

turn back to the bluff it has left, before reaching the opposite one ; its course is in this case very irregular, and for more than 100 miles it will sometimes fail to cross the bottom land. Such is the case where the Missouri forms the boundary line between Iowa and Nebraska, the river keeping near the Nebraska bluff almost the entire distance.

The most favorable location for a bridge is just below one of the great bends, especially if the current of the river there impinges upon a rocky shore. Under these circumstances the bed rock, to which the foundations of the channel piers must in general be carried, is found at a comparatively small depth on the bluff side, while the piers on the opposite sand bar can often be founded safely without going to any very great depth ; a moderate stone protection above the bridge will also suffice to secure permanency of channel. The least desirable location is on a long straight reach, especially if bordered on both sides by the low alluvial banks of the bottom land. The bed rock will then usually be found only at great depth, and the current veins are very variable, making it necessary to found all piers at the full depth, and largely increasing the expense and complications of shore protections, as well as requiring a greater length of bridge.

Though the current is too strong to allow the Missouri to freeze directly across, the ice forms rapidly along the banks in cold weather, and a single frosty night will suffice to fill the river with loose cakes of soft ice, which have broken off from the shores. If the weather continues cold, these cakes, rounded by constant attrition and increasing in strength and thickness as they float, freeze to each other, and, finally jamming at some narrow or obstructed point, pack together, and close entirely across, sometimes gorging to the bottom of the river. At Kansas City the river usually closes in this way in December, and continues closed till February, when the ice is sometimes found to be as much as two feet thick ; there is, however, little regularity about it, the river having, in some winters, remained open through the whole season, and in others closing and breaking up several successive times. The river is always low when frozen, and if the ice is left to rot by the warmth of the sun, unaccompanied by rains, it breaks up quietly, and with a slow current ; the force of the shove, even in this case, however, is enough to do very serious injury to