3.6.3 Cost Efficiency

Throughout the discussion in this chapter, we mentioned the optimum clear span ranges, advantages, and disadvantages of various systems. Where structural efficiency and cost are of paramount importance, these guidelines are intended to help an experienced practitioner to narrow down the system choices. However, the design team should choose a framing system that results in the lowest *overall* costs for the building, not just the least expensive structure. If a structural system penalizes other building systems, it may not be the bargain it appears to be.

3.6.4 Flexibility of Use and Expansion

The design team should carefully evaluate the owner's requirements for clear span, height, and building layout, and check this information against recently designed similar buildings. With the information and technology revolution in full swing, it is unlikely that a manufacturing plant being designed today will still contain the same production operations 20 years from now. On the other hand, a church layout may not change at all.

There is an obvious trade-off between cost efficiency and planning flexibility. For maximum flexibility, framing should be easy to remove, alter, or reinforce to accommodate future demands; all these are easiest to accomplish with simple-span framing. Of all the framing materials, hot-rolled structural steel beams are still the most adaptable. Conversely, the most economical building systems utilize continuity, multispan cantilevered beams, or prestressing. The owner and its team must decide whether it is wise to spend a little more now for a complete planning flexibility later.

3.6.5 Construction Time

Frequently, the owner will put a premium on shortening duration of construction. This is understandable: Time is money. Several months shaved off the schedule may mean real savings on the construction financing, perhaps greater than the differences between the competing structural schemes. The framing with faster erection time (such as metal building systems) scores some extra points on this item.

3.6.6 Soil Data

All too often, preliminary design and design development proceed without adequate geotechnical information; the engineers are expected to recommend a structural system without any soils data. This is quite unfortunate, because soil properties are crucial to the system selection. With good soil, economical spread footings are possible; with poor soil, expensive deep foundations might be called for. Much of the land still available near big cities probably has poor soils considered unsuitable for earlier development. A belated realization that expensive piles will be needed can kill a project with tight budgets. In such circumstances, the choice of a lightweight and flexible building system capable of tolerating some differential settlements can spell the difference between proceeding with the project or not.

3.6.7 Local Practices

Prevailing local practices can weigh heavily on the system selection and should never be ignored. On the island of Guam, for example, most buildings are made of concrete; specifying a metal building system, however seemingly suitable for a new building, might raise many eyebrows. An abundance of local contractors skilled in a certain type of construction means that there will always be qualified people interested in submitting a bid with few contingencies. It probably also means that the needed materials are plentiful and inexpensive.

3.6.8 The Choice

There are many other factors, often conflicting, that can influence a choice of structural system; most only remotely relate to structural issues. People skilled in making such decisions realize that selection of a structural system is more art than science. Various members of the design team may even initially disagree; in many cases, studies of alternative schemes accompanied by cost estimates are developed. Most importantly, the decision-making process should allow everyone involved to make their first and second choice of the systems that are later thoroughly analyzed and debated. The best solution is not always the most obvious.

Swensson and Robinson[15] tell about selection of a structural scheme for a large athletic facility. Four final schemes were considered: a basic gable metal building, a gable truss, a flat truss, and an arch. The designers eliminated the flat truss because it needed a much larger volume of air-conditioned space than others. The arches were ruled out as providing less workable finished space than the gabled frames. And finally, the gable truss system was chosen over the gable metal building despite its higher cost. Why? Because "the quality and flexibility of design provided by [this scheme] more than made up for the approximate 10% cost premium . . . ."

With perceptions like this still widespread among engineers, it might be difficult to justify the selection of a pre-engineered building system for a high-visibility project. In the future, as the metal building industry continues to prove its mettle in nontraditional applications, and as its technical sophistication continues to increase, the quality of pre-engineered construction will likely rival that of stick-built structures. This book is but a small effort in this endeavor.

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REVIEW QUESTIONS

1 Name any three structural systems that directly compete with metal buildings.

2 Explain the common method of attaching vertical rod or cable bracing to metal building columns. What improvements could be made to this type of attachment?