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 $740.74/20 = 37.04$ cm/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.