Dr. Lukas Gebhard
Dr. Severin Haefliger
Institute of Structural Engineering
D-BAUG, Master Civil Engineering

Advanced Structural Concrete

Information Sheet: Strut-and-Tie Model

(101-0127-00L)

Stress fields and strut-and-tie models (STMs) are common tools for practicing engineers to design and assess in-plane loaded structures such as beams and walls. For design, the engineer is free to choose a suitable solution and dimension the reinforcement accordingly, whereas for assessment the engineer needs to verify the load-bearing capacity of the chosen solution. The design principles of simplicity, stiffness, and efficiency should be followed.

Here, a short step-by-step approach for the choice of a suitable STM is given, shown with an example of a simply supported beam subjected to partially distributed load q (see 0. in the figure below). The enumeration corresponds to the number in Figure 1.

1. Solve the static system.

2. Define locations and forces of chords ($F = \dfrac{M}{z}$).

3. If there are distributed loads, select a suitable stress field inclination α (usually 25..45°)

4. Propose a basic STM. Ensure the force flow and that equilibrium in all nodes is fulfilled.

5. Calculate the forces in the STM.

6. Calculate the required amounts of reinforcement A_s.

7. Detailing (verify concrete forces and define the location of reinforcement)

    a. Nodal zones

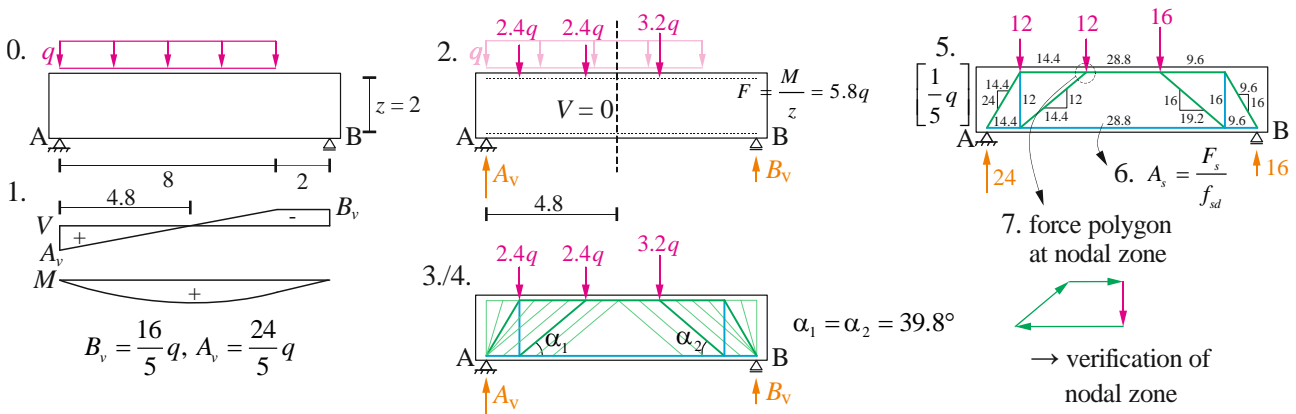   b. Critical details with stress fields

Figure 1: Example of a suitable strut-and-tie model for a simply supported beam with partially distributed load q.