

Some Visual Aspects of Highway Design

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"It is in the vogue today to say that the highway should blend into the landscape, that it should follow natural contours, that independent alignments for each roadway of a divided highway will allow for a more esthetic and economical facility, that continuous curves should be used instead of tangents, that horizontal and vertical alignment should be coordinated to result in safer and more esthetic highways. All of these statements have merit, but . . . few designers . . . translate the words to actual design." (1)

If we are to translate the above words to the actual design of highways which are aesthetically pleasing there are two fundamental steps that must be taken:

1. The highway designer (and administrator) must be made aware of the importance of the visual aspects of his designs. He must realize that he has a responsibility for creating aesthetically (visually) pleasing designs.

2. The designer must have some tools to use or guidelines to follow in achieving a visually pleasing design; for when he becomes aware of the importance of the visual aspects of highway design he will probably ask ". . . but how do I create such designs?" Some of the answers to this question lie in the use of splines in conjunction with topographic strip maps (2, 3), the use of aerial photography and on-site visits by the designer. All of these are aids in achieving a good coordination of horizontal and vertical alignment, the providing of continuity in the design and the presentation of vistas or changing views to the road user.

Another question that is likely to follow is "How do I test the design for visually disturbing elements?" Perhaps this can be answered with a series of drawings or pictures of awkward situations and suggested techniques for steering clear of them (4, 5). Models which can be rapidly constructed may also be of help.

The authors first became aware of "visual quality" in roadway design about 1964. At that time we were driving over a section of particularly well-designed Interstate Highway in Kansas and it suddenly dawned on us that this was the first "visually-pleasing" highway on which we had ever driven. We wonder how many highway designers or civil engineers "see" the road on which they are traveling. Are they really aware of the visual discontinuities and do they see opportunities for affording the driver a refreshing change of view? (6) If the engineer is not fully aware of the visually disturbing elements in many highway designs then it is extremely doubtful that he will, other than by accident, improve on those designs. The following pictures and commentary are aimed at bringing "awareness" to the highway engineer (administrator as well as designer)—an awareness of visually disturbing elements, an awareness of opportunities for providing an interesting and pleasant experience for the road user and an awareness of such opportunities missed.



Figure 1. To appreciate more fully the value of good design it is instructive to observe a few examples of discontinuous alignment where "how it looks" was considered unimportant. A continuous curve beginning at the bottom of the slide and ending where the right lane disappears would have been a much superior design.

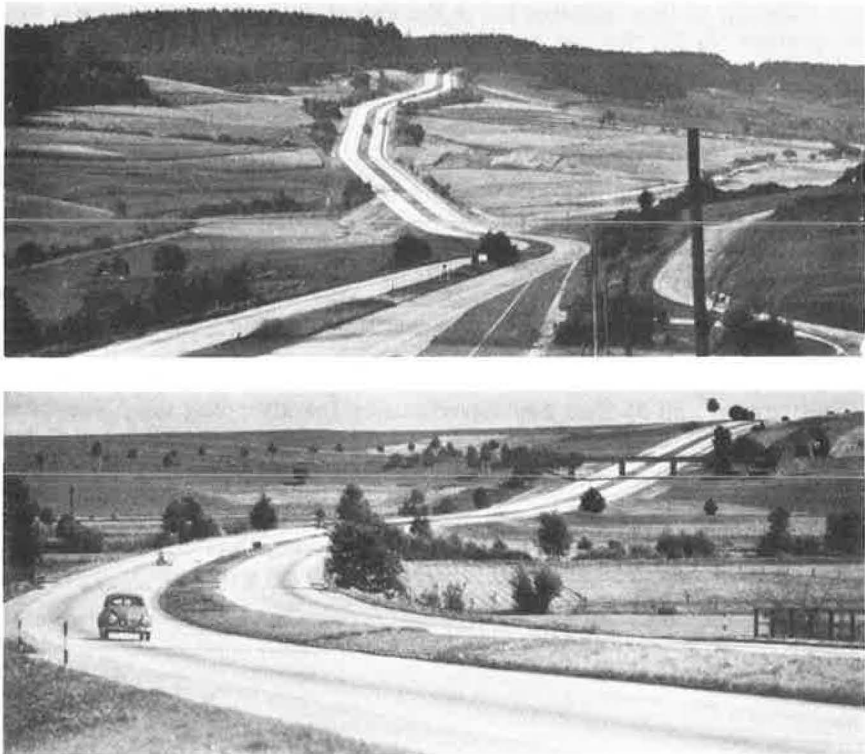


Figure 2. These contrasting photographs illustrate vividly the difference between long tangent-short curve design vs continuous curvilinear alignment. The top view gives one the impression the designer laid out each segment of highway on a separate sheet of plan paper without regard to the continuity of the entire roadway. The other highway (bottom) flows with the natural contours of the terrain with a minimum of sudden change in alignment or grade (5).

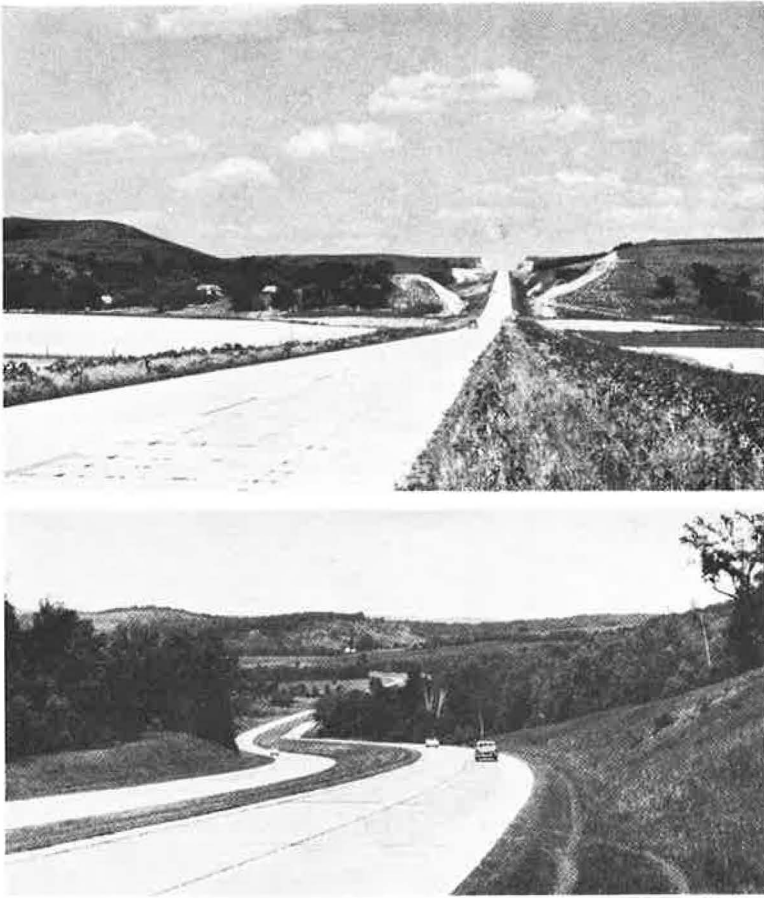


Figure 3. The AASHO Blue Book (7) states, "Alinement should be as directional as possible, but should be consistent with the topography. A flowing line that conforms generally to the natural contours is preferable aesthetically to one with long tangents that slashes through the terrain. The construction scars can be kept to a minimum and natural slopes and plant growth can be preserved." (5)



Figure 4. Because of straight alignment one often can see a long distance ahead. When this happens it is almost impossible to avoid a roller-coaster appearance. Secondly, any median width changes are difficult to conceal. Observe the width change just above the grade separation structure.



Figure 5. The Blue Book (7) states, "The 'roller-coaster' or the 'hidden-dip' type of profile should be avoided. Such profiles generally occur on relatively straight horizontal alignment where the roadway profile closely follows a rolling natural ground line. They are unpleasant aesthetically and hazardous."

The vertical alignment, which attempts to match the rather minor "humps and hollows," is not in scale with the more liberal horizontal alignment.

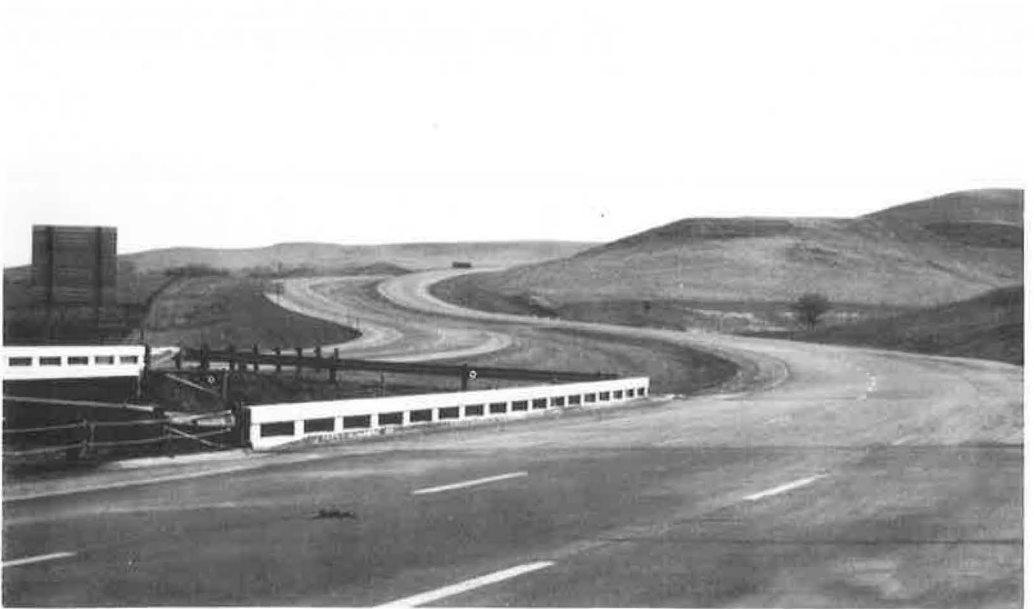


Figure 6. This example of curvilinear alignment in western Kansas enables the driver to scan the surrounding landscape without turning his head for a better view.

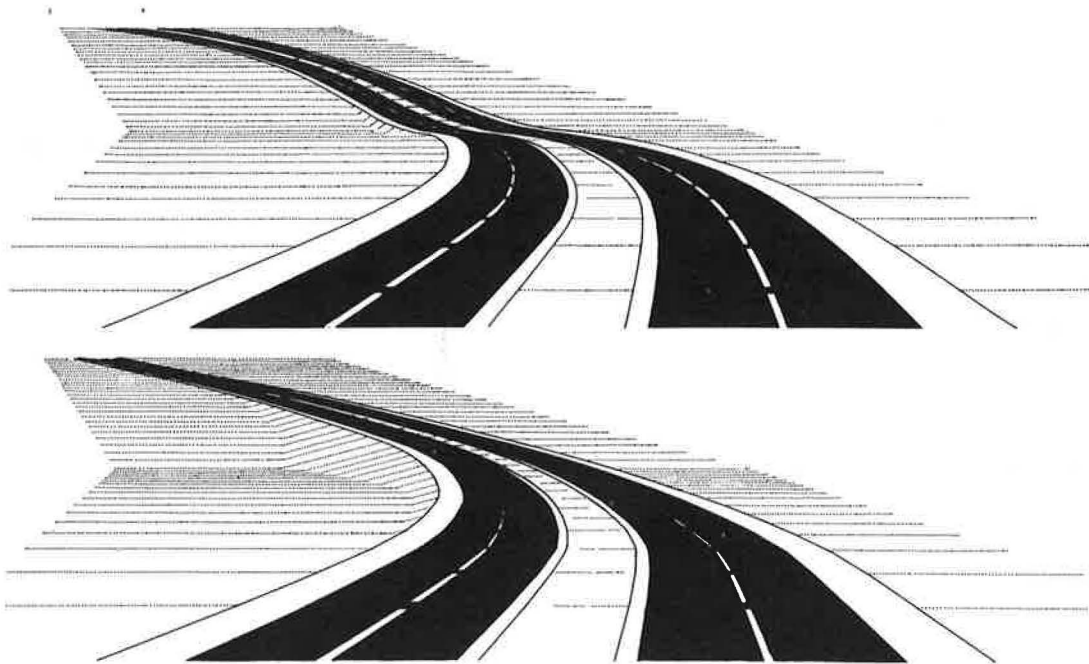


Figure 7. This drawing illustrates the effect of superimposing a short vertical curve on a relatively long horizontal curve. To eliminate the appearance of a settlement of the roadway it is necessary to increase the length of vertical curve to nearly that of the horizontal curve (5).



Figure 8. The sagging effect is clearly evident in this picture.

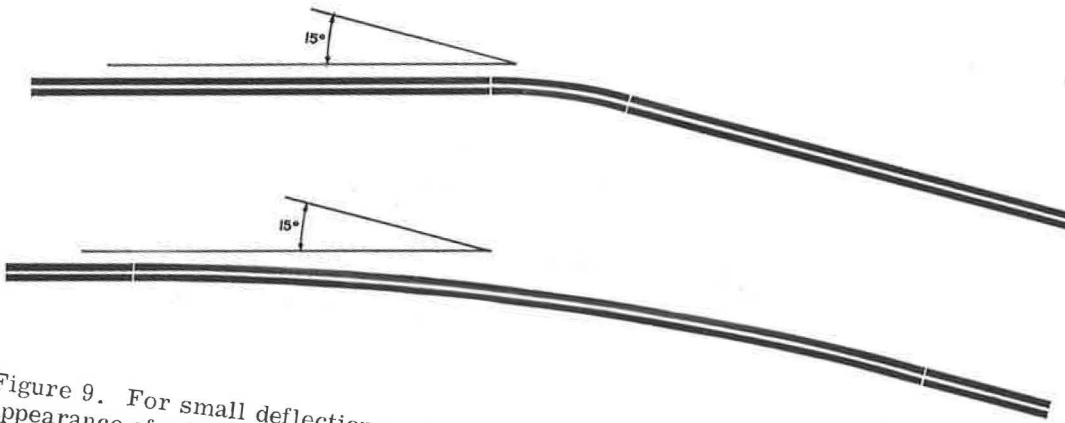


Figure 9. For small deflection angles, curves should be sufficiently long to avoid the appearance of a kink (5).



Figure 10. In this view, one has the feeling that the designer changed his mind rather suddenly and did not plan very far ahead. To avoid this, the authors believe the length of curve should be proportional to the maximum distance from which one views the curve.

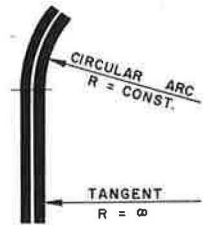
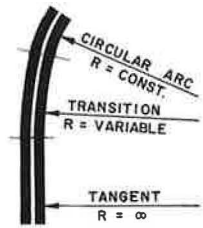


Figure 11. One effect of perspective viewing is that distant objects seem nearer than they really are. Because of this the circular curve in the lower picture appears to diverge from the tangent rather rapidly and the curve no longer seems continuous. This gives the impression the designer was unable to make the curve meet the tangent properly. To remedy this situation the use of long spirals is suggested and is illustrated in the upper picture (5).



Figure 12. The horizontal curve does not appear to be tangent to the straight alignment. In fact, it visually jerks away from the tangent alignment. The left-hand roadway does, however, give the driver a good "clue" that the road continues to the left and does not merely "fade away."



Figure 13. A long spiral beginning at the first entrance at the bottom of the hill and ending near the position of the truck would have improved the appearance of this curve.

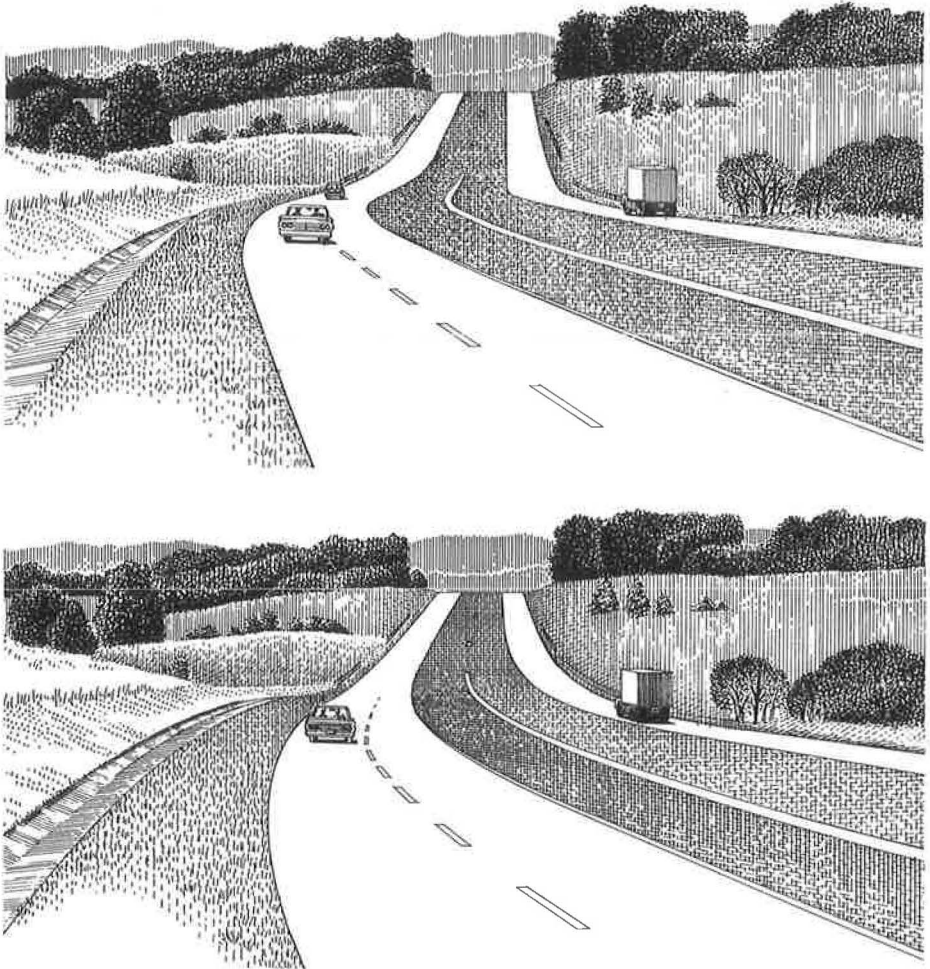


Figure 14. Short vertical curvature at the end of a long horizontal curve will usually produce a warped appearance. This situation can be improved by using a longer vertical curve than otherwise would be needed (5).



Figure 15. A short vertical curve at the beginning of a horizontal curve. Again, this is not a well-balanced design.



Figure 16. Almost in trouble, visually.

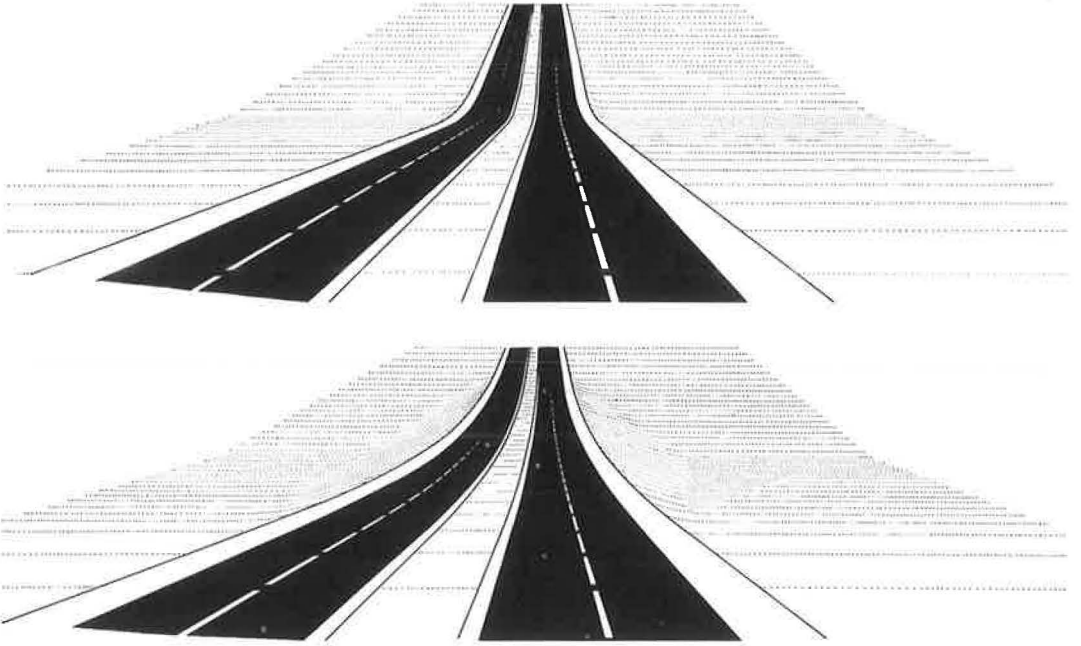


Figure 17. When the relatively short vertical curve in the upper picture is viewed from some distance away the transition from downgrade to upgrade appears rather abrupt. The alternatives to this design are longer vertical curves and/or curvilinear alignment to shorten the "long look" ahead (5).



Figure 18. The curve at the bottom of the hill is too short when viewed from this distance.



Figure 19. From an intermediate point the curve is only a little too short.



Figure 20. From this position the length of vertical curve is about right.



Figure 21. Because the vertical curve is too short, the left edge of the pavement forms a V at the bottom of the hill.

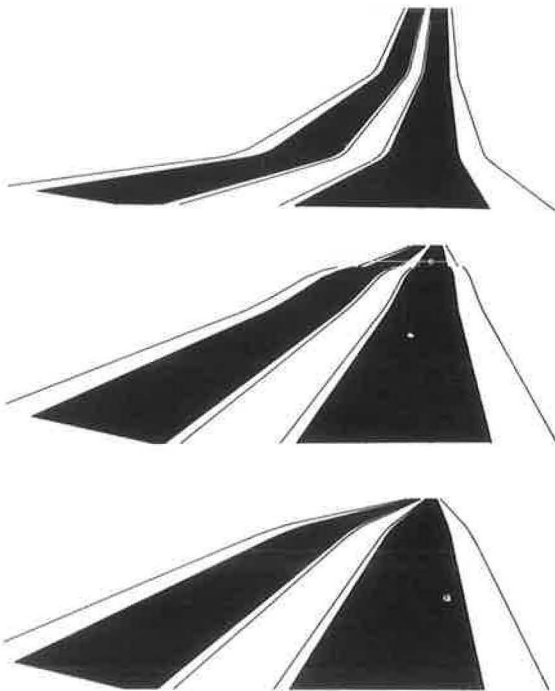


Figure 22. The broken-back arrangement of curves (flat back, or short tangent between two curves in the same direction) should be avoided (5).



Figure 23. A "broken-back" vertical alignment.



Figure 24. More common: the broken-back with small grade changes. This type of design destroys the flowing continuity of a high speed highway. Note the jerk in horizontal alignment.

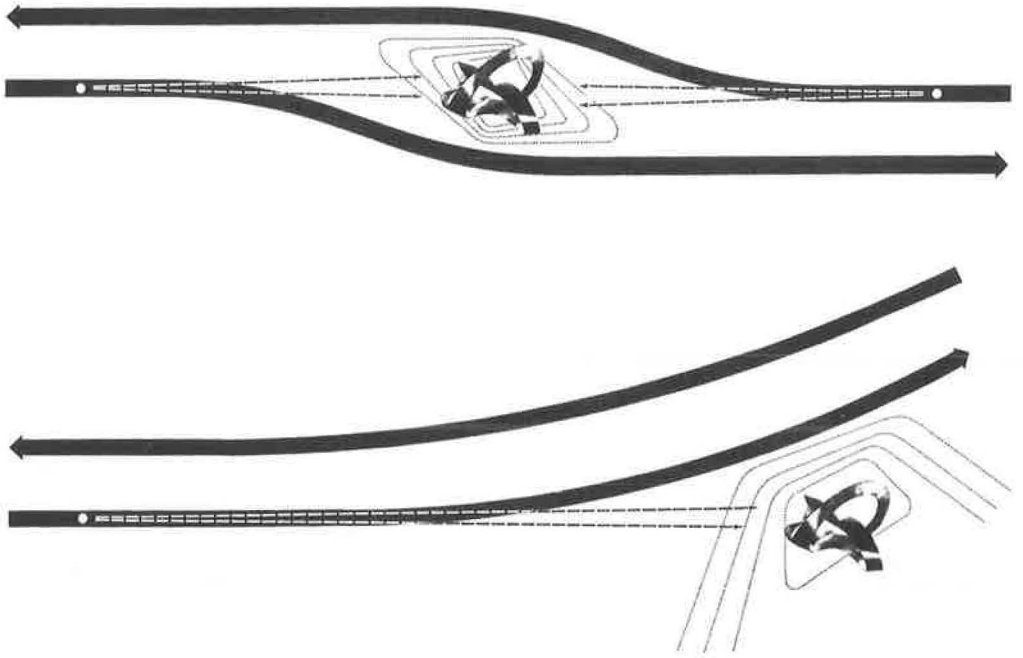


Figure 25. Pushkarev suggests that the road should aim the eye toward distant vistas (5).



Figure 26. An abandoned farmstead placed within the driver's view by the county road alignment.

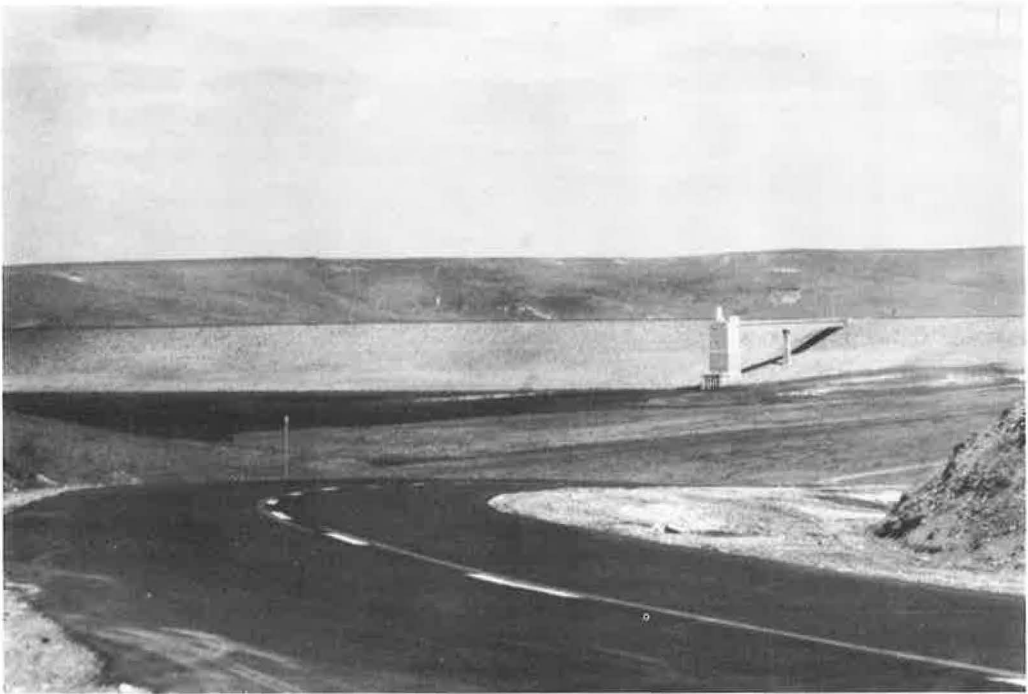


Figure 27. First sight of the lake!



Figure 28. Whether a highway or a structure has a pleasing appearance depends somewhat on the point of view. Observe the next sequence of pictures, all of the same bridge and taken from a road which passes under the bridge to a reservoir recreational area. This appears to be a structure well-fitted to the location.



Figure 29. Another view—a graceful bridge until we look far right.



Figure 30. There appears to be little reason for changing to the concrete bridge on the right.



Figure 31. By changing from one type of bridge construction to another, the number of piers was nearly doubled—the continuity of this design was lost (8). Also lost was the opportunity to provide a striking picture of civil engineering creativity for the thousands of reservoir visitors who will pass under this bridge and view it from near and from afar.



Figure 32. This figure and the next three show the interesting aspects of a roadway from which the view is somewhat restricted at first and then opens up overlooking a valley where the view is comparatively unlimited.



Figure 33. A clue to where we're going—is that our road in the far distance?



Figure 34. The eye skims across the promise of a valley to the road far ahead. A water tower helps attract the eye.



Figure 35. The view is shortened and we're looking into a wide pleasant valley. The road ahead points to the left for driver guidance. Perhaps a longer vertical curve would have made this view even more pleasing.

It seems a shame that such a sequence of views to the driver should occur by chance rather than by design!



Figure 36. And finally—it doesn't have to be like this.

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