RC Stair Slabs

Types:
There are two types of stair flights, classified on the direction of span:

1. **Transverse:** The steps may be supported on both sides, or may be cantilevered from an adjacent wall, for example.
2. **Longitudinal:** The stair flight spans onto landings or beams at either end of the stair flight.

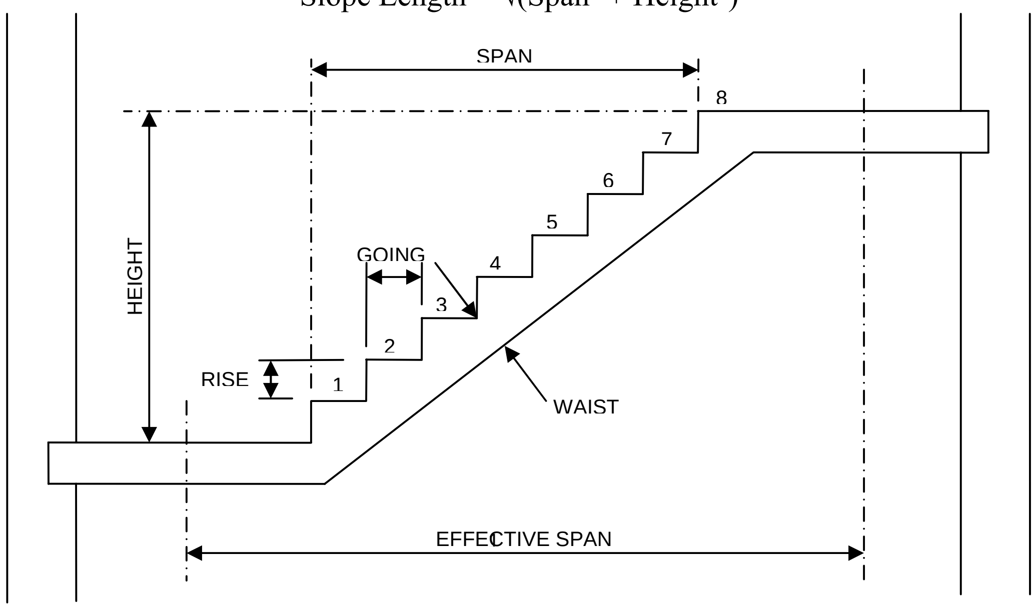
Design of Transverse Stairs:
Design of these sections are based on the average effective depth of the section. These flights may cantilever from a wall or span from a wall to a stringer beam, for example.

Design of Longitudinal Stairs:
The design of these stairs is more complicated. The additional factors to consider are:

1. **Geometry:**
Given the rise, going and the number of steps, the span and overall height rise can be determined:

$$\text{Span} = (\text{No. Steps} - 1) \times \text{going} \qquad \text{Height} = \text{No. Steps} \times \text{rise}$$

$$\text{Slope Length} = \sqrt{(\text{Span}^2 + \text{Height}^2)}$$



When the flight is built monolithically into members spanning at right angles to its span, the effective span is given by:

$$l_a = 0.5(l_{b1} + l_{b2})$$

where l_a = clear horizontal distance between supporting members
l_{b1} = Breadth of supporting member at end 1 but ≤ 1.8 m
l_{b2} = Breadth of supporting member at end 2 but ≤ 1.8 m

Otherwise the effective span should be taken as the distance between the centrelines of support, or the clear distance between support faces plus the effective depth, whichever is less.

If a flight is built into a wall (which is running in the same direction as the span) by at least 110 mm, 150 mm can be taken off the loaded width of the stair flight.

The thickness of the waist is taken as the slab thickness.

2. **Loading:**
The dead load is based on the slope length of the stair flight. The average thickness of the stair slab is used to calculate the dead load:

$$h = 0.5 \times \text{rise} \times \text{going} / \sqrt{(\text{rise}^2 + \text{going}^2)} + \text{waist} + \text{finishes}$$

Finishes are included as they are generally assumed to have a density equal to that of concrete.

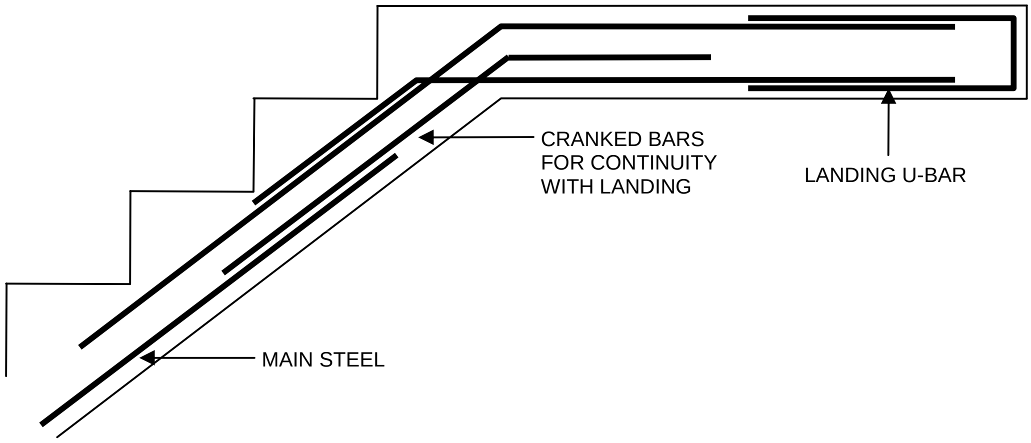
The live load is based on the plan area of the stairs and is to be taken as the same to the floor which the stairs give access, but ≥ 3 kN/m^2 and ≤ 5 kN/m^2.

If two stair flights, at right angles, share a landing, the landing loads may be assumed to be divided equally between the spans. As part of the landing may be considered as part of the stair flight, the loading on the landing must be taken into account in the shear check.

3. **Design:**
Flights with significant end restraint, such as those that are continuous with their supporting slabs or beams may be designed for mid-span design moment of $wl^2/10$ and hogging moment at the supports of the same value. Where there is not sufficient end restraint the stair slab is to be designed for $wl^2/8$.

The maximum shear should be ascertained from a simply-supported model of the stair slab. Shear should not be critical in a stair flight.

When the stair flight (on plan) occupies at least 60% of the effective span, the permissible span/*d* ratio may be increased by 15%.



4. Detailing:

The reinforcement arrangement in stair flights follows a standard pattern. Deviation from this is not recommended unless a specific need arises. Longitudinal steel is the main reinforcement and in the transverse direction the minimum percentage of steel is provided as "distribution steel" to help prevent cracking.

Strength requirements are not always critical for stair slabs. It is therefore essential that the other limit states are checked:

a. Deflection
b. Cracking
c. Min % A_s