Advanced mobile loads

esas.03, esas.36

The esas.03 module calculates the interference of several groups of mobile loads on frames.

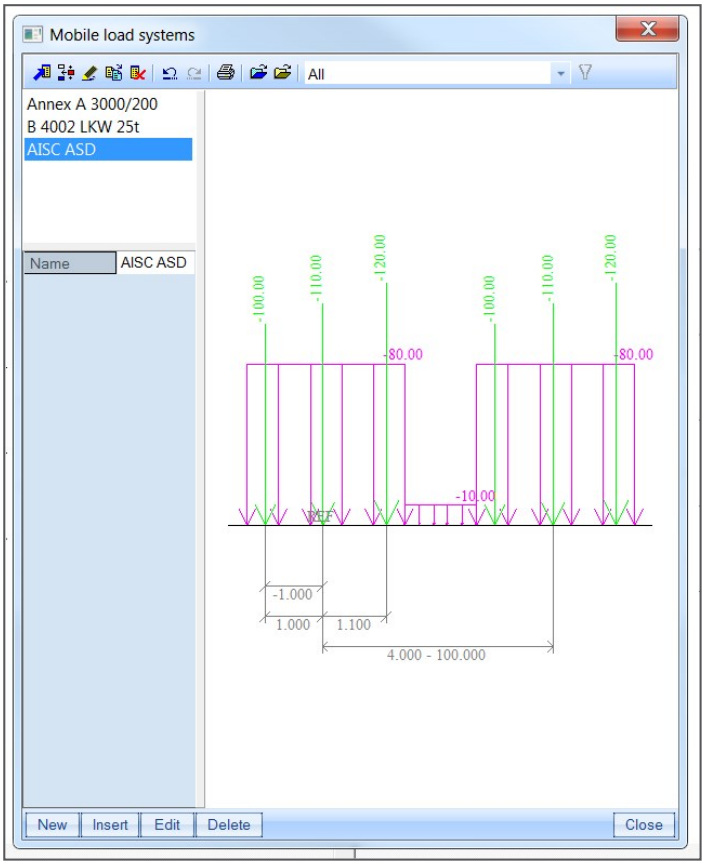
- user-defined single or grouped mobile loads consisting of point or/and distributed loads can be simulated;
- built-in load groups according to different national codes are provided.

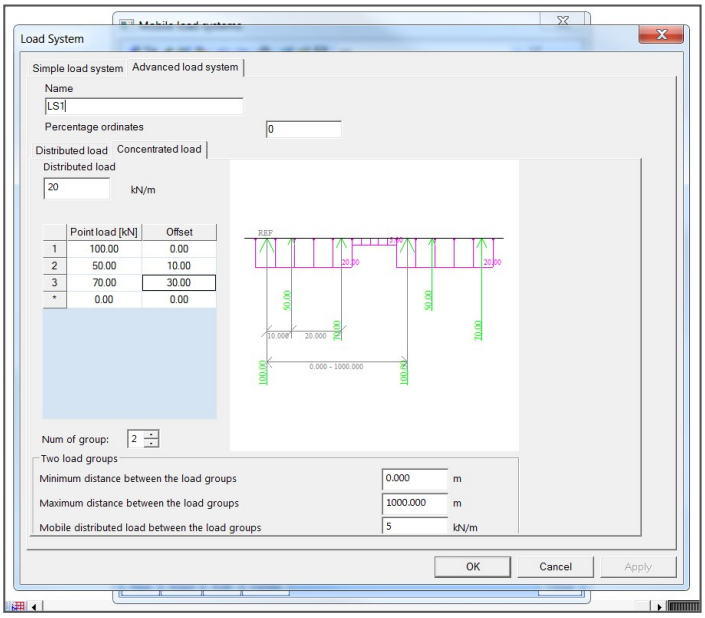
The esas.36 module calculates the interference of several groups of mobile loads on frames and surfaces. It includes the features of module esas.03 which are extended towards surfaces;

Advanced load systems

An advanced load system contains multiple groups of mobile loads. Each group is a combination of line and point loads that move together on a predefined path on the structure:

- In a moving load group, a distributed line load of finite length may be combined with a line load of indefinite length, and a number of concentrated loads at relative locations specified by the user.
- Distributed loads may overlap or not with concentrated loads; if these should not overlap, settings for the interruption in the line load are provided.
- In an advanced load system, a single, or two, or more identical and independent load groups may act together on the traffic lane;
- When two identical load groups form a system, a minimum and maximum distances can be defined between the load groups - i.e. although the load move independently, some restrictions on the placement can be defined by the user.
- When more than two identical load groups form a system, these are placed a fixed distance apart;
- An ambient distributed load of indefinite length or between the groups may be added;
- There is no limit to the number and variety of load systems that can be defined;
- A library of predefined load systems according to various standards is provided.





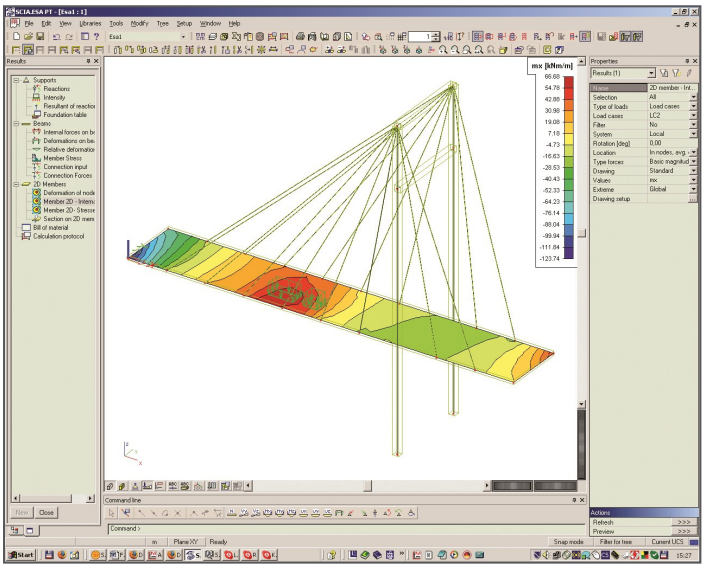
Traffic lanes

- The user manually defines the track along which the mobile loads will move;
- Tracks can be updated and do not need to be redefined after changes in the model geometry - changed node coordinates, cross-sections, etc.;
- Along the selected tracks, the extreme design components (such as maximum and minimum bending moments, reactions and deformations) are determined per load system.

Applications

Advanced load systems are suitable for the modelling of complex loads on structures such as:

- traffic on road- and rail-bridges, viaducts, etc.;
- moving loads on crane tracks;
- crowd movement on pedestrian bridges and floor slabs.



Analysis of advanced load systems (envelope derivation)

SCIA Engineer determines the effect of moving load systems through influence line analysis:

- Influence lines (esas.03) or surfaces (esas.36) for internal forces and deformations are generated per section on the existing traffic lanes;
- An automatic searching routine determines the critical position of the load systems.

Some decisions need to be made in function of the sign of influence line ordinates. A number of user-defined options stir the automated process:

- Reduction coefficients may be applied on concentrated loads that fall in favourable regions of the influence line function;
- Uniformly distributed loads can be set to only act in unfavourable regions of the influence line function;
- The user may specify whether it is allowed to place the load partially outside the structure, if this would result in higher internal forces or deformations;
- Loads can be set to appear only on a restricted interval of the traffic lane.

Based on the influence line analysis, envelopes (minimum and maximum functions) for internal forces, reactions and deformations are generated.

- Envelopes are automatically calculated per mobile load system;
- An additional multiplication factor can be applied according to the VOSB code (NEN code) for internal forces and reactions.

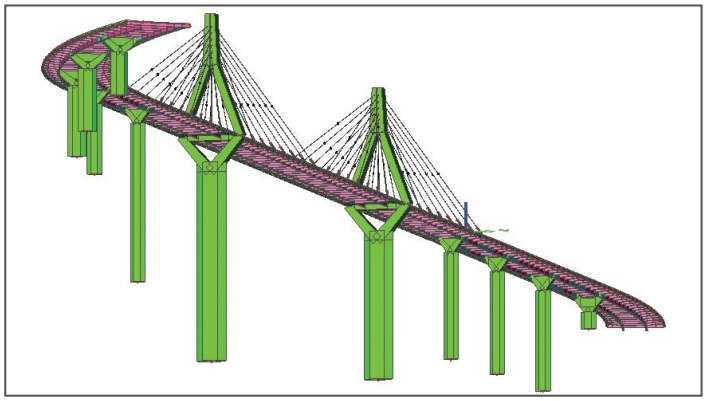
> The standard stipulates that this factor is not to be applied on deformations. Therefore, it is possible to obtain larger deformations form a load case linked to envelope internal forces compared to load cases linked to envelope deformations.

Load case generation

Actual or fictitious load cases may be generated based on envelopes.

- Actual load cases contain the load systems converted to standard loads on the structure, and placed on the critical positions as determined in the influence-line-based analysis;
- A series of fictitious load cases with the maximum and minimum function of the components of internal forces and displacements may be generated; these load cases contain no actual loads - rather just the effect of such loads - moment diagrams, etc.
- These load cases can be combined with other types of loads in standard combinations and thus be used in section and stability checks.

> Fictitious load cases have the limitation of being valid only for the component for which they were derived. Thus, a load case derived for minimum bending moments M_y will contain valid and meaningful results only for M_y diagrams, and not for other internal force or deformation components.



Required modules

For esas.03: esas.02

For esas.36: esas.35