

THREE DIMENSIONAL PROGRESSIVE COLLAPSE OF WAREHOUSE RACKING

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Abstract

Collapse of light weight, multi-aisle, steel warehouse racking structures tend to spread progressively in three dimensions. Some of the problems associated with such three-dimensional progressive collapses are investigated and partially solved in this dissertation.

The progressive collapse of racking involves the development of complicated three dimensional mechanisms in the structure. In this dissertation various collapse mechanisms are investigated and it is argued that a study of the nature and causes of these requires a numerical three-dimensional structural analysis. Further, dynamic aspects of the collapse are considered to be very important. The literature and a suitable computer program are developed. This computer program is calibrated against the available results.

A geometrically quarter scale racking model is designed and fabricated in the laboratory. Various experimental tests are carried out on members of this model to provide data for the computer program. By varying specific parameters of the model, it is used to represent the wide range of racking systems available in the market. The three dimensional computer program is used to predict the collapse behaviour of the quarter scale racking model and nine experimental collapse tests are carried out to study various collapse mechanisms. In the light of the results presented, the collapse of two commercial racking systems is also investigated.

Finally in this dissertation, some conclusions are drawn from the work presented, and some further work is proposed.