

Geotechnical Software Maintenance

by D.G. Fredlund and L.D. Fredlund

The emphasis on computing in geotechnical engineering has been on the coding of suitable basic algorithms. Much of this development has originated at universities and subsequently been distributed to industry either officially or unofficially. This practice has also been endorsed by the Canadian Geotechnical Society through the publication of the "Catalogue of Geotechnical Computer Program Abstract"; a publication to which one of the authors has been party. Though this ad hoc development and movement of software has proved of value in reducing redundancy in software development, it has been plagued by two vital factors; namely, lack of maintenance support and inadequate testing and verification of code. While these two aspects are somewhat related, this article will focus on the importance of software maintenance.

By way of definition, software maintenance will be considered the task of ensuring that an existing software product operates in a manner satisfactory to an end user. This task involves not only ensuring that the product performs according to original design specifications (or user manual specifications), but that all enhancements required by users are incorporated into the product in a timely manner.

Though the understanding of the objective of software maintenance may be well agreed, the approaches to satisfy the objective are not. It is at this point that we see considerable difference between the broad software classifications of business and scientific software. Whereas corporations have recognized the importance of providing budgets and organization to the task of maintaining business software, the need for maintenance of scientific software is only beginning to be recognized. So significant is this maintenance task and of such a priority that many corporations are utilizing the majority of their data processing personnel just to maintain and enhance existing business software. Compare this to engineering software where the majority of the software used is not officially maintained or enhanced. Is this not somewhat of a paradox in a discipline where accuracy and reliability are attributes to be admired? This

disparity will only be eliminated when the engineering community recognizes the need and assigns a high priority to effective maintenance of the software it utilizes. We must come of age.

Recognition of the need, however, is only the first step. Corporations who have developed significant software maintenance groups have realized that this noble objective quickly consumes between 50 and 80% of all available data processing personnel. This statistic has caused corporations to evaluate and analyze the maintenance task much more closely to determine how it can be effectively managed. The analyses and experience has revealed several characteristic problems. First, software maintenance involves considerably more

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enhancement implementation than error corrections. Lientz, Sivanson and Tompkins (1978) estimate that 60% of all maintenance effort is spent on enhancement changes. Secondly, software maintainability generally has a much lower priority than schedule and cost during the 'development' lifecycle. This afterthought mentality has resulted in poorly documented and structured programs which become virtually incomprehensible to software maintenance staff. Thirdly, software maintenance has been considered the domain of the 'left-over programmer'. Management have been quick to utilize the class A performers for the high profile development systems leaving the lowest-ranking programmers for the thankless maintenance task.

Given that the above factors are some of the core issues which face the software maintenance area, wherein lies the solution?

There is a little question that the single most important factor in the overall solution lies in the attitude of management. Management must perceive the need and assign a high level of priority to the software support function. Only

then will the efforts of some of the 'quality' people within the organization be brought to bear on this challenging problem. Reliability of a software product is the most important objective of the software maintenance function. If we want to ensure software reliability, one cannot use 'left-over programmers'.

To date, the geotechnical engineering field has placed little emphasis on the need for software maintenance. This attitude has resulted in a low-level of software reliability and a declining confidence factor on the part of the geotechnical engineer. If we are going to hold to global attributes of accuracy and reliability, we must apply the appropriate priority to software support.

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References

Lientz, B.P., Sivanson, E.B. and Tompkins, A. (1978), "Characteristics of Applications Software Maintenance", Communications of the ACM, June.