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Planning and Control of Building Foundation Work in the Seventies

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INTRODUCTION

There is emerging a feeling that our traditional approach to this matter needs modifying to take into account new environmental changes that have occurred recently. Economical and technological factors will produce confusion unless properly understood and incorporated in the programme.

Business Executives throughout Australia are very critical of the inability of Foundation Engineers to control foundation progress and cost. The failure of some property ventures can be traced to under-estimates of foundation conditions. It is quite clear that while the Quantity Surveyor can estimate the cost of the superstructure fairly accurately from sketch plans, he cannot do the same with foundations. In order to produce an estimate of costs of the same order of accuracy, the Geomechanicist has a vital role to play prior to the project being initiated.

There are signs of change; Foundation Engineers are becoming aware of and applying new management techniques and have found the traditional phasing of operations prior to the start of construction needs re-thinking.

ENVIRONMENT

Owing to Government policy of restricting loan funds for Public Works, there has been a slowing down in the economy. There is increased competition between companies providing housing and office space. Analysis has shown that buildings must be bigger to be competitive. Margins are thus reduced to a point where foundation costs must be known far more accurately.

The speed of construction has hastened greatly of late. Prefabrication of building components is necessary to reduce construction time. It is no longer possible to do all the design before calling of tenders since this would unnecessarily delay the start of construction. Instead, planning and building economists are used to ensure the financial success and therefore it is possible to phase design and construction in parallel with one-another.

Buildings are higher, foundations are thus deeper to cater for increased loading on the soil. Horizontal shoring is necessary to prevent damage to adjacent buildings. The movements to be prevented are small, in the order of $\frac{1}{2}$ inch, and sophisticated methods of analysis are required.

Foundation construction methods are more diverse and in the hands of many different specialist firms who cater for such techniques as rock bolting, vertical sand drains, slurry trench retaining walls, ground freezing, to name a few. Many of these processes require as much as a year to get mobilised and therefore require early warning.

In this environment it is increasingly evident that a one-shot investigation, design and tender would require a considerable time to carry out and it is very likely that the building would be obsolete when erected. The following problems are created by the environment:-

1. Cost escalations due to delay and wage rises, loss of profit and the like, are greater now than ever before.
2. A foundation designing programme which would supply soil parameters for the whole range of foundation expedients would be very costly to perform. For example, commercial testing laboratories offer as many as 30 standard laboratory tests involving over 100 soil parameters for each class of soil.
3. Most foundation investigations at present prove inadequate because of alteration in either the Client's intention, the building regulations, or the range of contractors interested at any one time.
4. Analytical techniques for solving soil mechanics problems are greater in number and diversity than ever before. Considerable research in a number of places throughout the world and the advent of computer programming has made the subject very large and difficult to keep up-to-date.

PRESENT TRENDS

We must now accept the fact that the foundation investigation should now be conducted in stages. It is necessary to have qualified engineers continuously assessing and up-dating the investigation programme. Simultaneously, there must be dialogue with the structural engineer designing the foundations and with the specialist contractors. The following principles will be apparent:-

Plan a feasibility study aimed at getting the cost of the foundations to the same order of accuracy as the rest of the superstructure. In order to do this, one would need to do sufficient drilling and testing

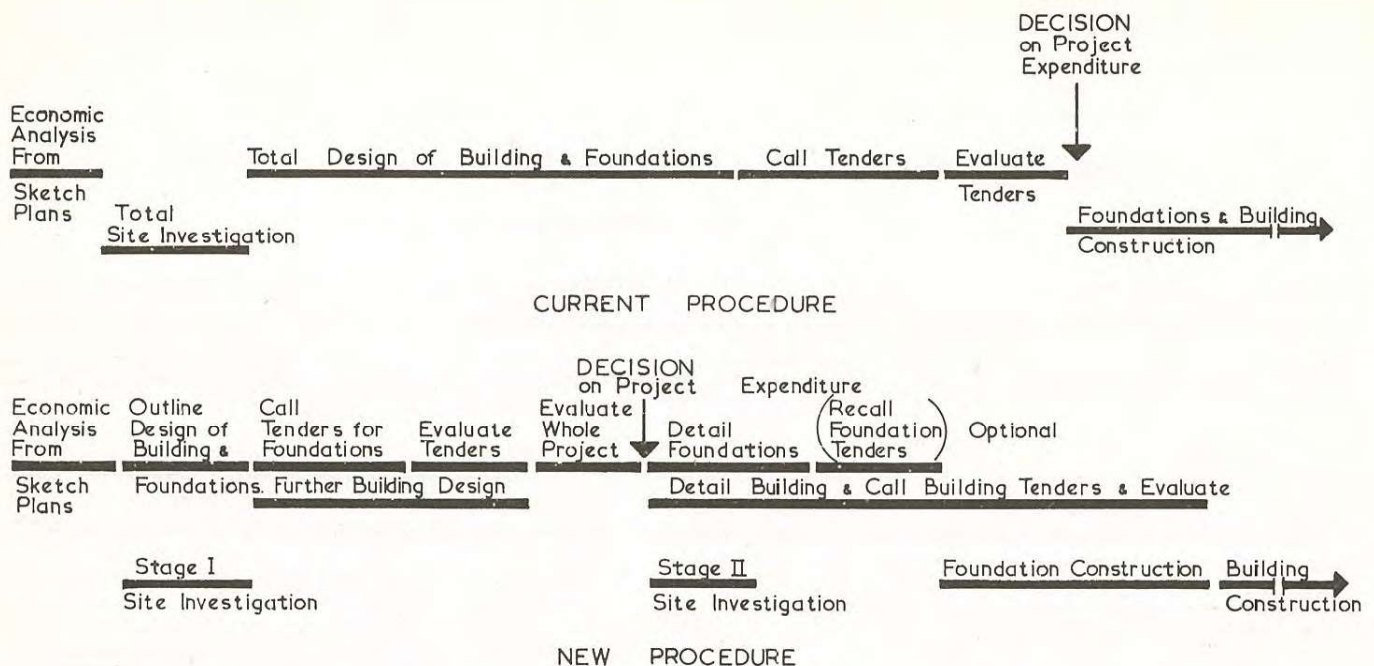


Fig. 1. - Design - Construction Procedures for Building Projects.

to determine the most economical foundation method. The foundations should be designed in some detail, and tenders called; and this sum combined with a Quantity Surveyor's estimate for the remainder of the work. If the project is approved, it will only be necessary to firm up the foundation design and construction started well before the superstructure design is completed.

This whole process is illustrated in Fig. 1 which compares current procedure with the new procedure just described.

SUMMARY

- (a) Abandon one-shot investigation design and replace with at least two shots and perhaps three.
- (b) Call tenders and select foundation sub-contractors with firm rates for their work before committing your Client to the project.
- (c) Parallel as many activities as possible to save time.
- (d) Use statistical methods to quantify the probability of variations in soil strata from the norm, e.g. the occurrence of dykes, soft or hard layers, perched water tables which are not possible to locate in the early stages.

CONCLUSIONS

The way is now open for improvement in the management of foundation construction for high rise developments. Major Australian companies, most of whom are design-construct organisations are now using these techniques with great cost savings; many more will follow.

It is most important for all foundation engineers to supply the data, energy and knowledge to the planners not fully acquainted with foundation problems. If the planner is old-fashioned, he must be told; if the soil data is insufficient, additional appropriations must be obtained.

The foundation engineer is a very important partner together with the quantity surveyor, structural engineer and architect in conducting the feasibility study. It is not sufficient to be an expert in geomechanics, but it is necessary to know something about what the other members in the team are trying to achieve. The foundation engineer must therefore acquire an interest and skill in planning techniques to fully utilise all the latest developments that geomechanics can provide.