to admit of the passing of boats, or, of boats moving simultaneously in it, in opposite directions. Two tow paths would in this case be necessary; one or either side, rather than one on one side, sufficiently wide to allow the horses to pass—such tunnels being very dark, such an arrangement would probably best avoid confusion. The water way between the tow-paths to be 30 feet clear, the tow-paths severally 4½ feet in width. These tow-paths not to be solid but to consist of massy flags connected with the walling and resting outside on frequent supports of stone or otherwise. The two tow-paths can be made sufficiently substantial in this way and the water extending thus underneath the tow-paths immediately to the side walls will in proportion to this additional width of water, afford a freer and easier passage to the boats. The whole width of water surface will therefore be 39 feet, the depth of water 6 feet, the bottom covered with concrete and paved; the arch stones 2 feet in depth, the shafts situated six hundred feet apart and thirty feet away from the side of the tunnel. The expense of these shafts has been estimated at $40 per foot of depth, being the cost of those sunk on the tunnel of the Chesapeake and Ohio Canal; and the proportion given for shafts in the detail below is founded on this estimate.

A single tunnel would not well accommodate the trade on which your estimate of the supply of water is predicated. Our longest tunnel is 8400 feet in length. For the wide tunnel described, the rate of movement of a boat would not probably exceed 1½ miles an hour. In a single tunnel it certainly would not exceed 1¼ mile per hour. This would equal 76.3 minutes expended in the passage and with single boats passing alternately day and night, would only admit of 9 passages each way: to cover (as assumed by you) 80 passages each way, the boats therefore would have to move in large fleets of 9 each way, nor could such fleets pass in the time I have estimated for the passage of a single boat. To afford the trade proper facilities double tunnels would necessarily be called for.

The excavation even through very compact rock, for a width of tunnel necessary to allow boats to pass in it (47 feet at least, including the side walls) would be very hazardous. No tunnel of such dimensions, exists that I am aware of. On such a width an immense mass of rock is exposed without support and should its natural tenacity be exceeded by the weight of the exposed mass, any depth of masonry or arch which we can construct there would, we should imagine, be crushed. I should therefore suppose that in practice it would be more prudent to construct two single tunnels, under the circumstances, although in an estimate (into which hazard of this description cannot enter) the cost of the two single tunnels would exceed that of the double one. Were single tunnels constructed in a case of this kind, whenever a very hard and tenacious vein of rock was encountered, arching might probably be dispensed with.

The slate rocks which would occur in the tunnel in question seem to crumble on exposure to the weather, and in that case a lining of