

TRAMROADS

IN

NORTHERN INDIA,

IN CONNECTION WITH THE

IRON MINES OF KUMAON & GURHWAL.

BY

W. P. ANDREW, ESQ., F.R.G.S.,

AUTHOR OF "RAILWAYS IN INDIA," BY AN OLD INDIAN POSTMASTER,
CHAIRMAN OF THE SCINDE AND PUNJAUB RAILWAYS.

"We shall never be able to export Cotton in any great quantity without long and cheap Railways, and they can never be constructed until we can use native iron."—*Vide* REPORT OF PROCEEDINGS OF LAST MEETING OF SCINDE SHAREHOLDERS.

"Speed in forming communications is of more importance to India, than speed in travelling on them."—COLONEL COTTON.

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1857.

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HOME NEWS.

A new line of railway—new, especially in its plan—has been brought out. The cost of the railway will be half the common price in the more costly portions, and generally little more than one-fourth. The traffic will be carried at a slower rate than by heavy engines on expensive lines; but the cost will be small, and the line will bring down the produce of the Himalaya slopes, and the fertile regions between them, Delhi and Meerut, to join the Punjaub line and the Indus river.

The details of the plan are distinctly stated in the prospectus, which we publish. Its success will feed the Punjaub and Scinde lines and the Indus river navigation; that is an important matter to the shareholders in these great works. Its importance to North-Western India consists in cheap and yet rapid carriage of its productions. Its importance to all India, and to all similar regions, rests in its model character.



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THE NORTH OF INDIA TRAMROAD COMPANY LIMITED.

For introducing a cheap System of Communication throughout the Province of Rohilkund and adjacent territory, connecting the Ganges with the Indus, and also with the Iron Districts of Kumaon and Gurhwal, vid Futtayghur, Shahjehanpore, Bareilly, Rampore, Moradabad, Meerut, Seharunpore, Umballah, Loodheana, and Umritsir.

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To be Incorporated under the Joint Stock Companies' Act, 1856.

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## CHAPTER I.

IMPORTANCE OF RAILWAYS IN INDIA—NECESSITY FOR SPEEDY COMPLETION OF—DIFFICULTIES OF GETTING OUT MATERIALS—INDIA MADE SELF-SUPPLYING, EVILS AND DEFICIENCIES OF MAIN TRUNK LINES—ROHILCUND “THE GARDEN OF INDIA”—ITS THREATENED DECAY—IRON DISCOVERIES ON ITS BORDERS—CAPT. YULES’ REPORT ON TRAMROADS FOR ROHILCUND—BISHOP HEBER ON ROHILCUND—MR. STRACHEY’S OPINION ON TRAMROADS—WANT OF ROADS AND ROAD METAL—MR. BATTEN’S OPINION—MR. SOWEBBY’S REPORT AND ESTIMATE—MR. MURRAY ON ANIMAL TRACTION.

THE value and importance of railways for India has been now so fully discussed, and the necessity for their early completion acknowledged by every person interested in the subject, that it would be superfluous to repeat here all the arguments which have been adduced in their favour. But the mode of accomplishing this important object is a matter upon which there is still much to be said, and the difficulties to be encountered, are of a kind that require no small amount of energy and foresight to overcome.

The first and almost insurmountable difficulty in the way of rapidly covering India with a net work of railways adequate to the requirements of such a vast, fertile and densely populated territory, is from the impossibility of transporting materials such as iron, fast enough to complete the works. Besides, India requires more than all other countries, an inexpensive system of railways, or rather of tramroads. The cost, however, of sending out from England the whole of the materials for the making of the permanent way would involve so great an expenditure, that a complete railway system suitable to

the wants of India could only be constructed at an expense far too great to be ever undertaken, and thus many valuable districts would remain unprovided for. But recent researches have shown that India possesses within herself the very material which is most wanted; namely, abundance of indigenous iron, requiring only to be worked on a proper plan, to ensure a cheap and rapid supply of the very article, the want of which now retards their progress, and the possession of which will be the means of giving to the country a system of railways unsurpassed by that of any country in the world.

As the main trunk lines in India slowly progress towards completion, it has also been foreseen by those who are ever watchful over the future welfare of the country, that whilst they will be accompanied with the greatest benefits to those parts of the country through which they pass, that these benefits will also be accompanied by serious evils; and that other parts of India will suffer which are not in the immediate neighbourhood of the railway, and which are unconnected with it, by some equally cheap and expeditious mode of communication.

This is a natural result, and unless branches are made through those parts, the consequences will be most disastrous to the provinces thus left in the back ground. Their trade will become diverted from the old and well established channels, their great marts of exportation will become lost to them, and they will be superseded by remote districts at present separated from these marts, but which will become connected with them by the completion of the main trunk lines.

Moreover, the resources of a country can never be fully opened out by main trunk lines alone, there must be extensions, connecting links and branches, those liberal feeders of trunk lines, to bring down the produce of remote districts. But these must be of an inexpensive

description, otherwise they cannot be made, and they would never repay the outlay if they were made at a cost of £10,000 per mile, even supposing they can be made for that sum. Whilst, then, the main lines cannot be got forward with anything like the rapidity which the necessities of India and England demand, for the reasons already stated, the making of branches must have long remained in abeyance, had not the important discovery of iron in the country come to our aid. And the discovery is the more opportune, as it is made at a period when it is most loudly called for. It is one of those providential circumstances which resembles, in importance, the valuable gold discoveries of California and Australia.

#### *The Rohilcund Tramroad.*

One of the first districts which would suffer from the evils of a want of proper communication through it, where no provision is made to supply the want, is the rich province of Rohilcund, "the Garden of India," as it is invariably called; whilst its remote distance from the port of Calcutta would entail a heavy expense for carriage, if all the materials had to be brought out from England. The timely discoveries above alluded to, and which lie on its borders, will now enable a remedy to be applied before the evil is seriously felt.

When the iron discoveries at the foot of the Himalayas, along the borders of Rohilcund, were first made known by Lieutenant-Colonel Drummond to Mr. Colvin, the Lieutenant-governor of the North-west Provinces, he judged rightly of their importance, and with his usual decision wisely determined, regardless of expense, to leave no stone unturned, and no experiment untried, which would settle the question of their value; for he well knew, and had long foreseen, what would be the consequences to Rohilcund if the East Indian Railway

was completed, and there was no such accommodation for this valuable and rich province.

Even as early as the season of 1854-55, before the iron discoveries were made, the Lieutenant-governor of the North-west Provinces had directed enquiries to be made on the subject of a railway for Rohilcund. This enquiry was ably conducted by Captain Yule, the deputy consulting engineer to the government of India, and a valuable report, full of practical details, was the result of his labours. This report goes into the practicability of the line, of which there can be no doubt from the level character of the country and the existing roads being very imperfect from the absence of proper road metal, thereby proving how urgent a need there is for an iron way, either railway or tramway. The report also enters fully into details as to the cost of making tramways adapted for animal traction,—which its author puts down as from £1,300 to £2,650 per mile,—as well as for a railway for light locomotives at from £4,350 per mile. This estimate is based on the assumption that the whole of the iron would have to be brought from England at a cost, when delivered on the works, at from £16 to £49 per ton,\* which is the present price of iron in Rohilcund. Captain Yule also goes carefully into the question of returns, which he makes out at from £6 to £8 per cent. on a very moderate traffic, far below what it actually is, especially since the annexation of Oude.

Mr. Sowerby, the engineer to the North of India Tram-road Company, after adding a sum for contingencies, fully confirms Captain Yule's report and estimates. This gentleman is well acquainted with the province, and had charge of the Government experimental iron works in Kumaon; and he states that, if he is able to get the iron on the spot, it will not only very greatly facilitate the rapid

\* See Table, page 67.



completion of the work, but will lessen the expense of the railway by at least £500 to £1000 per mile, according to the weight of the rail.

It would occupy too much space to follow out the details of Captain Yule's valuable report. He says, in reference to the line, "A complete line of railway, extending from Shahjehanpoor, would then connect in a space of 170 miles the towns of Shahjehanpoor (with a population of 75,000), Bareilly (112,000), Rampoor (probably 30,000), Moradabad (60,000), Umroha (35,000), Merut (40,000), and forty miles further, Delhi (152,000),—a string of populous places such as is rarely to be met with in the same compass." In another part he says, "*The project contained in this report is not for any branch properly so called, to the East Indian Railway, i.e., a tributary line to assist in swelling a great artery; it is intended as a remedy against a great mischief, which the great line is expected to cause to a great and productive province. And the remedy may be deferred too long; for trade having once changed its channel, it may be difficult to bring it back again.*"

The late Bishop Heber says, in reference to this province, "that, including the wooded part of the Terrai, there is a large forest along the whole eastern, southern, and northern frontiers." He found the southern part of the district to have a fine climate, little incommoded by hot winds, with a well-wooded, fertile, and highly-cultivated soil, producing in profusion rice, maize, wheat, cotton, sugar, tobacco, pulse, mangoes, plantains, walnuts, strawberries, grapes, apples and pears.

"*Cheap railroads,*" says Mr. Strachey, whose official position at Moradabad gives the utmost value to his testimony, "seem peculiarly adapted to this part of India. Through the greater part of Rohilcund there is little *kunkur* to be found, and there is no other material available for metalling roads. Consequently, the con-

struction of really good roads, fit to carry a heavy traffic, is generally impossible, except at an enormous expense. In this district there is not a single metalled road, nor can I see a probability of any being made. My experience of road-making in the plains has been so small, that I can say nothing from my own knowledge, but if Colonel Cotton may be believed, the average cost of a good metalled road in this country is not less than 5,000 rupees per mile. I believe that in this district it would probably much exceed that sum. The average cost of transit is now very great,—not less probably in the most favourable season than  $1\frac{1}{2}$  anna per ton per mile; and as for three months of the year the roads may be considered almost impracticable for carts, the true average cost of transit for the year must be still higher. If this state of things could be easily amended by the construction of good common roads, it might perhaps be doubtful whether it would not be better to expend a large sum of money in making a great many miles of good common road, than in making a comparatively few miles of railroad. But the difficulties in the way of making good metalled roads, fit to carry the traffic along the main lines of transit through Rohilcund, would be so great, and the expense of keeping up such roads, when made, would be so high, that I cannot doubt that it would be far better, and far more economical in the end, to construct a line of cheap railroad at once. The plan which I believe has been recommended by Captain Yule, that the railroad should be adapted only for cattle draught, seems to me to be a very judicious one. For my part, I entirely believe, with Colonel Cotton, that the thing wanted is, ‘*Speed in forming communications, not speed in travelling upon them.*’

“The effect which the opening of the great line of railway from Calcutta to Delhi may have upon the trade of

Rohilcund, is a matter deserving the most serious consideration. I have no present means of forming any positive conclusions on the point, but I think it clear, that the danger is no imaginary one, that the rice and sugar of Rohilcund may be superseded in the markets of the west, by the produce of the country to the south, lying near the line of railway. If such a thing were to happen, and its sole good market were to be lost, the results would be disastrous to Rohilcund. The proposed Rohilcund railroad would clearly be a complete preservation against any danger of this kind.”\*

Mr. Batten, late Commissioner of Kumaon and Gurhwal, says, in reference to the Rohilcund province, that “an ordinary subject of complaint, both by the Government trade authorities and the principal landholders of Rohilcund, is, that their produce of sugar, rice, &c., cannot now compete with that of Azimghur, brought up the grand trunk road of the Doab; and that the introduction of British government and increased agricultural prosperity in the Punjab will eventually close that market, the Punjab being self-sufficing. If this is the case, with a kunkur trunk road, what would the result against Rohilcund produce, with a railway in the Doab and no junction from Rohilcund? Even at the present time the landowners and others are selling their draught oxen and elephants, having no longer employment for them for want of good roads, and the consequent decreasing traffic along them.”

It is, then, for the preservation of this fine province from decay, and its industrious and tranquil population

\* Extract from Report of J. Strachey, Esq., Officiating Collector at Moradabad, to R. Alexander, Esq., Commissioner of the Rohilcund Division, dated 14th April, 1855, in the Appendix to the Report of Capt. Yule, Deputy Consulting Engineer to the Government of India, on “Railways for Rohilcund.”

from ruin, that a tramroad through Rohilcund is imperatively called for, and to provide which, the North of India Tramroad Company has been formed. Based, as the objects of the Company are, upon sound, old-established, and well-understood principles, it will, it is hoped, meet with the same encouragement from the Government that it has already done from the public, as shown by the rapidity with which the capital of the Company has been subscribed, and that too at a time of unusual commercial depression.

The prospectus of the Company states that its object is the introduction of a system of Tramroads into the most fertile and populous districts of Northern India, commencing at the Station of Futteyghur, and running thence through the Province of Rohilcund, "The Garden of India," containing a population of above 350 persons to the square mile.

From Futteyghur, it will proceed in a northerly direction to Shahjehanpoor, and thence to Bareilly the capital of Rohilcund, with a Branch to Philibeet, and ultimately to Bhurmdeo, at the foot of the Himalayas, where the merchants of Nepal, Thibet, and Chinese Tartary, meet those of Upper and Lower India, for the exchange of their commodities.

From Bareilly, the line will continue in a westernly direction to Rampoor and Moradabad, and thence to Meerut, and ultimately to Delhi.

The importance of this line will be best understood from the fact, that it has already been examined and reported on by the Deputy-Consulting Engineer to the Government of India, Capt. Yule, and its construction urged by the authorities of the province. In reference to this Capt. Yule says in his report, "A complete line of railway, extending from Shahjehanpoor, would then con-

nect in a space of 170 miles, the town of Shahjehanpoor with a population of 75,000, Bareilly (112,000), Rampoor (probably 30,000), Moradabad (60,000) Umroha (35,000), Merut (40,000), and forty miles further, Delhi (152,000), a string of populous places which is rarely to be found in the same compass."

Subsequently, it is proposed to extend it in a north-western direction by way of Moozuffurnugger and Saharunpoor to the great military Station of Umballah, with a branch by the Government Works at Roorkee to Hurdwar, the Nishni Novgorod of India. At the celebrated fair of Hurdwar, merchants congregate, not only from every part of India, but from the most distant parts of Central and Northern Asia, and in such crowds, that the number of visitors is estimated, at times, to equal the population of London. The line to Hurdwar would also be the great communication between India and the western part of Thibet, as well as an outlet for *the tea of Dehra Doon*, and the timber of the lower Himalayas. From Umballah, the line will continue north-west through Loodheana to Umritsir, where it will join the Punjaub Railway; thus connecting the railway systems of the Indus and the Ganges.

Southward from Shahjehanpoor, should it eventually be deemed desirable by the authorities, the line would run through the recently acquired territory of Oude, *viâ* Lucknow to Benares, where the Ganges is permanently deep, and capable of floating powerful steamers, even in the driest seasons, down to Rajmahal. Thus, an alternative line would be offered for the conveyance of troops and stores to the north-west frontier, a strategic advantage of which it is difficult to exaggerate the political importance.

Such portions of the line as are required for heavy traffic will be formed of a substantial character. It has

been estimated that the cost of constructing no portion will exceed £5,000 per mile, and a large portion will not exceed one-half that amount.

The first portion of the line intended to be constructed will be about 250 miles; namely, from Futteyghur to Delhi, *viâ* Shahjehanpoor, Bareilly, and Moradabad. For the completion of this section the estimated capital will be sufficient.

The system intended to be introduced will be more suitable to the actual requirements of the country than lines costing £9,000 to £10,000 per mile. The present rate of travelling in India by camels and carts seldom amounts to 80 miles per week. If, therefore, 80 miles per day can be accomplished, it is obvious how great a boon will be conferred upon India. Of such a system, this line would be not only the model, but the fruitful parent. By establishing a connection with the iron districts, and by its inexpensive construction developing local traffic in parts unfitted for more costly works, it would not only act as a most important and liberal feeder to the lines already in course of construction, but bring down to them, at a cheap rate, much of the material so indispensable for their speedy completion.

Animal power will be employed in the first instance, until the traffic becomes more developed. "A horse," says Capt. Yule, "can draw at least eight times as much gross weight on a level railway as it can on a level turnpike road." But as the traffic increases, light locomotives may be used, with a moderate speed. Some portions of the line, however, will be adapted for light locomotives from the commencement.

The construction of the tramroad will be rendered very cheap by reason of the facility for drawing timber in any quantity from the adjacent dense forests at the foot of the

Himalayas, and ultimately the Company expect to obtain a large portion of their iron for rails, at a reduction of one-half the present cost, from the recently-discovered iron mines of Kumaon, where iron works have been already commenced. But the estimates for the line have, in the mean time, been based upon the supposition that the iron will have to be brought out from England.

The Company hope to complete the line, recommended by the Deputy Consulting Engineer to the Government of India, from Futteyghur through Shahjehanpoor, Bareilly, Rampoor, Moradabad and Meerut, to Delhi, in about three or four years, from the time of obtaining the sanction of the authorities.

The following letter and reports fully explain the proposed operations of the Company.

FROM W. P. ANDREW, ESQ., TO SIR JAMES C. MELVILL,  
K.C.B., &c., &c.

*The North of India Tramroad Company Limited,  
Gresham House, Old Broad Street.*

*London, E. C., April 7th, 1857.*

SIR,

IN my letter of November 22nd, 1856, relative to a proposal, therein contained, for the development of the iron mines of Northern India, I drew the attention of the Honourable Court to the favourable opportunity that would thus be presented for introducing on an extensive scale iron tramways, suitable for animal power, especially into that part of India, and thus of affording a cheap and expeditious mode of completing the connection between Delhi and Lahore, as well as of facilitating the construction of the proposed railway in the valley of the Indus.

2. In furtherance of this object, I have now the honour to enclose for the information of the Honourable Court, the

prospectus of the North of India Tramroad Company, which has lately been incorporated, with a capital of one million, for the purpose of introducing a cheap system of communication throughout the province of Rohilcund and the adjacent territory, connecting the Ganges with the Indus, and also with the iron districts of Kumaon and Gurhwal, commencing at Shahjehanpoor, and running to Bareilly, Rampoor, Moradabad, Umroha, Meerut and Delhi, with branches to Futteyghur, Philibeet and Nugeena, as proposed by Captain Yule, the deputy consulting engineer to the government of India, with eventual extensions northward to Umritsir and (if deemed advisable by the Honourable Court) southward to the Ganges at Benares.

3. With the exception of 15,000 shares reserved for India, the whole of the capital of the North of India Tramroad Company has been subscribed for, and the deposits paid to the bankers of the Company.

4. From the detailed reports of the engineer and consulting engineer, copies of which are appended to this letter, the Honourable Court will perceive that, in the first instance, it is proposed to construct the tramroad from Shahjehanpoor to Delhi, with branches to Futteyghur, Philibeet and Nugeena, a length of  $306\frac{1}{2}$  miles, of a character fitted for the occasional use of light locomotives, at an outlay not exceeding £3,000 per mile.

5. At the same time, however, the line will be so constructed as to admit of being eventually adapted to constant use by such locomotives, in the event of the development of the commerce of Rohilcund and Oude occasioning so great an increase of traffic, especially on that portion between Bareilly and Meerut, as to render such alteration necessary.

6. The entire expenditure, including rolling stock on the  $306\frac{1}{2}$  miles of tramroad, with the construction of which it



is proposed to commence, will not not exceed £907,500, thus leaving a margin for contingencies of £92,500.

7. The importance of establishing such an inexpensive means of communication as would connect the iron districts with the places where their produce is most urgently demanded, and at the same time develop local traffic in parts as yet unfitted for more costly works, will at once be recognised by the Honourable Court, especially when so constructed as to admit of the use of more powerful locomotives so soon as the traffic of the country may render it advisable.

8. Considering, therefore, the important bearing these projected tramroads have on the speedy distribution of the inexhaustible supplies of the native iron from the mines at the foot of the Himalayas to the lines in course of construction, or under survey, in the valley of the Ganges and the Indus, as well as their effect on the development of local traffic, and their operation as feeders of the more expensive railway systems, it is hoped that this Company may receive the sanction and support of the Honourable Court, and a similar guarantee on capital to that heretofore granted to Indian railway companies.

9. From numerous conversations with eminent officers, engineers and other local authorities in the service of the Honourable Court, whose knowledge of the country and its requirements gives great value to their opinions, I have learned with satisfaction that the proposal I have now the honour to submit meets with their entire approbation, and is considered by them as specially adapted to the immediate wants of Rohilcund and the adjacent territory.

10. Soliciting the early attention of the Honourable Court to this communication,

I have the honour to be, &c.

(Signed) W. P. ANDREW.

*Chairman.*

TO SIR JAMES C. MELVILL, K.C.B.

From W. SOWERBY, Esq., C.E., F.G.S., to the DIRECTORS  
of the North of India Tramroad Company.

*London, April 3rd, 1857.*

GENTLEMEN,

I have the honour of submitting to you an estimate for that portion of your proposed undertaking which passes through the province of Rohilcund, commencing at Futtygurh and terminating at Delhi, with its branches to Philibeet and Nugeena.

In doing so, it will be as well to make a few general observations for your information and guidance.

In selecting the route of the proposed line and branches, I have followed with but little deviation that suggested by Captain Yule (Deputy Consulting Engineer to the Government of India), who, as you are aware, examined and reported on the subject some time ago to the Government of the north-west provinces.

The maps of this part of the country, which are published by the authority of the Honourable East India Company, are so minute and full of detail, as to have enabled me to lay down the line, measure the distances, and obtain other necessary details, with great accuracy. Having had occasion to use these maps when in India, for laying out portions of the line I was then employed upon, and for the survey of the iron districts, I have the greatest confidence in their correctness.

Having, upon several occasions, traversed the greater part of the country through which the proposed line passes, I am therefore quite familiar with its general features.

I have also a personal knowledge of the size and peculiarities of the various streams the line will have to cross. This familiar acquaintance with the country has enabled me to lay down the line and prepare the estimates, almost,

if not quite, as correctly as if I had actually surveyed the ground for this especial purpose.

In preparing the estimates, I have also had the advantage of being able to compare them with those contained in Captain Yule's report, which is full of valuable data, both as to cost of materials and to labour, and likewise as to the traffic likely to pass over the line. But I have likewise had the advantage of my own personal experience in this part of India as to the cost of labour and materials, so that the estimates may be fully relied upon as a very close approximation to the truth.

There is one item in the estimates for the line to which I think it right to direct your particular attention, that is, the price of iron for the rails, which I have put down at £16 per ton, which is the present price in Upper India, and which is double the average price in England.

I have also taken for smaller iron work, such as bolts, straps, and spikes, a proportionate higher rate. Captain Yule has assumed the same high prices for iron.

This material will, however, I believe, be very greatly reduced in price by the manufacture of iron at the foot of the Himalayas, where the working of iron has, as you are aware, already been begun by the Government.

The amount of reduction in price will, I think, be at least one-half, bringing the cost down to the same as what it is in England, thereby saving the expense of freight and carriage.

It is not, however, so much in a reduction of the cost of the iron that should be looked forward to, as the greater facility that will be afforded for the more rapid completion of the works, by avoiding those delays that are due to the transport of the materials from England.

Until proper works are established on an adequate

scale by an independent company, under the sanction of the Honourable East India Company, there will be no difficulty in procuring every kind of small iron work at a moderate expense, but which is very expensive when sent out from England. This could be done by introducing a cheap improvement in the native mode of manufacturing iron, and can be done by your Company at a trifling outlay of capital, to supply its own immediate requirements.

The timber intended to be used, both in the permanent way and in the bridges, can be procured in unlimited quantity from the dense woods at the foot of the Himalayas, where the Saul forests exist, covering many hundred square miles ; but they are too well known to require any particular comment.

The East Indian Railway Company are at present procuring a large portion of their sleepers from these forests, to which railway they have to be conveyed upwards of 200 miles ; whereas to your line the average distance will be about 40 miles, — consequently, the timber will be obtained at a very moderate price.

With regard to these forests, I am speaking from my own personal knowledge of them, having myself cut considerable quantities of various kinds of timber in them, when employed upon the iron works.

#### *Route of Line.*

I will now proceed to describe the route of the proposed line.

What may properly be considered the main portion of the line will commence at Shahjehanpoor, and run in a westernly direction to Bareilly, thence to Rampoor, Moradabad, Umrohah, Dhunowrah and Merut, finally terminating at Delhi.

From Shahjehanpoor it is proposed to have a southern branch to the Ganges, opposite Futtygurh; and from Bareilly and Dhunowrah it is proposed to have two northern branches, one to Philibeet and the other to Nugeena.

Captain Yule on his plan omits the branch to Philibeet, but marks one to Nugeena, but the immediate execution of both or either of these branches, as well as the branch to Futtygurh, must be a matter for future decision, when the precise character of the main line from Shahjehanpoor to Delhi has been determined upon.

The following is a tabular statement of the places and distances :—

*Main Line.*

|                                 |           |
|---------------------------------|-----------|
| Shahjehanpoor to Bareilly . . . | 46½ miles |
| Bareilly to Rampoor . . . . .   | 37½ „     |
| Rampoor to Moradabad . . . . .  | 15 „      |
| Moradabad to Umrohah . . . . .  | 19 „      |
| Umrohah to Dhunowrah . . . . .  | 15 „      |
| Dhunowrah to Merut . . . . .    | 30 „      |
| Merut to Delhi . . . . .        | 37½ „     |
| Total . . . . .                 | 200½ „    |

*Branches.*

|                                  |           |
|----------------------------------|-----------|
| Shahjehanpoor to Futtygurh . . . | 36½ miles |
| Bareilly to Philibeet . . . . .  | 28½ „     |
| Dhunowrah to Nugeena . . . . .   | 37 „      |
| Total . . . . .                  | 102 „     |

The entire length of line proposed to be executed is therefore 302½ miles, and for which the estimates have been prepared.

*Character of the Country.*

The general contour of the country over which the proposed line will pass is almost uniformly flat, and with only a very moderate difference of elevation in any part. Consequently, the line will only require to be raised to a sufficient elevation by side cuttings, to prevent its being covered during the rains with water, or injured thereby; the average elevation of such embanking will in no case require to be more than four or five feet.

The line will cross several streams in its course, two of which only are of very great importance, namely, the Ramgunga and the Ganges.

The Ramgunga I have examined at Moradabad, and there will be no great difficulty in bridging it over.

The Ganges I have also examined, and from its great breadth it would require a bridge of some considerable magnitude. I therefore propose that it should be deferred until circumstances shall actually require it. In the meantime there will be no difficulty in passing the traffic over on a temporary structure resting on pontoons, or by having a steam ferry, similar to that on the Frith of Forth, where the train of waggons, &c. is bodily transported on a platform propelled by steam; or a still more simple and inexpensive mode can be adopted by means of manual labour, having a chain laid across the river. This latter plan is adopted on the Elbe, below Hamburgh, where the whole of the public traffic of carts, carriages, omnibuses, &c., are carried across the river, which is about half-a-mile wide, and about the same as the Ganges.

The following is a list of the principal streams to be crossed, the expense of crossing which, by bridges, it is estimated will be from £15 to £20 per yard forward, according to the size of the stream. The expense of

crossing these streams is included in the cost per mile of the line.

|          |                          |
|----------|--------------------------|
| Dorunnea | Ramgunga                 |
| Sunka    | Gangun                   |
| Dajora   | Nullahs, near the Ganges |
| Kosilla  | Chooeea, &c.             |
| Rajhera  |                          |

The expense of crossing the river Ganges is not estimated for in the regular estimate ; this will have to be provided for out of the marginal sum remaining of the capital of one million sterling above the regular estimates.

The expense of a chain ferry, as on the Elbe, will be about £5000 and of a steam ferry £10,000 sterling.

#### *Execution of the Works.*

In order that you may have a clear understanding as to what can be done with the amount of capital at your disposal in the first instance, namely, one million, I have prepared separate estimates for laying down the line on different plans. And to simplify the matter to you, I have reduced the estimates to a price per mile.

As the primary object of this Company is, "the introduction of a cheap system of communication, adapted to animal traction," the first estimate which I have prepared is for the entire line and its branches, being a length of 302½ miles, to be of an uniform character throughout.

This I have estimated for as a first-class tramway, with rails of 35lbs. per yard ; such a line would also admit of the occasional passage for special purposes of one or two light locomotives, not exceeding eight or nine tons, running at about ten to fifteen miles per hour. The estimated cost of such a line I have made out to be £3000 per mile, including every item of expense, such as earth-work, ballasting, permanent-way, sidings, stations, bridges,

culverts and rolling-stocks, and the estimate would stand thus :—

|                               |            |
|-------------------------------|------------|
| 302½ miles at £3000 . . . . . | £907,500   |
| Balance . . . . .             | 92,500     |
|                               | <hr/>      |
| Total . . . . .               | £1,000,000 |

But as that portion of the line between Bareilly and Merut, a distance of 116½ miles, will in all probability have a very considerable traffic passing over it from the commencement in conformity with the tenor of your prospectus, I have prepared an estimate for this portion of your line of a more substantial character, namely, with rails of 50 lbs. per yard, and adapted to the passage of light locomotives of about 9 to 12 tons weight, running at speeds of from 10 to 20 miles per hour.

It is proper here to explain, that in laying this portion of the main line of a character adapted for light locomotives, it is not, therefore, intended necessarily that locomotives should be used from the commencement, but only gradually introduced from time to time, as they could be obtained; the traffic in the meantime being worked by means of animals, precisely as was done originally on the Stockton and Darlington, and other English and foreign railways at their commencement, a few locomotives only being used after the lines had been opened several years, and then only used for particular purposes.

The estimate for this portion of the line, without the locomotives and necessary workshops, sheds and watering stations, would be £4,000 per mile, and including the locomotives, &c., it would be £4,500 per mile.

The making of this portion of the main line at £4,000 per mile would involve the necessity of shortening the length to be executed, and I would therefore recommend



the branch to Nugeena to be deferred ; the estimate would then stand thus :—

|                                               |                       | £          |
|-----------------------------------------------|-----------------------|------------|
| 116½ miles from Bareilly to Merut at £4,000 = |                       | 466,000    |
| Futtygurh to Shahjehanpoor . . . . .          | 36½                   |            |
| Shahjehanpoor to Bareilly . . . . .           | 46½                   |            |
| Merut to Delhi . . . . .                      | 37½                   |            |
| Bareilly to Philibeet . . . . .               | 28½                   |            |
|                                               | Miles 149½ at 3,000 = | 447,000    |
|                                               |                       | 913,000    |
| Balance . . . . .                             |                       | 87,000     |
|                                               |                       | £1,000,000 |

But if locomotives, with the necessary workshops, sheds, and watering stations, are to be included in the estimate for the portion between Bareilly and Merut, it would be necessary to defer not only the branch to Nugeena, but also the execution of the branch to Futtygurh from Shahjehanpoor, and the estimate would stand thus :—

|                                     | MILES. | £           | £          |
|-------------------------------------|--------|-------------|------------|
| Bareilly to Merut . . . . .         | 116½   | at 4,500 =  | 524,000    |
| Shahjehanpoor to Bareilly . . . . . | 46½    | ,, 3,000 ,, | 139,500    |
| Merut to Delhi . . . . .            | 37½    | ,, 3,000 ,, | 112,500    |
| Bareilly to Philibeet . . . . .     | 28½    | ,, 3,000 ,, | 85,500     |
|                                     |        |             | 861,500    |
| Balance . . . . .                   |        |             | 138,500    |
|                                     |        |             | £1,000,000 |

A part of the balance of £138,500 might be applied in making a simple tramway, adapted only for cattle draught, between Shahjehanpoor and Futtygurh, or between Dhunowrah and Nugeena.

Or the balance might be applied in laying down a similar tramway to the foot of the Himalayas at Birmdeo, a distance of forty miles from Philibeet, in order to bring down the timber, and likewise iron, if its manufacture is carried on. The cost of this extension would, I think, be in a great measure saved by the reduced cost of transport of timber, iron, stone, &c., used in the execution of the main line.

The expense of such a tramway, with rails of 25lbs. per yard, would be £1,700 per mile.

Another plan remains to be estimated for, namely, the making of the main portion of the line from Shahjehanpoor to Delhi throughout of an uniform character, adapted for the passage for light locomotives such as specified.

This might be a most desirable plan to adopt, inasmuch as since the annexation of the territory of Oude, the traffic along that portion of the line from Shahjehanpoor to Bareilly has been materially increased.

The estimate for this, without engines, &c., will be as follows:—

|                                             |                   |
|---------------------------------------------|-------------------|
| 200½ miles at £4,000, from Shahjehanpoor    |                   |
| to Delhi . . . . .                          | £802,000          |
| Branch to Philibeet, 28½ miles, at £3,000 . | 85,500            |
|                                             | <hr/>             |
|                                             | 887,500           |
| Balance . . .                               | 112,500           |
|                                             | <hr/>             |
|                                             | <u>£1,000,000</u> |

If the engines and stations are to be included, the branch to Phillibeet, and all other branches, would have to be deferred, and the estimate would stand thus:—

|                                |                   |
|--------------------------------|-------------------|
| 200½ miles at £4,500 . . . . . | 902,250           |
| Balance . . .                  | 97,750            |
|                                | <hr/>             |
|                                | <u>£1,000,000</u> |

With regard to the whole of these estimates, I may mention that they are higher than the estimates of Captain Yule, because he has omitted to allow anything for engineering superintendence, and a margin for contingencies. The difference is not, however, considerable; and I do not think it possible that the cost of the works can exceed the estimates. But I think it very probable, that the expense of making the line may be very considerably reduced, especially if iron is obtained on the spot.

### *The working of the Line.*

With regard to the working of the line with animals, I can speak with the greatest confidence, from my own personal knowledge, having been employed upon the Stockton and Darlington Railway for several years, and well acquainted with every part of it, from a very early period of its progress.

The use of animals as a tractive power is adopted on the minor branches in the coal and other mining districts, even at the present time, both in the north of England, Staffordshire, Scotland and Wales, and it is the only power available in most of the underground tramways in coal and other mines.

The general flat and level character of the country will admit of a very light description of locomotive engines to be used, the tractive power of which would be applied to the fullest possible extent, having no steep gradients to overcome.

The weight of such engines as I should recommend would be from 9 tons to 12 tons, and capable of drawing loads of from 50 tons to 250 tons net, exclusive of waggons, at speeds of from 10 to 20 miles per hour. Captain Yule estimates that a 14-ton engine is capable of drawing 80

tons net ; but I believe that this estimate is very much too low, and that 300 tons would be much nearer the truth.

This class of engines are very much used on the Edinburgh and Glasgow, on the North-London and Blackwall, the Belgian, and upon several other lines, both at home and abroad, with great advantage and economy, both as regards the working expenses, and the wear and tear of the rails.

The working of the line with animals would very slightly deteriorate the rails ; it is the locomotive engine that is so destructive, especially when they are so heavy.

#### *Extensions.*

With regard to the extension northward towards the Punjab, the distance to Amritser, and the branch to Hurdwar, will be about 268 miles ; and the cost per mile will be about the same as for the Rohilcund portion of the line. But in order to lay down the exact route, and prepare an accurate estimate, it will be necessary to have a more careful examination of the ground. The commencement of this portion might be delayed until the arrangements are completed with regard to the Rohilcund portion.

The extension southward to Benares, *viâ* Lucknow, a distance of about 256 miles, may also be deferred until the northern portion is in an advanced stage, and the Rohilcund part quite completed.

I am aware of the existence of two other Railway Companies for making railways in Oude ; but without being acquainted with the nature of their projects, it is impossible to say how far your proposed extension southward would interfere with their plans ; but it is possible that a junction might be formed with one or other of their lines at Shahjehanpoor, where your proposed undertaking

might terminate, if either of the other Companies undertake to complete the extension.

In conclusion, I beg to state that I have submitted this report, with the plans and estimates, to your consulting engineer, John Murray, Esq., whose approval is hereunto appended.

I have the honour to be, &c.,

(Signed) W. SOWERBY.

CIVIL ENGINEER.

F. G. S.

From JOHN MURRAY, Esq., to the DIRECTORS of the  
North of India Tramroad Company.

11, *Great Queen Street, Westminster.*

*April 4th, 1857.*

GENTLEMEN,

Having had Mr. Sowerby's remarks and maps of the country laid before me, with Captain Yule's report and details of the proposed railway, I concur with the former in the line adopted by him from Futteyghur to Delhi. I am further of opinion, that the estimates he has formed for constructing it are correct, and at prices rather above those assumed by Captain Yule.

The recent inspection of the country by Mr. Sowerby has enabled him to lay down on the large maps of India the line of railway ; which, in such a level district, can be done without difficulty, and thus avoid the necessity of exploring it by preliminary surveys.

It will, however, be requisite to have accurate sections taken of the different rivers and their adjacent banks, with the height of the floods, and the nature of the strata beneath their beds, before coming to a decision as to the proper situation for the passage of the railway. The

approximate estimate of Mr. Sowerby is, however, so ample, that I consider the difficulties will be met under the head of contingencies.

I deem it my duty to impress upon you the advantage of executing the main line in so substantial a manner as to be capable of working it hereafter by light locomotives; but for a time, dependent upon circumstances, to confine it to animal power.

I am, Gentlemen, &c.,

JOHN MURRAY.

From W. P. ANDREW, Esq. to Sir JAMES C. MELVILL,  
K.C.B.

*April 9th, 1857.*

SIR,

In continuation of my letter of the 7th inst., I have now the honour to enclose for the information of the Honourable Court a copy of a Memorandum, on the application of animal motive power to railways in India, by Mr. Murray, the consulting engineer to this Company.

I have, &c., &c.,

(Signed) W. P. ANDREW.

Sir JAMES C. MELVILL, K.C.B.

From JOHN MURRAY, Esq., C.E., to the DIRECTORS of  
the North of India Tramroad Company.

11, *Great Queen Street, Westminster,*

*March 19th, 1857.*

GENTLEMEN,

The following observations show the useful application of horses to railways in general. I am of opinion, therefore, that the introduction of the system of animal power to the railways in Upper India is the most advantageous that can be adopted.

I am, &c., &c.,

(Signed)

JOHN MURRAY.

*On the Application of Horse Power to Railways.*

The tractive power of a horse, according to the formula of Leslie (Nat. Philos. p. 283, 2nd edit., 1829), assumes  $V$  to be the velocity in miles per hour. Taking the common pace of a draught horse at  $2\frac{1}{2}$  miles an hour—

Then a strong horse will draw

$$(15 - V)^2 (15 - 25)^2 = 156.25 \text{ lbs.}$$

And an ordinary horse

$$(12 - V)^2 = (12 - 25)^2 = 90.25 \text{ lbs.}$$

Consequently,  $\frac{156.25 \times 90.25}{2} = 123.25 \text{ lbs. mean of both.}$

2

Tredgold (Railroads, p. 68, edit. 1825) arrives at the power of a horse in a different manner.

Taking  $M$ .—A constant quantity ascertained from experience for a horse of average strength to be 250 lbs.

Taking  $V$ .—The extreme velocity of a good horse, unloaded, which should not be taken at more than 6 miles an hour when continued for 6 hours.

Taking  $U$ .—The ordinary pace of a draught horse.

Then the power of a horse

$$= M \left( \frac{V - U}{V} \right) = 250 \left( \frac{6 - 3}{6} \right) = 125 \text{ lbs.}$$

moving at the rate of three miles per hour for six hours a day.

The practical experiments of Bevan with horses of the common breed, used by farmers, makes the average force in ploughing equal to 163 lbs., at a speed of two, or two and a-half miles an hour. But some deduction should be made on account of the horses being in sound condition for such ploughing matches.

A better comparison is that produced by Mr. Nicholas

Wood's experiments, on the performance of horses on different railroads. He says (Railroads, p. 431 *et seq.* 3rd edit. 1838), "The average resistance overcome by the effect of the largest horses was found to be 189 and 157lbs. respectively, and that by the smaller horses at 100lbs., making a mean of 148lbs. as the performance of a moderate sized horse."

He was, "however, inclined to assign no higher value than 125lbs., moved at the rate of  $2\frac{1}{2}$  miles an hour for 20 miles a day."

Supposing the horses' work to be 8 hours a day ; then

$$\begin{aligned} & \frac{2\frac{1}{2} \text{ miles}}{60 \text{ minutes}} \times 125 \\ & \frac{13200 \text{ feet}}{60 \text{ minutes}} \times 125 = 27500 \text{ lbs.} \end{aligned}$$

This, however, is less than the actual performance of a horse when his exertion is continuous.

Therefore, from the experiments of Mr. Wood himself, conjoined with those of Mr. Bevan, I am inclined to take a higher standard and adopt 138 lbs. as the tractive power of a horse, making it capable of raising 30,360lbs. one foot high in a minute. Even this is considerably below the mechanical effect of horse-power adopted by Messrs. Boulton and Watt, and other manufacturers of steam engines.

Friction varies with the insistent load. On railways it has been taken by some at 8lbs. per ton =  $\frac{1}{15}$  = 18.86 feet per mile.

Mr. Wood adopts  $8\frac{1}{2}$  lbs. per ton =  $\frac{1}{17}$ . 53 = 20.03.

Others consider it 11 lbs. per ton =  $\frac{1}{16}$  = 26.4.

Adopting, with Mr. Navier, the last, as most applicable to the numerous causes met with in practice, we have

$$\frac{138 \times 200}{2240} = 12.32 \text{ tons gross weight.}$$



And deducting  $\frac{1}{4}$  for the weight of the waggons, a net weight of about 8 tons is capable of being conveyed a distance of 20 miles by a horse per day, at the rate of  $2\frac{1}{4}$  miles per hour, on a level railway.

On the Stockton and Darlington Railway, before the introduction of locomotives, a single horse took with ease down an average inclination of 1 in 286, at the rate of 3 miles an hour, four waggons, each containing 53 cwt. of coals, in all about 15 tons, and returned with the empty waggons, weighing 96 cwt., having performed a day's work and 20 miles.

---

Our knowledge of the tractive power of horses, at different rates of speed, is very limited. The formula of Euler, confirmed by Schulzes' experiments at Berlin, is

$$f = m \left( 1 - \frac{u}{v} \right)^2$$

where  $m$  denotes the whole force of a horse, with no velocity, (found by these experiments to average 420 lbs.

$v$  = the utmost velocity when drawing nothing,

$u$  = any other velocity,

$f$  = the effort answering to it.

Taking  $m$  (in place of 420 lbs.) at 200 lbs., *practically as the average strength of a horse, with a dead pull continuously applied for his day's exertion,*

And  $v = 14.7$  miles per hour as his utmost speed and so assumed by Tredgold.

Then with  $2\frac{1}{2}$  miles an hour for the ordinary pace of a draught horse his tractive power would be as above stated.

$$= 200 \left( 1 - \frac{2.5}{14.7} \right)^2 = 138 \text{ lbs.}$$

c

If the velocity be increased to 8 miles an hour, then the tractive power,

$$=200 \left(1 - \frac{8}{14.7}\right)^2 = 42 \text{ lbs.}$$

$$\text{And } \frac{42 \times 200}{2240} = 3.75 \text{ tons the gross weight.}$$

Supposing the carriage to weigh 40 cwt., each passenger 140 lbs., and his luggage 28 lbs.; then 22 passengers could be conveyed by it, with one horse, a distance of 8 miles in an hour on a level railway.

Sir John Macneill found that on a railway (but the gradient is not given) the effect which one horse could produce was equal to  $6\frac{1}{4}$  tons gross, or 45 passengers, conveyed at the rate of 10 miles an hour.

On the Stockton and Darlington Railway, one horse used to draw a carriage carrying six passengers inside and from fifteen to twenty outside, with a proportionate quantity of luggage, at a much greater speed than four horses could take an ordinary coach on a turnpike road.

On the Dalkeith Railway, coals are conveyed from the pits in waggons drawn by horses to Edinburgh; and upon this line passengers are conveyed at the rate of one penny per mile, the horses travelling at the rate of nine miles an hour.

There are numerous railways in different parts of the country, where for short distances, chiefly for the carriage of minerals, horse power has been long and most efficiently employed, at a slow rate of speed.

In the Second Report of the Irish Railway Commissioners, it is stated (p. 91, minor edit., 1838) that, "We do not intend to infer, in every case, it would be advisable to construct a railway with a view to its being permanently worked by horses, at least as part of a general system. All that we are desirous to enforce is, that where there is

a fair prospect that increased facilities will lead to increased traffic, it will be more economical, in some cases, to commence with horse power, till that increase be such as to call for the more powerful aid of the locomotive engine."

In this view of the case I fully concur. In the upper part of India, I am given to understand, that native ponies of a hardy and strong race are to be obtained in any number. Bullocks, also, of much activity, are in daily use as beasts of burden on the ordinary roads of the country, and their exertions are considered equal to that of an ordinary draught horse, but only able to accomplish twelve miles a-day. They could, therefore, be used for heavy loads at a slow rate of speed, while two ponies could be applied at one time to the lighter passenger carriages.

In a horse railway, the cost of original construction is less than on a locomotive line, inasmuch as the gradients can be made more in unison with the land traversed, and thus require no deep cuttings nor heavy embankments. The rails, also, may be of much less weight per lineal yard, and, more than all, the wear and tear, when in use, would be comparatively little. Horse power is effective on a rise, where locomotives are inapplicable, while on a descent the horse obtains much relief from the effect of gravity. A level line of railway, with short planes, worked by animals, seems, therefore, the most appropriate for the upper parts of India, where that moving power is at hand; whereas, locomotives would have to be brought from England, and, on their arrival in the country, would have to be conveyed a long distance into the interior, at a great expense.

JOHN MURRAY.

## CHAPTER II.

IRON MINES IN NORTHERN INDIA—DEVELOPMENT OF—  
ESSENTIAL TO EXTENSION OF RAILWAYS, AND INTRODU-  
CTION OF IRON TRAMWAYS AND OTHER WORKS.—CHIEF  
ENGINEER'S OPINION. — COLONEL DRUMMOND'S RE-  
SEARCHES.—MR. SOWERBY, C. E. — HIS PRACTICAL SUG-  
GESTIONS—COST OF WORKS—SUPPLY OF FUEL—MR. MUR-  
RAY'S OPINION OF THE IRON—MR. P. N. JOHNSON'S  
OPINION—REVIEW OF SUBJECT BY LAHORE CHRONICLE.

The production of iron in India, and the practicability of its manufacture and applicability to engineering works, is a point of great public interest and importance. The manufacture of native iron for rails is second only in importance to the construction of railways themselves in India. From the recent researches of Lieutenant-Colonel Drummond, there is now no doubt that iron, in every way suited for rails, might be raised in any quantity at the foot of the Himalayas, where iron ore is found in vast masses, and where there is also abundance of fuel for smelting, lime for flux and fire-clay for furnaces, with the advantage of good roads, and navigable rivers, and canals for transport. Thus, the great difficulty and expense of procuring materials from Europe for Indian railways might be avoided; and we may look forward to the day, and that not distant, when the railways of the Punjab and North-west Provinces would be made of native iron, and wrought by native manufacturers. *Railways can never be constructed in India on the extensive scale demanded by the wants of the country, until Indian rails are made of Indian iron.*

In the latter part of 1854 the Home authorities sent to India, on my recommendation, a commission of mining

engineers and smelters to aid Colonel Drummond in his important mineralogical researches in the provinces of Kumaon and Gurhwal, and the foundation of the first blast furnace in Northern India was laid on the 22nd of November, 1855. The locality chosen is easy of access, surrounded with enormous surface deposits of ore of the finest quality, with abundance of fuel, lime, clay for fire-bricks, and water-power close at hand. India has now a fair prospect of manufacturing her own iron; we shall therefore hear no more, we hope, of iron suspension bridges being sent out from this country to span rivers and ravines, whose sides are composed of a far superior ore to that from which the bridge itself was made.

The following abstract gives the opinion of an eminent public officer as to the quality of Indian iron :—

From CHIEF ENGINEER, Lower Provinces, to SECRETARY  
to Government of Bengal.

(EXTRACT.)

*Dated Fort William, 27th June, 1855.*

“SIR,”

“Iron being the most valuable metal which is known for its use in every art, and more particularly for its extended application to purposes of engineering and building, I am induced not so much to bring the subject to the notice of his Honour the Lieutenant-Governor, who has, I know, a great interest in it, as to point to its abundance in this country, and the great necessity that exists for establishing the means of working the native ore.

“2. Its abundance has been testified, too, by almost every journal in India, and confirmed by many reports, although the details may have varied with the views of the reporters; whilst I have myself seen its extensive existence in several

parts of the country, and having witnessed the native mode of working it with a considerable percentage of good metal gained, can state that there is the richest prospect of advantage if more scientific means and liberal capital were employed.

“3. Of its deficiency as a manufactured article, I cannot write too strongly; it is everywhere complained of, and not more so than by the Department of Public Works. Need I say that we are working with perishable material when we ought to have permanent; in wood where, by the means that iron would give us, we should be using stone. This deficiency is becoming daily more apparent, and our work is cramped and paralysed from the extremely limited supply from England, added to which the price has been so much advanced, and the freight raised so high, that there is little or no relief to be expected from the home market.

“That the Indian iron can not only be successfully worked, but structurally applied, was proved many years ago by Colonel Presgrave, formerly mint master at Saugor, who smelted the iron in the neighbourhood, rolled it in the mint rollers, fashioned it into bars and rods, and then erected an excellent suspension bridge near Saugor entirely from the ore in the vicinity. Its manufacture in India is a subject of prominent importance, and scarcely less so than the establishment of railways and electric telegraphs.

“That the iron of India was formerly allowed to be so long in its native state may be traced to the corrupt and despotic sovereignties by which the country was swayed; but there are now under the British Government the strongest motives, some of which only I have urged for bringing this most valuable metal into extensive use, placed as it is by Providence in our very grasp.

“4. I will not here enter into details of the profits or per-

centage gained by native processes or the nature of those processes ; suffice it to notice here, that the result is most satisfactory as a guarantee to enterprise, whilst the specimens that I have seen, and which are extant, show the metal to be of superior quality where attention has been paid to locality."

(Signed)

"H. GOODWYN,  
*Lieut.-Col., Chief Engineer,  
Lower Provinces."*

SECRETARY TO  
GOVERNMENT OF BENGAL.

The existence of iron mines in the province of Kumaon has been long known. In 1854, Lieut.-Colonel Drummond, of the Bengal establishment, was deputed to this province to carry on the investigations necessary to satisfy the British public that sufficient inducement existed for the investment of capital in iron works in India. Colonel Drummond entered on his duties on the 18th October, 1854, and continued his researches for a period of about seven months. His inquiries appear to have been principally directed to the Bhabur district of Kumaon, and the results may be briefly summed up as follows:—

In order to obviate the necessity of carriage through a mountainous country, it became an object of importance to trace the existence of iron as near the plains as possible, and Colonel Drummond's first inquiries were consequently directed to the tract of country at the foot of the hills. At Dechouree, the most western point of Colonel Drummond's route, a rich iron ore was discovered associated with clay. Here the deposits are stated to be readily discoverable, not only by the larger masses lying on the surface, but also by the beds being extensively exposed by deep ravines. In one part the solid bed of ore is exposed to a thickness of thirty feet; in another, it measured

twenty-four feet; in a third, it exceeded the depth of fifty feet. "Where a bed of such rich material," says Mr. Sowerby, one of the civil engineers connected with the East India Railway Company, "is ascertained to be at least fifty feet thick, a few feet more or less cannot be of much importance." The extent of ground examined at Dechouree was about a mile, and the quantity of ore at or near the surface was estimated to yield, if smelted, 100,000 tons of pig iron.

From Dechouree, Colonel Drummond pursued his course in an easterly direction, passing by Loha Bhurbhur, Kaleedoongee, Chowzilla, Beejapore, Jham, Burgote, and Burragur. These researches were subsequently continued westward by Mr. Sowerby as far as the river Ganges. The entire length of the route was about 150 miles, and rich deposits of iron ore were discovered to be more or less continued throughout, varying in thickness from twenty-five to fifty feet. At Loha Bhurbhur, the ore is associated with clay, not mere clay impregnated with iron, but solid ironstone. Huge blocks are here represented as lying exposed on the surface; several of these were measured and found to be upwards of ten feet long, six broad, and four feet in thickness, each of which it is said, if smelted into pig iron would yield upwards of three tons of metal. These blocks were not occasional but frequent, and common over the whole distance traversed, which was a mile in length with a width of 175 yards. It was estimated that upwards of 60,000 tons of metal would be obtained from the ore lying on the surface. The beds in the route pursued by Colonel Drummond fully show that *an inexhaustible supply of workable iron ore, yielding the quality of iron which is most useful for railway purposes, can be obtained in an accessible tract along the outer face of the lower Himalaya Ranges, close to the plains.*



The existence, however, of rich iron ore in abundance is unimportant, unless accompanied by facilities for working the iron and transporting it to the markets or places of shipment. These advantages are not wanting in some of the localities described by Colonel Drummond. It was consequently determined that a model mining experiment should be carried on by the Government at Dechouree, where iron ore (better suited for smelting and railway purposes than the purer ore of the interior) together with fuel, limestone, fire-clay, a ready command of water, and a cheap supply of labour, are to be found in great abundance.

A blast-furnace was accordingly erected at Dechouree, and, upon the works being completed, two experiments were made to test its efficiency for the smelting of iron ore. These trials were made in March and April, 1856, and the metal, which was smelted, "flowed out in a very liquid state into pigs, which, when fractured, showed them to be iron of the very best quality, known in the trade as No. 1, Grey metal pigs, first quality."

"The operations of smelting," says Mr. Sowerby, "require an amount of manual dexterity and practical acquaintance with the subject which can only be acquired by a long apprenticeship to the business of a furnace-keeper. There being but one such man (Mr. Davies) on the works, he continued to exert himself until quite exhausted, with the aid of native labourers, by whom the work was kept going for several hours; but, from the amount of physical exertion required and the heavy nature of the implements, together with the fierce character of the work, to which they were quite unaccustomed, they were unable to keep the furnace in proper order for any length of time." A few English workmen would have obviated this difficulty.

"The qualifications of natives as smelters," it is added, have not yet been properly tested, but, from what has

been seen of them, and from their previous knowledge, and their observations and remarks during the progress of the experiments, it is believed they will ultimately become very fair workmen. But in any future works undertaken, it would be exceedingly injudicious to depend on them solely ; it would be better and more prudent to incur the expense of bringing out a sufficient number of European smelters, accustomed to the work, who, if well selected, and good useful men in other departments, could, when the natives were trained to take part in the work, be the means of extending the number of furnaces and other works. Any shortcoming in respect of European workmen at the outset would in the end prove to be a false economy."

The facts before enumerated sufficiently demonstrate the existence of iron ore in great abundance in the Bhabur district. Some further notice of the Bhabur forests may be deemed desirable, to form an estimate of their fuel capabilities. On this point the Lieutenant-Governor of the North Western Provinces remarks, that "for mining operations on an extensive scale, supplies of fuel both within the hills and on their borders will be found to be abundant for a long course of years." The Commissioner of Kumaon, Mr. Batten, states that the forests of that district are boundless, and, to all appearance, inexhaustible. "I fully believe," he says, "*that the lower hills and Bhabur, at every iron locality discovered by Colonel Drummond, can supply sufficient charcoal for the largest English furnace for a hundred years to come.*" Captain Ramsay, the senior assistant commissioner of Kumaon, is of opinion that if the miners cut fuel judiciously, the forests in the vicinity of the iron mines throughout the district would furnish a permanent supply of fuel. Mr. Strachey, the collector and magistrate of Moradabad, and formerly senior assistant at Gurhwal, says, "many hundred square

miles of unbroken and untouched forest are available for mining operations in the Kumaon Bhabur. The Dechouree mines are actually in this forest. I believe that there is enough fuel within an easily accessible distance of Dechouree to supply the largest mining establishment for a century to come." These statements, put forward upon the authority of the best informed local functionaries, cannot but be regarded as highly satisfactory and perfectly conclusive as to the abundance of fuel.

Dechouree possesses one great advantage over any other locality suggested, in lying at the foot of the hills instead of among them; the mines being situated so near to the level of the plains, and always accessible to wheel carriages, the transport of the produce can be easily accomplished. There is at present a good road for nearly the whole distance from Dechouree to Moradabad (about fifty miles), at which place the Ramgunga is navigable throughout a great part of the year. Moreover, cheap tramways can be laid down as soon as the works are in active operation.

An analysis of the Bhabur clay iron ores by Dr. Macnamara, professor of chemistry at the Calcutta Medical College, gives the following percentage of metal :—

|                                    |   |   |       |
|------------------------------------|---|---|-------|
| Dechouree <i>selected</i> specimen | . | . | 66.3  |
| Do. ordinary do.                   | . | . | 55.6  |
| Do. do. do.                        | . | . | 46.9  |
| Do. do. do.                        | . | . | 47.7  |
| Do. do. do.                        | . | . | 49.2  |
| Do. do. do.                        | . | . | 55.47 |
| Do. do. do.                        | . | . | 49.7  |

Assays by Mr. Piddington, curator museum economic geology :—

|           |   |   |   |   |       |
|-----------|---|---|---|---|-------|
| Dechouree | . | . | . | . | 47.60 |
| Do.       | . | . | . | . | 50.96 |

Trial assays by Mr. Davis, the smelter, with remarks :—

|                     |     |
|---------------------|-----|
| Dechouree . . . . . | 49½ |
| Do. . . . .         | 37½ |

Good grey cinder, very easy to smelt.

Mr. Davies, the smelter, estimates the cost of a ton of pig iron, manufactured according to the European method, at 46 rupees, and the additional cost of making castings from the pig iron, including mouldings, re-melting, &c., at 25 rupees ; but observes that the cost would be gradually reduced as the works progressed.

There are other localities within the Kumaon district ; those, for instance, of Ramghur, and Mungla Lekh, and those of Khetsaree and Chowghurkha within the hills, and some others at no great distance from the plains, where iron ore of the best quality is found in abundance ; not, however, so suitable for railway iron as the Bhabur deposits, but more fit for making steel and the finer quality of iron. But with reference to the extensive deposits of Loha Bhurbhur and Dechouree, the necessity for looking for other beds in Kumaon may be regarded as a very remote contingency.

A more detailed and prolonged examination into the extent and quality of the iron formation on the outer range of the Kumaon Hills, was projected at the close of the rainy season of 1855. It was conducted by Mr. Sowerby, C.E., F.G.S. ; and the result of these researches is, that the iron deposits have been discovered to continue up to the river Ganges, at a point a few miles above Hurdwar, at the head of the Grand Ganges Canal.

Mr. Sowerby, in his Report, remarks, “ that the quantity of iron ore obtainable is so great that the work of ages on never so large a scale, would produce but a feeble impression on the deposits ; and the same might also be said of the fuel and other requisite materials.”

Notwithstanding the proved superabundance of iron and its necessary adjuncts, we are still told that:—

“The great want of India at the present juncture is Iron! Iron! Iron! For a single line of rail from the Ganges junction, a little above Burdwan, to Delhi, we shall require from 200,000 to 250,000 tons of iron, and there can be little doubt that whenever the rail is open for traffic to the Ganges, a double line must be immediately laid down. Such is the extent of iron rails which must be provided at the lowest computation, if we would realise the hope which has been held out of opening the line to Delhi by the 1st of January, 1860. At present, there is no prospect of procuring these supplies except from England, and the difficulty of obtaining a sufficiency of freight for the conveyance of the iron appears to be the greatest obstacle to success. It is, therefore, a mere truism that the greatest benefit which could at the present time be conferred on this Presidency would be the establishment of iron works, and the preparation of rails in the country. If we could manufacture only one-half the rails required for the Gangetic valley on the spot, we might save nearly a million sterling.”\*

“The great success which has attended the railway to the collieries, and the rapid increase of traffic on it has naturally created a very earnest desire to have the whole line to Delhi opened as rapidly as possible, and we are frequently receiving enquiries on the subject. To these questions we have never yet been able to give any decisive reply, inasmuch as the completion of the rail depends on two parties, the Railway Board at home, and the Railway Executive in India. In reference to the work to be accomplished in this country, we should say that to all appearance the rail might be opened within three years

\* “Friend of India,” 25th January, 1855.

from the present date without any difficulty. All the arrangements and contracts have been made with a special view to this period, and the embankments and masonry will probably be completed throughout the entire line by that time. We have, it is true, many rivers to bridge, but the preparations which have been made, and the great impulse which has been given to the undertaking, afford every prospect that the opening of the line will not be retarded by these operations. Whatever depends, therefore, on India, will in all probability be finished within the period we have mentioned. But we can do nothing without the permanent way and the rolling stock, for which, at present, we are dependant on England.

“Our prospect regarding these supplies are now brought to a definite point. The information which has reached India from England within the last month unfortunately throws a wet blanket upon our expectations. It is stated that the permanent way, which consists chiefly of rails, could be manufactured within the time,—not so, however, the rolling stock, except at most extravagant prices. But this conclusion is evidently based on the supposition that, as the Great Western has two engines on the average to each mile, so we would require 2000 engines for the 1000 miles to Delhi. But it is the question of *transport* which presents the most insuperable barrier to the accomplishment of our hopes. On a calculation of the average number of vessels proceeding to India annually, from London, Liverpool, Bristol, and the Clyde, the average of dead weight which can be expected to be available does not exceed 49,000 tons a year; and past experience has shown, that if the railway Company can secure 35,000 tons annually they may consider themselves fortunate.

“But the quantity to be shipped for a single line from the middle of the present year will not fall short of 230,000 tons; and we may therefore feel confident that it will reach

250,000. At the rate of 35,000 tons a year, the whole of this quantity cannot be shipped before the middle of 1862; and if the opening of the line is to depend on its arrival, it will not be till after the commencement of 1863 that the Governor General will be enabled to inaugurate the line from the British to the Mahommedan capital of India. Neither is it considered possible in London to obtain any important augmentation of tonnage. Vessels from England, with few if any exceptions, calculate on the return cargo from India as the most valuable portion of the voyage; and unless the exports from Calcutta can be increased in proportion to the increased number of vessels engaged for the transport of the rails, the main expense of both voyages must be charged on the outer voyage with the railway material. The chartering of vessels would not materially mitigate the difficulty, because the amount of exports which furnished the home cargo would not be thereby increased; and the owners could be saved from loss only by fixing an excessive charge on the outward-bound goods. The East India Railway Company must therefore be content with its share of the existing tonnage or engage extra tonnage at an exorbitant rate, and thus increase the original cost of the rail to an extravagant and ruinous extent.

“This argument appears to be clear, business-like, and unfortunately, decisive. There is no gainsaying it. The conclusion to which it drives us is this,—that if we are dependent on England for rails, with only the present available tonnage, there is little hope of being able to open the line to Delhi before 1863. But this is not the worst. The quantity of iron stated above, about 250,000 tons, is the amount required for a single line. But even now, at the very threshold of the enterprise, we are daily reminded of the want of a double line; and every additional ton of freight we now take on, only serves to render the risk of a

smash more imminent. As soon as we reach Rajmahl and 'tap the Ganges,' a double line will be absolutely indispensable, whatever any crochetty engineer may have taken into his head. It is simply ridiculous to suppose that the traffic of the entire Gangetic valley, with a population of between sixty and seventy millions, and a trade of thirty or forty millions sterling, can be accommodated by a single line. A double line, however, will require nearly 500,000 tons of rail, and with the tonnage at present available, cannot be landed at Calcutta under fourteen years from the present time. But to have to wait fourteen years for the completion of a double line of rail to Delhi, when, but for the difficulty of importing the material it might be opened in a third of that time, is too much for human patience. The only effectual remedy for this most deplorable prospect is to be found in 'developing the resources of the country itself.' This has been often discussed as something very advisable and very desirable; but the project has invariably terminated in some vague and undefined hopes of its accomplishment at some future period, and by some auspicious conjunction of circumstances not apparent at the time. It is now, for the first time, that the necessity for *immediate* as well as vigorous effort is forced on the mind, by the fact, that unless we can obtain in the country itself a considerable portion of the rails which are indispensably necessary for the full development of the traffic through the North-West Provinces and Bengal, the rail cannot be completed before 1869. To accomplish this object, however, we require the direct interposition of Government, and without that assistance nothing will be done to any purpose. Private speculators must feel their way as they go."

"Whatever machinery may be required for the success of these exertions should be liberally and promptly fur-



nished, not with the intention that Government should undertake to supply rails for the lines, but that it should conduct the first practical demonstration that the country can supply its own exigencies. This £100,000 would be the means of saving at least a million sterling in money and four or five years of time."

"Even supposing the enterprise to be abortive—which, however, seems incredible—and the whole £100,000 to be absolutely lost, still the experiment is not only worthy of a great Government but imperative on it, and after all, the sacrifice will be far less than the sum which Government threw away in an abortive law commission."\*

It has been known to the authorities of India for many years that iron of the finest quality exists in that country, with every appliance at hand for the conversion of its rude and shapeless masses, by the hand of science, into instruments of social and commercial progress.

Iron is the Prime Agent of civilisation, and India can never advance until her rich iron ores cease to be a reproach. Who is to develop them? The Government or private enterprise?

What reason is there to expect now energy and promptitude by the agency of Government, when experience has proved that enterprises of this nature are better conducted by private individuals? The benefit to India of a rapid development of its mineral and other resources may much more readily be obtained not by Government taking the initiative and setting aside 'for a season' private enterprise, but by a judicious concurrence of each, *in its own sphere*. Government, by means of its powerful agency and organisation in every locality, can test and verify the data on which individual or private enterprise is grounded, and may give

\* "Friend of India," July, 1855.

their official *imprimatur* to facts or statistics that might otherwise be suspected as tinged with partiality or self interest. They may indicate the wants and requirements of the country, and by a well-considered policy check rash and over-sanguine speculation or too hot a competition, which in many instances has proved the ruin of initiatory enterprise in a new and untried sphere. They may give every facility by means of grants of leases for a term of years on liberal terms, and in consideration of the distance and the peculiar character of Indian undertakings, guarantee at the first start a minimum rate of interest on the capital expended;\* but here their interposition should stop. There is no need for their adventuring £100,000 or even £10,000 to pioneer the way for the private adventurer, nor, should this course be pursued, does it at all follow that 'there would be no lack of enterprising capitalists prepared to take over the machinery and establishments from Government.' The machinery might prove to be unsuitable, the establishments inefficient, and the *prestige* of the work so severely crippled by mismanagement that private adventure might be deterred.

"India, with its cotton, its indigo, and its sugar, needs only facilities of intercourse between the interior districts and the outports to become a first-rate commercial country. After the experience we have gained, and the delusions we have undergone, it would be idle to imagine that these can be obtained by any instrumentality short of that of the railway. The projectors of systems of internal communication by means of roads, rivers, and canals, belong to a school now happily passing away. If India is to com-

\* This is in accordance with the suggestion of their own officers on the spot, whom they have consulted. See page 26 and also page 92 of Selections of Government of India, Supplement to No. viii., 1855.

pete with other countries in staple produce, its roads must be rendered subservient to the railway. The majority of its rivers are unnavigable. These, indeed, may prove invaluable as feeders of canals; but in India, water is too precious a commodity to admit of its being economized for any purpose save that of irrigation. It is to the railway, then, that we must look for anything like close connection between the heart of the country and the maritime districts, and in this respect the great *desideratum* for India is a network of iron road spread over the face of the country.”\*

“With reference to Kumaon, the section of this province selected for geological survey stretches along the foot of the lower Himalaya range of mountains extending from Dechowree and Loha Bhurbur to Burrager, a distance of sixty miles. Here the testimony is all on one side. Of all the iron districts of which anything is known, Kumaon is by far the most promising. Every functionary, from the Lieutenant-Governor downwards, concurs in ascribing to the deposits an unequalled richness of quality and a vast extent of continuity. Mr. Sowerby, the civil engineer of the East India Railway Company measured an area at Loha Bhurbur one mile in length by one hundred and seventy-five yards in breadth, and calculated that the iron-stone lying on the surface, and requiring neither mining nor quarrying, would yield upwards of 60,000 tons of metal. Huge blocks were thickly strewn over the surface, several of which were upwards of ten feet in length, six in breadth, and four in thickness, and which, when smelted, would each yield upwards of three tons of pig iron. At Dechowree, where the quality is a rich red iron ore, a broad ravine cuts through the solid bed *in situ*, and exposes the metal to a thickness of fifty

\* “Allen’s Overland Mail,” October, 1856.

feet and upwards. Lieutenant Greathed, the deputy consulting engineer to the Government, examined a wall of rock, pronounced by the mineralogists of his party to be good iron ore, extending three hundred feet in length, and denuded to a depth of twenty feet, yet the floor of the deposit had not been attained. This officer had never met with iron ore equal to that at Dechowree, and felt satisfied, from the different specimens taken at random along the whole length of the deposits, that he was standing on an iron field. With these facts before us, it seems evident that India will shortly become independent of England for a supply of iron. Colonel Drummond, the spirited and talented officer to whom the merit of discovering the iron beds at Dechowree and Loha Bhurbur is due, is now in this country endeavouring to form a company to work the iron mines of Kumaon. The task should not be difficult, considering the certainty of success which must attend a well-devised plan of operations. No large amount of capital is required, and abundant evidence is at hand to satisfy the most scrupulous inquirer. That the ruling authorities are favourably disposed does not admit of doubt. Colonel Drummond's undertaking is one of no narrow compass; it embraces high national interests, and if due support and encouragement be accorded, Kumaon may at once become that which its rich deposits entitle it to be,—the Staffordshire of our Eastern possessions.”\*

At a Meeting of the Institution of Civil Engineers on the 9th of December, 1856, G. P. Bidder, Esq., Vice-President, in the chair:—†

Specimens of the recently discovered iron deposits in the Himalayas, Northern India, were exhibited by Mr. W. Sowerby, Assoc. Inst., C. E.

\* “Allen's Indian Mail,” October, 1856.

† Vide proceedings of Institute of Civil Engineers.

These deposits were found in the lower range of hills, called the Bhabur, at a general elevation of about 500 feet above the adjacent plains; and they were more or less continuous from the Sada river, on the confines of Nepal, to the River Ganges, a few miles above the head of the grand Ganges Canal, at Hurdwar, being about 150 miles in length.

There were six different beds of iron-stone, one above the other, of varying thickness and quality. The lowest bed was a rich red iron-stone associated with clay, and its thickness was, in many places, upwards of 50 feet. They contained on an average nearly 50 per cent. of metallic iron. The following was the analysis of these ores:—

|                                   |         |
|-----------------------------------|---------|
| Water and Carbonic Acid . . . . . | 2·00    |
| Earthy matter . . . . .           | 22·40   |
| Arsenic . . . . .                 | 0·91    |
| Lime . . . . .                    | 2·60    |
| Peroxide of Iron . . . . .        | 73·50   |
|                                   | <hr/>   |
|                                   | 101·41  |
|                                   | <hr/>   |
| Excess . . . . .                  | 1·41    |
|                                   | 100·000 |

· Metallic Iron 50.96 per cent.

The other beds were chiefly a compact brown clay iron-stone, about 15 to 20 feet in thickness, containing about 40 per cent. of metal. There were also yellow hydrates and siliceous iron-stones, of less thickness, and of poorer quality. Masses of the richest iron-stone, many tons in weight, were found lying on the hill slopes, and the beds were in numerous places seen exposed in high escarpments and deep ravines.

The enclosing rocks of the beds were micaceous sand-

stones, not unlike the sandstones of a coal formation; thin seams of lignitic and slightly bituminous coal had been found outcropping. Mountain limestone, of excellent quality for flux, formed part of the adjacent hills.

The district in which the iron ore was found was a dense primeval forest of Saul, Huldoe, Khyr, Jamin, and other hard woods, in inexhaustible quantity, and peculiarly suitable for making charcoal. The number of small streams and large rivers issuing from the hills would afford ample water power for any amount of machinery.

The Government of India decided on erecting a small experimental work during the cold season of 1855-56, which was entrusted to Mr. Sowerby; specimens of the iron produced were exhibited, and were so conclusive, as to have determined the question of the extension of the works.

The interior of the hills was also stated to contain immense deposits of rich hæmatite, specular and magnetic iron ores; likewise copper, galena, and other minerals. Views of the locality, and of the work erected, were also shown.

At the conclusion of the meeting, the specimens were examined by the members present with great interest; and there was but one opinion prevailing as to the excellence of the iron stone, and the first rate quality of the iron produced from it, many expressing their belief that iron of a better quality could not be manufactured anywhere.

From the foregoing, it will be seen how much might have been accomplished had the manufacture of iron preceded the formation of railways in India, or even commenced simultaneously with the introduction of the railway system; and this would most probably have been done but for the want of good reliable information,

although an enterprising officer, had, twenty years ago, pointed out the importance of the subject to the Government and the public, and urged the necessity for proper researches, and the desirableness of establishing an iron work in Kumaon, to work the iron mines then known to exist in the province.

FROM W. P. ANDREW, ESQ., TO SIR JAMES C. MELVILL,  
K.C.B., &c., &c.

GRESHAM HOUSE, OLD BROAD STREET,

SIR,

22nd Nov., 1856.

I am requested by a Committee of Gentlemen, interested in the development of the Iron Mines in Northern India, to submit for the consideration of the Honourable Court, the accompanying Memorandum from Mr. Sowerby, lately employed by the Lieutenant Governor of the North West Provinces to investigate and report upon the mineral resources of Kumaon and Gurwhal, the facilities for their development, and the advantages that might fairly be expected from making the iron of Northern India available for the construction of railways, or other public works in that country.

2. The local Governments in India have repeatedly brought forward the fact of the existence of iron ore of great richness and inexhaustible quantity, which scientific investigation has confirmed.

3. It is well known that the Court have long been solicitous to see the wants of India supplied from her own resources, of a metal of all others the most necessary and important.

4. It is also well known that the Honourable Court are anxious that the iron mines of India should be worked by

private enterprise and capital; and the proposition I am charged to lay before them is, whether they would be disposed to entertain a proposal for a guaranteed rate of interest being granted upon a moderate amount of capital (say £150,000), to enable the necessary funds to be raised by a private company, under certain stipulations and requirements, and its expenditure to be subject to such supervision and control as might be satisfactory to the Honourable Court.

5. I have further to state, that it is the opinion of the gentlemen with whom I am associated, that in the event of the manufacture of the iron being equal to their expectations, a favourable opportunity would be presented of introducing on an extensive scale iron tramways suitable for animal motive power.

6. This would afford, among other advantages, a cheap and expeditious mode of completing the connection between Delhi and Lahore, and would facilitate the construction of the proposed Punjab Railway, as it would probably reduce the price of rails for that line to about *the cost of their freight from London to Lahore*.

7. As it is believed that railways can never be introduced into India on a scale commensurate with the wants of that country from the high price of iron in England, and the large amount of tonnage required for its transport, *until Indian rails are manufactured from Indian iron*, I cannot but feel that the proposition I have now the honour to submit, will receive from the magnitude of the interests involved, the considerate attention of the Honourable Court.

I have the honour to be, &c.,

(Signed) W. P. ANDREW.

SIR JAMES C. MELVILL, K.C.B.

&c.,      &c.,      &c.



Memorandum by W. SOWERBY, Assoc. Inst. C.E., on  
HIMALAYAN IRON WORKS, KUMAON.

In preparing an estimate of cost of establishing Iron Works in Northern India, it will be as well briefly to review the natural facilities afforded, and the difficulties to be overcome, in order that a clear conception may be arrived at; as well in respect to the prospects held out as a commercial undertaking, and the ultimate results as to the economic value of the produce likely to be obtained.

The requisites for the successful establishment of an iron manufactory, are—raw materials, labour and markets.

The existence of a superabundance of the raw materials in Kumaon, of almost every variety and quality, has been already well established, the only exception being mineral coal, which has not yet been actually discovered in any large quantity; but from indications it is believed to exist; there, however, exists such a very great quantity of wood for making charcoal fuel, in the vast primeval forests of the province, that it more than compensates for the absence of mineral coal, inasmuch as the one is obtained on the surface, and the other would require mining operations. Charcoal fuel also possesses the well-known advantage of producing a superior kind of iron to coal.

The blast furnaces for making iron from charcoal fuel are always much smaller than coal or coke furnaces, being usually not more than one-third the cubical contents, and frequently as small as one-sixth; consequently, the first works are simple and inexpensive. Coke or coal furnaces require expensive and powerful blowing apparatus, hot-air apparatus, coke ovens, roasting kilns, &c., and a large number of well-skilled labourers. Charcoal furnaces are easily worked, and the requisite skill is more readily acquired.

There exists also in the province, abundance of water power, for driving every kind of machinery, thereby saving the expense of steam power, not only in its first cost, but in its transport to the works.

The raw materials being so very abundant, and the natural advantages so obvious, the next question that arises is that of labour.

The common opinion prevails, that the expense of skilled labour to manufacture iron in the commencement of new works in a foreign country is a serious difficulty, and will be more than the profits. From a careful analysis of the cost of manufacturing iron, both pig metal, and rolled malleable railway bars, it will be seen that, the amount paid for skilled labour is not such a serious item in the expense of making iron. These analyses have been obtained from actual data, taken from the Dowlais Iron Works.

Analysis of the cost of making pig iron :—

|                            |                |
|----------------------------|----------------|
| Raw materials . . . .      | 83·3 per cent. |
| Common ordinary labour .   | 7·9 do.        |
| Skilled labour . . . .     | 1·9 do.        |
| Blast, and general charges | 6·9 do.        |
|                            | <hr/>          |
|                            | 100·0          |
|                            | <hr/>          |

Analysis of the expense of making bar iron from pig metal, including every expense :—

|                             |                |
|-----------------------------|----------------|
| Materials . . . .           | 71·0 per cent. |
| Common labour . . . .       | 4·0 do.        |
| Skilled labour . . . .      | 16·0 do.       |
| General charges, blast, &c. | 9·0 do.        |
|                             | <hr/>          |
|                             | 100·0          |
|                             | <hr/>          |

In the making of pig iron, the cost of skilled labour is so exceedingly small, that the amount might be quadrupled

without becoming a heavy item, and far from approaching the reduction due to the less cost of the raw materials obtainable in the province of Kumaon.

The skilled labour for making bar iron is a larger item ; but much of this labour is mere manual dexterity, not requiring practical experience of a complicated nature ; and would consequently be readily acquired by the native labourers, who are already acquainted with the rude modes of making iron, and are a steady, hard working race of men, possessing considerable intelligence, and though not so able-bodied and strong as Europeans generally, they still possess good physical strength, and powers of endurance.

In estimating the rate at which iron works can be developed, a good example is obtained of what can be done in this country in the Cleveland district. This has been at the progressive rate of 25,000 tons per annum, spread over a period of ten years, the present manufacture being about 250,000 tons annually, of which about 30,000 tons are converted into bar iron in the district. Assuming then that progressive rate of manufacture should be about one-half the above rate in India, or say 12,000 tons per annum for pig iron, and for bar iron 3,000 tons per annum, this would give at the end of five years 60,000 tons of pig iron, and 15,000 tons of this could be rolled into bars as the annual produce.

To accomplish this, it would be necessary to erect sixty blast furnaces, each yielding 1,000 tons per annum, or at the rate of twelve small furnaces per year, together with the necessary works for making bar iron ; and to carry on these works, it would require about 300 skilled workmen, fully one-third of which should be Europeans in the outset, subject to reduction as the natives acquired skill, the remainder being trained natives.

The estimated cost of the works above specified, will be

£141,900. This estimate is made from careful calculations, based upon actual data. This would require a capital of £100,000, spread over a period of five years, being at the rate of 20 per cent. per annum, the remainder of the capital of £41,900 to be obtained from the value of the materials produced. The estimated annual value of the produce of works at the end of five years is £290,000, thus :—

|              |                                          |          |
|--------------|------------------------------------------|----------|
|              | 15,000 tons bar iron at £6 . . .         | £90,000  |
|              | 40,000 „ of castings 5 . . .             | 200,000  |
|              | 5,000 „ waste and used on<br>works . . . |          |
| Total 60,000 |                                          | £290,000 |

The estimated cost of production of the above is £160,000, including every item of expense, thus :—

|                                                     |          |
|-----------------------------------------------------|----------|
| Cost of making 60,000 tons of pigs . . .            | £90,000  |
| Ditto of converting 15,000 tons into bars . . .     | 30,000   |
| Ditto of converting 40,000 tons into castings . . . | 40,000   |
|                                                     | £160,000 |

This would leave a profit of £130,000 on one year's produce, assuming the value of it to be according to English prices.

#### *Economic Value of the Produce.*

With regard to the economic value of the iron produced, the fact of its being charcoal-made iron enhances its commercial value; and the first iron produced can be used as chairs, sleepers, turntables, girders, or as rails for sidings and standage ground at the various stations on existing lines of railway now in course of formation; or

until rolled bars in any great quantity can be produced, cast iron rails might be used with perfect safety after being toughened by some of the well-known processes, these might be laid down temporarily for various branch lines where the traffic is light and undeveloped, the waggons, &c., to be drawn by animal labour, or by light locomotives.

To what extent the iron made can be so applied it is impossible to say, inasmuch as there are few examples of such a quality of iron being so applied, and recent experiments lead to the belief that it might with advantage be applied on an extensive scale. One fact is worth much argument, trials have been made on the Stockton and Darlington Railway with various kinds and qualities of rails, and it has been proved that the rails which nearest approach to the character of cast rails are the most durable, this is on a line with heavy mineral traffic, so this matter is worthy of serious consideration, inasmuch as the greater part of the iron first made, and that made most easily and cheaply, will be cast iron.

(Signed) WILLIAM SOWERBY.  
ASSO. INST. C. E.

LONDON, *21st November*, 1856.

FROM W. P. ANDREW, Esq., to SIR JAMES C. MELVILL,  
K.C.B., &c., &c., &c.

*5th December*, 1856.

SIR,

With reference to the letter which I had the honour to address to you on the 22nd ult., regarding the development of the iron mines in Northern India, I beg to enclose for the information of the Honourable Court a tabular statement by Mr. Sowerby, Civil Engineer, of the probable

results to be obtained during the progress of the works in a period of six years.

I am, &c.,

(Signed) W. P. ANDREW.

SIR JAMES C. MELVILL, K.C.B.

&c. &c. &c.

APPENDIX TO MEMORANDUM.

*On Himalayan Iron Works.*

GENERAL TABULAR STATEMENT of the results obtainable by the progressive development of the Works during six years:—

| Years.     | Capital to be expended each year. | Number of Furnaces in operation. | Produce in Pig Iron.  | Produce in Cast Iron. | Produce in Bar Iron. | Miles of Tramways Single. | Miles of Permanent Way. Single. |
|------------|-----------------------------------|----------------------------------|-----------------------|-----------------------|----------------------|---------------------------|---------------------------------|
| First . .  | £ 25,000                          | The first year                   | TONS.<br>year will be | chiefly tak           | en up in ma          | king prepa                | rations, &c.                    |
| Second . . | 25,000                            | 12                               | 12,000                | 8,700                 | 3,000                | 82                        | 25                              |
| Third . .  | 25,000                            | 24                               | 24,000                | 17,400                | 6,000                | 163                       | 50                              |
| Fourth . . | 25,000                            | 36                               | 36,000                | 26,100                | 9,000                | 245                       | 75                              |
| Fifth . .  | 25,000                            | 48                               | 48,000                | 34,500                | 12,000               | 327                       | 100                             |
| Sixth . .  | 25,000                            | 60                               | 60,000                | 43,500                | 15,000               | 409                       | 125                             |
|            | 150,000                           | 60                               | 180,000               | 130,500               | 45,000               | 1226                      | 375                             |

Thus, 375 miles of permanent way might be completed at the end of six years, and 1,226 miles of good serviceable tramway fit for any ordinary traffic, and quite equal to the wear and tear of all traffic that could pass over the line during the first few years after being opened.

(Signed) WM. SOWERBY, C. E.

LONDON, 4th December, 1856.

FROM SIR JAMES MELVILL, to W. P. ANDREW, Esq.

EAST INDIA HOUSE,

11th March, 1857.

SIR,

I have laid before the Court of Directors of the East India Company your letter dated 22nd November last, submitting a memorandum by Mr. Sowerby, lately engaged in the examination of the iron districts in Kumaon, on the mode and cost of working the ores; directing attention to the various advantages to be expected from the manufacture of iron in northern India, and enquiring on behalf of a committee of gentlemen interested in the subject, whether the Court "would be disposed to entertain a proposal for a guaranteed rate of interest being granted on a moderate amount of Capital, (say £150,000,) to enable the necessary capital to be raised by a private company," on certain stipulations not particularly specified by you.

In reply, I am commanded to state, that the Court are fully aware of the great importance of developing the resources which India is believed to possess for the manufacture of iron, and that they have for some time had the subject under their anxious consideration, with special reference to the demand for iron for railroad purposes.

It appears from the information, which has so far been obtained, that the iron of Kumaon from its great abundance, from the facility with which the ore may be obtained, and from the presence, in immediate proximity of all the materials for working it, offers the greatest encouragement for the commencement of operations, with a

probability of the largest results within a comparatively short period. It is the opinion of the Court that the working of these ores may most suitably be carried out by means of private enterprise, and they will be willing to sanction liberal concessions to any company or companies which, with sufficient capital, may be prepared to engage in the undertaking.

The Court are not, however, at present in a position to state particularly in what form and to what extent the aid and encouragement of Government may best be afforded to the enterprise. The information they possess as to the result of the recent experimental operations in Kumaon is very limited, and they are at present unacquainted with the sentiments of the local Government and of the Government of India, as to the terms which should be granted to any company willing to undertake the working of the mines. They have recently addressed the Government of India on these points, and expect to be furnished with the necessary information, and to be made acquainted with the views of the Government at an early period.

In the mean time they are unable to do more than reiterate their intention to afford every reasonable encouragement to an undertaking which they consider of great public importance.

I am, &c.

(Signed) JAMES C. MELVILL.

W. P. ANDREW, Esq.



From JOHN MURRAY, Esq., C.E., &c., &c., to W. P.  
ANDREW, Esq.

11, GREAT QUEEN STREET, WESTMINSTER,  
*January 22nd, 1857.*

DEAR SIR,

The sample of Indian iron shown to me by Mr. Sowerby is peculiar. It possesses a greater degree of ductility than the cast iron of this country, and I have no doubt of its suitability for rails. The application in the upper parts of India would, in my opinion, be best tested by using them, in the first instance, in the form of cast iron laid solidly on longitudinal timbers firmly tied together by cross sleepers and bolts. Malleable iron rails from the same sources would be more advantageously used at an after period, when the trade of the country is developed, and a greater speed with heavier loads becomes necessary.

I am, dear Sir,

Yours very truly,

(Signed) JOHN MURRAY.

W. P. ANDREW, Esq.

From W. SOWERBY, Esq., C.E., to W. P. ANDREW, Esq.

LONDON,

*January 21st, 1857.*

DEAR SIR,

Herewith I beg to hand you a memorandum about the fuel, the calculations being taken from actual data, they are indisputable. The only person in India whom I ever met who doubted the capability of the forests, and who appeared anxious for their preservation was a keen sportsman whom I met at Roorkee. He was the gentle-

E

man who put up the iron bridge over the Khyrna, the foundations being built upon an iron mine, of which, I think, he was unconscious; but I know that he was unaware of the existence of iron a little way above the Roorkee Works, although he had been engaged on the Grand Ganges Canal Works, and at Roorkee for years, and had frequently traversed the jungles.

I trust the memorandum will set the question at rest as to fuel.

I am, &c.

(Signed) W. SOWERBY.

W. P. ANDREW, Esq.  
&c., &c., &c.

Memorandum by W. SOWERBY, Civil Engineer, F.G.S., on the Supply of Fuel at HIMALAYAN IRON WORKS, KUMAON.

In my report on the experimental Iron Works at Dechowrie, it was stated, "that the number of blast furnaces that could be kept in operation by the forest fuel was two hundred. This is, however, by no means the maximum that might be kept in operation by a proper management of the forests."

Some doubts having been expressed upon this point, the following calculations have been prepared, based upon well authenticated data.

The two hundred furnaces above named was to be only from the Gola to the Ganges, a distance of about ninety miles; but the entire distance of the iron fields and forests is from the Ganges to the Sada, or about 135 miles; and the average width of the forest as ascertained by actual survey is upwards of 12 miles. The number of square miles of forest is, therefore, (1620) one thousand six hundred and twenty.

According to Mushet (the best authority on iron manu-

facture) it takes 120 acres of forest timber of about 16 years' growth in England to make 1000 tons of iron. Since his time, improvements have taken place in the manufacture, which has reduced the acreage to about 100.

But taking Mushet's data of 120 acres, one square mile of clearing would produce 5,330 tons of iron. Therefore, 1,620 square miles would produce 8,634,600 tons. But the forests are not the growth of 16 years only, but of ages. Who, then will undertake to estimate the quantity of iron that can be produced from them?

According to the best and most reliable authorities in India, namely, Dr. Jameson, Superintendent of the Botanical Gardens, Captain H. Ramsay, Commissioner of Kumaon, and Mr. J. O. Beckett, Deputy Collector and Superintendent of Irrigation Works in Kumaon, the forests renew themselves to be large enough for charcoal every eight years.

Captain Ramsay stated to me personally that one species of wood, namely, Khyr, gave him the greatest trouble to keep down, he being obliged to have it cleared annually, at a great expense, to prevent its getting so high as to become a shelter for wild beasts. This kind of wood is very hard, and makes the best kind of charcoal, even better than Saul. The natives prefer it to any other for their own smelting operations. Mr. Beckett informed me that at his father's distillery works (at Shahjehanpoor, I believe) he used to cut his fuel from an adjacent small patch of ground, close to the works, and it renewed itself quite regularly and without any trouble every eight years.

Taking eight years as the period of renewal, and 120 acres as requisite for 1,000 tons of iron, it would require 960 acres, or  $1\frac{1}{2}$  square miles, to keep up the supply for one blast furnace—it requires three square miles in Europe—then the area of 1,620 square miles is capable of sup-

plying 1,080 blast furnaces producing 1,080,000 tons of iron annually for ever.

Therefore, in proposing only sixty blast furnaces, with rolling mills, I think it will be readily seen how very moderate the proposed works are, and how very much it is within the limits of what could actually be done.

This, however, is not all: for in taking the area of the forests I have only estimated that portion properly appertaining to the Bhabur, namely, the southern slopes of the hills, and a few miles into the plains. I have not reckoned upon the oak, pine, and other suitable woods, that could be drawn from the dense forests in the interior of the hills; nor have I taken into account the supplies of fuel obtainable from the bamboo, which makes the best possible charcoal.

With regard to the density of the forests, I can speak with the greatest confidence from personal knowledge, having passed through them in very many directions, always with the greatest difficulty, and not unfrequently with danger, having been several hours in getting through a very short space, and becoming benighted and lost in consequence. I have travelled over some thousands of square miles of bush and jungle in South Africa, but I am quite certain I have never traversed anything so dense and impenetrable as the forests of Kumaon, and more especially the Bhabur.

Captain Ramsay states that it is absolutely necessary to annually burn down the underwood, otherwise the country would be overrun with wild animals, and the inhabitants driven forth from it: a circumstance that I believe has actually occurred in some other part of India. This burning is still, however, but a very imperfect clearing; a proper clearing would be a heavy expense.

Assuming, therefore, that coal could be obtained and

used instead of charcoal, the forests would then have to be properly cleared to make the country inhabitable. A portion of the underwood of the forests was cleared by me last cold season, under the orders of his honour the Lieut.-Governor of the N.W. Provinces, and it cost about £200 per square mile. The annual expense of keeping the forests clear only to make them inhabitable would, therefore, be at least £40,000, and yet the iron made would be inferior if made from coal to that made from charcoal.

(Signed) W. SOWERBY.

LONDON, *January 21st, 1857.*

According to a recently-published Report on Railways for Upper India, by Capt. H. Yule, Deputy Consulting Engineer to the Government of India, the prices for iron are stated to be as follows:—

|                                                      |     |          |
|------------------------------------------------------|-----|----------|
| Common Railway Bars . . .                            | £16 | per Ton. |
| Spikes for Railways . . .                            | £42 | „        |
| Bolts and Straps for Railway<br>Bridges, &c. . . . . | £49 | „        |
| *Cast Iron . . . . .                                 | £32 | „        |

This is with the present demand, which demand is very rapidly increasing. It is, therefore, impossible to anticipate what the prices will be before long, unless the native mines are put into operation.

\* Vide Selections from the Records of the North-western Provinces, Part XXII.

Extract from Letter of P. N. JOHNSON, Esq., Consulting  
Metallurgist.

STOKE HOUSE, DARTMOUTH,

August 13th, 1856.

I consider it of first rate quality, particularly for rails, as it combines the requisite properties of toughness and hardness, which from the nature of the ore from which it has been reduced, might be expected. I also think that from its containing less silica and alumina than most cast iron, that it would more readily be reduced to good tough and malleable iron for general purposes.

(Signed) P. N. JOHNSON.

*Review by the Lahore Chronicle, of 28th January, 1857, on Selections from the Records of the Government of India, No. XVII.—Reports of the Survey of the mineral Deposits in Kumaon, and on the Iron-smelting Operations experimentally conducted at Dechouree-Calcutta, 1856.*

We look with regret on this elaborate, costly, and we will add, satisfactory report. Why should a report which is satisfactory occasion regret? Because we cannot but regard it as a result of that energetic movement for the development of the internal resources of India, which was so completely *the* movement of the day two or three years ago, but with regard to which a powerful re-action has set in, which bids fair to leave us with nothing but unfinished works and partial experiments to show, for the sums which we squandered in our short-lived mood of enterprise and liberality. There are many to assure us that the iron will slumber in the Kumaon Hills as long as it would have done, if its existence had not been established by Mr. Sowerby's careful researches, and its adaptability to practical uses by his intelligent experiments.

Whether the Government of India will now hold its hands or not remains to be seen; it has at least done its best to prove the folly of such a course by publishing the present report. Mr. Sowerby's mission will have been cheap indeed, if it leads to the practical use of Indian iron; it will have been ludicrously expensive if it is to remain in its present terminus, viz., Selections; from the Records of Government No. XVII., nay the report itself with its red covers, its gilt letters, its expensive illustrations, and its 98 pages will have been a gross extravagance, if the Government of India or of the north-west provinces, is contented to have agitated the matter and does not pursue investigation so elaborately commenced.

The undeveloped mineral wealth of the Himalayas has always been a standing Indian common-place. Lieutenant-Colonel Drummond had already made investigations in the Kumaon Hills, which established the existence of considerable quantities of iron ore, and it is a creditable illustration of the talent which the Indian Government can always command on almost any subject within the ranks of its own Service, that Colonel Drummond's observations have been entirely borne out by those of Mr. Sowerby, who testifies with creditable alacrity to their invariable accuracy. But the Government of the north west provinces determined on instituting a special and minute investigation as to the iron deposits in the Kumaon Hills; and Mr. Sowerby, a civil engineer, lately employed on the East Indian Railway, was deputed in the cold weather of 1855-56 to survey and report on the whole belt of the lower hills from the river Golah to the Ganges. We have not space, nor would our readers care for an enumeration of the localities in which iron was found, with a description of the qualities of the various ores. Such information forms of course the bulk of the report under

review : but for the present it may be enough to state that the hills are full of iron ; in some places “ literally full of iron-stone from the lowest valleys to the highest peaks,” p. 30. And generally the question of quantity is thus disposed of by Mr. Sowerby :—“ The supply of iron-stone along these lower ranges is so great, that it would be utterly impossible to give any approximate calculation. An idea of the size of the beds will be best formed by comparing them with the vast mountain range of which they form a part. If works are established on never so large a scale, they would, in the course of ages, produce but a feeble impression on the beds.” p. 44. Or, as the natives say, the hills are *pucka* throughout.

In the same way as regards quality, the geologist will read with delight the minute descriptions of the various kinds of ore—some so fusible ; some so refractory ; some so rich ; some so poor ; some precisely resembling those which in the neighbourhood of Furness, and generally in Lancashire and Cumberland, set their rich red mark upon the soil ; but for the general reader, we may state that “ the lower beds are of unexceptionable quality, containing a high per-centage of metallic iron ; the upper narrow beds will be found valuable for reducing the richer beds, the latter being generally too rich to be smelted :” that “ the ores are precisely similar to the valuable deposits so extensively worked in many parts of Europe and America, and they are also of the same character as the ores found in the extensive mineral fields of South Africa recently investigated by myself (Mr. Sowerby,) where they are found overlying a valuable coal deposit,” p. 43.

The valuable coal deposit has not been yet discovered, nothing but thin seams of very poor coal in the Kumaon Hills. This fact is accepted by some persons as rendering the iron discoveries valueless. The *Friend of India*



asserts in almost so many words that to be worked profitably in India iron must be found in exactly the same relation to coal and other accessories as it exists in England. Mr. Sowerby is not of this opinion, and indeed we expect that few engineers in the nineteenth century will be found to assent to the doctrine that any new attitude which nature may assume may not be reduced by new inventions to the same obedience as those of olden date to art and science. For our own part we have something of poor "Leatherstockings" sentimental dislike to a clearing, and it is not without compunction that we follow Mr. Sowerby's calculation as to decimating the dense forests, which now in a state of nature, (which state is one of very great density indeed,) clothe the southern slopes of these lower Himalayan Hills. But it is impossible not to feel that the forests and the iron have as natural a relation to each other as the iron and the coal, and if Mr. Sowerby's calculation is correct, there is no fear of exhausting the supply. He says at p. 44 :—" Taking the quantity of timber in these forests at a low calculation, and assuming that it is re-produced in ten years, the forest would supply sufficient fuel to keep 200 blast furnaces at work, each producing at the rate of three tons per day. The total annual supply of iron would be upwards of 200,000 tons, the area to supply this being taken at 100 miles in length, and 10 miles in width, or 1,000 square miles." In a subsequent portion of the report Mr. Sowerby out of consideration for the vastly increased demand for timber likely to arise from the production of iron, reduces his estimate of the number of blast furnaces which it would be prudent to maintain within the above area, from 200 to 60. .

To test practically the feasibility of working the iron, experimental works were established at a total cost of rupees 10,478 at Dechouree. They consisted of a large

water-wheel working a blast engine at 30-horse power, and a furnace for smelting. The account of this experiment is full, clear, and exceedingly interesting. It was only partially successful: not from the want of ordinary skilled labour: for although Mr. Sowerby appears to have been justly annoyed at the want of foresight by which he was compelled to commence operations without picked workmen and good tools, yet he succeeded admirably, with Mr. Davis, the smelter, in teaching the common native labourers, to whose docility and intelligence he bears frequent witness, entirely rejecting, from his own experience, the notion at one time entertained, of its being necessary to import some skilled charcoal burners for the works from England; not from any defect in the furnace or the wheel, which though costly, owing to the indifferent quality of the tools supplied from Roorkee, were substantial and stood the test applied to them, but from want of any person, except Mr. Davis, capable of serving the furnace during the first trying twenty-four hours, before the metal begins to run. Poor Mr. Davies worked till he could stand no longer; when he gave in, natives were appointed in his place; but this work requires not only great endurance, but practice. The natives were staggered at what Mr. Sowerby calls the fierceness of the duty, and were unable to prevent the accumulation of the cinder in the hearth; consequently the liquid metal could not be drawn off from the furnace. But the small quantity of iron which was procured was so good, that Mr. Davies states that "in the course of his thirty-four years' practical experience he never saw materials which worked more favourably together and better adapted for the production of cast-iron of the best quality." And Mr. Sowerby adds that, "as an experiment the success is so far complete that it proves beyond doubt that at Dechouree, the means of producing

cast-iron of the best description exist in the greatest profusion.”

The great question of carriage remains. It is all very well to build a canoe, but it must be brought to the water's edge.

On this important point, the report says, it must be owned, less than we could wish. In one place Mr. Sowerby says :—“ the whole of the deposits are accessible by means of waggons ; tram-ways would make them still more so.” p. 44. In another place he estimates the cost of making a wooden tram-way at rupees 300 to 500 per mile—p. 99. And we gather elsewhere that the nearest station to Dechouree of any importance is Mooradabad 50 or 60 miles distant. It is evident then that the objection as to carriage, which does for the present seem fatal to any practical development of the iron discoveries in the Kangra and Chumba Hills, exists in Kumaon in a very much less degree. From the highest mines Mr. Sowerby would bring down the ore easily and cheaply by means of inclined drops or spouts similar to the coal spouts on the Tyne ; and the lower deposits are, as has been stated, already actually accessible by waggons from the plains.

The last document in the report, a letter dated June 6, 1856, informs us that the Governor General has applied to the Court of Directors to send out two founders for the works at Dechouree. We do not know whether the application has been granted, and whether the experiment is being at this moment successfully prosecuted or not.

But we are inclined to augur far more hopefully from this report, than our contemporaries the *Bombay Gazette* and the *Friend of India*. We do not believe, with the latter journal, that the iron resources of Himalayas are to be disposed of for ever in one condemnatory paragraph.

We do not believe, that it will be necessary in future years to repeat the practical joke which was perpetrated some years ago, in these very Kumaon Hills, to send to England for the materials of an iron bridge, one end of which was actually built into an iron mine. We have these conditions given; mines of inexhaustible quantity containing iron of first rate quality, situated at a moderate distance from the great arteries of traffic. Water power not indeed inexhaustible but amply sufficient (pp. 105, 106); fuel cheap, abundant and self-renewing; cheap labour, and labourers capable of attaining skill.

Under these circumstances, we find it hard to believe that ten years hence we shall be importing iron rails from England.

## OPINIONS OF THE PRESS,

MORNING HERALD.—*March 18th, 1857.*

“Speed in opening communications is of more importance to India, than speed in travelling on them.” However much we may hesitate to endorse this dictum of Colonel Cotton to its fullest extent, we cannot but readily admit that “speed in opening communications” is quite as necessary for the future good government of the vast empire as “speed in travelling on them” is for their preservation from invasion; and that every month’s delay in the introduction of a system of cheap intercommunication, retards the progress of its teeming population. Strategically viewed, it is impossible to over-estimate the value of the great trunk lines of railway projected and being constructed in the valleys of the Indus and the Ganges, as well as the connecting links between the three presidencies sanctioned by the authorities. The time may come, however sensibly retarded by the late European conflict, when the most rapid concentration of troops on the north-western frontier may be indispensable for the preservation of British rule in India, and even a day’s delay may involve the loss of half an empire. However much, therefore, the enormous cost of these lines may have acted as an impediment to their speedy completion, it can hardly be doubted that it was wise that, as the great military roads, the back-bone, as it were, of railways in India, in solidity of construction and speed of locomotion, they should be fully equal to their European types.

India, however, has wants, crying wants, apart from preservation from either rebellion from within or invasion from without, which railways at ten thousand pounds per mile, and trains at twenty miles an hour, cannot satisfy—nay, which to a certain extent, they tend to aggravate. India has districts strategically worthless, and yet commercially invaluable; provinces in which population is abundant, and the earth teems with every kind of production. These provinces, lying out of the line of the great trunk railways, are not only cut off from the advantages these highways offer, but their cultivators are unable to compete with the produce of far distant districts brought to their former marts at a less

cost—irrespective of the distance—than they can carry their goods with the rude means and bad roads of the country. To dream of remedying this crying and increasing evil by the construction of first class railways would be madness : it would be like threading a needle with a steam-engine. What these provinces require (and it must be borne in mind that they include some of the most fertile and populous of India), is such an improvement in the means of intercommunication as will supersede the present crawling ponies and creeping bullock-carts, and act not as rivals but as feeders to the great trunk lines. Inexpensive tram-roads, adapted in the first instance to animal traffic, yet capable of being gradually improved as the commercial requirements of the localities through which they now are developed, would readily meet this requirement. The change thus effected, in the speed attained, and the weight carried, would be as great, if not far greater, in comparison, than that between the coach and waggon of England and the huge luggage and swift passenger trains of her railroad system. Eighty miles a week is now considered good average travelling with the bullock-cart and ponies of India. With a light tramroad and proper relays of animals, not only could 80 miles a day be obtained, but each load might be increased ten times in weight without distressing the draught animals, or diminishing its speed. Such a change in a country so perfect in its communications as England, would naturally be as valueless as in India; it would be invaluable, where the tram-road system is the inevitable supplement of that already commenced on the main lines.

For the initiation of such a simple and inexpensive system, the fertile and thickly inhabited districts of northern India, between Oude and the Punjab, offer marked advantages. Nay, more, they demand its introduction as the sole means of preventing the produce of those districts from being superseded in their natural markets by that of most distant portions of India, lying on the great trunk lines, and as the best, if not the only method by which the vast iron districts of the base of the Himalayas may be enabled to send down the material so indispensable for the early completion of the great trunk lines themselves. At present the

province of Rohilcund, which occupies the greater portion of the district to which we have alluded, is the granary of India, and notwithstanding all the impediments, commands an amount of trade disproportioned even to the great fertility of the land and the density of its population. If, however, the lines in the valleys of the Ganges and the Indus are completed without such a connecting system throughout Rohilcund as we have indicated, this extensive trade will be in peril, and the district which could supply iron for the whole of India will be isolated from the stream of commerce and of enterprise.

Two years ago Captain Yule, the deputy surveyor of the province, strongly urged the immediate introduction of this system on the Indian and home authorities. In his report to the local government he showed how a loop line, constructed at about 2500*l.* to 3000*l.* per mile, might be run from the Ganges opposite Futteyghur, across a nook of the then independent territory of Oude, to Bareilly, the capital of Rohilcund, whence, turning westward, it would open up the districts of Rampoor and Moradabad, before bending a little to the south, in order to reach the great station at Meerut, and thus onward to a junction with the trunk line at Delhi. By such a line Captain Yule proposed to accommodate an urban population alone of more than half a million, ensuring a profit of five per cent. on the then estimated outlay, and a speed of nearly fifty miles a day instead of less than eighty per week. The loop line of some 250 miles thus roughly sketched out by Captain Yule, and so cordially approved by the local authorities, has only to be looked at on a map to convince the most casual observer, acquainted with that part of India, that it is itself the basis of a much more extended system. Northward from Bareilly, the well-known mart of Pilhibeet invites a short branch of about forty miles; whilst at the other extremity, from Meerut, an extension through Mozuffurnugger and Saharunpore to Umballa, and thence to the commercial capital of the Punjaub, offers the most natural and most reasonable link of connection between the railway system of the Indus and the Ganges. On this part, too, a branch from Mozuffurnugger, northward by the Government works at Roorkee would reach Hurdwar, the world-renowned rendezvous of

merchants—the Eastern rival of the Russian Novgorod. To the extreme west again such a system would almost naturally extend from Bareilly, through Lucknow, to Benares. This proposal in its totality is at last in the hands of the public, “either to be moulded into a better shape,” as its author said of his loop portion, “or to be thrust out of doors.” It has much to recommend it. Based on cheapness and economy, the system seeks to meet immediate wants by immediate remedies, and yet to lay the foundation for more costly works when the development of commerce may call for their construction. As a means of saving from decay and elevating one of the noblest provinces of the Indian empire, it invites the earliest attention of the politician, whilst as a speedy developer of local traffic in districts utterly unsuited at present to more expensive operations, it comes forward as an important feeder of its predecessors—the friend and servant, and not the rival, of the great trunk lines already sanctioned. As bearing on the present great want of India, a full and reasonable supply of iron, we cannot now discuss its importance. This, however, is past denial, that railroads will never be made at the cost, and on the scale, imperatively demanded by the wants of India, until the great bulk of the iron for their construction is supplied from the inexhaustible supply that India herself so liberally offers to the capital, skill, and enterprise of England.

BELL'S WEEKLY MESSENGER.—*March 20th, 1857.*

Northward of the Ganges, between our newly-acquired territory of Oude, and the other portion of the Punjab, lies the province of Rohilcund—known by all Easterns as the Garden of India. Populous to a degree, and fertile beyond measure, it has long been the great source of the food of India, and its produce has been scattered far and wide through that country, despite the painful impediments opposed to its conveyance by the rude means of communications offered by the native carts and ponies. Lying away from the direction of the main line of railway from Calcutta to the north-west, the Garden of India is not only, to a great extent, cut off from the advantages of rapid communication now offered to other districts, but even in the neighbouring marts, where its pro-



duce once reigned supreme, the productions of far distant districts are not unlikely to compete with it successfully. Something, therefore, must be done, in the form of improved communications in Rohilcund, to save it from impending decay. Good roads would, no doubt effect much, but throughout the province there is such an entire absence of the material necessary for their maintenance, that their construction is not to be expected. The real remedy appears to be found in cheap railways, or tramroads fitted to the use of animal power, and yet capable of being eventually adapted to light locomotives. Such is the view taken by the local authorities, strongly advocated by Capt. Yule, the deputy consulting engineer to the government of India. In the appendix to his valuable report on this subject, Mr. Strachey, the officiating collector at Moradabad, one of the important towns of the provinces, speaks thus plainly:—

“ Cheap railroads seem peculiarly adapted to this part of India. Through the greater part of Rohilcund there is little *kunkur* to be found, and there is no other material available for metalling roads. Consequently, the construction of really good roads, fit to carry a heavy traffic, is generally impossible, except at an enormous expense. In this district there is not a single metalled road, nor can I see a probability of any being made. My experience of road making in the plains has been so small, that I can say nothing from my own knowledge, but if Colonel Cotton may be believed, the average cost of a good metalled road in this country is not less than 5000 rupees per mile. I believe that in this district that it would probably much exceed that sum. The average cost of transit is now very great—not less probably in the most favourable season than  $1\frac{1}{2}$  annas per ton per mile; and as for three months of the year the roads may be considered almost impracticable for carts, the true average cost of transit for the year must be still higher. If this state of things could be easily amended, by the construction of good common roads, it might perhaps be doubtful whether it would not be better to expend a large sum of money in making a comparatively few miles of railroad. But the difficulties in the way of making good metalled roads, fit

to carry the traffic along the main lines of transit through Rohilcund, would be so great, and the expense of keeping up such roads, when made, would be so high, that I cannot doubt that it would be far better, and far more economical in the end, to construct a line of cheap railroad at once. The plan which I believe has been recommended by Captain Yule, that the railroad should be adapted only for cattle draught, seems to me to be a very judicious one. For my part, I entirely believe with Colonel Cotton, that the thing wanted is, 'Speed in forming communications, not speed in travelling upon them.' The effect that the opening of the great line of railway from Calcutta to Dehli, may have upon the trade of Rohilcund, is a matter deserving the most serious consideration. I have no present means of forming any positive conclusions on the point, but I think it clear, that the danger is no imaginary one, that the rice and sugar of Rohilcund may be superseded in the markets of the west by the produce of the country to the south, lying near the line of railway. If such a thing were to happen, and its sole good market were to be lost, the results would be disastrous to Rohilcund. The proposed Rohilcund railroad would clearly be a complete preservation against any danger of this kind."

The line indicated by Captain Yule, to which Mr. Strachey refers, and adopted by the North of India Tramroad Company, is one embracing an urban population of more than half a million of persons, and connecting, within the space of 250 miles, districts of surpassing richness, and abundant population. Starting from the great station of Futteyghur, it proposes to run northward to the town of Shahjehanpoor, and thence to deflect north-west to Bareilly, the capital of Rohilcund. Still tending westward, it would thence run to Rampoor, Moradabad, and Umroha, cities containing more than 150,000 inhabitants, and so on to Meerut and Dehli. The value of this line, as developing the local traffic of so valuable a district, is by no means its only recommendation. When considered in its relations to other parts of India, it offers every facility for an extension to the north west by Moozuffurnugger and Sheharunpoore, to the great military station of Umballah, and

thence through Loodhiana to Umritzur, the mercantile capital of the Punjaub. Eastward again from Shahjehanpoor, the line might run through Lucknow to Benares, tapping the Ganges at the point where it becomes permanently navigable for vessels of heavy draft, and offering that great strategic gain—an alternative line to the north-western frontier.

Another view of the importance of this line rests on its relations to the great iron districts of the Himalayas, that border the province of Rohilcund and its adjacent territory on its northern side. Miles and miles of iron ore, only waiting for the hand and the capital of man to reduce it into iron of the best quality, extend at the foot of the mountain range, within easy distance of more than one station of the projected line. From Bareilly, for instance, a short branch to Pilhibeet, the famous rice mart, and thence to Bhurmdeo, would connect the iron works with the great places of demand. Of the imperative necessity for the immediate development of the mineral wealth of India, there can be but one opinion. Having regard to the amount of tonnage available for the carriage of iron from England to India, the mere weight of rails requisite to complete the 3000 miles of railway already sanctioned in India, could not be conveyed to its destination in less than ten years. Nor could this be done, save at a cost that renders it impossible to construct first-class lines in India, except in those few districts where the through traffic must be over abundant, and the communication is quite as important in a strategical as in a commercial view. If, however, the iron mines of India were at once developed, and these cheap tramroads constructed, running into the immediate neighbourhood of the most productive sources of this metal, and thus communicating with the great trunk lines, not only would those lines be completed at a far less cost,—at the cost we believe now expended in their carriage to India—and within a much shorter period, but India would at last be able to have such a development of railways and tramroads throughout her length and breadth as is adequate to her wants.

In thus advocating, most strenuously, the immediate introduction of a cheap system of tramroads, as well as the development

of the Indian iron mines of Northern India, and its distribution to the points of demand, we by no means deny that the great trunk roads have been rightly constructed in solidity and capability of speed, equal to their European rivals. Without, for a moment, overlooking the commercial value of these lines, we regard them as quite as valuable—if not more so—as great military roads. As the means by which the military power of our Eastern empire may be practically doubled, they are invaluable. And when we bear in mind how great may be the importance of a day, whenever the struggle shall come, either with discontented subjects, aggressive neighbours, or determined invaders, we admit that the utmost speed, power, and solidity that could be insured should be secured to these invaluable highways. India, however, has wants quite apart from those incident to the danger arising from rebellion at home or invasion from abroad. These wants cannot be met by railways at £10,000 per mile, for the simple reason that they press for immediate cure; and to be well cured, must be cured for a reasonable fee. The importance, therefore, of this new kind of railway for India is by no means, in our eyes, confined to its evident applicability to the district in which it is to be introduced. We regard it as the first of a long series of cheap tramroads, with which, ere long, India will be covered—the servants and feeders of the great trunk lines, and not their rivals—the means by which local traffic will be enormously developed, and a foundation securely laid for the gradual, but inevitable improvement of the communications of India, until they are worthy of that noble empire and its rulers.

THE LONDON WEEKLY INVESTIGATOR.—*March 18, 1857.*

A few days since an article appeared in the *Times* Newspaper, in reference to the report recently published by Captain Galton, upon the extensive system of Railroads in the United States, especially drawing attention to the principle adopted at the commencement of these great undertakings, namely, the laying down of the cheapest possible form of road, capable of effecting an improvement, however small upon the rate of transit of merchandise,

goods, and passengers previously existing. In this particular, we note the distinguishing feature between the railroads of the United States, and of this country. Here railroads have been constructed without regard to cost, with the highest degree of attainable practical science, and fitted for the maximum velocity. In an old country, perhaps, with a crowded population, and largely developed internal commerce, and with abundant wealth, such a system is not without its recommendations; although its disadvantages have been manifested by the miserable dividend too frequently declared. But no doubt can exist in the mind of any reasonable man that in an untried country—in a country where the rate of travelling is by imperfect means—where the traffic is by waggons, for instance, over ill-formed roads, every improvement however small is a great gain to the population and commerce in general, and is certain to afford a very ample remuneration on the outlay demanded. As the traffic increases the road is improved, because the additional outlay is justified. In some of the earliest lines of America it is said to have been customary to carry a lifting-jack with the trains, so that if the engine got off the line, the train waited whilst the machinery was put in order again, and some of these lines have since attained a character the highest amongst the Railroads of the United States. It has always been a firm conviction on our minds that this is the true principle upon which to construct railways in any new country and had the same principle been applied, travelling in India—which at present is conducted at the rate of eighty miles a week by camel and cart conveyance—we should by this time have covered India with rails adequate to a considerable increase in the rate of travelling in that vast empire, for less than the amount of capital which has already been advanced for that purpose since 1844, and which has resulted in the opening of only 200 miles in the presidency of Bengal; 100 miles in the presidency of Bombay; and about an equal number in the presidency of Madras. The great error which has been committed has been the construction in India of railroads upon European principles, and adapted to the high demands of European civilization. We are glad to see from an advertise-

ment which appears in another column, that an attempt is now about to be made to introduce a cheaper mode of railway construction in India by a substitution of a tram road, to be worked by horses, through the most fertile and populous districts in Northern India. commencing at the station of Futteyghur, and running thence through the province of Rohilcund, "the garden of India," containing a population of above 350 persons to the square mile. From Futteyghur it will proceed in a northerly direction to Shahjehanpore, and thence to Bareilly, the capital of Rohilcund, with branch to Philibeet and ultimately to Bhurmdeo, at the foot of the Himalayas, where the merchants of Nepaul, Thibet and Chinese Tartary, meet those of upper and lower India for the exchange of their commodities. From Bareilly the line will continue in a westernly direction to Rampoor and Moradabad, and thence to Meerut, and ultimately to Delhi. As to the prospects of remuneration which the districts proposed to be traversed will afford, we have the evidence of Captain Yule, the consulting engineer to the Government of India, who says in his report that "a complete line of railway extending from Shahjehanpore would connect in a space of 170 miles the town of Shahjehanpore with a population of 75,000, Bareilly 112,000, Rampoor probably 30,000, Moradabad 60,000, Umroha 35,000, Meerut 40,000, and Delhi 152,000 a string of populous places rarely to be found in the same compass." We shall not follow the incidental traffic or the possible advantages to be compassed by future extensions, it appearing to us that these localities of busy population are in themselves ample to cover an outlay which is estimated upon very careful and reliable authority as not likely to exceed £5,000 a mile on the average, although it is stated that it is the intention of the promoters to construct, in a substantial manner, such portions of the line as are required for the more heavy traffic. The first portion of the line to be constructed will be about 250 miles, namely, from Futteyghur to Delhi, *via* Shahjehanpore, Bareilly, and Moradabad; for the construction of which the capital now proposed to be raised, namely, one million sterling, will be sufficient. This capital it is proposed to raise in shares of £20 each, with a deposit of only 2s. a share,

and no call will be made until arrangements have been made with the East India Company for a guarantee of interest. The guarantee being obtained, the line can be constructed within three or four years, from the time of obtaining the sanction of the authorities. We regard this company as conferring a great boon upon the empire; and we cordially concur in the following paragraph of the prospectus, which states that.—“The system intended to be introduced will be more suitable to the actual requirements of the country than lines costing £9,000 to £10,000 per mile. The present rate of travelling in India by camels and carts seldom amounts to 80 miles per week. If, therefore, 80 miles per day can be accomplished, it is obvious how great a boon will be conferred upon India. Of such a system this line would not only be the model, but the fruitful parent. By establishing a connection with the iron districts, and by its inexpensive construction developing local traffic in parts unfitted for more costly works, it would not only act as a most important and liberal feeder to the lines already in course of construction, but bring down to them, at a cheap rate, much of the material so indispensable for their speedy completion.” The system thus happily inaugurated, by W. P. Andrew, is we have no hesitation in saying the true one, and we are glad to recognise the prospect of a realization of some of those advantages which Mr. Andrew shadowed forth in his remarkable declaration at a meeting of the Scinde Railway Company, that “India would never get the full benefit of the railway system, till Indian rails were made of Indian iron.” It is unnecessary for us to do more than refer to the list of names in the Board of Direction as the best, as the very best guarantee that can be afforded to the public, that the work undertaken will not only be done but will be well done; and that at the least outlay for preliminary expenses. The public know by this time that they are in safe hands in entering upon any concern with which Mr. Andrew consents to associate his name, and we sincerely hope that his exertions to introduce a system of cheap railway communication in India, may be attended with the most complete success.

MINING JOURNAL.—*March 21st, 1857.*

The best description of road for the transit of passengers and merchandise in thinly-populated countries, or in districts where the amount of travelling is not deemed sufficient to justify the construction of railways and the use of locomotive engines, is a question calling for the most careful consideration; and we, therefore, subjoin some data, which will, no doubt, prove interesting. The more important points involved are the cost of construction in the first instance, and the expense of working and maintenance afterwards. In comparing the tramroad system with common roads, the far greater facilities offered, both by the increased amount of merchandise and passengers carried, and the much shorter time required in the transit, with the application of the same animal power, by the tramway, is so apparent, that we presume no question would be raised upon their relative merits, but the comparison with ordinary railways has been more closely questioned. The experience of a railway twenty-six miles in length, and in a prosperous colony, where 10,000 square miles of surface require lines of communication, and the population scattered over it is less than 100,000, or, in other words, where there are about ten persons to the square mile, is taken as an instance of the inutility of constructing expensive railways with locomotives. In this case, although the published returns showed a balance in favour of traffic of upwards of £325, it was found upon investigation that no charge or provision was made for wear and replacement of engines, and other rolling stock. There were three engines then on the line, which cost £12,700, and by adding the interest that had accumulated, their actual cost was taken at £4,500 each. English experience has established that 86,000 miles is the average work an engine will perform; therefore, if one engine will do all the work upon the line, it would be worn out in a year and a half, thus showing £3,000 per annum for replacement of engines, casual repairs, renewal of boiler-tubes and fire-bars, with maintenance of the rest of the rolling stock. would be a still greater source of expense, and which estimated



at another £3,000, would give £6,000 as the annual cost of rolling stock.

The number of persons travelling on the line referred to does not exceed fifty each way, which has been taken as the basis of calculations. The number of trains daily are two each way, which calculated at 4s. 6d. per mile for haulage (the actual cost), the daily amount of that item will be £23 18s. The cost of the engine (£4,500), divided by the miles run (36,000) gives 2s. 6d. per mile travelled, or for the daily work (104 miles) £13. The annual cost of keeping the engine in repair (£1,600), divided over the working days of the year, gives nearly £5 per day, and these items, added to the interest on prime cost of at least two engines at ten per cent., £900 per annum, or £2 17s. 8d., makes the daily cost of haulage £44 15s. 8d. Estimating the amount of revenue derived from the carriage of goods at one-half—the actual proportion being one-third—£22 7s. 10d. is chargeable against passengers, which, divided by 200, the number travelling each day, gives 2s. 2d. as the cost of haulage for each passenger over the entire distance of twenty-six miles.

Instead of constructing more railways in the colony, as it is calculated that the population will be many generations before it will equal that of Scotland (92 to the square mile), it is proposed to lay down tram ways with light, long coaches, suitable for traction by one horse, and capable of accommodating twelve inside and sixteen outside passengers; four each way would suffice for the above number of passengers; but to provide for occasional increase of numbers, and to afford greater accommodation by more frequent departures, calculations are based on six coaches daily each way. These coaches need not exceed one ton weight empty, when fully loaded three tons, while the medium load would be about two tons. Repeated experiments by the first engineers in England have established 8½ lbs. as the power required to draw one ton on a level rail, and as the line is nearly level, the deviations from it being about the same either way, the force required to draw these coaches will vary between 17 and 25 lbs. The numberless experiments of Mr. Telford on the

Holyhead and Liverpool turnpike roads determined the performance of horses drawing stage coaches at the rate of ten miles per hour to be 42 lbs. each horse, consequently one horse with the proposed coaches would not be more than half loaded.

Short stages are considered preferable, making the horses work two of them daily. On this line there should be five—three intermediate, and those at the ends. Seven horses at each stage would be sufficient to work six each day. The first cost of these thirty-five horses, at £50 each, would be £1850. Allowing 5s. per day as the cost of each horse, including everything—the actual cost would be little over 3s. 6d.—there would be an expenditure of £8 15s.; ten horses must be renewed every year, £500; add interest on original stock, £185=£685, or £2 4s. per day, making a total of £10 19s. per day, being a little more than 8½d. each passenger for the twenty-six miles, or less than one-third of that for locomotive traction. Of course, where the population is sufficiently dense, or where the goods traffic is of an extent to make locomotive traction remunerative, it would be infinitely superior; but there are many districts in which the construction of railways for locomotive traction would entail loss upon the shareholders.

Several companies have lately been formed for extending the means of railway communication in India, and it is now proposed to feed the several lines in course of construction, or shortly to be constructed, by the establishment of the North of India Tramroad Company (limited), by which a cheaper system of communication will be introduced throughout the province of Rohilkund and adjacent territory, connecting the Ganges with the Indus, and also with the iron districts of Kumaon and Gurhwal, *via* Futteyghur, Shahjehanpoor, Bareilly, Rampoor, Moradabad, Meerut, Seharunpoor, Umballah, Loodheana, and Umritsir. It has been estimated that the cost of constructing the heaviest portion of the line will not exceed £5,000 per mile, and a large portion will not exceed half that amount, so that the capital which it is proposed to raise will be sufficient for the completion of the present section from Futteyghur to Delhi. It is intended ulti-

mately to extend the tramroad system north-westerly by way of Moozuffurnugger and Saharanpore to Umballah, and southward from Shahjehanpore *via* Lucknow to Benares. Animal power will be employed in the first instance, but, as the traffic increases, light locomotives may be used with a moderate speed. Thus an improved mode of transit will be immediately introduced in districts where the character of the population would not justify the application of locomotive power with any chance of the shareholders being remunerated; whilst, as the traffic increases, the locomotive system could be introduced and still admit of the shareholders reaping profits.

MORNING HERALD.—*March 21st, 1857.*

The North of India Tramroad Company (limited) has obtained its certificate of incorporation under the Joint-stock Companies Act of 1856.

THE RAILWAY GAZETTE.—*March 21, 1857.*

One of the earliest iron roads opened in this country was the Stockton and Darlington. This Company was incorporated by Act of Parliament in 1820, "for a tramroad from the River Tees at Stockton, to Witton Park Colliery, with several branches therefrom," and was first opened for traffic in September, 1825. It was originally designed for the coal traffic; but in process of time it became the first upon which steam locomotives were used, under the celebrated GEORGE STEPHENSON. It now assumes the rank of the best dividend-paying line in the kingdom. The tramroad was adopted as the cheapest and most economical form of road. It was adapted to the wants of the traffic, and of the locality! and time, bringing with it a development of the traffic, made it worth the while of the owners of the tramroad to convert it into a steam locomotive line, which now it stands, the most remunerative in the kingdom. This is to begin at the right end; and the only wonder is that with such a remarkable mechanical fact before us, hundreds of miles of tramroad are not in operation throughout the kingdom, for the accommodation of

districts where the outlay required would pay, but where a steam-locomotive line, with all its costly appliances, would not pay for years, and "while the grass grew the steed would starve."

We are beginning to open our eyes to these things. "Cut your coat according to your cloth," is a favourite proverb with a practical people, but which we have hitherto lost sight of in the matter of railway construction; and in no instance is this more strikingly demonstrated than in the case of railways in India.

A nation of shopkeepers, of all others, ought to know the class of goods that will commercially suit the market. No prudent tradesman would send figured satins and Brussels lace to a market which can afford only gingham and calico, or modest Nottingham edging; and there is equal want of judgment in constructing a costly railway in a district which would be amply accommodated with a useful tramroad, effecting an economy in rate of carriage and speed in the transit of goods and passengers. Yet this has been done in innumerable instances, but we have gone further than this in the case of railways in India. We have hitherto denied to that empire *any* improvement in the existing means of transit because we cannot give them the *best* form of improvement; that is, we have refused to give them a tramroad until we can give them a steam locomotive line, rattling along with engines, at a speed of 50 miles an hour! and this in a country where all that is wanted is to go at a rate faster than 100 miles a week!

But as we have said we are beginning to open our eyes on this subject. Within the last week a company has been brought before the public, under the title of the North of India Tramroad Company, having for its object to associate a subscribed capital of one million sterling, in £20 shares, for the purpose of introducing "a cheap system of communication throughout the province of Rohilkund and adjacent territory, connecting the Ganges with the Indus, and also the iron districts of Kumaon and Gurhwal *via* Futteyghur, Shahjehanpoor, Bareilly, Rampoor, Moradabad, Meerut, Seharunpoor, Umballah, Loodheana, and Umritsir. Southward from Shahjehanpoor, should it eventually

be deemed desirable by the authorities, the line would run through the recently acquired territory of Oude *via* Lucknow to Benares, where the Ganges is permanently deep and capable of floating powerful steamers, even in the driest seasons, down to Rahj mahal, *now* on the East Indian Railway line. But for the purposes of the original design without regard to the extension, the official returns collected by the Government Engineer, Captain YULE, show an amount of population of a very remarkable character; Shah-jehanpore containing 75,000 people; Bareilly, 112,000; Rampoor, 30,000; Moradabad, 60,000; Umroha, 35,000; Meerut, 40,000 and Delhi, 152,000!

Now the very cheap form of road proposed, will do wonders for the conveyance of merchandize in India, since the traffic is at present conducted by camels and carts at the rate of about 80 miles a week, and at a great expense; loss and other contingencies being added to the estimate. A tramroad then, which whilst using animal power would work at a reduced rate of charge, and at about 80 miles a day is a wonderful advance, and would prepare the commerce of the country for a progressive development should the time arrive when steam locomotion would be equally remunerative to the proprietors, and prove adapted to the increasing requirements of the country!

We expect to see this undertaking warmly supported. It is a plain common sense proposal, which is made as we believe in "due season."

THE MORNING HERALD.—*March 26, 1857.*

The shares in the North of India Tramroad undertaking were allotted to-day with a degree of fairness which is worthy of imitation on the part of all directors who may be anxious to stand well, not only with their shareholders, but with the public. India owes a deep debt of gratitude to Mr. Andrew, which probably will not be fairly recognised till, by his exertions, it is brought within ten days' reach of England.

## JOHN BULL AND BRITANNIA.

A new description of public company has been announced, that of the North of India Tramroad, to form a branch or feeder to the Scinde and Punjaub Railways in the upper provinces of India, where the more costly rail would be unnecessary for the traffic. The company has already obtained a certificate of incorporation, and will doubtless prove the parent of many similar works of useful character towards developing the riches and resources of India, which promises to give forth its wealth in greater profusion in the future than ever it did in the past. India is indebted for this practical adaptation of the railway locomotion in a modified form to Mr. W. P. Andrew, a gentleman who has given a great impulse to the future greatness of the East by the formation of the necessary works of art to develop the resources of the interior of India.

THE CIVIL SERVICE GAZETTE.—*March 21, 1857.*

Much interest has been excited in East India and general commercial circles by the appearance of the prospectus of the North of India Tramroad Company, with a capital of £1,000,000 in £20 shares. The promoters of this undertaking are men of the first character for integrity and practical ability. The object is to furnish the populous and fertile province of Rohilcund with cheap roads, and the first intention is to construct 250 miles from Futteyghur to Delhi. They are intended to be for animal power, although capable of being made available for light locomotives. Some portions are estimated to cost £5,000 per mile, and others only £2,500. The district is especially adapted for tramroads, its geological character rendering the formation of good ordinary metalled roads almost impracticable, and the experiment on a moderate scale seems, therefore, highly expedient. No call is to be made, except upon a guarantee being obtained from the East India Company.

THE RAILWAY RECORD.—*March 21, 1857.*

The example of the United States in reference to railway construction has hitherto been lost upon the promoters of colonial lines. We have been in the habit of setting to work as though we were about to substitute the highest rate of velocity for an average speed of 10 miles an hour, as in the old coaching days in this country, and we consequently rush into an enormous expense when a very moderate outlay would effect all that is immediately required—namely, *improvement* upon the existing means of conveyance in any given country. And this habitual desire for perfection leads to this practical inconvenience, that a country is compelled to *wait* because the best and most perfect appliances are not attainable! This is peculiarly demonstrated in the case of Railways in India. Since 1845, we have been dangling on because nothing else would be countenanced but railways of first-class gradients, engines, rails, stone bridges, and all the mechanical contrivances of the best kind to which we are accustomed in the United Kingdom! What is the result? About 500 miles laid down in 10 years, in presence of the notorious crying want of *any* improvement upon the slow system of travelling in that country which does not exceed the rate of about 100 miles a *week*! We have continually referred to the example of the United States in this matter; and we are glad that public attention is likely to be attracted to this subject by the report recently issued by the Board of Trade. The *Times* of Tuesday contained some very striking remarks upon this document, and so ably expresses our own views upon the subject that we gladly transfer them to our columns:—

“ The most remarkable feature (writes the *Times*) which this report brings out is the energy and impetus with which the Americans have rushed *in medias res* at once in the construction of their railways. This explains the rapidity and the small cost of this vast work more than the cheapness of land or the grants of land. There are some persons who cannot begin to work till they have a perfect tool. They are fidgetty and uncomfortable

without it ; they wait and wait, and delay operations indefinitely till their tool is nicely ground, polished, and shaped, and a convenient handle put to it. There are others who won't wait, but take the first tool they can get and work with it. A bad tool is worse than a good one, but in the meantime they are doing so much work while the others are doing nothing, but only waiting. It depends, of course, on what the department of work is, which of these two methods is the best. An epic poem requires the very best tools and waiting ; a speech on the hustings or in Parliament must be made with whatever tool comes to hand—*i. e.*, with the best kind of expression we can summon at the moment. Some persons, however, cannot bring themselves to speak till they have hit on the very best word. The late Archbishop of Canterbury was so fastidious in his choice of words, that he used to keep his audience painfully waiting till he had tried one word after another to see how it would fit, and, as this process took place once or twice in every sentence, the constant search for perfection was hardly repaid by the tardy discovery. In matters of "time and tide," and over which that great power to which one of the seven wise men consecrated the result of a life's wisdom, "Opportunity," presides, it seldom answers to wait very long for your machinery. In war, for instance, you cannot.

"The object for which railways are wanted in America is in one very important respect different from that in this country ; they are wanted not simply as railways, but as *roads*, not only to quicken communication between different towns, but to open a way into the heart of large spaces of territory, and to carry off their produce. The railway is the carrier there. Railroads, as Captain Galton informs us, are *cheaper* than roads ; there would not be funds forthcoming for making even tolerable roads over the vast prairies of the West ; but the railway comes *before* the road in this extraordinary world of inversions ; it is the aboriginal road of the West, performing the very first function which a new country wants—that of opening it to human labour, and affording a channel by which the results of that labour can make their way to a purchaser. "When first opened, three years ago," says Captain



Galton of the Illinois Central Railway, "the station-houses were almost the only habitation on the line; now there is a large village at each station, surrounded by vast tracts of cultivated ground. When I passed along the line last autumn, sacks of corn covered every available spot round the stations, and the means of the company were scarcely adequate to removing them." With boundless tracts of land, then, lying idle and waiting to be used—land which will give an enormous return to cultivation, it is obviously not the interest of the American to delay his railway till he can make one with the best curves and the most even rails. He cannot afford to wait for a *chef-d'œuvre* of engineering; no, every minute is lost that this land lies idle, and therefore he just lays down a railway good enough to take him into the heart of this profitable region, and set him down there with plough and spade, and a channel of conveyance for the produce of his farm. He bends the railway to his temporary object, and makes it serve the purpose he wants at the time he wants—*i. e., now*. He dashes at his end, and does not mind sharp curves and inclined planes. This is making the most of the instrument in his own case and wielding it most victoriously and effectively. The Baltimore and Ohio Railway, as first made, avoided an expensive tunnel by "a series of zigzags, ascending over a hill by a gradient of 1 in 18 at its steepest part, each zigzag terminating in a short level space, so that the train was run up one zigzag on to this level space, and then backed up the next zigzag and so on." This eccentric expedient was superseded by a tunnel afterwards, but the American would not wait for perfection before he had his railway in the first instance. *We wish our Indian authorities would take a hint from American expedition. They go on waiting for perfect engineering, and doing nothing till they can do everything as it is done in this country. The Americans would have covered India with railways before now.*"

Precisely so: but after eleven years we have the gratification of finding that a bold step has been taken in the right direction, by the able and indefatigable promoter of so many admirable

undertakings in connection with our Indian Empire, Mr. W. P. Andrew. At the head of a board of directors composed of gentlemen thoroughly acquainted with the details of the work they have undertaken, and of the highest character and standing, Mr. Andrew has introduced to the public a company under the titles of the North of India Tramroad Company, for the establishment of a system of cheap communication throughout the province of Rohilcund, and the adjacent territory connecting the Ganges with the Indus, and also with the Iron districts of Kumaon and Gurhwal, *via*. Futteyghur, Shahjehanpoor, Bareilly, Rampoor, Moradabad, Meerut, Seharunpoor, Umballah, Loodheana, and Umritsir. The first portion of the line proposed to be constructed, will not exceed an average cost of £5,000 a mile, and the total capital will not exceed one million, to be raised in £20 shares, with a deposit of 2s. a share, and no call will be made until a guarantee is obtained from the East India Company.

The statement of the promoters explains the grounds upon which to recommend this tramroad, upon which animal power will be employed until the traffic is more developed. They say—

“The system intended to be introduced will be more suitable to the actual requirements of the country than lines costing £9,000 or £10,000 per mile. The present rate of travelling to India by camels and carts seldom amounts to 80 miles per week. If, therefore, 80 miles per day can be accomplished, it is obvious how great a boon will be conferred upon India. Of such a system, this line would be not only the model, but the fruitful parent. By establishing a connection with the iron districts, and by its inexpensive construction developing local traffic in parts unfitted for more costly works, it would not only act as a most important and liberal feeder to the lines already in course of construction, but bring down to them, at a cheap rate, much of the material so indispensable for their speedy completion.”

The philosophy of the whole matter lies in this:—Make your railway as quickly and as cheaply as you like, but make it; and don't keep the commerce of the country waiting for its comple-

tion! Make it serve the purpose you want at the time you want—*i. e.*, now!

LONDON MAIL.—*April 10th, 1857.*

Tramroads, which were first formed in England about fifty years since, and though found to answer, were abandoned in consequence of competing means of communication, are about to be revived in this city and the immediate environs, as being necessary to relieve the overgrown traffic of the metropolis. A company has also been formed to introduce them in India, where the cost will be far below the expense of railroads, either in money or in time of construction. It is proposed to make the fertile portions of the northern districts the first field of operations, which will be ultimately extended throughout the continent. That ordinary beasts of draught will form a sufficient traction is evident from the fact that in the coal districts of England one miserable horse may be seen drawing upwards of twenty tons with the greatest ease.

MORNING HERALD.—*April 13, 1857.*

At the moment when the question of introducing tramroads into those parts of India in which the local traffic is not as yet sufficiently developed to pay for first-class railroads at £10,000 per mile, it is interesting to find this cheap and expeditious system of intercommunication is finding favour in our Australian colonies. "Amongst the many subjects of interest to this colony," writes an Adelaide journalist, "to which Mr. Torrens directed his attention during his recent visit to Melbourne, the tramroad to the Yan Yean Water-works deserves special notice. It is strange that, throughout the long controversy that has taken place during the last few months in Adelaide on the subject of intercommunication, such a striking example of the successful and cheap application of the tramroad principle should not have been impressed upon the public. It is not too late now to supply the omission, and as Mr. Torrens has courteously put us in possession of the particulars of

his examination of the line above referred to, we place them before the public, in order that the system may receive the consideration it deserves. The line has been constructed for a distance of 20 miles, at a cost in the dearest times of £90,000, or £4,500 a mile. This sum, though large, cannot be taken as a fair index of the expense likely to be incurred here if the plan were adopted; but from the difference in the times and the cheaper ruling of labour and materials in this market, we do not think the cost would much exceed one-half of the price paid in Melbourne. The mode of construction is exceedingly simple, and would appear to require but a very small amount of skilled labour. The line is formed of transverse logs, about 10 feet long, and varying in diameter from 9 inches to 20 inches. These are laid down as they are cut from the tree, and longitudinal planks of gum or stringy bark, 8 by 3 inches and 12 feet long, and notched into them, and secured in their places by wedges. The line is well drained, and except for a few miles, is not ballasted. It follows, as a rule, the natural undulations of the ground; and, except in extreme cases, no cutting or filling up is resorted to. From cursory observations, Mr. Torrens estimated that there is a rise of 50 feet in the last quarter of a mile, or about 1 in 26, and in other places the gradients are stated to be equally heavy. Upon this line four bullocks have been seen to draw a weight of eight tons, independent of the carriage, at the rate of  $2\frac{1}{2}$  miles an hour. The cost of repairs is stated to be less than that of a metalled road. The Yan Yean tramway is constructed on a gauge too narrow for two bullocks to work conveniently abreast; but that is a defect which may be easily avoided. This is the substance of the information put into our hands, except that the line would appear to require flanged wheels to make it successfully available. Mr. Torrens proposes that an experimental line shall be laid down from the city to the eastern fork of Brownhill Creek; or from Adelaide to the head of the gully. This, certainly, would very much facilitate the carriage of stone and wood into Adelaide, and if it succeeded, there would be but little difficulty in continuing the line to Mount Barker. A part of this line could be worked by gravitation. This



is a suggestion which is very well worth the consideration of engineers and parties otherwise interested in the subject.

MORNING HERALD.—*April 13th, 1857.*

The unpretending character of the North of India Tramroad Railway in Rohilcund, appears to be its greatest recommendation. It is no new scheme, as the country was explored and reported on as long ago as 1854-55 by Captain Yule, the Government engineer in which report he says—"It is not a branch of the East Indian Railway; it is intended as a remedy against the mischief which the great line is expected to cause to a great and productive province; and the remedy may be deferred too long, for trade having once changed its channel it may be difficult to bring it back again." The promoters appear to have made out a good case with which to come before the public, and as their capital is subscribed, and their surveys of the country so complete as not to render further investigation necessary before applying for the requisite guarantee, there need be no delay in the decision of the authorities.

TIMES.—*March 18th, 1857.*

The prospectus has been issued of the North of India Tramroad Company, with a capital of 1,000,000*l.* in 20*l.* shares. The object is to furnish the populous and fertile province of Rohilcund with cheap roads, and the first intention is to construct 250 miles from Futteyghur to Delhi. They are intended to be for animal power, although capable of being made available for light locomotives. Some portions are estimated to cost 5,000*l.* per mile, and others only 2,500*l.* The district is especially adapted for tramroads, its geological character rendering the formation of good ordinary metalled roads almost impracticable, and the experiment on a moderate scale seems, therefore, highly expedient. No call is to be made, except upon a guarantee being obtained from the East India Company.

MORNING CHRONICLE.—*March 18th 1857.*

A practically useful project has been announced, called the

North of India Tramroad Company, the main object of which is to introduce a cheap system of tramroads, adapted to animal power, into those districts of India which are unfitted for more expensive works, yet capable of being improved as the local traffic becomes developed. It is thus proposed, without delay, to connect the present railway systems of the Indus and the Ganges with each other, and with the iron mines of Northern India, commencing at the station of Futteyghur, and running thence through the province of Rohilcund, "The Garden of India," containing a population of above 350 persons to the square mile. The line has already been examined and reported on by the Deputy Consulting Engineer to the Government of India, Captain Yule, and its construction urged by the authorities of the province. The first portion intended to be constructed will be about 250 miles, namely, from Futteyghur to Delhi viâ Shahjehanpoor, Bareilly, and Moradabad. The present rate of travelling in India by camels and carts seldom amounts to 80 miles per week. If, therefore, 80 miles per day can be accomplished, it is obvious how great a boon will be conferred upon India. Of such a system, this line would be not only the model, but the fruitful parent. By establishing a connection with the iron districts, and by its inexpensive construction developing local traffic, it will act as a most important and liberal feeder to the lines already in course of construction. The company hope to complete the line from Futteyghur, through Shahjehanpoor, Bareilly, Rampoor, Moradabad, and Meerut, to Delhi in about three or four years from the time of obtaining the sanction of the authorities. There is at once a great practical utility in this project, and it will probably be the parent of many similar undertakings in those districts where the ordinary rail would be of too costly a character for the district. As another stimulus to the trade of India, it is a plan which recommends itself to the Hon. East India Government for participation in the system of guaranteeing a certain amount of interest to the capitalists who so liberally provide the means to develop the wealth of the country over which they exercise a sovereign sway.

MORNING ADVERTISER.—*March 18th, 1857.*

The attention of the investing public is now being extensively directed to India, the vast and incalculable resources of which country will soon be rapidly developed through the introduction of the railways now in course of construction. The agricultural operations of the country will no doubt assume dimensions which even those acquainted with the subject could scarcely have contemplated, but the opinion has often been freely expressed that the full effect of these railways will not be felt until a judicious system of tramroad conveyance is established. This *desideratum* is likely to be supplied, at all events in one part of the country, by the North of India Tramroad Company, the prospectus of which appears in our advertising columns. This company is formed, as the promoters state, "for introducing a cheap system of communication throughout the province of Rohilcund and adjacent territory, connecting the Ganges with the Indus, and also with the iron districts of Kumaon and Gurhwal, via Futteyghur, Shahjehanpoor, Bareilly, Rampoor, Moradabad, Meerut, Seharunpoor, Umballah, Loodheana, and Umritsir." The capital required is one million sterling, but no call is to be made until a guaranteed rate of interest has been obtained from the East India Company. The directors are highly influential, and all, more or less, connected with India. The chairman is Mr. W. P. Andrew, the promoter of several other projects identified with India, which have taken a high position among the investments dealt in on the Stock Exchange.

DAILY NEWS.—*March 18th, 1857.*

Numerous companies have lately been projected for the construction of railways in India. The prospectus of the North of India Tramroad Company is now issued. The object of this company is to form a cheaper medium of communication than can be attained by means of railways. The view of the promoters is that, whilst the main or trunk lines must consist of railways, tramroads may be of great value for the accommodation

of the traffic of districts which, though both fertile and populous, do not yet need works of greater cost. In the terms of the prospectus, the company is formed "for introducing a cheap system of communication throughout the province of Rohilkund and adjacent territory, connecting the Ganges with the Indus, and also with the iron districts of Kumaon and Gurwhal, *via* Futteyghur, Shahjehanpoor, Bareilly, Rampoor, Moradabad, Meerut, Seharunpoor, Umballah, Loodheana, and Umritsir." To a certain extent, the project may be regarded as an extension of the lines of the Scinde and Punjaub Railway Companies. It is estimated that the maximum cost will be 5,000*l.* per mile, and that a great portion of the lines can be made for half that amount. The million forming the capital of the company is thus to suffice for the first section of 250 miles, from Futteyghur to Delhi. It is proposed to employ, in the first instance, animal power, and it is intimated that 80 miles a day can be accomplished by this inexpensive means of traction. The shares are of 20*l.* each, but only a deposit of 2*s.* per share is to be paid, until the East India Company shall have sanctioned the project and granted a guarantee. The chairman is Mr. W. P. Andrew (chairman of the Scinde, Punjaub, and Euphrates Valley Railway Companies); the deputy chairman, Sir Herbert Maddock; and the other directors are highly respectable.

MORNING POST.—*March 18th, 1857.*

The prospectus of the "North of India Tramroad Company" will be found in our advertising columns. This is another of the useful projects for improving intercommunication between various parts of our vast Indian empire which owe their origin to the indefatigable energy and accurate knowledge of Mr. W. P. Andrew. The object of the company is to introduce a cheap system of tramroads adapted to animal power into those districts of India which are unfitted, at least for the present, for more expensive works, and, by so doing, develop their resources. The tramroads at present contemplated are to connect the railway systems of the Indus and Ganges with each other, and to render available the rich iron mines of Northern India. It is proposed



to make the province of Rohilkund the first scene of the enterprise, that province being more populous and more wealthy than most other parts of Northern India; and it is calculated that all the necessary works for constructing the tramway will not exceed 5,000*l.* per mile in any part, whilst a large portion will be made for one-half of that amount per mile. The capital is fixed at £1,000,000, in shares of £20 each; and the management of the company is in the hands of an experienced and most respectable board of directors, with Mr. W. P. Andrew at their head.

ALLEN'S INDIAN MAIL, *April 3, 1857.*

Notwithstanding what has been done, and what is being done, in India, in the way of providing means of internal communication, the cry is still heard for "Roads, Roads." And if roads are, for the first time, to be made in a particular district, why, it is asked, should not the additional advantages of the rail, at the same time, be made available? The cost of draught will be less, the capabilities of transit greater, and the accommodation more complete. And all these benefits may be gained by a small additional expense in the cost of construction. The main arteries of communication in the country may be formed of permanent solid works, so that political as well as commercial objects may be gained by the speed which is obtained through the instrumentality of the locomotive; but the feeders to these trunk lines should be formed less with a view to speed than to general usefulness, and should be prepared, in the first instance, only for cattle-draught. The rails, also, should be lighter than those usually employed. Such is the system which the promoters of "The North of India Tramroad Company" propose to adopt in providing "a cheap system of communication through the province of Rohilkund and adjacent territories." So desirable an object, and one so likely to yield a profitable return, will, we should hope, meet with the support it deserves. The districts through which the line would pass are among the most fertile in India, and the damage which their markets are about to sustain by the superior advantages that will be bestowed upon the more favoured pro-

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vines on the line of the East Indian Railway should be mitigated and counteracted by conferring more facile means of communication upon them. By these measures large tracts of country will be enabled to send forth the rich produce of their soil to neighbouring districts as well as to foreign ports, promoting thereby both the agricultural and commercial interests of the country. We are glad to observe that it is proposed to conduct the line of tramway to the mineral districts of Kumaon and Gurhwal. This is a most important feature in the undertaking. By developing the resources of these localities, the company will obtain their iron on the spot, and thus reduce still more the cost per mile of the undertaking, in order that a comparison may be made with the more expensive lines of railway now under construction.









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