

Calculation of the MÜPRO Support Channel Profiles

The MÜPRO support channel calculation program is used for calculating and dimensioning the MÜPRO support channel profile while taking into account the special cross-section values for the profile.

Great importance has been attached to providing an efficient data input dialog so that even users who are relatively unfamiliar with the system can generate fully described calculation models in a very short time. The dialog "Select static systems" in particular allows you to generate standard systems very quickly. The loads for these systems can be calculated using the "Select pipe" dialog.

Once you have entered the type of calculation model (type of rail, supports, nodal loads, distance loads), the deflection and element forces are calculated automatically by FEM together with the resulting stresses, supporting forces and forces required to extract plugs.

For the analysis of the load rating, the stress analysis – normal stress, shearing stress, bending stress, bending and normal stress – and the deflection analysis are performed at the critical points for the selected load direction.

This program is not intended for more complex investigations, e.g. buckling or dynamic loads. Special calculation programs are available from other software manufacturers for these tasks if required.

The user has a choice of allowing the program to select the suitable profile for a given system and its loads automatically, or to calculate the permitted load for the existing system.

General notes on the calculation of static systems using FEM

The abbreviation FEM stands for

F	i nite
E	e lement
M	e thod

This is a calculation technique used for solving engineering problems in the area of technical mechanics.

In order to dimension a load-bearing structure, it is essential to gain the most detailed possible overview of the loads and deformation behaviours of the construction as well as to be able to make realistic statements about the stresses.

FEM divides a structure into discrete units. It starts from the modular concept of a continuum (the complete construction) and separates this into a finite number of areas (the finite elements). For these, the program can calculate the displacements and stresses.

In order to do this, it is necessary to idealise the actual existing construction into a structure, which is suitable for the calculation process being used.


The construction, its mountings and the forces acting on these must be depicted using the means provided by the calculation program. The calculation model generated is always an approximation and its quality can be influenced directly by the effectiveness of the idealisation.

Selecting the correct supports when using the MÜPRO support channel system

The type of mounting selected ensures that the support channel system is connected to the structure. The supporting forces, which depend on the selected support conditions, are transmitted through the mounting into the structure.

For the calculation model it is essential that the complete system cannot be shifted horizontally, vertically or torsionally.

The following types of support are the most commonly used in the calculation of MÜPRO support channel systems:

<i>Symbol</i>	<i>Type of Support</i>	<i>Acceptance of</i>
	Restraint	normal force, lateral force, torque
	Fixed bearing	normal force, lateral force
	Expansion bearing	lateral force

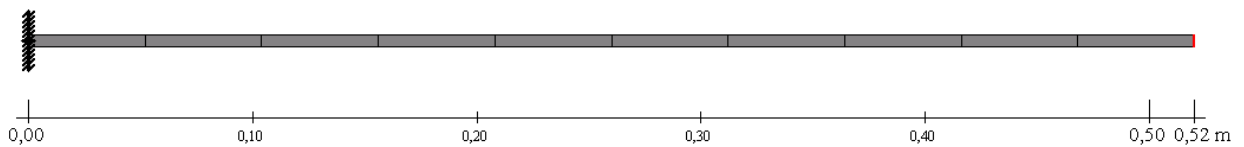
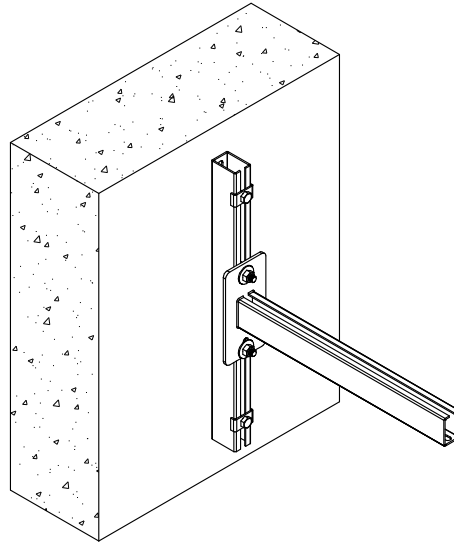
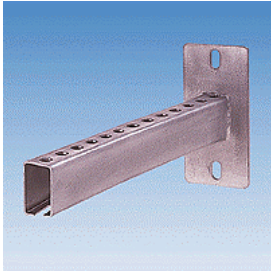
When using wall mountings with a mounting plate, please remember when you dimension the plugs that the permitted dowel forces may diminish in relation to the distances between the plugs. A preferable method is to attach the mounting plate to a support channel profile, which itself is fixed to the wall using plugs.

Deformations to the fasteners are not taken into account in the calculation of the support channel system. Connecting parts are not calculated or dimensioned here. The results of the support channel calculation (supporting forces, dowel forces) can be used as a basis for designing the fasteners.

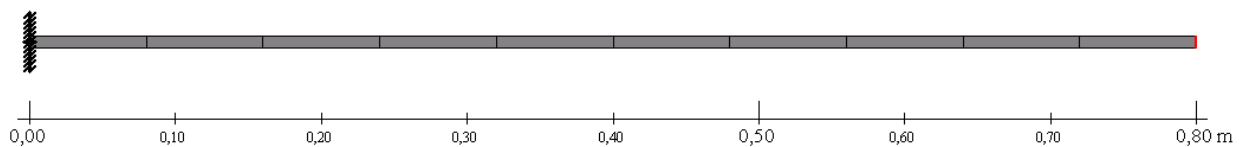
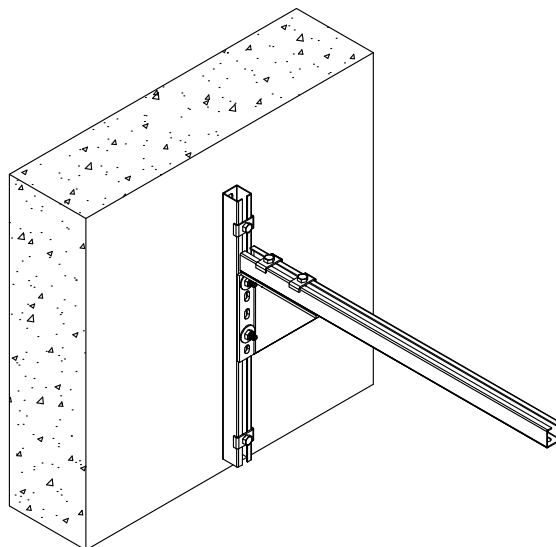
The following sections provide examples of fastenings and the appropriate calculation models.

Other combinations of assembly components can usually be followed back to this basic model.

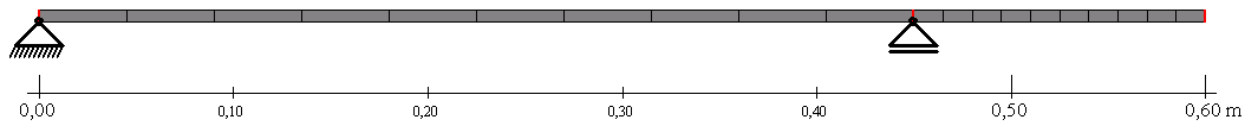
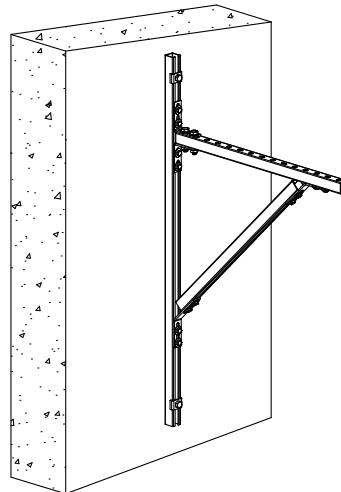
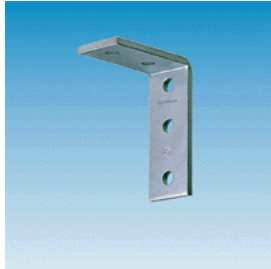
Wall profile 40/60 with support channel bracket 40/60



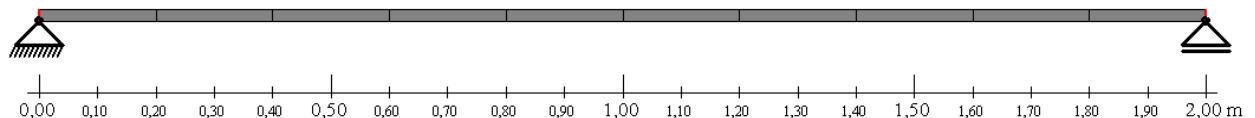
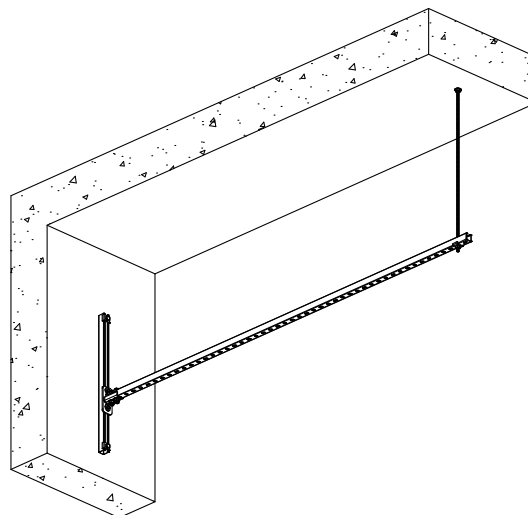
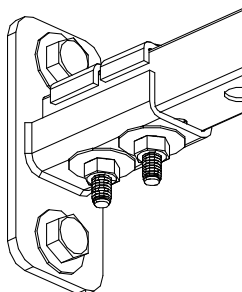
Wall profile 38/40 with bracket angle 200x200 and profile 38/40



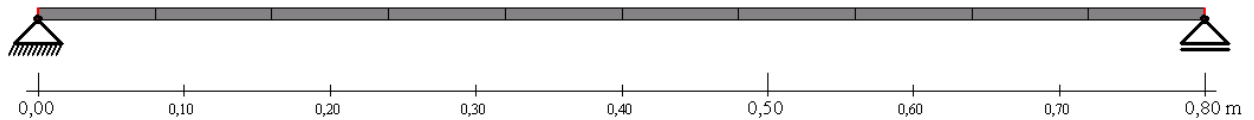
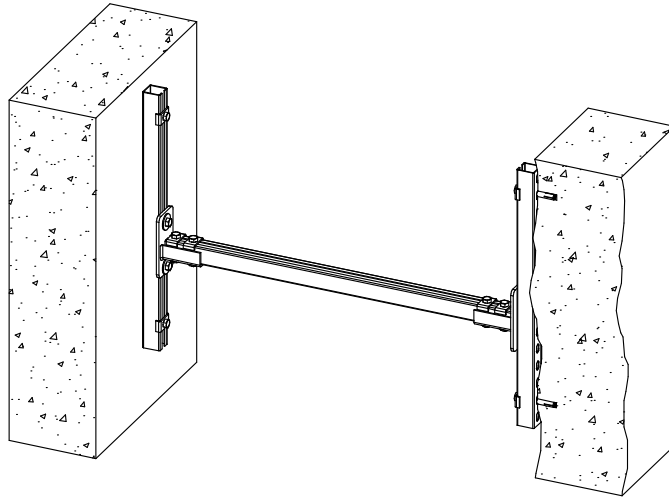
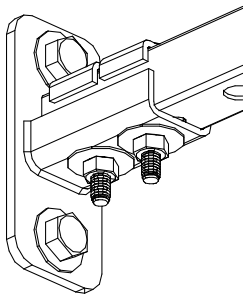
Wall profile 28/30 with mounting angle 45° and 90° and profile 28/30



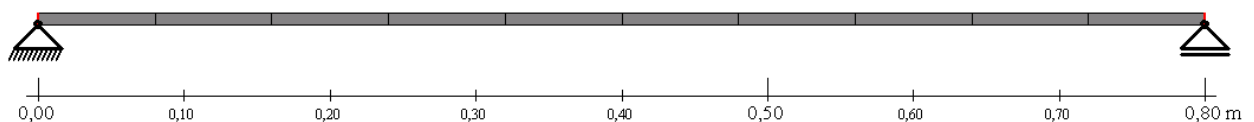
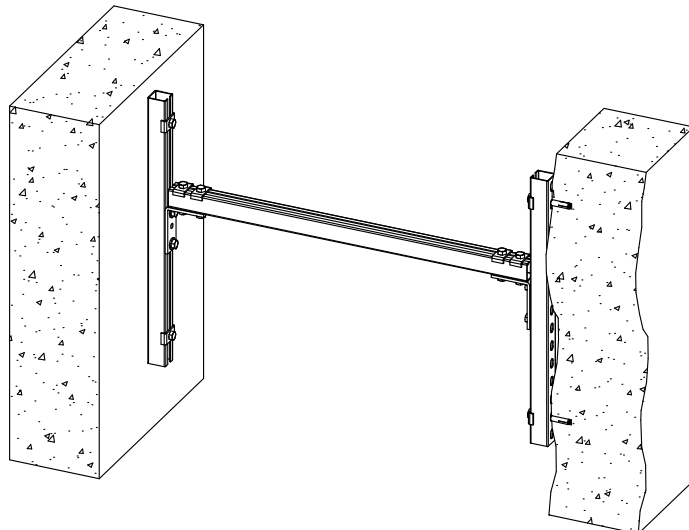
Wall profile 28/30, profile 28/30 with longitudinal saddle support and threaded rod M10

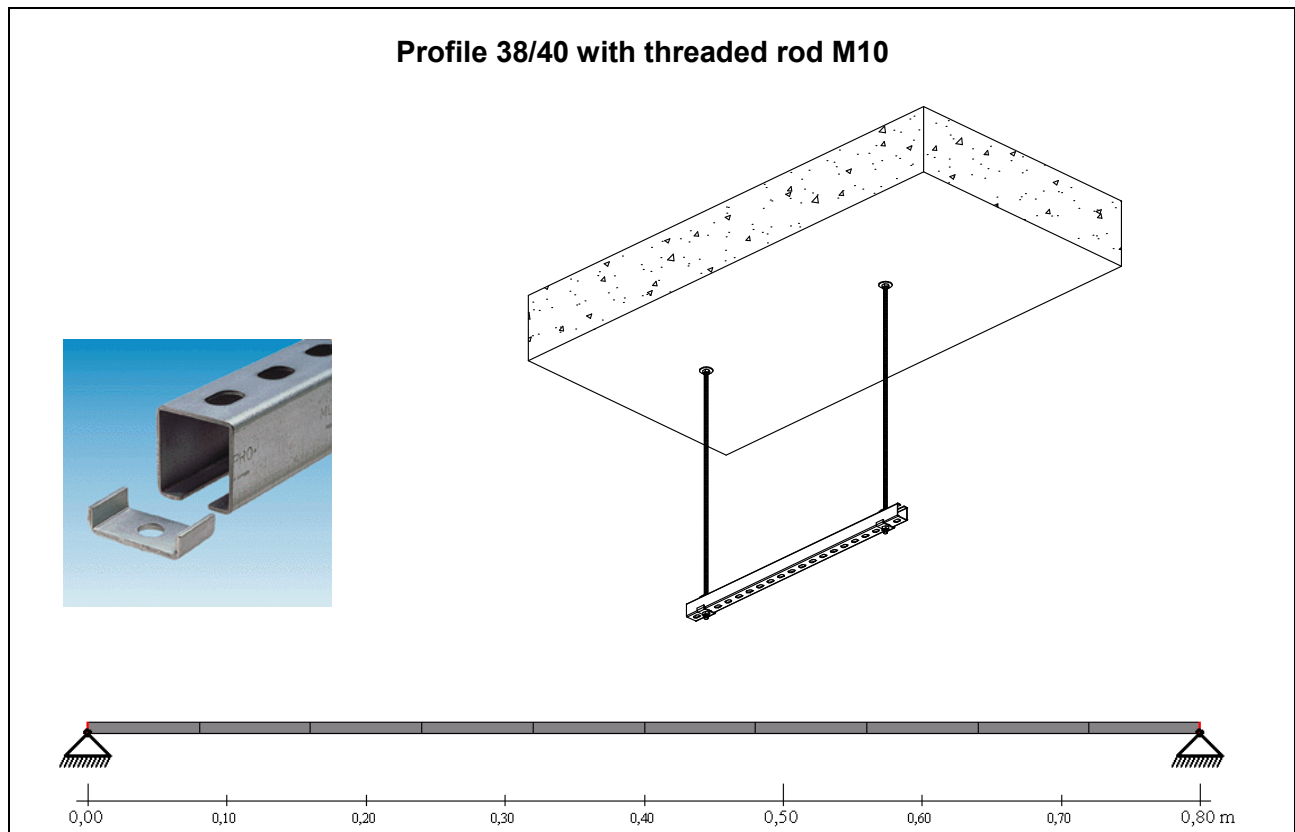


Wall profiles 38/40 with longitudinal saddle support and profile 38/40



Wall profiles 38/40 with mounting angles 90° and profile 38/40





Special note for this particular application:

The idea that the mountings for the support rail are not located at the ends of the profile but just before the ends and that the supports could therefore be moved in from the ends of the support rails does not lead to an improvement in the idealisation.

In fact the opposite is true and the system behaves in an unexpected manner:

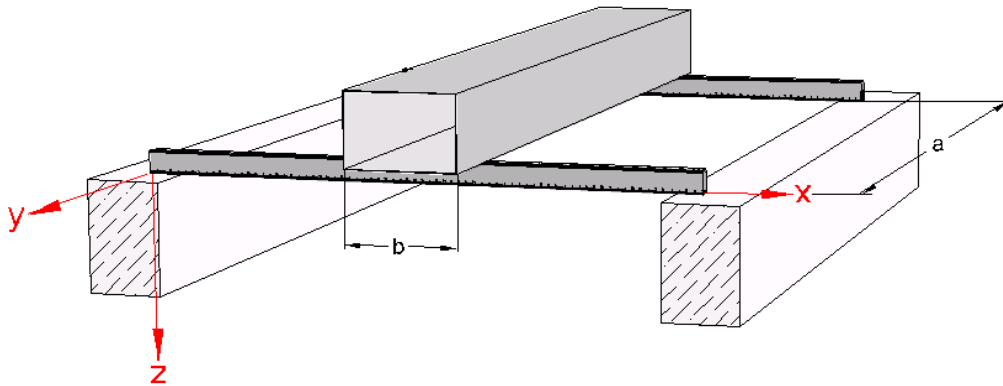
The free ends are treated as cantilever arms with corresponding consideration of the permitted deflection ($f_{\text{perm}} = L/150$). If the mounting is moved in (=field length) by e.g. 5 cm the result is a permitted deflection of 0.33 mm, which leads to a very strict limitation of the possible deflection of the support rail profile. The profile required for the actual load would have to be much stronger than that for an idealisation without cantilever arms.

However, if you do wish to perform the calculation using the cantilever arm design, there is still the option of increasing the set permitted deflection parameter for the specific application. (Free entry of the deflection parameter permitted for cantilever arms in the dialog 'Select type of support channel', e.g.: $L/10$).

Calculation of distance loads for the support channel calculation program

Given : Weight of air duct in direction y

Unknown : Load on the support channel in direction z



Method :

1.) Collect the required values :

Distance between mountings: $a \text{ [m]}$

Width of air duct: $b \text{ [m]}$

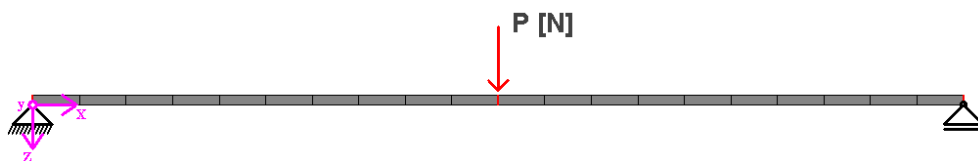
Weight of air duct: $p \text{ [kg/m]}$

2.) Calculate the weight G of the air duct related to a support channel:

$$G \text{ [kg]} = p \left[\frac{\text{kg}}{\text{m}} \right] * a \text{ [m]}$$

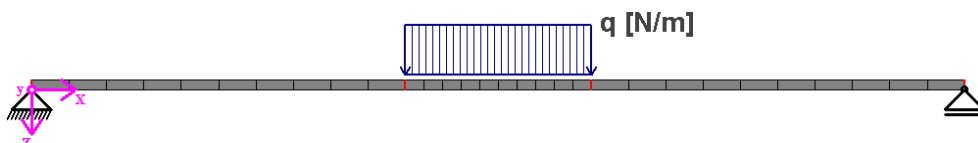
which corresponds to a point load P of

$$P \text{ [N]} = G \text{ [kg]} * 9.81 \left[\frac{\text{m}}{\text{s}^2} \right]$$



3.) Distribute load P on the width of the base b of the air duct:

$$q \text{ [N/m]} = \frac{P \text{ [N]}}{b \text{ [m]}} \quad q_l = q_r = q$$



As we are dealing with an equally distributed linear load, the left q_l and right q_r ordinates are equal.

If necessary, the units for the settings must be adjusted in the program.