3rd Session, 1st Parliament, 33 Victoria, 1869.

# REPORT

OF THE

# SELECT COMMITTEE ON WOODEN RAILWAYS.

Mr. CARNEGIE.

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# REPORT

OF THE

# SELECT COMMITTEE

ON

# WOODEN RAILWAYS.

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*To the Honourable the Legislative Assembly of Ontario.*

The Select Committee "appointed to enquire into and report upon the usefulness, and cost of Wooden Railways as a means of furthering the settlement of the country," beg leave to report,—

That they have examined Mr. J. B. Hulburt, contractor of the Quebec and Gosford Wooden Railway—a gentleman, whose whole time for the past ten years, has been devoted to building and working railways of this description. Mr. John Foster, C.E., of Montreal, and patentee of a wooden rail, and Mr. Kivas Tully, Architect and Engineer of the Public Works Department of this Province.

Your Committee also obtained from Mr. C. W. Moberly, Chief Engineer of the Northern Railway of Canada, and Mr. T. N. Molesworth, C.E. of the Public Works Department, written opinions upon the systems of Messrs. Hulburt and Foster.

Besides the information thus obtained, your Committee had brought under their notice certain documents published in England, relative to experiments made with "Prosser's patent guide wheels on either iron or wooden rails."

The evidence, and other information thus obtained, will be found in the Appendix to this Report, and to which the Committee desire to direct particular attention.

Upon a careful perusal of the information thus obtained, your Committee believe that it must become evident to the most casual observer, that railways of this description are destined to play an important part in the future development of this Province.

With regard to the usefulness of wooden railways, your Committee have no hesitation in expressing the opinion that such roads are eminently calculated to supply a want long felt in this Province, and will prove most valuable in opening up and developing the resources of the new townships.

At the present time all the natural wealth of the newer portions of the country (with the exception of a part of the pine) is useless, in fact a nuisance, or positive loss to the settler from the the additional labour it necessitates in clearing up his land, over the prairie land of the west. Without railway or water transportation to give it a money value, these heavy, bulky articles cannot be profitably taken to market a distance of from thirty to a hundred miles. Neither will pot ashes, obtained at a heavy cost, pay for the time and expense of making and transporting over a long rough road to market; on the other hand, with the cheap wooden railways in operation, the whole position is reversed by practically bringing the points of supply within reach of a market. The new set-

tler at once obtains a proper remuneration for the labour of felling the timber (his first crop), and in this manner maintains his family during the time the clearing is in progress, soon rendering his land fit for cultivation, and self-supporting; and the market and the money thus brought to his door, will in a few years place him in comfortable circumstances. While without a railway and its attendant advantages, the backwoods settler has but a life long struggle with poverty and toil, in which he frequently succumbs at an early age, or leaves the country in disgust for the prairie land of the west.

A railway of this kind will tend *more than any other means* which can be adopted, to the rapid settlement of our wild lands, and so both keep the native population in the country and incite immigration.

Referring to the evidence of Mr. Hulburt, and the estimates of Messrs. Moberly and Molesworth, it will be observed that railways of this description can be built for one-third of the cost of the iron road. The importance of such a reduction in the first cost of railways in a country like our own, where capital is scarce, where for a time at least, the traffic must be small, where, at the outset the benefits derivable from such undertakings consist of the development of the country served by them; and when this reduction in their first cost does not entail any loss when the increase of traffic requires an iron rail, can hardly be over estimated.

That these roads are possessed of the advantages of cheapness of construction, combined with a capacity equal to, if not surpassing that of several railways now in operation in this Province, your Committee believe to be beyond doubt. Coupling this with the fact that the speedy settlement of the country, and the development of its resources, are of paramount impartance to our future welfare as a Province; and remembering the trifling success attending the large expenditure which has been made in building long lines of colonization roads.

Your Committee are convinced that no more important subject has been brought under the consideration of the Legislature of this Province, than that of wooden railways. And would earnestly commend them to your favourable consideration, as by far the best and cheapest means yet divised for developing the resources of the country, and securing its speedy settlement with an industrious and happy population.

JOHN CARNEGIE,
*Chairman.*

# APPENDIX.

TORONTO, Dec. 3rd, 1869.

*To the Chairman of Committee on Wooden Railways.*

SIR,—In accordance with the request of your Committee, I have examined the systems of wooden rail track, introduced respectively by Messrs. Foster and Hulburt, and beg to submit the following observations thereon:—

Mr. Hulburt's system is the longitudinal maple rail, the grain of the wood running with the track. The rails are supported on cross ties laid two feet apart. These ties are notched out, and the rails are fastened into the notches with wooden wedges. He submits two modifications of his principal:—

1st. A plain longitudinal rail 4 inches × 7 inches, in 14 feet lengths, with square end joints, and simply held in place in the ties by the wedges.

2nd. A longitudinal rail 4 inches × 7 inches, two thicknesses in depth, breaking joint with square ends, each joint being fastened together with two $\frac{1}{2}$ in. bolts through from top to bottom of rail, and wedged in the ties in a similar manner to No. 1.

Mr. Foster claims an improvement on Hulburt's system, inasmuch as he opposes the end grain of the wood to the action of the trains. He places maple blocks $3\frac{1}{4}$ in. × 7 in. on end to form the rail. These blocks are held together between two longitudinal stringers, slightly notched out to give a seat for the blocks to rest on—the stringers break joint, thus forming a continuous rail. The cross ties are notched out, and the stringers wedged in the same manner as in Mr. Hulburt's rail. A hardwood pin is driven through the stringers between each joint of the blocks, in order to keep the blocks from shifting out of place.

The following is a comparative estimate of the cost of each system of wooden rail, and of an iron T rail 56 lbs. to the yard. I do not include the earthwork, ballast or fencing, as I assume the grades and curves to be common to each. The estimate is based on a 5 ft. 6 in. guage, and the cost of cross ties is included.

| | | |
|---|---|---|
| Iron Rail (56 lbs.) | $5,000 | per mile. |
| Foster's Wood Rail | 2,100 | " |
| Hulburt's do (No. 1) | 1,290 | " |
| " " (No. 2) | 1,420 | " |

An iron rail, of say 56 lbs. to the yard, should last, in this climate, with a fair traffic (such as is done by the Northern Railway of Canada) about ten years, and the best hardwood rail, with a similar traffic, could not last over two years. A well-constructed hardwood rail. if properly maintained, would probably last five years, with a small traffic and light engines not running over a speed of from 10 to 12 miles an hour.

The main points to be considered, in comparing the different systems of wooden rail, are simplicity in the number of parts, and convenience in construction and repair, because the greater the number of parts, the greater is the liability to get out of repair, particularly in such a climate as Canada, where the sudden thaws and extreme frosts throw the rails out of line and out of level.

As to the comparative merits of the different systems under consideration, I am of opinion that Mr. Hulburt's single rail, No. 1 (with an addition of a wood fish-plate, notched and bolted at each point), is the most practicable, as it is the simplest and cheapest in construction, and can most easily be kept in repair.

I consider the wooden railway to be best adapted for colonization roads through new tracts of country, where sufficient money cannot be obtained to build an iron road. A

wooden railway would serve the purpose, until a sufficient traffic could be established to warrant a more substantial track.

I have the honour to be
Your obedient servant,

J. W. MOBERLY,
*C. E.*

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TORONTO, 6th December, 1869.

*The Chairman of Committee on Wooden Railways, House of Assembly, Ontario.*

SIR,—I have examined the models in connection with the system of wooden railway construction, and find three different classes of rails presented for inspection.

1st. Mr. Foster's compound wooden rail, formed of blocks of hardwood, bolted between longitudinal pieces of timber, so as to form an endless rail, having the cross-sections of the grain of the timber in the blocks presented as a bearing surface to the wheels.

2nd. Mr. Hulbert's plain wooden rail, consisting of longitudinal pieces of hard-wood, 14 feet in length, laid on, and notched into the cross-ties, and fastened thereto by wooden wedges.

3rd. Mr. Hulbert's compound wooden rail, where a longitudinal strip of timber is placed underneath the rails, breaking points with them, and having iron bolts, fastening each end of each rail to the longitudinal pieces underneath.

In the construction of wooden railways in a new tract of country, that system of rail which combines the greatest simplicity of construction with economy in first cost, is the one which should be selected for use, provided this is not more than counterbalanced by any advantages which may be derived from the adoption of a more complicated and costly system, but in the comparison of the construction of these rails, I do not see that such an advantage is to be gained, and, therefore, I prefer Mr. Hulburt's wooden rail.

In comparing the advantages of a light iron track with a wooden one on a railway for use in opening up a new district, I have made the following estimate of cost and maintenance of rails for 15 years, presuming that the traffic would be of such a light nature that a road laid with iron rails of 56 lbs. to the yard would stand 15 years without renewal and allowing three years as the period of reenwal for the wooden rails.

RAILWAY WITH LIGHT IRON RAILS.

| | |
|---|---|
| Iron rails for one mile, 56 lbs. to lineal yard, 88 tons, at $50.... | $4,400 00 |
| Fish plates, at $1 per pair..... | 500 00 |
| Spikes..... | 200 00 |
| Ties, 2,112, at 20 cents..... | 422 40 |
| Track laying ..... | 250 00 |
| Total cost..... | $5,772 40 |

RAILWAY WITH PLAIN WOODEN RAILS.

| | |
|---|---|
| 2,640 ties, notched, at 20 cents ..... | $528 00 |
| 25,000 feet B. M. hard-wood rails, at $10..... | 250 00 |
| 1,510 wedges..... | 50 00 |
| Track laying..... | 250 00 |
| Total cost... ..... | $1,078 00 |

The difference in first cost being $4,694 per mile.

Allowing one man per mile for maintenance work on each road, and the duration of the ties, ballast and other things being equal on both systems, the comparison of difference of cost in maintenance for that period will be between the cost of renewal of the iron rails,

fish plates and spikes on the one, and the wooden rails and wedges on the other, with the addition of the extra labour for more frequent renewals, and may be stated thus :—

IRON RAILS, RENEWAL ON 1 MILE IN 15 YEARS.

| | |
|---|---|
| 88 tons (less cost of old iron), at $28 | $2,464 00 |
| Fish plates and spikes, half amount renewal | 350 00 |
| Cost per mile | $2,814 00 |

WOODEN RAILWAY RENEWAL.

| | |
|---|---|
| Hard-wood rails and wedges, costing $300 per mile, renewed once in each three years | $1,500 00 |
| Extra labour required for renewal | 750 00 |
| Cost per mile for 15 years | $2,250 00 |

The difference in cost of renewal being in favour of the wooden rail.

The difference in first cost in favour of the wooden rail amounts to $4,694, or say $4,600, the interest on which, at 6 per cent., amounts to $276 per annum, or $4,140 in the period of 15 years, for which the renewals of each rail are given ; and I think that there can be no doubt that, taking these facts into consideration, the wooden railway supplies a desirable means of opening up the resources of a new district, with a light traffic, which would not yield a proper return for the more costly iron track ; but in the construction of such a railway through a fertile district, the works should be constructed with a view to the wooden rail being replaced by an iron one at a future period, when the increased traffic should render such a change desirable.

I have the honor to be,
Sir,
Your obedient servant,

T. N. MOLESWORTH,
*Civil Engineer.*

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*Evidence taken before the Committee, Nov. 30th.* 1869.

Mr. FOSTER was called to explain his system of wooden block railway track. He said the advantages to be derived from the placing of the blocks with ends upwards was, that the rail resisted the wear and tear of the engine. The rail was also covered with pitch, which, when ground into the rail, would help to make it more durable, and to fill up interstices. The dry wood pins driven through the end of each block would compress the blocks, so that even though there was a possibility of the wood shrinking afterwards, it would not affect the durability of the rail. The resistance of wood endways was superior to iron, or any other material used in railway tracks. He had proved this by experiment. The cost of a railway, constructed in this way, would exceed that of a wooden railway made in any other way ; but it would be well worth the extra cost to secure a durable track. The covering of the rail with pitch would render it impervious to the action of the weather.

Hon. Mr. MCMURRICH suggested that there might be a danger of shaking the rail by the passage over it of heavily laden trains.

Mr. FOSTER said no such result had attended the experiments so far made. The blocks remained perfectly solid, and were not crushed by the pressure of trains.

Dr. BOULTER asked if this system of railways had been adopted anywhere yet.

Mr. FOSTER said it had been tried in the Province of Quebec on a small scale.

The CHAIRMAN wished to know what would be the comparative cost between this block rail and the straight wooden rail.

Mr. FOSTER said he had never made an estimate; but the cost of the block rail was $1 per yard, or $1,760 per mile. Of course, it would cost more than a simple straight rail. There was a decided gain over the iron rails in ascending grades. On the Clifton line, there were grades of over 300 feet to the mile. The adhesion of a block wooden rail was twenty-five per cent. greater than that of the horizontal rail, that was to say, if the same piece of maple were laid horizontally, the adhesion would not be 1-5th as great as if it had been placed endways, and therefore the block rail would carry 1-5th more.

Dr. BOULTER wished to know if the wooden road in Quebec was perfectly level.

Mr. FOSTER said it had never been touched since it was laid down, and never had ballast laid under it. In fact, it was almost laid down in the mud. Of course there were soft places in the road the same as in iron rails. The dampness in the atmosphere seemed to be sufficient to keep the blocks from opening.

Hon. Mr. MCMURRICH wished to know if the blocks should all be of the same kind of wood.

Mr. FOSTER said one piece was maple, another oak, another elm or some other kind of wood; it was difficult to get all maple.

Hon. Mr. MCMURRICH said his reason for asking this question was, that it might be possible that if the blocks were of different kinds of wood, one would wear out much faster than another. It would be well to bring out this point clearly.

Mr. FOSTER, in reply to Mr. Cumberland, said he would not mix woods if he could avoid it. He considered maple best. Rock elm was also good; so was beech, but it did not last long.

Mr. CALVIN—Red beech will last as long as oak.

Mr. FOSTER continued—The wooden railway near Montreal had proved very durable. About thirty trains passed over it every day, and he was satisfied that the experiment had proved a complete success.

Mr. CUMBERLAND supposed that the blocks would depreciate in the same per centage as iron rails. He meant to say that, whilst perhaps three or four blocks might last three years, the next block might not last one year.

Mr. FOSTER—The wood might be chosen, so as to make the track as uniform as iron.

Mr. CUMBERLAND said, even in iron rails, from the same rolling mill, there was a difference. It was impossible to get a track perfectly uniform. In the system of Mr. Foster, the blocks were united so as to form a continuous line, and were kept firm by pins. If it were found necessary to remove an unsound block, and replace it with a sound one, he wished to know if it would not be an expensive operation?

Mr. FOSTER said there was very little expense attending such an operation. The pin could be bored out. In fact, in many instances it would be found necessary to bore it out, as he had found it to be the case in repairing the Industry and Lanora Road. The pins were found to be as solid as the wood itself.

The CHAIRMAN—You have seen the Clifton Railway. What is your opinion of the results of that line?

Mr. FOSTER replied that the results were most extraordinary. The grades on that line were the steepest in the world, and yet no difficulty had been found in ascending them. The system which he now submitted would produce even greater results, for it was obvious that his line was more adhesive than the horizontal line. The gain would be about one-fourth more. He did not believe it was necessary to have the blocks cut a great length of time before laying them, because even though they should shrink, the pitch would work into the interstices, and keep the blocks close. He thought a line, constructed on the system now submitted, would last about six years. The cost per mile per annum for keeping it in repair would not be much, because the men employed on the line could manage it. A carpenter could make all the repairs needed. He did not consider it any disadvantage to have the blocks narrow. It added very little to the cost of laying them, the boring being done by machinery. The curvatures and longitudinals were cut before laying them. The points were made of flat steel. All the work, excepting the points, was laid on wood. There was no doubt that an iron rail was better. The object of the wooden railway was simply to give a cheap line where an iron rail could not be laid. Not only was the wooden rail cheaper than the iron, but the grading cost less. That should be borne in mind, for the grading was the great item in constructing a road.

Mr. CUMBERLAND wished to know if the cost of a strap rail of iron on the horizontal wooden rail would greatly exceed the cost of the block wooden rail.

Mr. FOSTER said that experiment had been tried, and it was found that the iron strip alone cost within a trifle of $1 per yard, or nearly the same as the entire cost of his system. The strip rail in the case mentioned was an inch thick, and two and a half in breadth. It was found that a thinner strip would not stand the traffic. It curved up and broke in a short time, and was found to be useless.

The CHAIRMAN wished to refer to a pamphlet issued in 1845 on this question, in which it was stated that the "bite" of the wooden rail (Crozier's system) was double that of the iron rail.

Mr. J. B. HULBERT, who is now building the Quebec and Gosford Railway, was next called. He produced the models,—one of a simple straight rail, fastened at the ends like the ordinary iron rail; the other was a compound rail, with the end of each rail overlapping the next. The wood was hard maple, and the cost of the superstructure and ballast per mile would amount to about $1,200. The cost of the manufacture of the rails, ties and wedges was about $600 per mile. The ties which he found best were tamarack and hemlock. The gauge he spoke of was four feet eight and-a-half inches. To increase the gauge to five feet six inches would add about twenty per cent. to the cost. He did not approve of a narrow-guage, for the embankment was not likely to stand. He found the four feet eight inches in all cases the best suited to this country. Taking the average of the whole road he believed a wooden rail would last for about five years. The average speed on such a road was about ten miles per hour, but it could be increased to thirty miles. He had used an engine of 23 tons weight on such a road. He did not believe a wooden rail was equal to an iron rail. The Gosford wooden railway now in course of construction would be completed in the spring. The highest grade on the Clifton Railway was 330 feet. The whole secret of keeping those railway was to keep them in a good state of preservation, but if the repairs were not promptly attended to they would soon become as bad as the Grand Trunk Railway. (Laughter). The cost of keeping up the road was about $250 per year. A good sound maple rail would stand any ordinary traffic for four years. The ties were laid about sixteen inches apart, and the flat on the side touching the ground, and round on the upper side. The advantage of the compound rail prevented them from wearing at the ends. He found too it kept the rails more smooth. The additional cost of the compound rail was about two hundred dollars, which was principally caused by the iron bolts used in joining. A wooden road had an equal capacity for trains with an iron road. He offered to construct one in Missouri, which would carry 2,000 tons per day He found some difficulty from snow and ice in winter, but no greater than if the rails were iron. He believed there was no great difference between the five ton car and the ten ton car, in fact the advantage lay with the latter in carrying lumber, for the weight was distributed over a greater space. He calculated the average load to a train at two tons to two and a half per pair of wheels. After the road was built, he considered that, running eight trains over it per day, it required one man per two miles. On the Clifton road it required one man per mile, but the road was constructed at the beginning for a ten ton engine; but they are now using engines weighing twenty tons. The country through which the Gosford road was to run was smoother than the country through which the Clifton road runs. The Gosford line would cost about $4,000 per mile. This including the grading track, water tanks, turn-tables and switches. He did not consider the wooden road any more liable to accidents than the iron. He had never seen an accident on one. He generally loaded a train heavier with lumber than with ore, for it was not such a dead weight. He did not consider it advisable to use an iron strap on the rail. Where the experiment had been tried on ordinary grades it had not proved successful. At curves it might be an advantage, but at such places he believed it would be better to lay the rails oftener. The Wooden Railways with which he had been connected had paid the companies to which he belonged He related his experience of the Clifton Railway, with which he had been connected. When he constructed that line, the shares sold at $2; and when he left they had sold at $14. Since he had left it, however, it had been handed over to inexperienced persons, and it was not paying so well. Another Wooden Railway was in course of construction from Carthage, to intersect the Clifton line. His experience in building car wheels was to make them large. When he commenced he

made small wheels, weighing 125 pounds, but experience proved to him that larger wheels were better, and he now used wheels three feet in diameter, weighing 450 pounds, and he found they could carry twenty per cent. more freight. The rolling stock of the Wooden Railway could be made available for an iron track. He did not find the curves cut by the running of the trains. He had improved the wheel by placing a piece of rubber in the flange. The largest locomotive on the Clifton road cost $9,500, American currency, in Erie. The 18 feet, platform, four-wheeled car, cost $225; the same car with eight wheels would cost about $600.—Adjourned.

Mr. TULLY (Architect and Engineer of the Department of Public Works)—Said he had examined the models of Mr. Foster and Mr. Hulburt, and the plans accompanying them. As far as his opinion went, the compound rail of Mr. Hulburt was the cheapest and best. The plan of Mr. Foster was too complicated. The blocks were liable to wear and become uneven, and a great deal of expense would be attached to keeping it in repair. Of the two rails of Mr. Hulburt, the compound rail was the better, but the more difficult to repair. If the other simple horizontal rail were bolted down instead of being wedged, he would be inclined to consider it the best system of all, it would be more cheaply and easily repaired. A dowel to join the ends of the rails would be likely to weaken the timber, He had read descriptions of wooden railways, and had descriptions of them from persons who had inspected them personally, and he was inclined to believe they would yet become a most important system of roads for the opening up of the back countries. He believed that like the Narrow Guage Railways, they would be superseded by a better class of railways. He believed if these railways could be constructed entirely of wood, without using iron in any shape, it would be better, for there would be no difficulty, and very little expense involved in repairs. If the compound rails could be kept in place by bolts at the ends, that system was the best. Of course, if bolts were required at the middle of the rail as well, it would greatly increase the cost of constructing the line. The cost of placing half-inch bolts at the ends of the rails was estimated at $200 per mile; and if bolts were placed at the middle of the rails as well, it would nearly double the cost. He had read the evidence of Mr. Hulburt as reported in the *Globe*, and he was satisfied that the statements and estimates of that gentleman were reliable. If a line could be constructed for $4,000 per mile, it was a very low rate indeed. He understood, of course, that sum included grading, and everything but the stations and rolling stock. The cost of grading must be very little, for according to the statements made by Mr. Hulburt, the line could almost follow the surface of the ground. He approved of the 4 feet 8½ inch guage, and considered it unfortunate that it was not the guage universally adopted. It was the guage mostly used in the United States—although some guages were as broad as six feet.

Mr. CUMBERLAND objected to the bolts being driven into the top of the rail. He wished Mr. Hulbert to give his opinion of placing a sub-sill under the rail. He believed there was danger of dilapidation in the compound rail.

Mr. HULBERT said there was no danger of dilapidation. The cost of the bolts was obviated in a measure by the saving of the timber in the sawing of the compound rail. He considered the single rail the stronger, but it would give way sooner, as the joints were not so firmly fixed as in the compound rail, which was fastened by bolts driven through the rail, and secured by a nut beneath. There was no danger of the top of the bolt being broken off. It would be driven down by the weight of the trains passing over it. Of course, they might become loose, but the men on the line could tighten the nuts on the screw, and keep the rail tight as easily as by wedges. However, there was very little danger of the bolts becoming loose.

Mr. CUMBERLAND suggested putting wooden fish plates at the sides of the joints, and driving the bolts through the sides, instead of the top of the rail. That would remove the danger of injury to the bolts.

Mr. HULBERT said it would increase the cost.

Mr. CUMBERLAND said things might be cheapened.

Mr. BARBER said it might interfere with the flanges of the wheels. Besides, the wet remaining between the fish plates and the rails would rot the wood. He believed the single rail was the best, as well as the cheapest.

Mr. CUMBERLAND believed there was a danger of the under rail, in the overlapping track, rotting at the joints of the upper rails.

Mr. HULBERT said he could speak from actual experience that there no such danger existed. He had tried the single and the double rail, and he believed the latter was much the better. He had tried different ways of splicing rails, and found they did not answer.

Mr. TULLY suggested placing fish-plates at the joints, and instead of fastening them with bolts, to fasten them with wedges.

Mr. HULBERT said he had tried that plan also, but found it impracticable. The wedges in the double rail never became loose. They were placed on the outside, in order to form an even guage. The wedges were sawed. The rails were made of hard maple, and lasted about five years. He found it lasted better as a rail than any other timber, especially when the sap was laid upwards. He believed it was possible to curve as short with wood as with iron, while there was a decided advantage in descending grades. A grade of over 300 feet in the mile could be descended with perfect ease, while on an iron track, the wheel would be likely to slip. If the curves were properly laid, a truer curve could be made. He always took pains to place the best wood on the outside of the curve, and found that they did not wear out any sooner than the other parts of the track. He made the embankments sixteen feet wide. His contract for the Gosford and Quebec Railway was twelve feet broad, but he made it sixteen feet. He placed the price of making embankments at 10 cents per yard, and grading 10 cents. He spoke of the line which he was now constructing, where sand could be easily obtained, and there were no rock cuttings. The highest grade on the Gosford line was fifty feet per mile against the load. The following was an estimate of the stock for a road 60 miles long, to run 200 tons per day :—

| | |
|---|---|
| 3 Locomotives (at $7,600 in gold) | $22,800 |
| 60 four-wheeled platform cars ($225) | 13,500 |
| 3 eight wheeled box cars ($800) | 2,400 |
| 3 passenger cars ($1,500) | 4,500 |
| 10 gravel and repair cars ($200) | 2,000 |
| 10 rubble cars ($60) | 600 |
| 4 hand-cars ($125) | 600 |
| Total | $46,400 |

The above will run two trains per day, of 100 tons each, leaving an extra locomotive for repairs, &c. The cost of running one train, of 100 tons, the round trip will be,—

| | |
|---|---|
| 1 engineer | $3.00 |
| 1 fireman | 1.50 |
| 2 brakesmen (at $1) | 2.00 |
| 4 cords of 3 feet wood (at $1.25) | 5.00 |
| Oil | 1.00 |
| Total | $12.50 |

Or 12½ cents per ton.

Cost of building a wooden railway on a fair route, timber at medium price, and no large bridges, $4,000 per mile. Rolling stock and incidentals, $1,000—say $5.000 per mile for a road complete with rolling stock ; which I consider a fair and safe estimate for the general run of the country, and prices of timber in Canada.

(Signed) J. B. HULBURT.

Mr. MOBERLY being called on, said he had not had time to look into this matter; but if the Committee would allow him to confer with Messrs. Hulbert and Foster respecting their schemes he would be better prepared to give his opinion. He supposed what was required was an estimate of the comparative cost of the iron and wooden railways above grade.

The CHAIRMAN said the object was to ascertain if it were practicable to lay wooden rails which would answer for the present, and in future should give way to iron rails.

Mr. MOBERLY said it would be desirable to grade the roads with the object in view of afterwards laying iron.

The CHAIRMAN said the grades could be lowered when the iron track was being laid.

Mr. MOBERLY believed the great objection to the wooden railway was the effect of the frost on the line. It would be no easy matter to repair it in spring. However, he would give his opinion on the subject after conferring with Mr. Hulbert and Mr. Foster.

Mr. FOSTER was next called on. He said there appeared to be a slight misapprehension respecting the number of iron bolts required in his rail. When the rails ran a straight line no iron bolts were used at all. The bolts were only used in joints at the curves. There was not a bit of iron anywhere except at the curves where the bolts were put to prevent the joints from spreading.

The Committe then adjourned.

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*Extracts from a pamphlet published in* 1845, *on "Prosser's Patent Railway Guide Wheels, on either Iron or Wooden Rails."*

The length of the experimental line laid down near Vauxhall bridge was 174 yards, with gradients of 1 in 95, 1 in 22, and 1 in 9, and a curve of 720 feet radius.

The speed attainable on so short a line was of course limited, but the power given to the engineer by the bite of the wheel on the wood, (for this line was laid with wooden rails) enabled him to drive it at the rate of 24 miles an hour, and to stop the carriage in a distance of 24 yards. In the presence of several engineers the carriage laden with passengers, ascended an incline of 1 in 9, the rails being in a very bad state at the time from wet.

Since the introduction of wood paving, it may be calculated that a saving of one-half has been effected in the wear and tear of carriages, horses and harness, in those districts where it has been adopted; a saving equally great can be made in the construction of railroads by the substitution of wood for iron rails.

The rails may be made of beech or other hard English timber, six or eight inches square, let into wooden sleepers, and secured by wooden wedges, forming one great frame, or wooden grating of longitudinal and cross sleepers."

An engine weighing 10 tons running on wood will have more tractive power than one weighing 18 tons running on iron; and as the concussion and abrasion on wood is so trifling, carriages built to weigh one and a half tons will be as strong as those having to run on iron weighing three tons.

An important question connected with this subject is the durability of the material of which the rails are composed.

The engine employed for the experiment weighed about six tons: it passed over the rails during the two months it ran 8,000 times in every variety of weather, which is equal to nearly seven years' traffic of 12 engines per day. The rails consisted of Scotch fir, about nine feet long and six inches square; and yet upon examining them after the severe test to which they had been subjected, they exhibited no appearance of wear from the friction of the wheels on the upper surface, as the saw marks were not effaced.

The capability of wood to sustain the strain to which it must necessarily be exposed, especially when moving over it at high velocities, has been satisfactorily proved by the experience of the Great Western, and other railways, where continuous longitudinal sleepers of wood have been employed, and experience has shewn that the solidity of the road is much greater than when the iron rails were attached either to stone blocks or traverse wooden sleepers. In proof that wooden rails cut from beech will bear the wear and tear of trains passing over it, it is well known that beech cogs have been known to last 18 to 20 years when working in gear with an iron wheel.

The rails on the Vauxhall line were prepared by Payne's patented process for preventing dry-rot and decay of timber.

Scotch fir, if subjected to pressure, will crush at 10 tons, while beech (the wood recommended for railways) will bear a pressure of 82 tons before it begins to yield.

Experience having confirmed the capability of Scotch fir to withstand the traffic

of 12 engines per day for seven years, without any visible wear; it would be difficult to say how long rails cut from beech, sustaining 82 tons pressure, would last.

Some of the impediments with which railroads have to contend, are, the undulations of the country, and the necessity of diverging from a right line, in order to obtain the traffic of important towns.

These obstacles can only be overcome by an enormous outlay of capital, in making the required excavations and embankments, or by the oftentimes ruinous system of tunnelling, and, after all, inclines of greater or less gradients are unavoidable, and prevent the line working economically. Curves on iron railroads are highly prejudicial, especially if the radius be small, as the wear and tear becomes proportionably increased.

Now, by the introduction of the proposed plan, the evils arising from the obstacles alluded to would be very materially diminished; for in the first place, the surface resistance obtained by the elastic character of wooden rails, enables a train to be propelled up inclines, with much greater facility and ease than on rails constructed of iron.

The advantages of wooden railways thus constructed in point of economy, comfort, durability, and as feeders to the great and central lines already formed, must be apparent to every one who has given the subject any consideration.

The result of a series of experiments, made to ascertain the proportionate power of the bite of wood over iron, has fully borne out the assertion of the patentee, that the bite of the driving wheel on wood, is nearly double that on iron.

On the surface of an iron wheel four feet diameter, a lever eight feet long was placed with a weight of seven pounds attached to the lever three feet from the centre of the axis of the wheel; the surface of the lever being iron at the tangent of the wheel, it required a weight of 28 pounds attached to the crank to make it revolve. On substituting a wood surface for the iron one, it required a weight of 42 pounds.

Another experiment confirmed the result with the iron surface: a weight of 28 pounds attached to the spoke of the wheel, at a distance of six and three-quarter inches from the centre, made it revolve; whilst with a wood surface, it required the same weight to be attached to the spoke at a distance of eleven and a half inches from its centre, thus clearly demonstrating the power obtained by the bite of the wood is nearly double the bite of iron.

And speaking of these experiments, Herepath's journal, says, "The rails just laid down, soused by a heavy rain, were in a most wretched state of level, such that we believe no ordinary train—we mean constructed in the common mode—could have traversed at scarcely a walking speed, much less at that which the model obtained on Wednesday. At the left-hand sharp curve, turning into the circle where the gradient was as heavy as 1 in a 100, the worst portion of the rails occurred: yet the engine and train ran up this incline, and worked the curve with the undiminished speed of 20 to 25 miles an hour. That was a pretty good test of the capabilities of the system.

Mr. J. M. Mason, (of *Trent* notoriety) when in England, devoted some attention to Prosser's system of wooden rails, with a view to their use in the Southern States during the war, and in a letter to Mr. C. J. Blomfield, he writes, "I was most strongly impressed with their *feasibility* and *durability*."