

Driven in a stage coach with perfect safety, when descending in as fast a trot as they can go; because, in such a case, the coachman can preserve his command over them, and guide and stop them as he pleases. For this reason it may be taken as a general rule, in laying out a new line of road, never if possible, to have a greater inclination than that of 1 in 35. Particular circumstances may, no doubt, occur, to require a deviation from this rule; but nothing except a clear case that the circuit to be made to gain the prescribed rate would be so great, as to require more horse labour in drawing over it, than in ascending a greater inclination, should be allowed to have any weight in favour of departing from this general rule. On any rate of inclination greater than 1 in 35, the labour of horses, in ascending hills is very much increased.

Hilly ground is not always to be avoided as being unfit for a road; for, if the hills are steep and short, it will often be easier to obtain good inclinations, or even a level road, by cutting down the summits, and laying the materials taken from them in the hollow parts. But this must be regulated by the expense to be incurred, which is a main consideration, that should always be scrupulously attended to before an engineer decides upon the relative merit of several apparently favourable lines. A perfectly flat road is to be avoided, if it is not to be raised by embanking at least three or four feet above the general level of the land on each side of it, so as to expose the surface of it fully to the sun and wind; for if there is not a longitudinal inclination of at least 1 in 100 on a road, water will not run off; in consequence of which, the surface, by being for a longer time wet and damp, than it otherwise would be, will wear rapidly away, and the expense of maintaining it in order will be very much increased.

The great fault in hilly countries is, that after they ascend to a considerable height, they constantly descend again before they gain the summit of the country which they have to traverse; in this way the number of feet actually ascended is increased many times more than is necessary if each height, when once gained, were not lost again.

In tracing a road across a deep valley between two hills, it should be carried in a direction opposite to the fall of the valley, as by so carrying it, that is by crossing the valley at the highest practicable point, the descent and ascent are diminished. Although this is the general principle, instances may occur, where a valley may be crossed with more advantage down stream; as, for instance, if the sides of a valley contract considerably, it may require much less embankment to raise the road to the same height, than if it were carried higher up the valley. Another instance where a valley may be crossed with more advantage down stream, is where detached or insulated hills are situated in the valley below the straight line of direction.

In many instances, particularly in mountainous countries, it will be found necessary to pass valleys or deep ravines by means of high arches of masonry, as in some parts of Scotland, where Mr. Telford has erected several great works of this description.

In most cases, however, valleys may be crossed by high embankments of earth, such as the earthen mound across the North Loch valley, between the Old and New Town of Edinburgh.

The peculiar circumstances of a river may render it necessary to deviate from a direct line in laying out a road. A difficulty may arise from the breadth of a river requiring a bridge of extraordinary dimensions, or from the land for a considerable distance on the sides of the river being subject to be covered with water to the depth of several feet in floods.

In these cases it may appear, upon accurately calculating and balancing the relative inconvenience and expense of endeavouring to keep a straight line and of taking a circuitous route, that upon principles of security, convenience, and expense, the circuitous course will be the best.

In general, rivers have been allowed to divert the direct line of a road too readily.—There has been too much timidity about incurring the expense of new bridges, and about making embankments, over flat land, to raise the road above the level of high floods.

These apprehensions would frequently be laid aside, if proper opinions were formed of the advantages that arise from making roads in the first instance, in the shortest directions, and in the most perfect manner. If a mile, half a mile, or even a quarter of a mile of road be saved by expanding even several hundred pounds, the good done extends to posterity, and the saving that will by the result be made, in annual repairs and horse labour, will, before long, pay off the original cost of the improvement.

The elastic nature of all bogs and marshes, and of all boggy and bottom land, makes it impossible to form a road of perfect hardness over a soil of this kind, unless a great deal of labour and expense is applied in draining the soil, and afterwards compressing it, by

loading it with large quantities of earth embanked upon it, in order to destroy the elasticity of the soil.

For this reason it will generally be prudent to deviate from the direct line in laying out a new road, if by doing so this sort of subsoil can be avoided, without adding much to the length of it. But when the additional length of the road would be considerable, it will then be necessary to incur the expense of a proper drainage, and of forming so high an embankment, as to compress and harden by its weight, the moist and porous soil; such an embankment, of 1740 yards in length, having this object in view, was made over Maldreath Marsh, in the Island of Anglesen, on the new line of the Holyhead Road.

It will sometimes happen that the road materials can be better obtained by carrying a line of road in one direction than another, this will be a good reason for making a road deviate from the direct line, because the expense of making and repairing it will much depend on the distance which the materials have to be carried.

It is necessary in making a road through a hilly country, to take particular care to give it a proper aspect. It is a great advantage to have the road on the north side of a valley fully exposed to the sun. For the same reason, all woods, high banks, high walls, and old fences, ought to be avoided, in order that the united action of the sun and wind may have full power to produce the most rapid evaporation of all moisture.

Too much attention cannot be bestowed on this object, in consequence of the effect of water in contributing to eat down and wear down the hardest substances.

It is for this reason that road materials, when they are wet and damp, wear rapidly away under the weight and pressure of heavy carriages. The hardest limestone wears very quickly away when wet, and all stones of an aluminous character, and also gravel that consists of flint, sandstone, or other weak pebbles.

The great advantage of having a road perfectly exposed to the action of the sun and wind, will be more accurately conceived, by referring to writers of science on evaporation. Dr. Halley states, that one tenth of an inch of the surface of the sea is raised per diem in vapour. He also says, that the winds lick up the water somewhat faster than it exhales by the heat of the sun. Other writers say, the dissipation of moisture is much accelerated by the agency of sweeping winds, the effects being sometimes augmented five to ten.

Trees are particularly injurious, by not allowing the sun and wind to have free action on the surface of roads in producing evaporation. Besides the benefit which a road receives from its drying rapidly, by an open exposure to the atmosphere, there is another of great importance, namely, that of affording to horses the advantages of free respiration; for it is well known that the powers of a horse to perform work with ease, particularly when moving rapidly, depends upon the quantity of cool and fresh air that he can pass through his lungs. If the cause of horses tiring or becoming ill under their work, be carefully examined into, it will often be found that it is not their muscles or limbs that fail them, but their wind; and therefore it is particularly important to have a road so circumstanced, that a horse may, on all points of it, have the benefit of a free current of air.

It may sometimes be proper to make a road deviate from a straight line, in order to go through a town; but the expediency of such a deviation must wholly depend on the general object of the road. If it be intended to expedite the communication between two places of great trade or otherwise of great importance, then nothing can be more erroneous than allowing the general line of road to be taken from the best and shortest direction in order to pass through a town. It is for this reason that little attention should be paid to the opposition of inhabitants of towns to new roads when to be made for the advantage of the general communication of distant and important parts of the country. After fixing upon a general line of road with respect to its direction, the precise line of it must be marked out, according to the smaller acclivities and declivities of the natural surface of the country it is to pass over.

As moderate curves add but little to the length of a road, they will not be objectionable, if they assist in the inclination and expense. [To be concluded.]

A wise man desires only what he can gain justly, use soberly, distribute frugally and subsist on decently.

The three things most difficult, are, to keep a secret, to forget an injury, and to make good use of leisure.

We are desirous of having well printed bibles; the best impressions are on the tablets of the believer's heart.

[FOR THE BEE.]

MR. EDITOR,

SIR,—Having lately heard many persons and some of them persons whom I supposed to possess some information, avowing it to be their belief that the inferior animals do not possess Reason; and believing that by such an opinion, gross injustice is done to a very numerous and respectable class of our fellow beings, I have been induced to offer a few remarks upon this subject.

Reason, as it appears in human beings, is generally understood to be that faculty by which we deduce conclusions from facts or evidence formerly known. From this definition, it must be evident to every person who thinks upon the subject, that without this principle, nearly all our Intellectual Powers, together with the knowledge which we acquire by their means, would be useless; thus, if I put my hand into a fire, it is burned and I feel pain; but, if I had not reason, I would feel as little reluctance to put my hand into the fire a second time as I had felt to put it in at first. I might indeed remember that my hand had been burned, but without reason I could not conclude that the same effect would be produced by again putting my hand into the fire. Applying this to the inferior animals, we find that any of them, if it be injured by anything, never again willingly exposes itself to the operation of the same cause. This then proves that the inferior animals possess, at least, a small degree of reason; but I think that it can also be shown that they exercise this principle to a still greater extent and even that their reason is little inferior to that of men. This I shall endeavour to do by a few examples derived from well authenticated "Anecdotes of Dogs," as I conceive that these animals have had better opportunities of improvement than most others.

"In the neighbourhood of Cupar, in the country of Fife, there lived two dogs, mortal enemies to each other, and which always fought desperately whenever they met. The master of our hero was Captain R. the other belonged to a neighbouring farmer. One of these animals was in the practice of going messages, and even bringing butchers' meat and other articles from Cupar. One day, while returning charged with a basket containing a joint of mutton and several other pieces of meat, he was waylaid and attacked by some of the curs of the town, which, no doubt, thought the prize worth contending for. The assault was fierce and of some duration, during which our messenger prostrated divers of his antagonists; but he was at length overpowered and compelled to yield up the basket, though not before he had secured a part of its contents. The piece saved from the wreck he then ran off with at full speed to the quarters of his old enemy, at whose feet he laid it down, stretching himself beside him until he had eaten it up! A few snuffs, a few whips in the ear, and other dog-like contumacies were then exchanged; after which they both set off together for Cupar, where they worried almost every dog in town, and what is more remarkable, they never afterwards quarrelled, but were always on friendly terms."

This dog having had his meat stolen by the curs, entertained deliberate resentment against them; having been accustomed to fight with the other dog, and knowing his prowess, he concluded, that though, when alone, he was unable to worry the curs, when assisted by this auxiliary, the feat might be accomplished; he therefore secured a portion of the mutton, and having, by this offering, appeased the enmity of his former antagonist; he obtained his assistance, and thus accomplished the end which he had in view. This in man would be called Reasoning from Experience.

"A dog which was several weeks under the care of Mr. Blaine, in the Infirmary attached to his premises, was visited every Sunday by its master, who could not find leisure to see it at any other time. Though no alteration was made in the treatment of the dogs in general, nor was any thing particular done to himself that day, yet this faithful animal knew perfectly well when Sunday morning arrived. Taking his station at the door he did not leave it for one moment, till his master had paid his accustomed visit. This was so well marked, and occurred so regularly every Sunday, and on that day only, that no possible doubt could be entertained as to the fact."