

Most of the improvements are likely to lead to an increase in capital cost. Some may involve slight increase in maintenance costs. But if these choices are not consciously considered the lessons from the Inangahua Earthquake would have been wasted.

A LETTER TO THE EDITOR

OCTOBER 1968

Re: Mr A.L. Andrews Article in Bulletin of July, 1968

I was interested in this article because:-

- (a) It had direct reference to Fleming's portal and cantilever methods.
- (b) The paper provided a good instance of the difficulties arising from assumptions and approximations in aseismic design.

As regards Fleming and his simplified methods; he developed them about 50 years ago. This was not long after the monumental studies of building frames by Professor Wilson of Illinois. These covered both gravity and lateral loading and were on a slope - deflection basis. Fleming was a celebrated engineer of his day whose work in practice was highly regarded. His views were often sought and his recommendations quoted by reliable authorities. Then, about 40 years ago, came the notable studies of deflected structures by Professor Hardy Cross, whose work particularly as to moment and shear distribution has been applied and extended for more than a generation. Yet in spite of all this no practicable analytical methods seem to be available to give anything more than a very dubious estimate of deflections due to seismic effects on multi-storey buildings. There are far too many imponderables, both within the structure and externally. But we have to try to cope with these as best we can - hence many approximations and assumptions. It is here that the paper is of particular interest; it demonstrates, by one fundamental instance, the need for continuing appraisal of the effects of any initial assumption or approximations.

As to structural approximations in general I have found "Statically Indeterminate Structures" by Benjamin of Stanford (1959) particularly good. Although I do not care for his treatment of shear walls that have openings in them, the letterpress of the book as a whole shows a firm grasp of the relationships between theory and reality.

Reverting once more to estimating deflections in buildings - I think that for anything in which we could have much confidence we are forced right back to more full scale local test data. In other words we need sufficient instrumental data from modern local structures plus the relevant seismological records. Such data can't be got or interpreted easily or cheaply but they are urgently needed. There is no worthwhile substitute: the complexities of transient response and damping, apart from many other factors, determine this. Who can or will, or whose business is it, to get and handle the information?

P.S. Structural Engineers Association of California a few years back made some suggestions about allowances for storey drift floor to floor and when to allow for same. But in the end recommendations were left merely as guidance and nothing, unless quite recently, has been made mandatory.

S. Irwin Crookes  
AUCKLAND.