BUILDING RESEARCH & TRAINING CENTRE

# DISTRIBUTION OF TORSION & BENDING MOMENTS IN BEAMS AND SLABS CONNECTED TOGETHER

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## S Y N O P S I S

The purpose of this paper is to present a rational analysis for the determination of the torsion and bending moments occuring in beams and slabs connected together.

The effect of the beam or slab rigidity on the other is taken into consideration.

Different cases are investigated including: outer beam subjected to a cantilevering moment, marginal beam different inner slab conditions, effect of beam end rotation and effect of beam deflection.

Formulas and practical Curves are given for a direct determination of the beam torsion and the slab Moment.

It is hoped that this work will give a designer engineer a better understanding of the actual forces to which an outer beam or slab is subjected.

Introduction :

In beams connected to a cantilever slab from one side and to an inner slab from the other side we are always neglecting the effect of the torsion rigidity of the beam in calculating the actual moment to which the inner slab is subjected. The presence of this beam will cause a restraint of unknown amount against the bending of the cantilever slab. However, such an inner slab is designed commonly to resist all the external cantilevering moment by assuming the supporting beam as a knife edge support.

Also in beams connected to a slab from one side only such as marginal or spandrel beams, we are always overlooking the fact that the presence of the floor slab prevents free rotation of the spandrel beam. This means that the connected slab will create an unknown restraint against the twisting of the beam.

Moreover, in office practice the previous beams are designed for bending only and disregarding any twisting moment. The effect of the latter is supposed to be covered by the safety factor which is not always a wise or correct procedure.

The object of this work is to present a method for the analysis and determination of the actual stresses in beams and inner slabs connected together taking into account the effect of the rigidity of each on the other.



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In the following, the theory is developed from a simple equation of equilibrium by considering the equilibrium of a beam prism strip taking into account the ext. moment $m_o$, (if acting), resisting beam torque T and the attached slab moment m. Since moment m & torque T could be expressed in terms of the angle of twist " $\varphi$ " a differential equation of the 2nd. degree is derived in terms of the slab moment m as the variable which could be solved for the determination of the unknown forces m and T.

In the investigation of all following different cases, the ends of the beam connected to the slab are considered totally restrianed against rotation. Also the effect of the beam rotation is discussed for the first case.



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