Step 11

Develop and Optimize Design Alternatives

The feasibility study is a logical process of developing practical alternatives, evaluating them from economic and technical viewpoints, and then selecting the most advantageous one for implementation. In this step we present ways of developing and optimizing design alternatives (see Figure 11.1).

The method is an interactive process that involves judgment and a sound knowledge of the requirements, existing facilities, and available technical solutions. Basically the method involves determining systems for the following network elements:

- subscriber access medium,
- exchange and collection point equipment, and
- trunk and transfer transmission medium.

A promising system design is selected for each of these elements in turn. Then an optimization process is applied to ensure that the configuration that gives the lowest life cycle cost over the study period has been found. This optimization process is briefly explained in the next subsection.

If the project is large, i.e., covers many local networks, the feasibility study should use a model of a local rural network or, if conditions are sufficiently variable, a set of models. The model or models must be carefully constructed to represent average conditions, ensuring that valid system design decisions and accurate cost extrapolations can be made by using them.

> ***Use of Computers***
> Computerized network analysis programs can assist in optimizing the network, provided the program is designed to accommodate the characteristics of a rural network. However, caution must be exercised in interpreting the results, if the input data are based on estimates with wide margins of error or of unknown accuracy.
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> Computers can also speed up the repetitive calculations and minimize computational errors. Recommended is a good electronic spreadsheet program on a microcomputer.

11.1 The Optimization Process

The objective of the optimization process is to find the configuration with the lowest life cycle cost over the study period. The following steps outline the procedure.

1. Describe the design under test in terms of the equipment types, quantities, capacities, and locations.
2. Estimate the implementation costs, including land, right of way, power, construction, equipment procurement, installation, and commissioning.
3. Estimate expansion costs and when, according to forecast growth, expansion is required.
4. Estimate replacement costs and residual value as applicable.
5. If changing the configuration alters any recurring costs, such as commercial power consumption or maintenance, then these costs must be estimated. Note: Any costs and incomes common to every configuration may be omitted from optimization calculations, because they do not affect the relative order when comparisons are made.
6. Prepare an annual cash flow, find the current worth of the total for each year, and sum these over the study period to find the total accumulated current worth.
7. Examine the configuration and decide whether any changes in equipment types, quantities, capacities, or locations could mean a lower cost. If so, then make the changes and begin again at Step 2. But if a minimum appears to have been found, select this lowest cost solution.

Configurations for the subscriber access system, exchange and collection point equipment, and trunk and transfer transmission system are optimized separately to minimize the number of variables that must be dealt with during calculations.