS loads, choose AASHTO or EN as the RC Slab/Wall design code. Shear reinforcement, anchorage and laps are checked separately. Screen languages: Korean, English, Chinese