

# Planned versus breakdown maintenance

By WILLIAM J. COAD

A building systems design engineer is now expected to provide considerably more input to a life cycle cost study of a building venture than he was in the recent past. The current dynamic nature of technology and the state of the art in the building industry have invalidated many of the statistical norms widely used as recently as the last decade. In a life cycle cost analysis, the three major ingredients controlled primarily by a system designer are: first cost amortization, energy costs, and maintenance/service/operations costs. The latter will be discussed with emphasis on maintenance and service costs.

Maintenance and service costs (M/S) should be grouped into a single entry, simply because well managed maintenance efforts initiated during the environmental system startup or debugging phase will reduce service costs during a building's life to a minimum. Conversely, without well managed maintenance efforts, service costs can be a serious financial burden.

Before attempting to quantify M/S needs and subsequent costs, two questions must be answered:

- How long does the owner intend to own and manage the property?
- Are special skills that might be needed for maintenance and service of complex apparatus available in the area, and at what cost?

The answer to the first question dictates whether at time zero a planned maintenance program should be put into effect. If the owner-developer intends to retain the property for a long time, the only intelligent course of action is to instigate such a program. Examples of this type of building are institutional buildings or commercial buildings planned for long time ownership by major real estate holding firms or major tenants.

The other alternative, short term ownership (less than 15 years), might dictate the breakdown maintenance or total dependency on service approach. Whether by plan or not, this latter approach is employed in the majority of today's buildings. Examples of projects where this approach is intended are the so-called blue shoe commercial buildings where the owner-developer intends to retain ownership long enough to achieve a financially beneficial crossover point between equity growth and depreciation tax shelter benefits.

Annual M/S cost versus years after startup for long term ownership is shown in Fig. 1. If a planned maintenance program is followed, system components will be in as good a condition after a projected 30 years as at the beginning. The only deterrent to permanency is obsolescence.

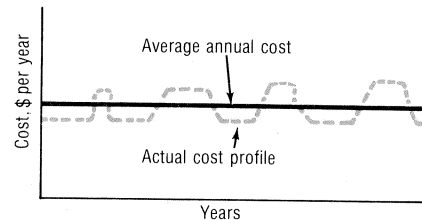
Fig. 2 represents a typical M/S cost curve for short term ownership. Generally, the crossover point occurs between 5 and 12 years.

The answer to the first question not only affects a designer's projection of life cycle cost, but it will also seriously affect the selection of machinery and components. The absence of the answer to this question has in numerous cases resulted in system designers being severely criticized for misdirected decisions. The results of which are that long term owners are stuck with a property planned otherwise, or rebound owners are not financially prepared for high M/S costs.

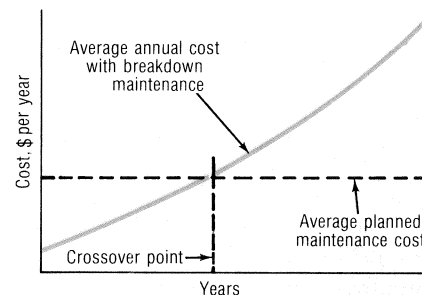
Unless there exists a pre-programmed written maintenance program and procedure, it is most likely that breakdown maintenance is the operating procedure.

The second question is best addressed by a few brief examples from my personal experience.

Of the many so called total energy systems (systems which convert available fossil fuel into all



1 Annual M/S costs of a planned maintenance program.



2 Annual M/S costs of a breakdown maintenance program.

the necessary end use energy forms for the building system—installed, several have been removed and replaced with conventional forms of available energy. Considering that the concept is valid, once installed, the investment monies spent, and unless extremely ill conceived in energy and load balance, the only reason these plants have been removed is the unavailability of necessary skills to maintain and service the machines.

An absorption refrigeration system installed in a remote area is another example. A lack of a readily available maintenance and service skills led to its removal and replacement by a vapor compression system.

After addressing these two questions, a designer has established the philosophy underlying the M/S aspects of a system design and eliminated certain classes of machines or subsystems. The next step is to assign M/S values to the selection of all system components or subsystems. This is perhaps the most difficult parameter of a system to quantify and will be detailed in a future column.

*On this page each month, the author shares his engineering philosophy by exploring a wide range of topics, ranging from fundamentals to new frontiers, as they relate to building environmental systems. Mr. Coad is vice president of Charles J. R. McClure & Associates and affiliate professor of mechanical and aerospace engineering at Washington University, St. Louis, Mo.*