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CIVIL ENGINEERING.

*On the Railways and Telegraphs of Great Britain.** Address of ROBERT STEPHENSON, Esq., President of the Institution of Civil Engineers, January 8th, 1856.

After a complimentary allusion to the addresses of his predecessors, the President observed, that he would apply himself to the great question of British Railways, which were described as spreading like a network over Great Britain and Ireland, to the extent of 8054 miles completed ;—thus, in length, they exceeded the ten chief rivers of Europe united, and more than enough of single rails were laid to make a belt of iron around the globe.

The cost of these lines had been £286,000,000,—equal to one-third of the amount of the national debt.

The extent of the railway works was remarkable ;—they had penetrated the earth with tunnels to the extent of more than fifty miles ; there were 11 miles of viaduct in the vicinity of the metropolis alone ;—the earth works measured 550,000,000 of cubic yards.

Eighty millions of train miles were run annually on the railways ; 5000 engines and 150,000 vehicles composed the working stock ; and the companies employed 90,400 officers and servants ; whilst the engines consumed annually 2,000,000 tons of coals ; so that in every minute of time 4 tons of coal flashed into steam 20 tons of water. The coal consumed was almost equal to the whole amount exported to foreign countries, and to one-half of the annual consumption of London.

In 1854, 111 millions of passengers were conveyed on railway ; each passenger traveling an average of 12 miles. The old coaches carried an

* From Newton's Lond. Journ., Feb., 1856.

average of 10 passengers; and for the conveyance of 300,000 passengers a day 12 miles each, there would have been required at least 10,000 coaches and 120,000 horses.

The receipts of the railways in 1854, amounted to £20,215,000; and there was no instance on record in which the receipts of a railway had not been of continuous growth, even where portions of its traffic had been abstracted by the competition of new lines.

The wear and tear was great; 20,000 tons of iron required to be replaced annually; and 26 millions of sleepers annually perished; 300,000 trees were annually felled to make good the loss of sleepers; and 300,000 trees could be grown on little less than 5000 acres of forest-land. The President considered, at some length, how these annual depreciations should be met. The principle of a renewal fund was questionable. After a certain period in the history of every railway, deterioration reached an annual average, and as that annual depreciation became a charge, as fixed and certain as the cost of fuel, or the salaries of officers, it should be admitted as an annual charge against receipts.

As regarded fares, the interests of the companies and of the public were identical: companies must regulate fares, by consideration of the circumstances which produced the largest revenue, and the circumstances which produced the largest revenue were those which induced the greatest number of individuals to travel. Nothing was so profitable as passenger traffic, as it cost less, in every way, than goods, and an average train would carry 200 passengers. The cost of running a train was over stated at 15 pence per mile; and 100 passengers at five-eighths of a penny per mile produced 5s. 2½d. But this argument did not imply that, in all cases, fares should be fixed at a minimum. Minimum fares were most profitable on short routes; but the public were too much occupied, to be tempted by minimum fares to undertake long journeys. High rates of speed and increased comforts were then required, and these might be charged for. Every case, therefore, should be treated in consideration of its local circumstances.

The postal facilities afforded by railways were very great. But for their existence, Mr. Rowland Hill's plan never could have been effectually carried out. Railways afforded the means of carrying bulk, which would have been fatal to the old mail coaches. Every Friday night, at present, when the weekly papers were transmitted, 8 or 10 vans were now required for post-office bags on the North Western Railway, and this use of 8 or 10 railway vans implied, at the least, the employment of 14 or 15 mail coaches; and the expenses of 14 or 15 mail coaches to Birmingham, could never have been sustained by a penny postage. For this great blessing, therefore, the nation had to thank the railways. They were the great engines for the diffusion of knowledge. The Parliamentary blue books never would have been printed; for except by canal, or by wagon, they could not have been distributed; and if they could not have been circulated, they would have been useless. Nevertheless, the post-office did not appear to treat railways with all the consideration they were entitled to expect. Great services were required, and in return, it had been contended, that no profit should be allowed to the railway companies, except as carriers and workers of the line.

Railway companies were, therefore, indifferent to postal traffic ; and this was shown to be a serious disadvantage to the public. At present the post-office competed with railways, as carriers of book parcels, a principle which might be extended still further, but not without injustice and hardship to the railways.

Parliamentary legislation for railways was full of incongruities and absurdities, which were graphically described and illustrated. The Acts of Parliament which railways had been forced to obtain, had cost the public fourteen millions sterling. But this was shown to be the exclusive fault of Parliament itself, and of the system it enforced. The legislation of Parliament had made railways pay 70 millions of money to land-owners for land and property ; yet almost every estate traversed by railway had been greatly improved in value. Parliament had taxed the Companies in favor of the land-owners for what was called "severance." Claims for compensation for severance were based on theories which were wholly ideal and imaginary. No one had ever been able to show a practical loss by severance ; and the claim was often made as customary, where it was even admitted that no ground for it existed. The remedy which suggested itself for this state of things, was a competent tribunal, which Parliament was not likely to grant. If a mixed commission could be organized, to consist of practical men of acknowledged legal, commercial, and mechanical ability, there might be some chance of railway business being efficiently conducted. But it was admitted that there was little hope of any such concession.

Railway management was next considered, and shown to be completely anomalous. Parliament had legislated for railways as toll-taking companies ; but every direction was obliged to embark in enterprises foreign to the parliamentary objects of the railway itself. This produced serious dilemmas. As long as dividends were kept up, the Directors were popular, however illegal their acts ; but the moment dividends fell, the Directors, however energetic, wise, or prudent, were visited by the shareholders and the public with all the penalties of having exceeded the letter of the law. Men, whose reputations were at stake, were consequently unwilling to incur the risk of becoming railway directors ; and the most enlightened managers and shareholders were revolving in their own minds how the dilemma could be escaped. It was suggested, that advantage might be taken of the Limited Liability Act, or of some analogous measure, to enable a limited number of men of business to take lines of railway from shareholders on leases, subject to certain conditions and terms. A few of the lessees would then constitute themselves managers ; and being free from apprehensions on account of shareholders, of external interference, or of personal liabilities, they would be able fully to work the line, and enter into those enterprises necessary for its development, and essential to its prosperity. A large profit would accrue to those who took the line, and managed it with vigor and economy ; whilst shareholders would derive great advantages from the certainty of receiving fixed dividends, and from the enhancement of the value of their property ; and practical security would be afforded to the public, whilst their best interests would be consulted.

The Electric Telegraph—that offspring and indispensable companion

of railways—was next considered. 7200 miles of telegraph, or 36,000 miles of wires, at least, were laid down. 3000 people were continually employed, and more than a million of public messages were annually flashed along this “silent highway.” To the working of railways, the telegraph had become essential. The needle was capable of indicating, at every station, whether the line was clear or blocked, or if accident had any where occurred. The telegraph could, therefore, do the work of additional rails, by imparting instantaneous information to the officers, and enabling them to augment the traffic over those portions of the line to which their duty might apply. It also enabled large savings to be effected in rolling stock, by affording the means of supplying such stock to any station at which it was needed, from some other station where it had accumulated and was not wanted. The mode in which this system was worked was described, and its simplicity was commended. As a perpetual current was passing through the wires, the guard, or engine driver, had only to break the train-wire in case of accident, and the officers at the nearest station were instantaneously apprized that something was wrong, and that assistance was needed. Statistics were given, to show that the business of the Electric Telegraph Company had increased fifty-fold in seven years.

Railway accidents occurred to passengers, in the first half of 1854, in the proportion of one accident to every 7,195,343 travelers. Ladies and gentlemen could scarcely “sit at home at ease” with the impunity with which, it appeared, that they could travel by railway. How frequent, comparatively, were the accidents in the street; how fearful the misadventures to those “who go down to the sea in ships.” Yet Parliament had seen fit to legislate expressly for accidents by railways, without legislating in the same way for accidents from other sorts of locomotion. This was unfair to railways, and ill-calculated to afford protection to the public where it was most needed. Lord Campbell’s Act, also, measured men’s lives by a class standard. The family of a high public functionary would get large compensation, whilst the family of the poor working-man would get nothing. The practical tendency of this law was to retard the adoption of low fares. Railway managers were compelled to consider, not only what they might gain, but what they might lose; and the larger the number of passengers, the greater the risk of accident to some one of them. The companies were, practically, obliged to insure the life of every person who traveled on their line, without being able to apportion the premiums to the risks incurred.

The results of railways were astounding: 90,000 men were employed directly, and upwards of 40,000 collaterally;—130,000 men with their wives and families, represented a population of 500,000 souls; so that 1 in 50 of the entire population of the kingdom might be said to be dependent upon railways. To the public “time is money,” and, in point of time, an enormous saving was effected; for on every journey averaging 12 miles in length, an hour was saved to 111 millions of passengers per annum, which was equal to 38,000 years in the life of a man, working eight hours a day; and allowing an average of 3s. per diem for his work; this additional saving was £2,000,000 a year. The moral results of railways were equally remarkable: railways were equalizing the value

of land throughout the kingdom, by bringing distant properties practically nearer to the centre of consumption, and by facilitating the transit of manures; thus enabling poor lands to compete with superior soils. The stimulus afforded to national industry was exemplified, by the progress of the boiler-plate manufacture; and the increased comforts afforded to the people were illustrated by the extraordinary progress of the fish trade, and the development of the inland coal traffic. It was observed, that before railways existed, internal communication was restricted by physical circumstances: the canal traffic was dependent on the supply of water at the summit levels, and upon the vicissitudes of seasons of either drought or frost. Railway communication was free from all these difficulties, and every obstacle that nature had opposed, science had hitherto effectually surmounted.

The address concluded with some words of practical application. The duty devolved on Civil Engineers, of improving and perfecting this vast system. Every farthing saved, on the train mileage of the kingdom, was £80,000 a year gained to Railway Companies. There was, therefore, ample field for economical appliances, and therefore no economical arrangement, however trifling, was to be neglected. Nothing would afford the President greater satisfaction than that from his observations some sound practical improvement should result to a system with which his name, in consequence of his father's works, had been so largely associated; for however extensive his own connexion with railways, all he had known, and all he had himself done, was due to the parent whose memory he cherished and revered.

*Remarks on Floating and Fixed Lighthouses.** By DAVID STEVENSON,
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SIR—At the meetings of the Institution of Civil Engineers held on the 13th and 20th of November, at which I was not present, Mr. George Herbert's proposals for constructing Floating Lighthouses were read and discussed. I find from the Transactions, that on that occasion it was stated that the important objects fulfilled by the Eddystone, the Bell Rock, and the Skerryvore lighthouses, could be attained by means of a floating tower, with equal efficiency, and at a cost greatly inferior to the amount expended on these national works; and in proof of this, the actual cost of these three lighthouses was compared with the *estimated* cost of towers constructed on the new principle. These important sea lights having been thus specially and publicly referred to, I feel that no apology is necessary on my part for taking this mode of vindicating the proceedings of the Boards under whose auspices they were erected, as it can be satisfactorily shown that the objects which they serve could not be obtained in the manner proposed, and, therefore, no comparison of cost, such as has been made in the Transactions of the Institution of Civil Engineers, can in reality be justly or fairly instituted. Mr. Herbert's

*From the Lond. Civ. Eng. and Arch's. Jour., Jan., 1856.