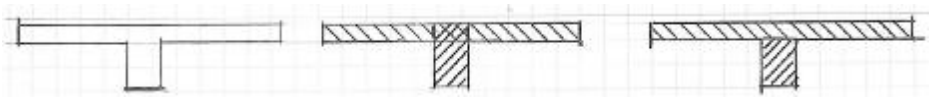
BEAM MODELING IN FLOOR PRO[1]

A flanged beam, as shown in Fig. 1a can be modeled either with an overlap on the slab (Fig. 1b), or with an offset (Fig. 1c). This Technical Note describes the impact of the two modeling schemes on the analysis and results of the flanged beam structure.



(a) Actual (b) Overlap (c) Offset

FIGURE 1 FLANGED BEAM AND MODELING OPTIONS

IMPACT ON SELFWEIGHT CALCULATION

When calculating the selfweight of the structure, the overlapped region will be considered twice. In most common structures, the impact of the added weight due to the overlapped region is not significant. Where the geometry of the structure is such that the geometry of the overlap is more than 5% of the total area, it is suggested to adopt the modeling scheme with the offset as shown in Fig. 1c. In this option, only the portion of the beam that extends outside the bounds of the slab will be modeled. FLOOR-Pro provides both options of modeling.

IMPACT ON CALCULATION OF STRESSES AND REINFORCEMENT

Regardless on which method of modeling is used, once the actions, such as moment and shear for the combined section are calculated, the program applies the actions on the actual cross-section shown in Fig. 1a. Likewise, the reinforcement calculated to resist the moment of the combined section is based on the geometry shown in Fig. 1a, irrespective of the modeling option used.

The following example illustrates the point. Consider a single span simply supported flanged beam as shown in Fig. 1 with the following values:

Particulars of the example:

- **v** Span = 18.30 m
- **v** Flange width = 5.50 m
- **v** Web width = 400 mm
- **v** Total depth = 760 mm

- Flange Thickness = 125 mm

- Concrete cube f'cu = 35 MPa
- Weight of the concrete = 2400 kg/m3
- Live load = 2.0 kN/m2
- Modulus of elasticity = 26,568 MPa

The beam was modeled using the two options described above, as well as using the strip method (ADAPT-PT). The results from the three analyses options are listed in Table 1.

TABLE 1 MIDSPAN MOMENT AND BOTTOM STRESS DUE TO LIVE LOAD

	M (kNm)	Stress (MPa)
Offset	460.6	7.643
Overlap	461.1	7.652
Strip Method	460.5	7.642

Note that the stresses are essentially the same in the three cases, since in each instance the calculated moment is applied to the actual geometry of the structure.

IMPACT ON STRUCTURE RESPONSE DUE TO SELFTWEIGHT

The calculated moments, shear and other actions due to selfweight will differ due to the added weight of the overlap, if option (b) is used.

IMPACT ON DEFLECTION CALCULATION DUE TO ANY LOAD.

The contribution of the overlapped area (Fig. 1b) to the stiffness of the section (second moment of area) will be accounted for two times. As a result, the option with overlap is likely to result in a somewhat smaller deflection than would be for the actual structure. Again, in most common structures the difference is negligible. For the above examples, the values are as follows:

- Deflection for "offset" modeling = 20.92 mm
- Deflection for "overlapped" modeling = 20.65 mm

The reduced deflection calculated for the overlapped modeling is insignificant.