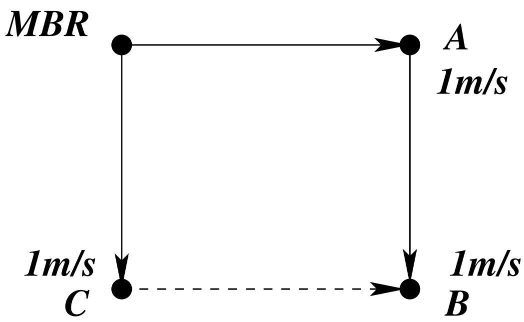
Head-Loss Calculations

Question: Gudwanwadi, of population 400, is to be served by a piped water supply scheme which will provide 40 liters per person per day. The supply is to come from a source 10km away from a tank which is about 20m above Gudwanwadi. The supply comes in a pipe with cross-section 20 sq.cm. The head-loss in this pipe is roughly 2m per km. per meter/sec of velocity of water through the pipe. If the water to Gudwanwadi is to be delivered in 6hrs, what is the head available at Gudwanwadi?

Answer The desired water is $40 \times 400 \times 1000 = 16 \times 10^6$ cu.cm. This has to be achieved in 6hours$= 6 \times 3600 = 21600$ seconds. Thus the volume flow is $16 \times 10^6/21600 = 740.74$ cu.cm/s. Thus the velocity in the pipe is $740.74/20 = 37.04cm/s$, i.e., $0.38m/s$. Thus the head-loss is $0.38 \times 2 \times 10 = 7.6m$. Thus, the net head available at Gudwanwadi is $20 - 7.6 - 13.4m$.

Here is another problem. Consider the towns A,B,C served by an MBR. Assume that all head-loss coefficients are 1, the demand is at 1m/s, and that the distance between the towns is 10km.



Without the link CB, we see that the flows in MBR-A is 2m/s, while all others have a flow of 1m/s. Thus the head loss at A is 20, at B is 30 and at C is 10. However, if we add the link CB, we see that the head-loss at A and C become 15, and at B, it becomes 20. Perhaps, this may be more acceptable than raising the MBR.