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Rate of Meander Development as Exhibited by Two Streams in Story County, Iowa*

By KEITH M. HUSSEY AND H. L. ZIMMERMAN

During the winter of 1950 Mr. Zimmerman undertook the study of the drainage of western Story County. His first concern was that of an adequate base-map. This problem he solved by tracing the drainage from air photos of the area involved in the study. It was during this phase of the research that we discovered the full-scale working-model of some of the very experiments conducted by the Army Engineers at Vicksburg, Mississippi.

The experiments were in effect detailed studies of the causation of meandering in rivers. Scale models of various situations were carefully constructed, then tested and the results noted and discussed in a report written by Captain J. F. Friedkin. Among the factors so tested was the effect of the initial angle of attack, or alignment of the flow of water into a straight channel, on the size of meanders (bends) developed. It was found that as the angle of attack increased, the length of the meander (bend) decreased and its width increased; that is, the greater the angle of attack the shorter were the radii of the meanders (bends) which developed. A sketch made from a photo of one of the experimental models is shown in Figure 1. Here is shown the modeled channel with a

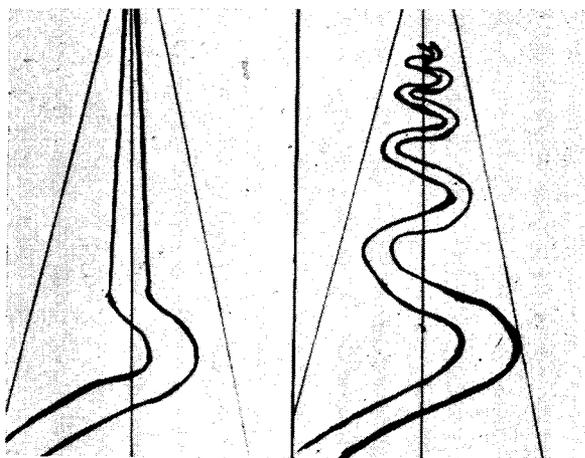


Figure 1.

*This paper was read at the 1952 session of the Iowa Academy of Science.

sharp bend (angle of attack) at the upstream end before the water was turned into it and the resultant pattern of bends after a flow of three hours duration.

In the course of our drainage study we noted, on the photos, that sections of the Skunk River and Squaw Creek south and east of Ames had been artificially straightened as shown in Figure 2 (note the similarity to Fig. 1). As nearly as we were able to determine, the straightening was done just prior to 1914. The photos also revealed that both streams had developed a new series of bends or incipient meanders as shown in Figure 3A, which was made from

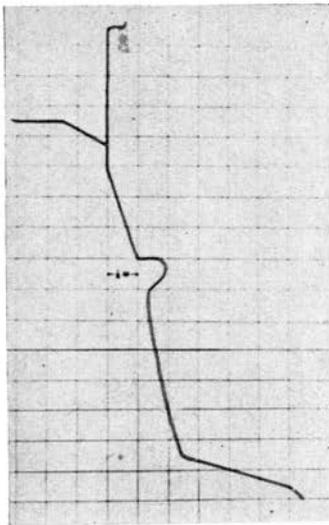


Figure 2.

photos taken in 1939. We were struck by the similarity of this pattern of new bends developed by the streams to those of the models in Friedkin's report. Note, for instance, the difference in the radii of the bends and their relation to the initial angle of attack which was provided by straightening only sections of the streams.

With the appreciation of the fact that we had in effect a controlled study of the rate of meander development, we endeavored to get some measure of the amount of change which had taken place since 1939. We made four photo flights before

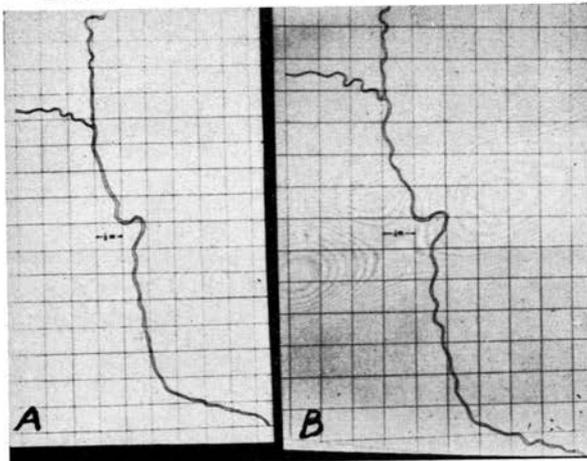


Figure 3A and 3B.

obtaining satisfactory pictures. The present-day situation is shown in Figure 3B. Note here that the bends are approaching the character of true meanders and have migrated downstream; and that there is a progressively greater contrast between the stage of development of the different series of bends than in the 1939 stage. Thus it is shown that the initial advantage has an increasingly important effect on the rate of meander development as the process proceeds towards its logical conclusion.

Figure 3 shows the 1939 and 1952 stages side by side to make for comparison of the changes developed in that period of thirteen years. Figure 4 is a reproduction of one of the 1952 photos. It shows some of the old (pre-1914) meandering courses of the two streams, traces of the old straightened channels, and the modern course of each stream. Where will they be in another thirteen years?



Figure 4.

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