

Harold Malcolm Westergaard

1888 - 1950



Harold Malcolm Westergaard was a Danish structural engineer and Professor of theoretical and applied mechanics at the University of Illinois in Urbana and of Civil Engineering at Harvard.

While completing his doctorate at the University of Illinois, Harold Westergaard developed the first theoretical basis for the design of concrete pavements. His mechanistic models have been used throughout the world to improve concrete analysis and design.

His major consulting projects included Hoover Dam and the Panama Canal.

As stated by Anastasios M. Ioannides¹,

"Just as Terzaghi (1883–1963) is the “father of soil mechanics,” Harold Westergaard (1888–1950) must be recognized as the person to whom modern pavement mechanics owes its birth. In his fertile mind germinated the seeds planted by a series of distinguished thinkers who preceded him. The methodology he brought to life in the early 1920s has been the progenitor of every significant and worthwhile development in pavement engineering since then."

And in a National Academies article, "Westergaard Solutions Reconsidered²",

The pioneering analytical work of Harold Malcom Westergaard has been at the heart of slab-on-grade pavement design since the 1920s. Every code of practice published since then makes reference to the "Westergaard solutions." These solutions are only available for three particular loading conditions (interior, edge, and corner) and assume a slab of infinite or semi-infinite dimensions. Since their first appearance, beginning in the early 1920s, Westergaard equations have often been misquoted or misapplied in subsequent publications. To remedy this situation, a reexamination of these solutions using the finite element method is described in this paper. A number of interesting results are presented: (a) Several equations ascribed to Westergaard in the literature are erroneous, usually as a result of a series of typographical errors or misapplications, or both. The correct form of these equations and their limitations have now been conclusively established. (b) Westergaard's original equation for edge stress is incorrect. The long-ignored equation given in his 1948 paper should be used instead. (c) Improved expressions for maximum corner loading responses have been developed. (d) Slab size requirements for the development of Westergaard responses have also been established.

References:

1. [Concrete pavement analysis: the first eighty years](#)- Anastasios M. Ioannides, Department of Civil and Environmental Engineering, University of Cincinnati
2. [Westergaard Solutions Reconsidered](#) - National Academies
3. [Westergaard Publications](#) - ASCE Library