Twenty-six pictures to the top of the tree

Easily the most fascinating experiment in the current search for a comprehensive method is the graphic technique proposed last year by Marvin Manheim, an M.I.T. researcher, and Christopher Alexander, then a Harvard Fellow. Although it has only been applied so far in the form of the preliminary solution shown overleaf (to the problem of locating a stretch of the Interstate Highway System near Springfield Mass.), it has opened up some exciting new paths for the planner. The most intriguing aspect of the graphic approach is that

Technology: new graphic method gives highway planners a much needed tool for comprehensive design

it eliminates the staggering task of deriving formulas needed for the mathematical model described above.

The designer's first step in applying the graphic technique is to isolate all of the requirements he wants to satisfy in working out his solution. In the example shown, 26 separate requirements are considered—a far broader approach to the problem of location design than current engineering methods are able to provide. For each of the design requirements, a graphic representation of relative desirability is made on a transparent overlay placed on the base map of the area. A simple scale of shading is used, from white for the least desirable locations to black for the most desirable. The result is the series of 26 symbolic maps shown on the opposite page.

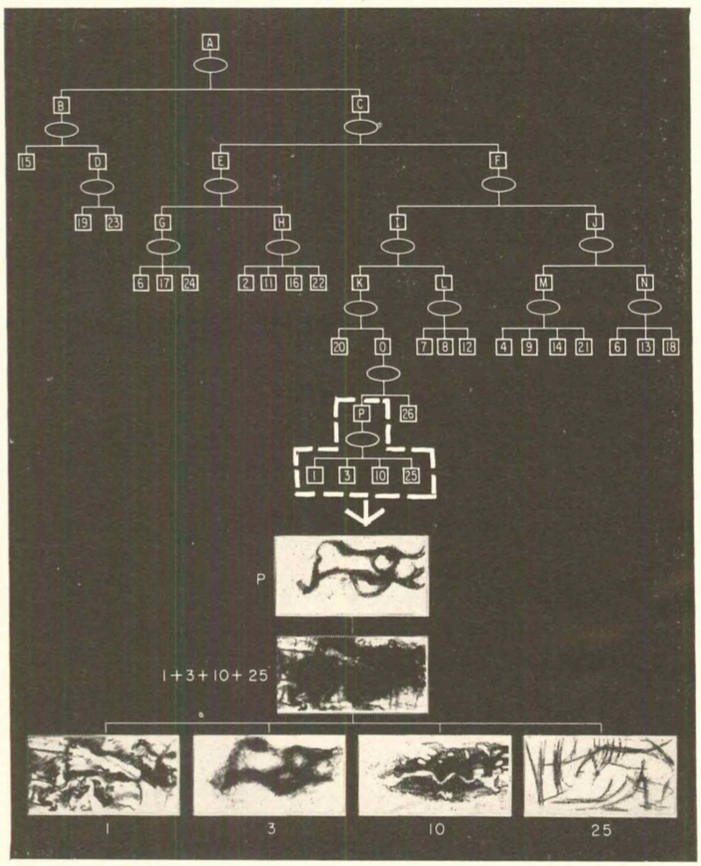
Organized by electronics, solved by eye

The next step seems almost magical, but is based on "set theory," a well established branch of advanced mathematics which Alexander applied to design problems for the first time in his doctoral dissertation at the Harvard School of Design. According to Alexander, the key to the design problem is "a set of conflicts which restrict the possible ways in which the requirements can be met simultaneously." If the designer can establish which of the requirements have inherent conflicts and which do not, he can then use Alexander's computer program (which has the imposing title: "The Hierarchical Decomposition of Systems Which Have an Associated Linear Graph") to sort out sub-groups of requirements which have the least conflict with each other. This produces the "tree" of related groups of requirements shown immediately at the right. If the designer's judgement of conflicts is correct, each of the sub-groups on the tree should be relatively easy to combine into a single solution. The difficulty of combination, of course, increases as one works his way up from the lowest level to the final solution at the top.

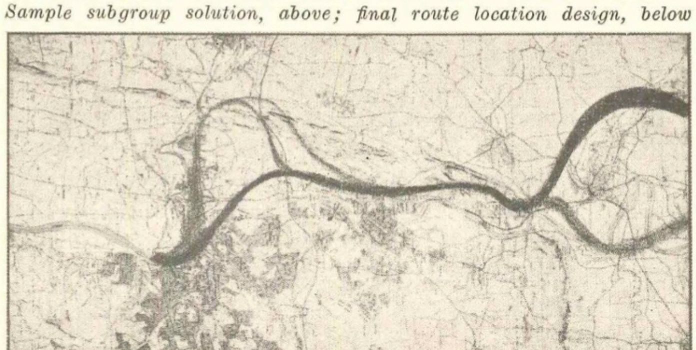
The least conflicting requirements in this problem (numbers 1, 3, 10 and 25) were combined graphically by making a composite photographic print of these four transparent overlays (oval symbol in diagram, right). By projecting this muddy combination on a drawing board, the resultant pattern of desirability was clarified in a new drawing ("P" in diagram).

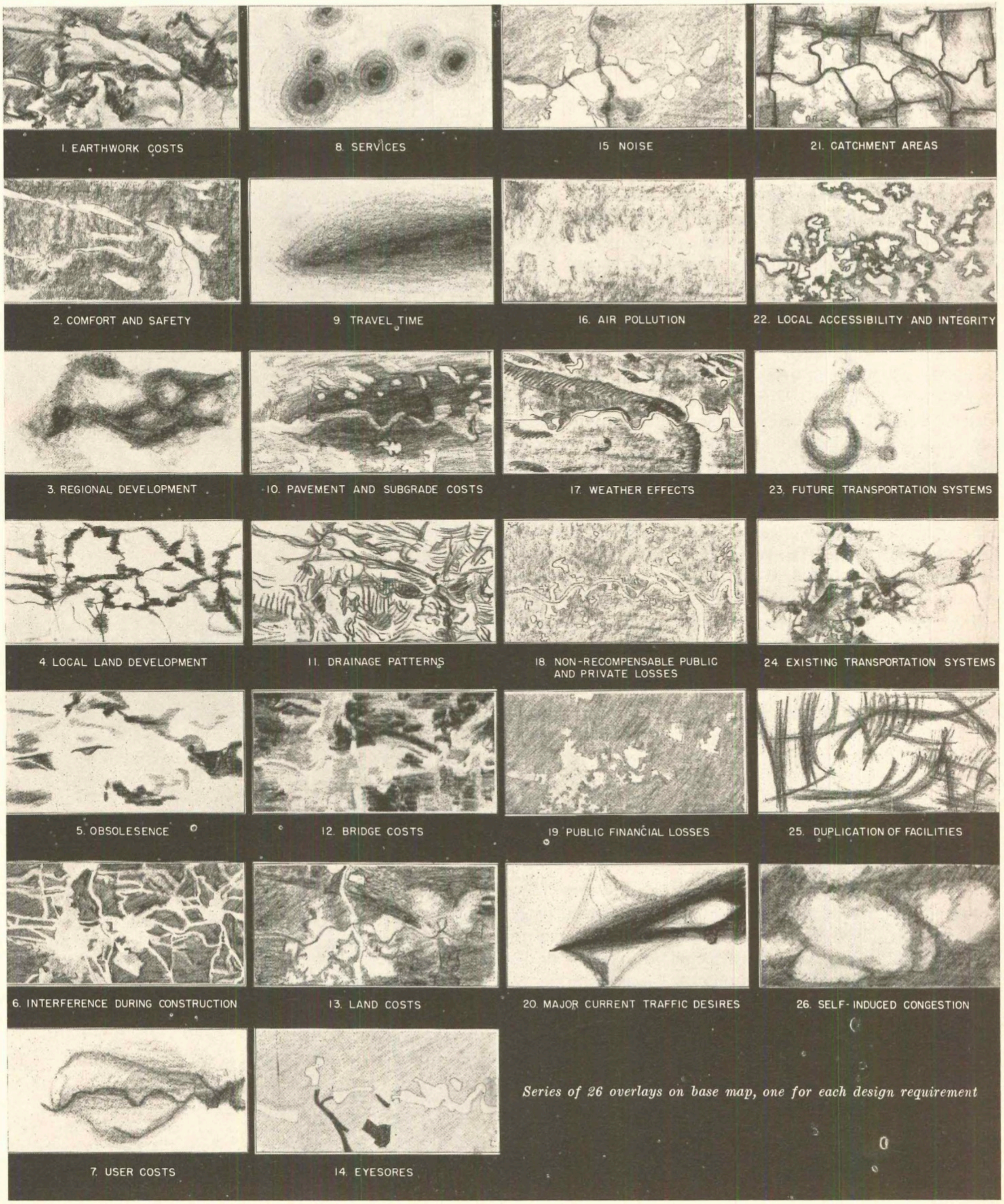
Manheim and Alexander found that it was remarkably easy for the human eye to detect the underlying common pattern in the composite print even though at first glance it might seem to be just a confusion of tones. According to the authors, the eye thus becomes in effect a "special-purpose computer" actually more powerful than any electronic device yet built. Continuing in this way, resolving a new composite photograph for every oval in the diagram, the top of the tree, pattern "A," was finally reached. This optimum location for the proposed highway, representing the simultaneous solution of all 26 requirements, is shown as a black path (along with grayer alternates) in the final area map at right.

Base map of area studied, above; diagram of design process, below



Sample subgroup solution, above; final route location design, below





Series of 26 overlays on base map, one for each design requirement