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RETAINING WALLS

Anchorages and Sheet Piling

Theory and Practice
Volume I

by

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PREFACE

The new method for the design of retaining walls which we present here is concerned with the calculation of the forces due to **thrust** (active pressure) exerted by a granular material on a wall retaining it and also with the **passive resistance** reactions which may in appropriate circumstances develop in opposition to the displacement of that wall tending to compress (push back) the material.

This design method, which is the result of research and experimental work extending over a number of years, establishes close agreement between the thrust and passive resistance calculations, on the one hand, and the observed actual phenomena, on the other. It achieves this on the basis of **a rigorous interpretation of the test results by new and very simple formulas,** which are extremely easy to apply and whose interdependence has enabled us to combine them into a **universal formula** which defines the forces – both active and passive – which affect the equilibrium of any granular material, with or without surcharge, retained by a vertical or an inclined wall.

We have assembled in a single chapter all the proposed formula as well as their graphical representation in the form of design charts which design engineers can apply easily and confidently. They can base this confidence on the fact that the coefficients of the universal formula have all been determined for the retaining wall and retained material "at rest", i.e., when no movement of the wall occurs. The maximum thrust and minimum passive resistance values associated with this condition are, as will be seen, the ones that are more particularly of interest to engineers who have to design and build non-deformable retaining structures with the safeguard provided by a well-defined margin of safety.

Finally, we have augmented the applications of the universal formula by dealing with the design of anchorages for ensuring the perfect stability of structures and with sheet piling design. In this context we wish to call particular attention to the fundamental law for the thrust caused by a point load and to the theorem concerning translatory passive resistance at rest which we have established.

ANNOUNCEMENT OF VOLUME II

The present book deals with the phenomena of thrust and passive resistance **at rest** as envisaged in the British Code of Practice (1952, clause 1421): "The pressure to be taken is the value of earth pressure at rest."

It is therefore intended for engineers who have to design structures under conditions of complete stability.

There are, however, cases where certain structures – e.g. sheet piling which has to serve in a temporary earth-retaining capacity – can permissibly undergo some deformation that will not harm their proper functional behaviour.

Such structures and conditions of service will be the subject of Volume II, entitled:
"Stress-strain phenomena in a granular material subjected to translational passive resistance, rotational passive resistance and toe resistance."

IMPORTANT PRELIMINARY NOTE

MINIMUM PASSIVE RESISTANCE:

The experiments relating to the equilibrium **at rest** of material developing **passive resistance** in opposition to material exerting **thrust** (active pressure), as reported in this book, show the expression for the translational passive resistance to be: $B = \gamma \cdot h^2/_2$ which is equivalent to stating that the coefficient of passive resistance is equal to 1.

However, if a wall retaining a granular material is subjected to a force tending to push it back, experiments – which will be described in Volume II – show that the wall will move and that the stress-strain phenomenon will manifest itself in three definite and characteristic stages: first, a stage in which the granular material adapts itself; then comes an elasto-plastic stage of equilibrium of the material whose graphical representation is rigorously a **straight line** which intersects the axis of abscissae at a point corresponding exactly to the value of the **minimum thrust associated with zero movement;** finally, a stage of plastic equilibrium whose graphical representation is uncertain because of the wide scatter of the experimental results.

This observation constitutes the reason why, as a general principle, the expression for **minimum passive resistance** will be adopted in the treatment of the subject.

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PART I

DETERMINATION OF THE MAXIMUM THRUST AND MINIMUM PASSIVE RESISTANCE APPLICABLE TO THE DESIGN OF RETAINING WALLS

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