Zeitschrift: IABSE congress report = Rapport du congrès AIPC = IVBH Kongressbericht

Band: 13 (1988)

Artikel: Prestressed foundations

Autor: Ganz, Hans Rudolf

DOI: https://doi.org/10.5169/seals-13162

Prestressed Foundations

Fondations précontraintes

Vorgespannte Fundationen

Hans Rudolf GANZ
Dr. sc. techn.
VSL International Ltd.
Berne, Switzerland

1. INTRODUCTION

Massive and large foundation slabs are often used where poor subgrade conditions and/or ground water are encountered (Picture 1). Apart from externally applied gravity and lateral loadings special attention must be paid to stresses resulting from differential settlements, hydration, temperature, shrinkage and creep. The latter effects result in imposed deformations which are restrained by the subgrade. Bending cracks and separation cracks may occur. Efficient measures to limit crack widths include:

- appropriate concrete technology and curing methods
- choice of a suitable structural system and careful detailing
- adequate design of prestressed and non-prestressed reinforcement.

2. WHY PRESTRESSING ?

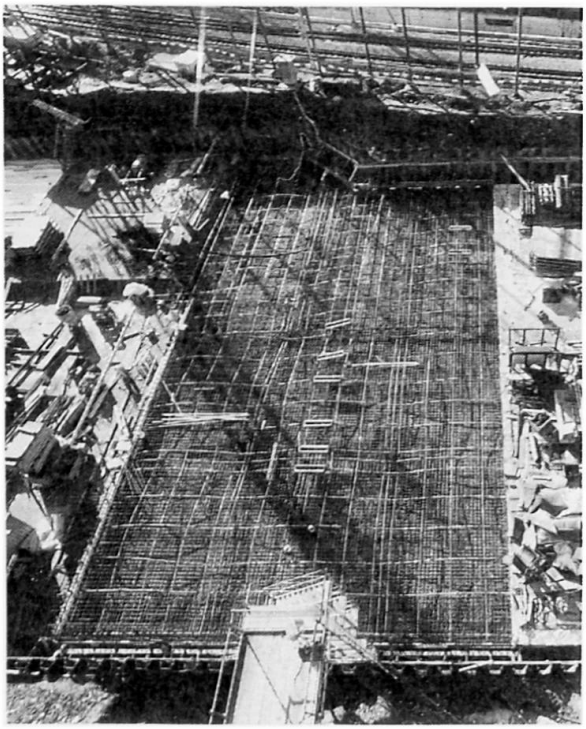
When a prestressing cable is stressed anchorage, deviation and friction forces are introduced in the slab. If an appropriate cable profile is used, externally applied loads may be balanced partly or completely by the deviation forces. Thus the designer can actively influence the distribution of the applied load to the subgrade (Fig. 1). Subgrade restraints do not effect the deviation forces.

For imposed axial strains, axial stresses are developed in the slab by subgrade friction (Fig. 2). If these stresses exceed the tensile strength of the concrete cracks will develop. Due to the applied compression, prestressing helps to delay or even prevent cracking. If the slab cracks, the behaviour of a section with both bonded prestressed and non-prestressed reinforcement will be similar to that of a reinforced section provided that both sections have the same total yield strength.

Early prestressing of foundation slabs helps to prevent cracking due to hydration of the concrete. However, the number of cables which can be stressed at this stage has to be evaluated carefully so that the strength of the slab is not exceeded (Fig. 3). Due to the use of high strength prestressing steel, reinforcement congestions may be avoided. The number of joints may be reduced.

3. APPLICATIONS

Prestressing may be applied to almost any type of foundations : buildings, bridges, towers, storage tanks, pavements, tie beams, etc. Similar problems and solutions as for foundation slabs apply to pile caps and transfer plates.



Picture 1 : Industrial building

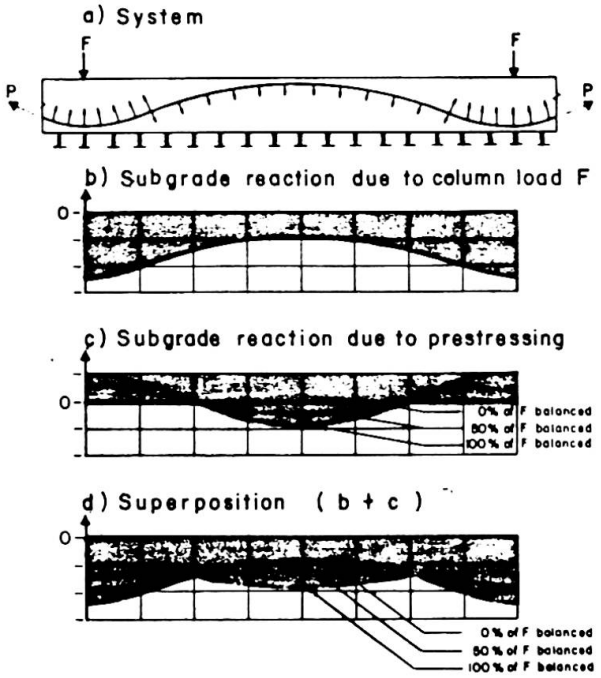


Fig. 1 : Subgrade reactions

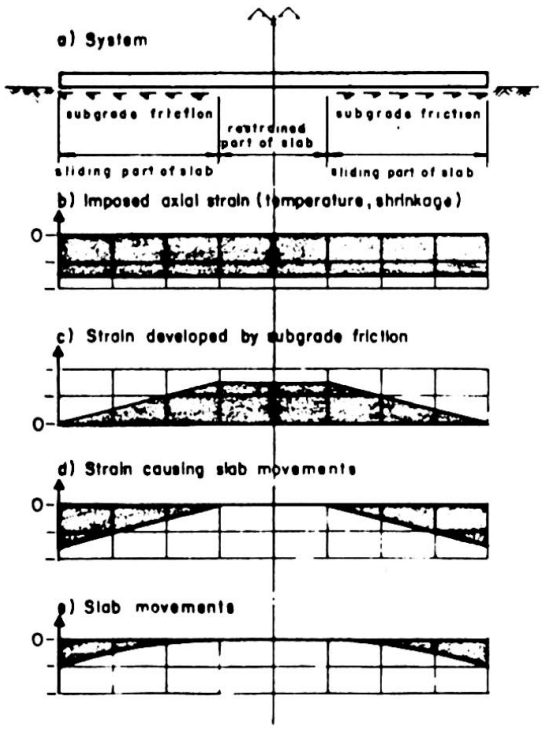


Fig. 2 : Axial restraints

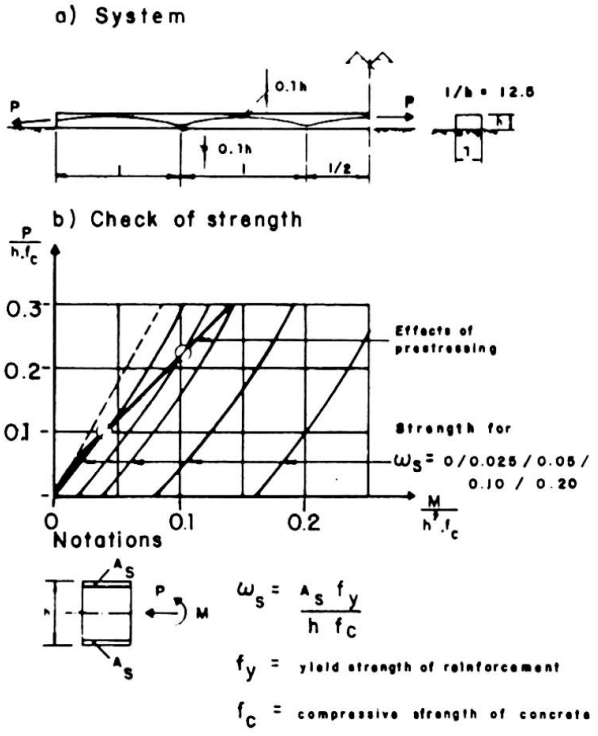


Fig. 3 : Transfer of prestressing