mons is of local interest merely, and many of the statements would find no application with us: a part even of the report of the committee might, perhaps, have been omitted, or have been condensed, without injury to the interests of our readers; we have, however, preferred to insert it unimpaired.

The inquiry with which this committee was charged grew out of representations made by those interested in the new application of steam to locomotion, in relation to the heavy tolls imposed upon their carriages on the different turnpikes. The subject, as referred to the committee, took, however, a wider range than that of a mere inquiry in relation to the tolls. The objects of examination were, first, in relation to the tolls which ought to be imposed upon coaches and other vehicles propelled by steam or gas upon turnpike roads, together with the tolls at present imposed; second, in relation to the present state and future prospects of this application to locomotion upon common roads, with the probable utility resulting to the public from such an application.

We purpose first to give the report of the committee, and afterwards, by extracts from the minutes of evidence, and condensed views of the more interesting parts of it, to put our readers in possession of the material facts developed in the examination.

Report of the Committee on Steam Carriages. CHARLES D. O. JEPHSON,
Chairman.

"The committee proceeded, in the first instance, to inquire how far the science of propelling carriages on common roads by means of steam or mechanical power, had been carried into practical operation; and whether the result of the experiments already made had been sufficiently favourable to justify their recommending to the House that protection should be extended to this mode of conveyance, should the tolls imposed on steam carriages, by local acts of parliament, be found prohibitory or excessive.

"In the progress of their inquiry, they have extended their examination to the following points, on which the chief objections to this application of steam have been founded, viz. - the insecurity of carriages so propelled, from the chance of explosion of the boiler, and the annoyance caused to travellers, on public roads, by the peculiar noise of the machinery, and by the escape of smoke and waste steam, which were supposed to be inseparable accompaniments.

"It being also in charge to the committee, 'to report upon the proportion of tolls which should be imposed upon steam carriages,' they have examined several proprietors of those already in use, as to the effect produced on the surface of roads by the action of the propelling wheels.

"As this was too important a branch of their inquiry to rest entirely on the evidence of individuals, whose personal interest might have biased their opinions, the committee also examined several very scientific engineers, by whose observations, on the causes of the ordinary wear of roads, they have been greatly assisted.

"The committee were directed also to report 'on the probable utility which the public may derive from the use of steam carriages.' On this point they have examined a member of the committee, well known for his intelligence and research on subjects connected with the interests of society, and they feel that they cannot fulfil this part of their instructions better than by merely referring the house to the evidence of Colonel Torrens.

"These inquiries have led the committee to believe that the substitution of inanimate for animal power, in draught on common roads, is one of the most

important improvements in the means of internal communication ever introduced. Its practicability they consider to have been fully established; its general adoption will take place more or less rapidly, in proportion as the attention of scientific men shall be drawn, by public encouragement, to further improvement.

“Many circumstances, however, must retard the general introduction of steam as a substitute for horse power on roads. One very formidable obstacle will arise from the prejudices which always beset a new invention, especially one which will at first appear detrimental to the interests of so many individuals. This difficulty can only be surmounted by a long course of successful, though probably unprofitable experiment. The great expense of the engines must retard the progress of such experiments. The projectors will, for a long period, work with caution, fearing not only the expense incurred by failure, but also that too sudden an exposure of their success would attract the attention of rivals. It is difficult to exemplify to the house how small and apparently unimportant an adaptation of the parts of the machinery, or of the mode of generating or applying the steam, may be the cause of the most rapid success; yet he who, by a long course of experiments, shall have first reached this point, may be unable to conceal the improvement, and others will at once reap the benefit of it.

“The committee are convinced, that the real merits of this invention are such, that it may be safely left to contend with these and similar difficulties; there are others, however, from which the legislature can alone relieve it. Tolls, to an amount which would utterly prohibit the introduction of steam carriages, have been imposed on some roads; on others, the trustees have adopted modes of apportioning the charge which would be found, if not absolutely prohibitory, at least to place such carriages in a very unfair position as compared with ordinary coaches.

“Two causes may be assigned for the imposition of such excessive tolls upon steam carriages. The first a determination on the part of the trustees, to obstruct, as much as possible, the use of steam as a propelling power; the second, and probably the more frequent, has been a misapprehension of their weight and effect on roads. Either cause appears to the committee a sufficient justification for their recommending to the house, that legislative protection should be extended to steam carriages with the least possible delay.

“It appears from the evidence that the first extensive trial of steam as an agent in draught on common roads, was that by Mr. Gurney, in 1829, who travelled from London to Bath, and back, in his steam carriage. He states, that although a part of the machinery which brings both the propelling wheels into action when the full power of the engine is required, was broken at the onset, yet that, on his return, he performed the last eighty-four miles, from Melksham to Cranford bridge, in ten hours, including stoppages. Mr. Gurney has given to the committee very full details of the form and power of his engine, which will be found in the evidence.

“The committee have also examined Messrs. Summers and Ogle, Mr. Hancock, and Mr. Stone, whose steam carriages have been in daily use for some months past on common roads. It is very satisfactory to find that, although the boilers of the several engines described, vary most materially in form, yet that each has been found fully to answer the expectation of its inventor. So well, in fact, have their experiments succeeded, that in each case where the proprietors have ceased to use them, it has only been for the purpose of constructing more perfect carriages, in order to engage more extensively in the business.

“When we consider that these trials have been made under the most unfavourable circumstances—at great expense—in total uncertainty—without any of those guides which experience has given to other branches of engineering—that those engaged in making them are persons looking solely to their own interests, and not theorists attempting the perfection of ingenious models—when

we find them convinced after long experience, that they are introducing such a mode of conveyance as shall tempt the public, by its superior advantages, from the use of the admirable lines of coaches which have been generally established—it surely cannot be contended that the introduction of steam carriages on common roads is, as yet, an uncertain experiment, unworthy of legislative attention.

“Besides the carriages already described, Mr. Gurney has been informed that from twenty to forty others are being built by different persons, all of which have been occasioned by his decided journey in 1829.”

“The committee have great pleasure in drawing the attention of the house to the evidence of Mr. Farey. His opinions are the more valuable from his uniting, in so great a degree, scientific knowledge to a practical acquaintance with the subject under consideration. He states that he has ‘no doubt whatever but that a steady perseverance in such trials will lead to the general adoption of steam carriages;’ and again, ‘that what has been done proves to his satisfaction the practicability of impelling stage coaches (by steam,) on good common roads, in tolerably level parts of the country, without horses, at a speed of eight or ten miles per hour.’

“Much, of course, must remain to be done in improving their efficiency; yet Mr. Gurney states that he has kept up steadily the rate of twelve miles per hour; that ‘the extreme rate at which he has run is between twenty and thirty miles per hour.’

“Mr. Hancock ‘reckons that, with his carriage he could keep up a **speed of ten miles per hour**, without injury to the machine.’

“Mr. Ogle states ‘that his experimental carriage went from London to Southampton, in some places, at 3 velocity of from thirty-two to thirty-five miles per hour.’

“‘That they have ascended a hill rising one in six, at sixteen and a half miles per hour, and four miles of the London road at the rate of twenty-four miles and a half per hour, loaded with people.’

“‘That his engine is capable of carrying three tons weight, in addition to its own.’

“Mr. Summers adds, ‘that they have travelled in the carriage at the rate of fifteen miles per hour, with nineteen persons on the carriage, up a hill one in twelve.’

“‘That he has continued for four miles* and 3 half, to travel at the rate of thirty miles per hour.’

“‘That he has found **no** difficulty of travelling Over the worst and most hilly roads.

“Mr. James Stone states that ‘thirty-six persons have been carried on one steam carriage.’

“‘That the engine drew five times its own weight nearly, at the rate of from five to six miles per hour, partly up an inclination.’

The several witnesses have estimated the probable saving of expense to the public, from the substitution of steam power for that of horses, at from one-half to two-thirds. Mr. Farey gives as his opinion, ‘that steam coaches will, very soon after their first establishment, be run for one-third of the cost of the present stage coaches.’

“Perhaps one of the principal advantages resulting from the use of steam, will be, that it may be employed as cheaply at a quick as at a slow rate; ‘this is one of the advantages over horse labour, which becomes more and more expensive as the speed is increased. There is every reason to expect that, in the end, the rate of travelling by steam will be much quicker than the utmost speed of travelling by horses; in short, the safety to travellers will become the limit to speed.’ In horse draught the opposite result takes place; ‘in all cases horses

* In the original, “hours.” Mr. Summers states this to be a mistake, and directs the substitution which we have made.—Meeh. Mag. March 1832, p. 445.

lose power of draught in a much greater proportion than they gain speed, and hence the work they do becomes more expensive as they go quicker.' On this and other points referred to in the report, the committee have great pleasure in drawing the attention of the house to the valuable evidences of Mr. Davies Gilbert.

"Without increase of cost, then, we shall obtain a power which will insure a rapidity of internal communication far beyond the utmost speed of horses in draught; and although the performance of these carriages may not have hitherto attained this point, when once it has been established, that at equal speed we can use steam more cheaply in draught than horses, we may fairly anticipate that every day's increased experience in the management of the engines, will induce greater skill, greater confidence, and greater speed.

"The cheapness of the conveyance will probably be for some time a secondary consideration. If at present it can be used as cheaply as horse power, the competition with the former modes of conveyance will first take place as to speed. When once the superiority of steam carriages shall have been fully established, competition will induce economy in the cost of working them. The evidence, however, of Mr. Macneil, showing the greater efficiency, with diminished expenditure of fuel, by locomotive engines on rail-ways, convinces the committee that experience will soon teach a better construction of the engines, and a less costly mode of generating the requisite supply of steam.

"Nor are the advantages of steam power confined to the greater velocity attained, or to its greater cheapness than horse draught. In the latter, danger is increased, in as large a proportion as expense, by greater speed. In steam power, on the contrary, there is no danger of being run away with, and that of being overturned is greatly diminished. It is difficult to control four such horses as can draw a heavy carriage ten miles per hour, in case they are frightened or choose to run away; and for quick travelling they must be kept in that state of courage, that they are always inclined for running away, particularly down hills and at sharp turns of the road. In steam, however, there is little corresponding danger, being perfectly controllable, and capable of exerting its power in reverse in going down hills.' Every witness examined has given the fullest and most satisfactory evidence of the perfect control which the conductor has over the movement of the carriage. With the slightest exertion it can be stopped or turned, under circumstances where horses would be totally unmanageable.

"The committee have, throughout their examinations, been most anxious to ascertain whether the apprehension very commonly entertained, that an extensive use of these carriages on roads would be the cause of frequent accidents and continued annoyance to the public, were well founded.

"The danger arising from the use of steam carriages, was stated to be twofold; that to which passengers are exposed from explosion of the boiler, and the breaking of the machinery, and the effect produced on horses by the noise and appearance of the engine.

"Steam has been applied as a power in draught in two ways: in the one, both passengers and engine are placed on the same carriage; in the other, the engine carriage is merely used to draw the carriage in which the load is conveyed. In either case, the probability of danger from explosion has been rendered infinitely small, from the judicious construction of boiler which has been adopted.

"These boilers expose a very considerable surface to the fire, and steam is generated with the greatest rapidity. From their peculiar form, the requisite supply of steam depends on its continued and rapid formation; no large and dangerous quantity can at any time be collected. Should the safety valve be stopped, and the supply of steam be kept up in a greater abundance than the engines require, explosion may take place, but the danger would be comparatively trifling, from the small quantity of steam which could act on any one portion of the boiler. As an engine, invented by Mr. Trevithick, has not been as Yet

applied to carriages, the committee can do no more than draw the attention of the house to the ingenuity of its contrivance. Should it in practice be found to answer his expectation, it will remove entirely all danger from explosion. In each of the carriages described to the committee, the boilers have been proved to a considerably greater pressure than they can ever have to sustain.

"Mr. Farey considers that 'the danger of explosion is less than the danger attendant on the use of horses in draught; that the danger in these boilers is less than in those employed on the railway, although there even, the instances of explosion have been very rare.' The danger arising to passengers from the breaking of the machinery, need scarcely be taken into consideration. It is a mere question of delay, and can scarcely exceed in frequency the casualties which may occur with horses.

"It has been frequently urged against these carriages, that wherever they shall be introduced, they must effectually prevent all other travelling on the road, as no horse will bear quietly the noise and smoke of the engine.

"The committee believe that these statements are unfounded. Whatever noise may be complained of, arises from the present defective construction of the machinery, and will be corrected as the makers of such carriages gain greater experience. Admitting even that the present engines do work with some noise, the effect on horses has been greatly exaggerated. All the witnesses accustomed to travel in these carriages, even on the crowded roads adjacent to the metropolis, have stated that horses are very seldom frightened in passing. Mr. Farey and Mr. Macneil have given even more favourable evidence in respect to the little annoyance they create.

"No smoke need arise from such engines. Coke is usually burned in locomotive engines, on rail-ways, to obviate this annoyance; and those steam carriages which have been hitherto established also burn it. Their liability to be indicted as nuisances will sufficiently check their using any offensive fuel.

"There is no reason to fear that waste steam will cause much annoyance. In Mr. Hancock's engine it passes into the fire, and in other locomotive engines it is used in aid of the power, by creating a quicker draught and more rapid combustion of the fuel. In Mr. Trevithick's engine it will be returned into the boiler.

"The committee not having received evidence that gas has been practically employed in propelling carriages on common roads, have not considered it expedient to inquire as to the progress made by several very scientific persons who are engaged in making experiments on gases, with the view of procuring a still cheaper and more efficient power than steam.

"The committee having satisfied themselves that steam has been successfully adopted as a substitute for horse power on roads, proceeded to examine whether tolls have been imposed on carriages thus propelled, so excessive as to require legislative interference, and also to consider the rate of tolls by which steam carriages should be brought to contribute, in fair proportion with other carriages, to the maintainance of the roads on which they may be used.

"They have annexed a list of those local acts in which tolls have been placed on steam, or mechanically propelled carriages.

"Mr. Gurney has given the following specimens of the oppressive rates of tolls adopted in several of these acts: On the Liverpool and Prescott road, Mr. Gurney's carriage would be charged £2 8s. while a loaded stage coach would pay only 4s. On the Bathgate road the same carriage would be charged £1 7s. 1d., while a coach drawn by four horses would pay 5s. On the Ashburnham and Totness road Mr. Gurney would have to pay £2, while a coach drawn by four horses would be charged only 3s. On the Teignmouth and Dawlish roads the proportion is 12s. to 2s.

"Such exorbitant tolls on steam carriages can only be justified on the following grounds:

"First, because the number of passengers conveyed on, or by, a steam carriage will be so great as to diminish (at least the extent of the difference of the

rate of toll,) the total number of carriages used on the road; or, secondly, because steam carriages induce additional expense in the repairs of the road.

"The committee see no reason to suppose that, for the present, the substitution of steam carriages, conveying a greater number of persons than common coaches, will take place to any very material extent; and, as to the second cause of increased charge, the trustees, in framing their tolls, have probably not minutely calculated the amount of injury to roads likely to arise from them.

"The committee are of opinion that the only ground on which a fair claim to toll can be made on any public road, is to raise a fund which, with the strictest economy, shall be just sufficient, first, to repay the expense of its original formation; secondly, to maintain it in good and sufficient repair.

"Although the committee anticipate that the time is not far distant when, in framing a scheme of toll for steam carriages, their general adoption, and the great number of passengers which will be conveyed on a small number of vehicles, will render it necessary not only to consider the amount of injury actually done to the road, but also the amount of debt which may have been incurred for its formation and maintenance; yet at present they feel justified by the limited number of such carriages, and by the great difficulties they will have to encounter, in recommending to the house, that in adopting a system of toll, the proportion of 'wear and tear' of roads by steam, as compared with other carriages, should alone be taken into consideration.

"Unless an experiment were instituted on two roads, the one reserved solely for the use of steam coaches, the other for carriages drawn by horses, for the purpose of ascertaining accurately the relative wear of each, it would be quite impossible to fix with certainty the proportion of tolls to which, on the same road, each class of vehicles should be liable. To approximate, however, as nearly as possible to the standard of relative wear, the committee have compared the weights of steam carriages with those of loaded vans and stage coaches. They have tried to ascertain the causes of the wear of roads; also the proportion of injury done by the feet of horses and the wheels of coaches; how far that injury is increased by increased velocity, and also in what degree the wear of roads by loaded carriages may be decreased by any particular form of wheel.

"The committee would direct the attention of the house especially to the evidence of Mr. Macneil, whose observations on this branch of the subject, being founded on a long course of very accurate experiment, are peculiarly interesting and useful. He estimates that the feet of horses drawing a fast coach, are more injurious to the road than the wheels, in the proportion of three to one, nearly; that this proportion will increase with the velocity; that by increasing the breadth of the tires of the wheels, the injury done to roads by great weights may be counteracted. He considers that, on a good road, one ton may be safely carried on each inch of width of tire of the wheels.

"Mr. M'Adam and Mr. Telford have given corresponding evidence as to the greater wear caused by horses' feet, than by wheels of carriages.

"Each of the above witnesses agrees, that adding the weight of the horses to that of the coach, and comparing the injury done to a road by a steam carriage of a weight equal to that of the coach and horses, (the wheels being of a proper width of tire,) the deterioration of the road will be much less by the steam carriage than by the coach and horses.

"As to the injury to roads which is anticipated from the 'slipping' of the wheels, it may safely be left to the proprietors to correct: the action of the wheel slipping involves a waste of power, and a useless expenditure of fuel, which, for their own sakes, they will avoid.

"Apprehension has also been entertained that, although the peculiar action of the wheels may not be injurious, yet that, from the great power which may be applied if the steam were worked at very high pressure, or if the size of the engine were increased, greater weight might be carried than the strength of the road could bear.

"Undoubtedly, in proportion to the advance of the science, will be the increase of weight drawn by an engine with a given expenditure of fuel; but there are many practical difficulties to be surmounted before the weight so drawn can reach the point when it could be destructive of roads. There are no theoretical reasons against the extension of the size of the engines. The difficulties, according to Mr. Gurney, are of a practical nature, and only in the 'difficulty of management of a large engine.' In proportion as we augment the power of the engines, we must increase their strength, and consequently their weight; the greater weight will be a material diminution of their efficiency. To a certain extent the power may be increased in a greater ratio than the weight, but with our limited knowledge of the application of steam, and with the present formation of the public roads, the point will be very soon attained, when the advantage of increased power will be counterbalanced by the difficulties attendant on the increased weight of the engines.

"The weight of the steam carriages at present in use, varies from 53 to 80 cwt.; but it must be recollected that they are mere models; they were made with attention to strength only, to bear the uncertain strain to which they would be exposed in the course of experiments, and a very considerable diminution of weight may be anticipated.

"The weight drawn, at the rate of ten miles per hour, by Mr. Gurney's engine, has not, on any extent of road, exceeded the weight of the drawing carriage; nor is it likely, with the difficulties to be encountered on the present lines of road, from their quality and the numerous ascents, that the weight drawn will be in excess of the strength of the roads. The immense quantity of spare power required to surmount the different degrees of resistance likely to occur, would render the engine too unmanageable. This will appear evident from the force of traction required to draw a wagon over the Holyhead and Shrewsbury road, which varied from 40 to upwards of 300 lbs.

"In considering the effect on roads, we must not overlook one peculiarity in which they have a great advantage over other carriages. In coaches drawn by horses, the power being without the machine to be removed, it becomes an object of the greatest importance to give as much effect as possible to the power, by diminishing the resistance arising from the friction of the wheels upon the surface of the road. For this purpose, the proprietors of coaches and wagons have adopted every possible contrivance, so to reduce the tires of their wheels, that a very small portion of them may press over the road; in some coaches they are made circular in their cross section, so that the entire weight of the carriage presses on a mere point; should the materials be soft, such wheels cut their way into the road like a sharp instrument. The owners of wagons too have adopted a similar plan. Mr. Macneil states that the actual bearing part of the tire of apparently broad wheeled wagons, is reduced to three inches by the contrivance of one band of the tire projecting beyond the others.

"With steam, on the contrary, a certain amount of adhesion to the roads is required to give effect to the action of the machinery, or the wheels would slip round and make no progress. It appears of little importance, therefore, so far as relates to the engine, whether the requisite amount of friction be spread over a broad surface of tire, or be concentrated to a small point; but as the wheels, by being too narrow, would have a tendency to bury themselves in every soft or newly made road, and thus raise a perpetual resistance to their own progress, it actually becomes an advantage to adopt that form which is least injurious to the road. The proprietors, who have been examined on this point, seem to be quite indifferent as to the breadth of tire they may be required to use.

"These considerations have convinced the committee, that the tolls enforced on steam carriages have, in general, far exceeded the rate which their injuriousness to roads, in comparison with other carriages, would warrant; they have

found, however, considerable difficulty in framing a scale of tolls applicable to all roads, in lieu of those authorized by several local acts.

"With this view they have carefully examined the various modes of imposing toll, either suggested by the witnesses or already adopted.

"They are as follows:

"1. To place a toll proportioned to the weight of the carriage and load.

"2. On the number of passengers.

"3. On the horse power of the engine.

"4. On the number of wheels.

"5. An unvarying toll.

"Each of these plans seems liable to serious objections, which the committee beg to submit to the house.

"No plan of toll has been more frequently recommended than that of a charge in proportion to the weight of the engine and load. As this is the most plausible, and (if it could be believed without other disadvantages,) would probably be the fairest standard, the committee have considered it right to state, at some length, their reasons for not recommending its adoption.

"If weight be taken as the standard, the toll must be a fixed charge, either upon the weight of the engine and carriage, without reference to the load; or upon an estimated average of the load carried; or a fluctuating charge, according to the weight, at the several periods of a journey.

"The first would be at least free from the uncertainty of the other two, and therefore would be preferable; but what scale of charge per. cwt. could the committee recommend as applicable to all roads! Their toll should vary according to every different rate of charge on carriages; besides, it would appear to the trustees very unjust to exclude the consideration of that which would be deemed the most material cause of the wear of their roads; viz. the load.

"A fluctuating charge on weight would be most injurious to a carriage which will mainly depend for success on its speed; constant alterations would take place between the toll collectors and proprietors; a minute calculation would be required at every turnpike gate; in fact, unless an accountant were placed at each, the committee cannot conceive how the proportions could be satisfactorily arranged, nor would there be any desire, on the part of the toll collector, to shorten the delay occasioned by these interruptions.

"Mr. Gurney has delivered in a scale of tolls graduated according to weight and width of tire of the wheel. As this has been drawn up by a person interested in the success of steam carriages, it might have been expected to be more favourable to them. The committee, however, have not adopted it, because of the difficulties and interruptions which a fluctuating rate of toll would induce; besides, this scale purports to be intended for a road where 3d. is charged for a horse drawing, and 1d. for a horse not drawing; the scale would be inapplicable therefore when the charge was 2d. and 1d., 3d. and 1½d., 4d. and 1d., 4d. and 1½d., 8d. and so on. Again, what standard of weight, in relation to horse coaches, could be adopted? The average weight of loaded coaches differs very much on different roads. It has been suggested, that a loaded coach, including the weight of four horses, would weigh on an average four tons; and that if 6d. per horse were chargeable to the coach, 6d. per ton should be placed on a steam carriage; this would be unjust, as vans, which frequently weigh upwards of six tons, would only pay 2s., and a steam carriage would pay 3s. Even if the injury done to the road by each were equal, this would be an unfair toll; but it will appear more evidently unjust if the greater proportionate injury done by the feet of horses drawing, than by the propelling wheels, be taken into consideration.

"The object of every steam coach proprietor will be to attain the greatest possible lightness of machinery and engine; because thereby he renders his power more efficient for the draught of the remunerating load. To place the toll on the weight of the engine would tend to induce him to decrease the

strength of his boiler and machinery to an extent which might be dangerous to the passengers, and very detrimental to the success of steam travelling, as the public will easily be led to believe that the accidents really occurring from injudicious legislation, were inseparable from the adoption of this power as an agent in propelling carriages.

"The only fair plea for charging tolls on such carriages in proportion to their weight, is to prevent a load being propelled or carried which would permanently injure the road; within this limit it would be as injudicious to interfere with their progressive efficiency, (which can only result from improvements of the machinery and the system of generating and applying steam,) as it would be to tax carriages drawn by large and well-bred horses, more heavily than such as were drawn by horses in worse condition, and of smaller size and power.

"The roads at present have to sustain wagons, weighing, at times, with their horses, nearly ten tons; it is in evidence, that the breadth of wheels required by various acts of Parliament, is so easily evaded, that it affords no protection to the road. There appears to the committee no fair reason to suppose that steam carriages, approaching even to this weight, will be used on any turnpike road, at least for a very considerable period, during which the increase of weight will be gradual, and will give warning to the legislature when it should interfere.

"To charge a toll according to the number of passengers conveyed, is scarcely less objectionable. If a fluctuating toll be intended, it would be as inadmissible as to propose a similar mode of charging for fast coaches, and would be open to all the cavil and interruptions to which a fluctuating toll on weight would be liable. If the toll were fixed according to the number of passengers the carriage were capable of conveying, it would imply the necessity of a license limiting the number of passengers, and cramping the progress of improvement of a machine, the capabilities of which can only be ascertained slowly and by continued experiment.

"It must be also recollected that these carriages will probably have to travel for a long period without passengers, until by their punctuality and safety they shall have induced the public to venture in them. Nor is this probability weakened by the immense number of passengers who commenced using the locomotive carriages on the Manchester and Liverpool rail-way immediately after their introduction: these engines were established among a population accustomed to machinery and steam, and therefore not entertaining the same apprehensions of its danger which will require to be surmounted elsewhere.

"The trustees of the Liverpool and Prescott road have already obtained the sanction of the legislature to charge the monstrous toll of 1s. 6d. per 'horse-power,' as if it were a national object to prevent the possibility of such engines being used. Besides, they have supplied no standard of their own conception of horse power. Engineers have differed very much in their estimates of this power; there is not, therefore, much probability that the opposite interests of a steam coach proprietor and toll collector would lead to any agreement as to the meaning of the term. But suppose the legislature were to settle this point, and to arrange that a certain length of stroke and diameter of cylinder should represent a certain power, we still fail to ascertain that which alone it is essential to know, viz. the actual efficiency of the engine. Can we regulate the density of steam at which an engine of a given size should be worked? To be effectual, it would be also necessary to ascertain the quantity of water consumed, and even this check would be inadequate with an engine on Mr. Trevithick's principle. If the toll be left as at present on 'horse power,' it would be the obvious interest of the proprietor to work with the smallest nominal power, but to increase as much as possible the force of his steam, thereby increasing the probability of explosion.

"Some trustees have placed the toll upon the number of wheels. The committee would object to this mode of charge, if only because it interferes between

the rival modes of steam travelling, and gives a bounty in favour of that in which the engine is placed on the same carriage with the passengers. The opposite plan of separating the engine from the carriage is that which probably the public will prefer, until the safety of the mode of conveyance shall have been fully ascertained.

“There is still a more serious objection to this mode of charge: it tends to discourage the use of separate carriages; although it must be evident that if a certain weight be carried it will be much less injurious to the road when divided over eight wheels, than when carried on only four. On this point the committee must again refer to Mr. Macneil’s evidence. They cannot, therefore, recommend the house to adopt a scale of toll which shall increase in inverse proportion to the injury done to the road. It will be seen in Mr. M’Adam’s evidence, that the toll on steam coaches imposed by the metropolitan roads act, is liable to this objection.

“Some of the local acts have placed an unvarying toll on steam carriages. This, if moderate, would be unobjectionable; but the committee could not propose any sum which would adapt itself to the necessary varieties of expense in keeping up different roads, by which the tolls on common carriages have been regulated. A fixed toll has, too, this disadvantage: that light experimental carriages, or such as are built solely for speed, would be liable to the same toll as steam carriages heavily laden.

“The committee feel that, however strong their conviction may be of the comparatively small injury which properly constructed steam carriages will do to the roads, yet this conviction is founded more on theory, and perhaps what may be considered as interested evidence, than practical experience; they would therefore recommend that the house should not make, at present, any permanent regulations in favour of steam. The experience which will, be gained in a very few years, will enable the legislature to form a more correct judgment of the effect of steam carriages on roads than can be now made. They therefore recommend that the tolls imposed on steam carriages by local acts, where they shall be unfavourable to steam, shall be suspended during **three years**; and that, in lieu thereof, the trustees shall be permitted to charge toll according to the rate to which the committee have agreed.

“The house will have perceived, in the former part of this report, that there are two modes of applying steam in lieu of horses in draught: one, where the engine and passengers are on the same carriage; the other where the engine is placed on separate wheels, and is merely used to propel or draw the carriage. Although the difference of weight may be in favour of the former mode, yet, as on the latter it is divided over eight wheels instead of four, its small excess cannot justify a larger toll being imposed, as it will be found much less injurious to the roads. The committee therefore recommend that, in charging toll, the engine carriage and carriage drawn shall be considered but as one.

“As it is the opinion of all the engineers examined, that the use of narrow wheels has been the great cause of the wear of roads, and that cylindrical wheels of certain width of tire, are not only the least injurious, but that, in some states of the road, they may be even beneficial, the committee recommend that the wheels of the engine carriage should be required to be cylindrical, and of not less than three and a half inches width of tire. No proprietor of steam carriages has expressed the slightest fear of any inconvenience or loss from the use of such wheels. Beyond this, the committee would not recommend interference with the breadth of tire, or form of wheels: it should be left to the proprietors freely to select the breadth of tire they shall find most convenient in proportion to the weight carried.

“The committee have divided steam carriages (intended for passengers) into two classes, to be subject to different rates of toll. The first, where the carriage is not plying for hire, or where, if plying for hire, it shall not be calculated for, or carry at any time, more than six passengers. The original cost of such machines, and the expense of working them, will sufficiently protect the

roads from any great number of merely experimental carriages; and for the same reason they will not be of a weight or size likely to be injurious. A steam carriage only calculated to convey six passengers, will be solely used where great speed is required, and will be so light as to cause very little wear of the road, probably much less than many carriages drawn by the number of horses which the committee recommend as the standard of charge for this Class. The toll, therefore, proposed to be placed on this class of steam carriages, is that which (on the several roads where they may be used) is charged on a carriage drawn by two horses.

"In the second class, they have placed all other steam carriages, except those travelling at slow rates, for goods only: carriages of this class should pay the same toll as may be charged on a coach drawn by four horses. This may at first appear unjust from the supposed power of steam to draw almost unlimited weight. The committee have already enumerated the difficulties hitherto encountered in attempting to propel very heavy loads on turnpike roads. They are such as to discourage the expectation that, within any short period of time, the system will have been so perfected as to give rise to inconvenience from this source; should any hereafter be found it will then be sufficient to remedy the defect. Until a due proportion of the parts of the machinery shall have been ascertained, the makers of these carriages will vary but cautiously from the models at present in use: their object will be, for some time, the perfecting of them, rather than the uncertain experiment of increasing their size.

"The committee do not anticipate that, for a considerable period, steam will be used as a propelling power on common roads for heavy wagons. It appears to have been the general opinion of the witnesses, that, in proportion as the velocity of travelling by steam on common roads is diminished, the advantages of steam over horse power are lost. The efficiency of horses in draught is rapidly diminished as their speed is increased; while, on the contrary, the weight which could be carried or propelled at any great velocity by steam, could not be more cheaply conveyed were the speed decreased to that of the slowest wagon.

"As speed, therefore, is the cause of greatly increased expense where horses are used, while with steam it is comparatively unimportant, it is probable that the latter will be chiefly resorted to when rapidity of conveyance is required. Mr. Gurney considers, that, under four miles per hour, horses can be used in draught more economically than steam. Should it, however, be deemed profitable to convey heavy goods by steam carriages, the committee recommend that there should be as little interference as possible with the number of carts employed; as the effect on the surface of roads would be infinitely more injurious if heavy loads were placed on a single cart, than if the same weight were divided over several. The committee recommend, that where carriages, containing heavy goods alone, are propelled by steam, the weight of the load should be charged, without reference to the number of carts on which it may be carried.

"As a horse is able to draw from twenty to forty cwt. on common roads, they propose that each twenty cwt. of load, conveyed in, or drawn by a steam carriage, should be chargeable at the same rate of toll as one horse drawing a cart.

"A charge on weight is not so objectionable where goods are conveyed at a slow rate, as when speed is alone required.

"In conclusion, the committee submit the following summary of the evidence given by the several witnesses, as to the progress made in the application of steam to the purposes of draught on common roads.

"Sufficient evidence has been adduced to convince your committee—

"1. That carriages can be propelled by steam on common roads at an average rate of ten miles per hour.

"2. That at this rate they have conveyed upwards of fourteen passengers.

"3. That their weight, including engine, fuel, water and attendants, may be under three tons.

- "4. That they can ascend and descend hills of considerable inclination with facility and safety.
- "5. That they are perfectly safe for passengers.
- "6. That they are not (or need not be, if properly constructed) nuisances to the public.
- "7. That they will become a speedier and cheaper mode of conveyance than carriages drawn by horses.
- "8. That as they admit of greater breadth of tire than other carriages, and as the roads are not acted on so injuriously as by the feet of horses in common draught, such carriages will cause less wear of roads than coaches drawn by horses.
- "9. That rates of toll have been imposed on steam carriages, which would prohibit their being used on several lines of road, were such charges permitted to remain unaltered."

The following bill, introduced in accordance with the views expressed in the foregoing report is extracted from the *Mechanics' Magazine* for **March** last.

Bill to regulate the Turnpike Toll on Steam Carriages.

"Whereas, of late years there has been invented an application of the power derived from steam to the propelling of carriages along the roads of this kingdom, and such invention is likely to become very beneficial to the public: And whereas in the absence of a just knowledge of the effect produced upon roads by carriages so propelled, and under a notion that such carriages would be more detrimental to the roads, and occasion greater inconvenience to **travelers**, than other carriages drawn by horses, various local acts of Parliament have been passed, imposing **excessive** tolls upon carriages propelled by steam or other elemental or mechanical power, amounting in some instances to a prohibition of the use of the said invention: And whereas the greater number of all the other acts of parliament whereunder tolls upon the roads and bridges of the united kingdom are collected, were passed before the said discovery was made, and by such acts no toll is imposed on any carriage so propelled as aforesaid; nor until such several acts shall be amended, or a provision in regard to the said insufficiency of such acts shall otherwise be made by parliament, can any tolls whatsoever upon carriages so propelled along the several roads or over the bridges to which such acts respectively relate be lawfully demanded; whereby in such instances the proprietors of carriages so propelled avoid contributing their fair proportion of the expense of maintaining the said roads and bridge's: And whereas the public ought not to be so precluded from benefitting by the said invention, and all such legislative obstructions to the further improvement of this application of steam, and to a free and extensive adoption of it, should for a limited time be suspended; and also, throughout the realm a reasonable toll should be paid in respect of every carriage so propelled along the said roads or over the said bridges; be it therefore enacted, by the king's most excellent majesty, by and with the advice and consent of the lords, spiritual and temporal, and commons, in this present parliament assembled, and by the authority of the same, That throughout the united kingdom of Great Britain and Ireland, from and after, the *first day of July next following the passing of this act*, all and every toll and tolls imposed by any turnpike or other act of parliament whatsoever upon any carriage propelled by any means or power other than animal power, by whatsoever name or description such carriage shall be called or known, shall cease during the continuance of this act, and not be collected.

"And be it further enacted, that from and after the day aforesaid, the tolls mentioned and set forth in the schedule to this act annexed, and no other tolls whatsoever shall be collected or taken on any carriage, by what name or description whatsoever the same shall be called or known, which shall be pro-

propelled by means of steam or other elemental or mechanical power, or by any power other than animal power, along any road or over any bridge whatsoever, in any part of the united kingdom. Provided always, that nothing in this act shall authorize any such toll to be collected in respect of any carriage so propelled along any such road or over any such bridge, unless and during **such** time only, and at such place or places only, as tolls upon carriages drawn by horses, whether such carriages drawn by horses shall be coaches, stagecoaches, chaises, post chaises, wagons, carts, or carriages of other names or descriptions, along such road or over such bridge, shall by law be receivable.

"And be it further enacted, that where the tolls on carriages drawn by horses shall expire, or otherwise be no longer receivable, there also the aforesaid tolls on propelled carriages shall likewise cease, and be no longer receivable.

"And be it enacted, that no toll shall be collected upon any propelled carriage, which carriage shall **belong** to or be in the employment of his majesty or any of the royal family, or being employed in conveying the mails or king's stores, or officers or men in the army, including yeomanry and volunteers, or the navy on service, or in carrying agricultural produce to or from market or sale, or in taking persons to or from church, or a funeral, or a county election, or on carrying the surveyor of the road, or in the transmission of vagrants.

"And be it further enacted, that if after the commencement of this act, any toll-taker or other person shall take or shall demand any toll upon any carriage so propelled, other than the toll imposed by this act, he shall for every toll so taken or so demanded forfeit and pay the sum of *five pounds*, one half thereof to our lord the king, and the other half to him that will sue for the same, to be recovered in an action of debt in any court of record in the united kingdom, with full costs of suit. Provided always, that such action shall be commenced within *ninety* days after the day of taking such toll.

And be it further enacted, that this act shall commence from twelve of the clock at noon of the *first day of July* next, and shall continue in force from that day during *five years*, and to the end of the then next session of parliament."

Schedule of Tolls payable on Steam Carriages, or Carriages propelled by any means other than Animal Power.

"Where any such carriage is not plying for hire, or if plying for hire shall carry not more than six passengers, the like toll as shall be payable in respect of a four-wheeled coach drawn by two horses; and if carrying a greater number of passengers than *six*, the like toll as shall be payable in respect of a four-wheeled coach drawn by four horses.

"And when the tire of the wheels of such carriage shall be less than three inches and a half in width, or have a greater degree of convexity than half an inch; the toll to be taken on such carriage shall be *double* the aforesaid tolls respectively.

"Where any such propelled carriage shall be used in the place of a wagon or cart for conveying goods or other things, and the load shall not exceed one *ton* of *twenty hundred weight*, the like toll as shall be payable for a single horse drawing a cart; and for every further ton or fraction of a ton, a further toll of the like amount.

"And where the engine carriage shall be a separate carriage from the first train-carriage conveying passengers or goods, the engine carriage shall not be charged separately, but one toll only shall be taken for both carriages.

"And where the engine carriage shall draw more than one train carriage, then for every train carriage after the first train carriage, a further toll of *one half* of the single toll shall be taken, and no more."

[TO BE CONTINUED.]