

REPORTS ON

CERTAIN PROJECTS

COTTON (A.T.)

1859.

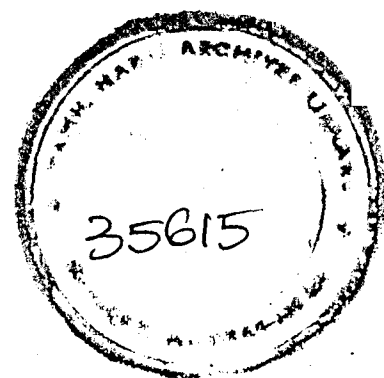


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REPORT

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The Lower Part of the Mahanuddy River in Orissa.

On receiving orders from the Madras Government, agreeably to instructions received by them, to proceed to Cuttack, (and after local enquiries to go on to Calcutta, and report to the Government of India my opinions as to the management of the Mahanuddy, I left Madras in the beginning of March, landed at Munsoorattah, near Ganjam, and proceeded by the Chilker and through the Delta to Cuttack. I there met Captain Harris, who has been employed in making surveys, taking levels, &c., in this tract, and who has with admirable diligence and ability collected a great mass of the most necessary information. I had also the advantage of meeting Mr. Cockburn, the Civil Commissioner, and Mr. Shore, the Collector, from whom I received much important information. After a few days, Captain Short, Superintendent of Embankments, arrived,—an Officer thoroughly acquainted with the Delta. This officer returned with me to Calcutta, and afforded every help and information I could possibly have needed. I took the opportunity of calling for the ryots of two different villages in the Delta, and enquiring from them particularly the value of present produce, and an estimate of the value of produce if they were secured from drought and flood. Two Missionaries, Mr. Taylor and Mr. Stabbins, most kindly interpreted for me on these occasions, and also gave me much information on the state of the districts, and the people. At the town of Cuttack, I also made the same enquiries from two land owners of large property. At Balasore, I had the benefit of conversation with Mr. Schaleh, the Collector, and at Madnapore of Mr. Montresor, the Collector, and also of Mr. Terry, the Manager of extensive estates belonging to an English Firm. Besides these gentlemen, I have had an opportunity of conversing with others well acquainted with this fine tract of country, especially Mr. Ricketts, Member of the Council of India, who was many years in that part of the country in various capacities, latterly as Civil Commissioner.

In Rajahmundry 36 lacs has been spent, and all the heavy works are executed. A total of 50 lacs will, no doubt, complete a more perfect system of works, with canal, of navigation, for 12,00,000 acres, or 4 Rupees an acre.

The result of this expenditure, without allowing for water carriage and other things, is, then, 400 per cent. in increase of produce only. If we allow the produce of an acre to weigh a ton, and to be carried only 50 miles, the saving upon the water carriage will be 6 Rupees, adding 150 per cent. more.

It is upon these simple facts, so easy of examination and so notorious, that the proposition that in India especially the first thing to be done is to regulate the water, is based. It will not be suggested by any one that any other mode of spending money will produce such enormous results as these.

Often as I have stated this before, it seems necessary to repeat it in every paper, for though none can deny that water can be regulated at such a cost, and that the value of the increase of produce is so great; and I believe its denial has never been attempted, and though many acknowledge it in words, yet hitherto the principle has never been acted upon. Every individual case has to be fought over, as if the effect of water had been clearly and fully proved to be no one-fiftieth of what is above stated, as if it was quite notorious that a lac of any other expenditure of capital was more advantageous to the community, or as if one lac saved by a Railway, or by a diminution of the current expenses of Government, were worth 100 lacs of additional income if it were obtained by means of water.

For instance, how many Commissions have been issued to enquire how a few lacs could be saved by diminished expenditure; has there ever been one to ascertain why one single district pays 20 lacs more than it did, and from 20 to 40 lacs more than any other district in India, and why, what has thus been effected in one district should not be done in any other?

What can be more astonishing than the fact that of the thousand volumes that have been written on the means of making the income of India meet the expenditure, not one single sheet should have been occupied with the investigation why the income from one individual district was so enormous, (52 lacs in 4,00 square miles) that if the rest of India paid only 1-1/2 lacs which Tanjore does in proportion to its area, there would be a considerable surplus income? that if only 3 districts out of all India had been improved as it has been, their Revenue would have made up the average annual deficit of the income. The water rate now levied on the lands in the Godavery and Kistnah Delta, will

amount to 40 lacs, when the water reaches the whole, so that the increased Revenue from 4,000 square miles so improved, will make up half the late deficiency of Revenue.

I am so fully convinced that this is the fundamental point to be insisted on, that till this principle is really acknowledged, there can be no right conclusions on any particular case such as that now before me, that I must urge its consideration in every way I can, before entering upon the actual subject of my report. Every new proof that has appeared, and every change of agency that I have seen for 30 years, I have hoped that at length there would be some indication that this principle had at last awakened attention. But in this I have been as yet entirely disappointed. In the mail now arrived I see it reported that one of the speakers in the late discussion says that "there could be no doubt that the difficulties of India were from the expenditure being so small." I cannot but ask, are not the few facts brought forward above, conclusive of what I am assured is the truth, that the exact converse of this is correct, viz. "that there can be no doubt that the difficulties of India arise from the expenditure being so small."

In Tanjore, a lac of Rupees a year is employed on 4,000 square miles of country in improving it, and the result is a Revenue of 52 lacs, half a million of Pondies sterling per annum. In every other district in India, (excepting a few where the same means have been used in a measure) the Revenue remains at 10 or 20 lacs in the same area from the time we received possession of it, solely because "the expenditure has been so small," and yet after 50 years experience the conclusion that is arrived at is one that is thus contradicted by the plainest facts of the case. Again, in Guntoor, 80,000 lacs of Rupees of Revenue were lost in the years following the famine, solely because from the day we occupied this fertile district, nothing worth mentioning had been "expended" on it.

After nearly 40 years experience, almost every district of the Madras Presidency, there is one conclusion of which I feel as certain as it is possible to be, that if more had been expended, there would both have been abundance of Revenue for every purpose, and there would have been "no difficulty" in India, as respects means, but that the people also would have been in a condition of physical comfort, curiously contrasted to their present state of poverty and ignorance. A trifling expenditure of one lac of Rupees a year in every district would have made the whole difference. All the efforts in the world to increase the expenditure will be utterly in vain, while even moderately judicious effort

by means of expenditure to increase the *income*, will be more than abundantly rewarded, and if carried out a few districts are dealt with, "the difficulties of India," so far as money is concerned, will assuredly be at an end. If a thousandth part of the labour and ability that has been, and is given to the subject of *expenditure*, were given to the *income*, the wealth of the country would in a few years be increased manifold. In the Godavery Delta the increase of Revenue has been nearly 10 lacs in 12 years, and not 1/4th of the land watered yet pays any thing at all for water-rate; if the water-rate, light as it is, had been levied as the water reached the land, the increase would have been nearly 2 lacs every year, or at least 20 lacs a year now, while the works are still unfinished.

Suppose, that district either of the two means hitherto trusted had been adopted instead of these works; suppose the pay of the whole establishment had been reduced, by reducing salaries, perhaps 20,000 Rupees a year might have been saved, or 1/10th part of the gain by increase of income; or suppose 30 miles of Railway had been laid for the sum that has been expended, if it had been eminently successful, it might have paid its own interest, but there is no probability that it would have yielded any profit at all.

It is in view this fundamental point, that the regulation of the water has been already proved to be incomparably the first thing to be attended to, we come to the consideration of the particular case of the Mahanuddy.

The Mahanuddy is one of the 2nd class of Rivers in India, it drains about 50,000 square miles.

The Godavery,	130,000	"
The Ganges,	250,000	"
The breadth of it where it enters the Delta country is,	0 1/2	mile.
At the head of the Delta,	3	"
At the head of the Mahanuddy,	1 1/2	"
Kujoorce,	1	"
Breadth of the Godavery at the narrow place near the head of the Delta,	1 1/2	"
At the head of the Delta on the line of the Delta,	1 1/2	"
Length of the water way or weir,	2 1/2	"
Breadth of the Ganges, near the heads of the Nuddea Rivers broadest place,	3 1/2	"
Narrowest place,	1 1/2	"
Extreme rise of the Kujoorce branch of the Mahanuddy,	3 1/2	feet
Ditto of the Mahanuddy branch,	3 1/2	"

Extreme rise of the Godavery at Rajmundry,	32	feet.
Ditto at the weir,	30	"
Ditto of the Ganges, at head of Nuddea Rivers, about,	32	"
Quantity of water passing in greatest known flood in the Mahanuddy,	240*	millions cubic yards per hour.
Of the Godavery,	200	"
Ditto of the Ganges, according to Major Lang,	180	"

(The extreme quantity of water passing down a river at any one moment is of course not in proportion to the area drained, but depends upon local circumstances.)

The fall of the Mahanuddy at the head of the Delta is,	1 8	ins.
That of the Godavery,	1 1	"
Ditto of the Ganges,	0 6	"

These comparisons show the position that the Mahanuddy takes among these three Rivers. The quantity of water to be dealt with, thus appears to be 1/3rd greater than that of the Ganges, and 1/4th than that of the Godavery. I do not, however, feel sure about the above being the exact discharge of the Ganges; it may be more, but from the actual section given by Major Lang, and the known fall per mile, and consequent known current, I think it cannot be much more.

The main difference between these Rivers is in the continuance of the floods. The great flood of the Mahanuddy continues nearly at the same level for 12 hours; the longest in the Godavery nearly at one height for 10 days; that of the Ganges for 40 days.

The matter which has principally called attention to the Mahanuddy is the imminent danger, of late years, to the town of Cuttack, containing 35,000 inhabitants, and standing, generally, on ground about 8 feet below the level of the last flood of the Kujoorce, so that, should the River would have broken in and most of the inhabitants would have been drowned. This, however, is only a small part of the evil. The southern part of the Cuttack district, and about of Pooree, is exposed to almost general inundation, and the amount of life and property destroyed is unknown.

The cause of all this mischief is perfectly obvious, and has been clearly pointed out by Captain Short. It is the change that has taken place in the heads of the Kujoorce and Mahanuddy within the last few

* N. B. To convert cubic yards per hour into cubic feet per second, divide by 2,700 and deduct 1/10th of the result. 240 millions cubic yards per hour is 1,100,000 cubic feet per second.

years, in consequence of which, a much larger portion of the whole water now enters the former River than its lower parts are capable of carrying off. All Delta Rivers continually change, if not in course, and when by some change above, the set of the stream is so thrown upon the head of a branch as to widen and deepen it, the water must continue gradually to enlarge the lower parts, till the channel is capable of holding the increased body of water down to the sea; but in the mean time the mischief that is done by flooding and destroying land is incalculable in a highly peopled country.

The remedy for this was some trifling works at the point where the evil originates, viz. at the termination of the hill country, 6 miles above Cuttack, by which excessive evils now experienced, have been stopped at once, and by which they can even now. Indeed, the turning over a larger portion of the water into the Mahanuddy has already commenced, as the effect of the small works already executed.

But though this now great evil can thus be easily remedied, it would only restore things to their former state, which was still such that the whole Delta was continually subject to awful droughts and floods, as indicated by the following Report of the Seasons. In the last 23 years, there have been—

- 3 years of famine, &c. (fi)
- 4 „ of drought.
- 2 „ of severe inundation.
- 7 „ of inundation, and
- 7 „ of moderate seasons.

In the first 9 years of this series, 32½ lacs of Revenue were remitted, or an average of 3½ lacs a year; during the last 14 years the remission has been 4 lacs, or 50,000 Rupees a year; but this diminution was not at all in consequence of any diminution of mischief, for, on the contrary, it seems quite certain that the state of the district is worse than it was, owing to the old imperfect embankments not only being kept up, but it was the result of the very simple process of refusing remissions, whatever mischief was done, a mode of meeting difficulty which is very simple indeed, and was very common in former years in all parts of India. No returns appear to have been taken for of the sufferings of the people in consequence of this merciless remedy, and, therefore, there was nothing to show how it operated.

No remission can at all meet the evils arising from this state of things. They are more indications of losses and sufferings which cannot be estimated. And these are incurred in all Deltas in an unintermit-

state. In a letter of Mr. Commissioner Cockburn he most truly states the the case of remissions. "I would further beg to observe that in considering the matter of remissions, it should be borne in mind, that the remissions are usually of Government Revenue only, and give but a faint idea of the terrible distress which inefficient embankments entail on the people who have suffered in consequence." It is evident that the state of this Delta when its sovereignty passed to us, was most disgraceful to the native Government. There was no attempt, beyond partial embanking of the river, to controul the waters, and under our rule even, these embankments have not been kept up to the state we found them in. It is not recorded what was spent on them for some years after we received possession, but in the last 17 years, 4 lacs have been spent in the whole of the Delta country (including that of the three rivers, the Mahanuddy, Brahminy, and Byturney), or, an average of 24,000 Rupees a year. To judge of this, I may mention that in Tanjore, containing about half of this area, about 116,000 Rupees has been spent per annum, or in proportion to area, nine times as much, and perhaps half of this was expended on repairs.

Now, what would be the state of the Public Buildings, if the same principle of spending one-fourth of what was absolutely necessary for their repairs, were adopted? And this also supposes that the old works left by the native Government were sufficient, whereas they were in every way contemptible.

The point I wish to insist upon, is this; that our duty as a Government, allowing even the most restricted sense to that word, (that is, the justice and equity due to those who provide the taxes), and economy imperatively demand that from the first, on our taking possession of a district, a sufficient sum should be appropriated for the Public Works, absolutely required, for the protection of the lives and property of the people; and that the question is not what is required to keep up the imperfect works of the native Governments, executed under their immense disadvantages, without science or extended rule, or means of raising funds, from want of public confidence, &c., but what does it become us to do with our own means?

What can be more simple and undeniable than that, at all events, on taking charge of this tract, the Engineers should have been called upon to consider what Public Works were necessary, and what annual sum would be required; first, merely to put the district into a tolerably safe state as respects life and property, and a tolerably convenient one as respects intercourse; and, 2ndly, what would be required to carry on a more

or less rapid improvement? If there were no other point in the question than economy, that is, "the equalization of the Revenue and expenditure," it is essential that this should be considered. Is it economical, or is it not, to neglect the Public Works? Is it economical or not to spend a certain sum in a certain district? It is universally allowed that it is not economy not to allow sufficient money for the repairs of a public building; that it would be no economy to let our soldiers die of dysentery or fever, because the roof of the barrack was leaky. And to let the ryots be drowned or die of famine from drought or flood, is also bad economy. During the first nine years of the above series of 23, 32½ lacs were remitted. Now can it be imagined that it would not have been more economical to have spent this on Public Works? About that sum was so spent in Tanjore in the first 40 years we held it, and the Revenue increased during that time 17 lacs a year. Which was economical? The withholding that sum from the voluntary expenditure, and then paying it compulsorily in remissions, as in Cuttack, or paying it intentionally on Public Works, as in Tanjore, and receiving in consequence, in 35 years, an average addition of 8½ lacs a year, or 300 lacs in all. This is leaving out of consideration the incalculable difference in the well being of 1½ millions of people.

Justice and mercy are always economical, and we have abundance of cases in point in India, besides Tanjore and Cuttack. I have before quoted Guntoor; the sum that was lost in Revenue there, would have made the whole district such a garden as Tanjore twice over. Since a system of true economy has been adopted in Rajamundry, during 12 years, about 30 lacs of additional Revenue has been actually received over and above all that has been spent.

The fact is, we have in our Western knowledge and energy, that to bestow upon an immense population, which is a hundred times of more value than what it will cost. The natives of the Godavery Delta have paid us twice the sum we have expended upon the works already, and they will continue to pay the whole amount over again every three or four years, while their own condition is immeasurably improved. The same in Tanjore; the total sum expended has been about 60 lacs in 58 years; the increase of Revenue is 22 lacs a year; the average for 58 years is about 11 lacs, and the total additional Revenue consequently 638 lacs, or ten times what has been expended. To show that these changes in Rajamundry and Tanjore are owing to the Public Works, I give in an Appendix a statement of their Revenue for 20 years, with that of their two adjoining districts for the same period. Vizagapatam, North of

Rajamundry, has fallen off half a lac, and Masulipatam, South of it, is just stationary; but Rajamundry, which remained also nearly stationary for the first ten years, increased 6½ in the latter ten (from the beginning of which the works have been carried on) and 8½ up to the present time. A man must be credulous indeed to believe that this is a mere curious coincidence. South Arcot has remained stationary, and Madura has increased only 1½ lacs, while Tanjore has increased 6 lacs. And it is particularly to be remembered that in Rajamundry not ¼th of the land watered has yet paid any water rate at all, and that in Tanjore by far the greater part of the lands has paid no additional tax. Orissa shows an increase in the same time of 4 lacs a year, but in the former part of the period 3½ lacs of remissions were granted per annum; and in the latter only half a lac, so that the real increase was only one lac, for there appears to have been no reason whatever for refusing remissions; on the contrary, the necessity for them had increased in respect of the state of the Public Works. The stoppage of the remission was simply an increase of the taxes, without any corresponding relief from the improvement of the Public Works.

This question of the control of the Mahanuddy is not a question of the preservation of the town of Cuttack, containing 35,000 inhabitants, it is a question of the preservation of the provinces of Cuttack and Pooree, containing probably 1½ millions. There is no disagreement in the accounts I have received of the state of this Delta; different classes, who usually see things with different eyes, the Revenue Officers, the Natives, the Missionaries, and the Engineers, all agreed in their statements of the miseries and sufferings of the people. Is it accordant with our duty, our honor, or our interests, that a district should continue another year in such a state? That our only expedient for increasing the Revenue should be stopping the remissions, whatever the sufferings of the people may be? Which is the best expedient in every point of view, this, or that adopted in Rajamundry?

As to what is required just to restore the former proportion in the distribution of the water at Cuttack, there is nothing more to be said, than that I am of opinion that the trifling works already commenced should be carried on to such an extent as the progress of the rivers shows to be necessary. The scouring of the sand from the foot of the revetment has already been entirely stopped, and the deep hole filled up by the admirable brush-work constructed near the place, the revetment has been repaired and raised, and the foot of a great part of it has now been well secured by the old revetment sinking into the sand and forming an excellent loose stone apron to the new work. Though there is now no scour excepting

for a short distance, where it will be arrested by the brush-work now extending, yet I think that it will be well to throw loose stones all along the foot of the revetment where there is none already, so that if the stream should again make a set upon any point, it may be prevented from laying the foot bare.

The small groyne or spur begun at Naraj point has also had great effect, causing a great deposit of sand along the west side of the Kujoree, and also scouring the head of the Mahamuddy, so that the difference of level of the two rivers at Cuttack, has already diminished. ~~And I am~~ I am of opinion that it is only necessary to continue this spur two or three hundred yards towards the head of the Delta, and to clear all the banks in the head of the Mahamuddy of grass and bushes. This is one material point in the management of these rivers. The formation of new islands is comparatively slow, till grass grows on them, after which they may rise one or two yards in a year, in consequence of the water depositing all its silt as it passes through it. The grass must be dug up. If this is not sufficient to prevent any injurious island increasing, the usual plan is to cut a channel through the sand in a direction corresponding to that of a groyne thrown out from the bank of the river above, so as to throw the stream upon it. Of course, wherever an island is allowed to form, there must be a corresponding cutting of the bank of the river on one side or the other; and the principal point in the management of the rivers is in destroying such islands by these simple means. Appart like this, is not, of course, the place to go into minute details about controlling of Delta rivers. The means are extremely simple, and, in general, comparatively very inexpensive; I say comparatively, but of course we must not guess at a sum without any grounds at all. I have often seen it said that certainly if rivers or works were out of order, it was not for want of sufficient money being expended on them, without an attempt to show by any argument at all what was sufficient. Perhaps, in the case, 5,000 rupees had been spent where 50,000 were required, and where the water at stake would have justified 5 lacs. We must necessarily try every expenditure by some standard or other, or else we must be wrong. As in this most striking case of Orissa, where, while an expenditure of no more than 24,000 rupees a year has been incurred, remissions for want of efficient works have been granted for the former part of the period, and required, though not granted, for the latter, of 3½ lacs a year. It is quite certain from this, that the sum of 24,000 rupees a year for Public Works, was based upon no principle whatever. It has not the least connection with the requirements of the district.

The general principles upon which Delta Rivers should be controlled, may be summed up in two means; one, is running out a groyne, or spur of loose stones or fascines and earth from any point where there is a set of the stream, and the other is, checking the formation of islands by rooting up the grass and making cuts through them.

It is quite evident that Captains Short and Harris, without having seen what has been done in the other rivers long kept in control, clearly discerned the principles upon which such works should be planned, as proved by the excellent results already obtained. It cannot be, in general, settled at first to what extent such works should be carried; it depends very much upon what time can be allowed for them to act. Their operation must be watched, and the effects hastened, if necessary, by extension, according to the emergency of the case. Of course as in all similar cases, the actual expense depends very much upon the remedy being applied early, as well as upon the skill and experience of the Engineer. In the Madras Rivers such cases as this constantly occur, and the local officers, in general, at once execute the necessary works, without waiting for the sanction of estimates.

These works cannot, however, possibly relieve the evils of Orissa. The Rivers must be thoroughly controlled, and till they are, poverty and suffering, desolation and destruction of life and property, and a Revenue which hardly pays for management, must continue.

The only thing that will be effective, the only thing that will prove to the people that they are under a beneficent and able Government; that Christianity is not a name, but a reality; the only thing that will enable Orissa to bear its proper share of the burden of the general Government and of its own protection; the only thing that will wipe off the terrible disgrace of a district, one degree worse than it was under the former distracted native rule, is a system of works that will completely regulate the waters of the Province, similar to those in the Godavery and Kistnah Deltas. We have now the immense advantage of having nearly a complete measure of the cost of such works. All the heavy works there are executed, and the water has reached about 700,000 acres of land. Including this season's expenditure, about 35 lacs will have been spent up to the end of the season; if 50 lacs in all are ultimately spent on 12 lacs of acres, it will give about four rupees an acre. The Deltas of Orissa and Rajamundry are very similar; the size, nature, fall, &c., of the rivers do not differ materially. The main difference is in the greater number of branch rivers, which will cause additional expence in aqueducts and embankments, but, on the other hand, the supply of materials is decidedly superior in the Mahamuddy, that is, they will be

cheaper, and there is also a remarkable difference in a discovery made by Captain Harris, *viz.*, that there is a point where an inexpensive cutting of 3 or 4 cables will discharge any portion of the flood of the Mahanuddy by a very short course to the Chilka lake, and thus greatly secure the Delta works, and diminish their cost in many ways. Under these circumstances, I do not know why the works in Orissa should cost more per acre than in Rajamundry, especially as we shall have the advantage of starting with the full benefit of the experience gained there and on the Kistna. If we allow some addition for possible contingencies, 5 rupees an acre for 2½ millions of arable acres in the three districts, it will give a total of 112 laes. To this should certainly be added the extension of the channel that runs on the highest level to Calcutta, 120 miles at 15,000 rupees, 18 laes, which would make in all 130 laes. The connection of the whole of these Deltas with the Port of Calcutta, would be so important a part of the scheme, that it certainly would not be advisable to omit it.

The works would consist of,—

- 1st.—Weirs across the Mahanuddy, Brabminy, and Bytarny.
- 2nd.—Irrigating channel, completed for navigation throughout the whole Delta tract.
- 3rd.—Drainage channels, between all the irrigating channels.
- 4th.—Embankments to all the rivers.
- 5th.—The high channel to Calcutta, which would also irrigate extensively.

It will be observed, that the data upon which the above estimate is given, are the best that can be obtained, *viz.*, the actual cost of similar works in a tract in the main quite similar. Estimates, after all, are really estimates, and there must be uncertainty about them, but no better grounds can be found for an estimate than those above given.

Perhaps the best way of further examining this subject will be by answering particularly the most common arguments at present in use by objectors.

1st. "Why propose a grand scheme like this? why not suggest something practicable?" Answer, first, when called upon to give my opinion I am of course bound to give my own opinion, not what I think would be some other person's, what some other person without my experience may guess to be "practicable."

I know this scheme to be eminently practicable; I had ample grounds for believing it to be so before either the Godavery or Kist-

nah works were executed. I was told then, as I was before the Godavery works were executed, that it was of no use to propose impracticable schemes. I am thankful that I have not now to defend myself from such a charge as this, made by a Commissioner enquiring into the cause of a famine in those districts. "How can you excuse yourself for proposing works which you knew to be insufficient and unequal to the demands of the case, when the Government, of course, looked to you, as the experienced professional and local officer, to give your conscientious opinion as to what the finances and the welfare of the people required to be done?"

With the further knowledge I now have, it would be inexcusable indeed in me to propose works inadequate when called upon. The question is not what other people think, or rather what I suppose them to think, but what is my own opinion? It is that which I am bound to lay before Government.

But we must further examine this word "practicable." It either means that we have not the knowledge of such works to enable us to execute them, or we have not the funds for them. The first is clearly answered by the positive fact that exactly similar works have been executed and in effective operation for many years.

As to what is constantly said, "but the case is quite different, the Godavery and Kistnah are not like the Mahanuddy, &c." There is and can be no answer, but that they are like the Mahanuddy in all respects; they have the same sandy bed, almost the same fall per mile, the same alluvial banks, the same floods, the same seasons, &c., &c. With respect to works being "practicable" as respects funds; first, it is quite a sufficient answer to this that a well organized company have been for a year hanging about the Board of Control and the India House begging to be allowed to execute such works, offering to provide millions on no other terms than those which the authorities have for 7 years acknowledged and granted for the Railways. On this ground alone, there is not a shadow of reason in the assertion that "we cannot afford to do it." But, secondly, how is it we can afford to lose 3½ laes a year in remissions, besides all the loss of increase of Revenue, which the improved districts show, if we cannot afford to pay 5 laes a year interest for the capital of 130 laes? The average Revenue of Tanjore is 5 rupees an acre, that of Orissa about 1½ rupee, the difference on 2½ millions of acres is 90 laes a year. Just as it was in Guntoor, where the provinces would not admit of an expenditure of 30 or 40 laes on Public Works, but could bear a loss of 80 laes of Revenue in consequence of a famine. But there is yet a third answer. During the 12 years that the Rajamundry works have been going on, there

will have been ~~up to~~ up to the end of this season, about 36 lacs. The average Revenue before the works was 19½ lacs, the total since, 298 lacs; the total should have been, at the former average, 234, so that there has been 64 lacs excess of Revenue collected. But part of these irrigated lands are in Masulipatam, I do not know exactly what the total excess has been there, but certainly above 6 lacs, making a total of 70 lacs, or 34 more than the expenditure. How strange it seems that still the expenditure of 36 lacs is constantly spoken of as if it were sunk capital.

Any of these three is a complete answer to the question about "practicability," so far as Ryots are concerned. It is quite certain that if the Engineer had been supplied with 10 lacs for Rajamundry, and told that he must collect the water-rate and carry on the works, in future, out of returns, he would every year have been paying many lacs into the Treasury after deducting the cost of the works. If all the lands, now watered, were paying the water-rate of 2½ Rupees an acre, and he were allowed to spend 10 lacs a year, he would still have about 10 lacs over to pay into the Treasury.

I need not here go into the matter of the non-collection of the water-rates in the Godavery Delta. I hope to append to the paper copies of documents by the Revenue Officers and Engineers, which will show the two sides of the case about this extraordinary refusal of the former to collect the rates.* The Sub-Collector went so far as to pledge the Government not to collect more than 10 per cent. on the land tax (which would amount to about 5 annas an acre,) till a survey was made, without any authority, or waiting for a reference either to the Collector or the Madras Authorities, and no notice whatever was taken of this. It costs the Government about 4 lacs a year at present, and will cost them more every year, and the Revenue Survey Officer says, that if the survey were commenced to-morrow, it would take several years. Had a constable taken upon himself to pledge the Government not to punish a thief, the matter would, of course, have been settled by punishing both.

Enormous as have been the returns for these works, notwithstanding these proceedings, the mischief that is thus done is incalculable, for a further addition of 10 lacs a year, would have greatly strengthened the argument against the "economy" of leaving almost the whole of India as at present without Public Works.

It will be seen by the Statistical Paper for Rajamundry in the Appendix, while 64 lacs of additional Revenue have been levied, not less than 180 lacs of additional value of produce have been sold *by sea only*, while in consequence of the people being now in good circumstances and

* These papers not yet received.

not obliged to sell as early there is an immense quantity of produce on hand beyond what there used to be.

It is asked, But where can such enormous sums come from? The answer is most obvious; by statements obtained in all sorts of ways, the old average produce was about nine rupees an acre, it is now about 25 rupees for one crop, and 40 rupees for two, so that the increase on 7,00,000 acres for one crop only, would be 112 lacs of rupees a year. Probably the average does not yet reach 25 rupees, because much of the land is not yet in complete order; but, on the other hand, there is a large quantity under two crops.

If it is asked, how far do the circumstances of the Orissa Delta agree with that of the Godavery in respect of present and probable future produce? First, from what I saw of the land, and from the enquiries I made, I conclude that the quality of the soil is inferior to that of the Godavery, but, perhaps, on an average, about equal to that of the Cauvery. The average produce at present does not seem to be more than six or seven rupees an acre. All, both Ryots and Zamindars, agreed, that if secured from draught and flood, the produce would be greatly increased, and that the people would gladly pay a water-rate for it. One set of Ryots finished their statement by saying,—"Oh! if you give us such works as you speak of, what with sugar and all sorts of things that we shall then grow, the land will produce *six times* what it does now." Thus far is quite certain, that, if the works cost five rupees an acre, the increase of produce will be 200 or 300 per cent. which is quite sufficient for our purpose.

When I entered Pooree I found the people, as every where in the Madras Presidency, raising water by human labour, at a cost of about one rupee for 500 cubic yards. This is quite sufficient to show the value of water in this Delta. If the works supply 5,000 cubic yards per acre for the greater crop of paddy, it would be worth 10 rupees. If, therefore, the water was sold at two or 3,000 cubic yards per rupee, or one-fifth of what they readily pay for it now, and the works cost five rupees, the return would be 3 per cent., from which deduct for repairs and management, perhaps 1½ per cent.

If only two rupees an acre are levied, that is, one rupee for 2,500 cubic yards, the amount would stand thus,—

Two rupees on 24½ lacs of acres,	49 lacs.
being in interest on 130 lacs,	3½ per cent.
Deduct for repairs and management,	5 " "

Net profit 30

Most certainly the results in Rajamundry abundantly support this calculation.

Of various pieces of information bearing on the point which I have received in Bengal, I select the following. Mr. Smith, the Executive Engineer of Burdwan, reports, at this moment, that a European Zemindar has thrown a bank across the Damoodah, at a cost of 2,000 rupees, by which water has been thrown upon 2,500 bigahs of his own land and 15,000 bigahs of his neighbours, producing a crop, valued at a "moderate rate," at three rupees a bigah, (ninerupees an acre) or 52,500 rupees in all. This is merely a dry season crop. It shows how insignificant a water-rate of two rupees an acre would be, to supply abundance of water for eight months and a considerable quantity for the remaining four, besides giving water carriage and protection from flood.

I have said that at one end of the Delta I saw the poor people raising water at one rupee per 500 cubic yards; at the other I saw a stream of water of about 300,000 cubic yards per hour, running to waste in the Kujoorce, worth therefore, at least 300 rupees an hour, 15,000 rupees a day, and 4½ lacs a month; 18 lacs lost in the four months of the dry season alone. Now, if this trifle of water were turned on to the land, and charged to the people at half the cost that they gladly raise it for themselves, it would yield a Revenue to Government equal to the whole present land Revenue of Cuttack, and pay the interest (at four per cent.) on two hundred and twenty-five lacs of capital. It would water 300,000 acres of land for a summer crop, worth, at the estimate just given for the crop in Burdwan of nine rupees an acre, twenty-seven lacs.

It is, indeed, wonderful, that any person should be at a loss, while such a system is pursued as the present one, to account for the state of the finances. How could any country in the world stand such a system of false economy? What would become of the house-property in Calcutta, if a merely nominal sum were spent on them in repairs?

If it be said that, supposing the Government do not choose to borrow money for Public Works, or to allow a private company to execute them, what then is the actual amount of capital it will be necessary to provide, out of this 130 lacs, before the works will begin to provide their own funds? I answer, probably 20 lacs would be ample. After that was spent, or indeed probably much before, the Engineer would be furnished with a large annual sum to continue the works.

There is a passage very suitable for insertion here, in a report of Mr. Lushington's, Collector of Masulipatam, on the effects of the irrigation from the Godavery. He gives the following statement of the Revenue of lands that formerly belonged to Zemindars, which the water had received.

	Revenue	above Peshkush.
1851-52,	2,64,000 Rs.	64,000
52-53,	2,72,000 "	72,000
53-54,	3,17,000 "	1,17,000

THE Peshkush is the tribute formerly paid by the Zemindar. He then goes on to say,—"I have before alluded to the wretched state of the Cuddindy Purgunnah, which contains a very large quantity of valuable land, the greater part of which has long been waste, chiefly from want of the means of irrigation. The average Revenue has been 3,400 rupees per annum. This year an irrigation channel was commenced. Immediately tenders for the Purgunnah came in, and it has been given on a three years' lease for 7,000 rupees, 7,500 rupees, and 8,100 rupees the third year." So that the moment the channel is begun the Revenue is doubled, and in the 3rd year, it is increased 1 2½ fold. He goes on to say,—"But no estimates of the quantities of food which have been produced through irrigation, no mere return of increase of Revenue realized in an irrigated district in a year when such heavy remissions of taxes have been found necessary in other less favoured tracts, can convey any idea of the benefit which has accrued both to the Government and the people, at all to be compared with that derived from actual observation of the effects in travelling through the district. No one could have witnessed, as I did, the wretched condition of the people and crops on the Kistnah side of the district, the difficulty of obtaining even the smallest supply of only moderately pure water, and then have passed to the Godavery side and witnessed with delight the contrast, the abundance of pure water, the splendid crops, and the contentment of the people, without being sensible that no figures can at all convey a true idea of the priceless blessing which the waters of the Godavery, brought by means of the weir and channels through such an extent of the Delta, have conferred upon the people.

"In May, I was encamped at Avengiddah, on the banks of a large branch of the Kistnah, then a sheet of mud. The cattle were dying of starvation in numbers; no signs of vegetation were apparent, the water was wretched, and I hope I may never again see so much poverty and wretchedness. The month of June was passed by me at Akeed, more than 30 miles from the nearest point of the Godavery, but there water and forage were abundant. The water of the Godavery, which had passed through the head sluice more than 50 miles up the channel, flowed past my tent, and numerous boats laden with the produce of the neighbouring lands daily passed to and fro."

Captain Short, who passed through the Delta of Orissa in the floods of 1854, and Mr. Shore, who went through the villages after the flood

of 1855, both give similar account of the misery of the people from flood. One of the officers in Balasore is stated to have rescued 90 people from drowning. In an account of the flood in the Nuddea district, in 1855, Mr. Forbes states that nearly 8,000 people, 22,000 houses, and 40,000 cattle were drowned; and two lacs of acres of crop, worth 3 lacs of rupees, destroyed in that single district, but of several in the Delta of the Ganges. Surely these statements are amply sufficient to induce the Government immediately to take this work in hand. I have very little doubt that the Irrigation Company alluded to would readily undertake the work upon the interest being guaranteed as for the Railway capital, and I cannot perceive any reason why it has been granted to the latter, and not to Irrigation Works. But I am convinced, there is nothing to prevent Government executing the works themselves if they prefer that method. A very few lacs would be required to start them, and they would carry on themselves very soon, as the Rajamundry works do.

I must state that though two or three severe floods have passed down the Godavery since the masonry was built, without injury, I do not consider they are safe from such floods as might occur, and still less are the Kistnah works, but that it will be necessary both to raise the embankments, and also to diminish the floods by making large tanks on the feeders of those rivers. In the case of the Mahanuddy, however, it seems certain, as I have stated, that at a moderate expence any amount of water may be discharged direct to the Chilka.

To put in a clear light the difference between a Delta which has been neglected, and one which had had a moderate expenditure allowed for Public Works, beyond what was necessary for keeping the old works in repair, I give here the Revenue of Cuttack and Tanjore, of almost equal area and equal fertility (but the former with a far better natural supply of water) for 23 years.

	Cuttack.	Tanjore.
1834-5,	5,42,000	36,87,000
36,	6,94,000	36,42,000
37,	6,42,000	36,66,000
38,	8,44,000	36,89,000
39,	8,17,000	37,86,000
40,	5,59,000	38,03,000
41,	6,35,000	33,15,000
42,	7,09,000	33,88,000
43,	8,29,000	36,69,000
44,	8,34,000	37,58,000
45,	8,21,000	38,12,000

	Cuttack.	Tanjore.
1834-45,	7,36,000	42,44,000
47,	8,76,000	42,23,000
48,	7,81,000	39,11,000
49,	8,22,000	37,55,000
50,	7,82,000	38,64,000
51,	7,69,000	39,03,000
52,	7,84,000	39,07,000
53,	8,71,000	38,29,000
54,	9,25,000	40,00,000 ?
55,	8,24,000	40,00,000 ?
56,	8,14,000	40,00,000 ?
57,	7,96,000	42,62,000

177 Lacs. 874 Lacs.
177 "

Diff. ... 697 Lacs.

I have not the Land Revenue of Tanjore for the three years marked (?), but it did not differ materially from the following year. Neither have I the returns of extra Revenue in Cuttack, but in Tanjore it has varied from nine to 11 lacs, which is, I think, more than double that of Cuttack. The difference in the Land Revenue, in 23 years, has been nearly 700 lacs; and, probably, including extra taxes, not less than 800 lacs, or eight millions sterling.

The Expenditure for Cuttack has been kept separate from the other two districts. For the whole it has averaged 24,000 rupees a year, and for Cuttack, Captain Short says, it has been about 13,000. The average for Tanjore is 36,000, or nine times as much. Now had the sum of 27 lacs, spent in Tanjore, been allowed also for Cuttack, instead of 3,00,000 actually spent, there is no doubt that the whole district might have been nearly completely furnished with a set of works, its produce probably increased four-fold, and if thus a million acres had been improved, and a water-rate of two rupees an acre charged, the Revenue would have increased 60 lacs; the average increase would have been 10, and the total in 23 years, 230 lacs, or 21 millions sterling.

Again, during the 23 years, there have been remitted in Cuttack above 21 lacs. It seems extraordinary that it should not have been thought better economy to spend 21 lacs on Public Works, than in the remissions which were the consequence of the want of them; to spend

5,000 rupees on the repair of a house, rather than to a tenant as a very partial compensation for the destruction of his property by roof being leaky.

I must beg to urge that these are not vague conjectures, but sound conclusions, drawn from the best possible sources, actual results in many similar situations. The effect of water on produce is not now a question; no fact in India is more fully established. Neither is the cost of controlling such rivers a matter of conjecture or estimate. The Revenue of Tanjore is a fact, and there is such a thing, and it is owing to any other cause than the hydraulic works, it behoves opposers to show why not one of the other 17 districts of the Eastern side of the Presidency has improved as Tanjore has. The two Western districts have improved to a certain extent, but they have water, and water carriage *naturally* to a very great extent.

It may seem absurd also for me to urge that I am speaking now only respecting things that I have seen and known, and almost every other officer of the Madras Engineers also. I see papers written, and hear of opinions spoken, by some who never saw an annicut, nor any other work whatever for controlling a Delta river, which show that they have no clear idea what an annicut is, and yet give a very decided opinion on the subject.

Lieutenant Colonel Baird Smith took a two or three days' run through the Godavery and Cauvery Deltas, and I would suggest that, as this matter *must* now be taken up in Bengal, for it cannot be any longer neglected, some of the Officers should be sent to examine those works. Indeed, it would be *absurd* for them to commence upon any such operations, without *first* getting such an obvious means for getting some idea about them. It seems specially desirable that the present Secretary of the Department at Calcutta should gain some information on the subject, as papers will necessarily come before him which can never be effectively dealt with in his office, and solid advice afforded to the Government of India, unless he has inspected works so entirely out of the line of Bengal experience. It will also save a world of explanations from those who are conversant with such works. There is, of course, no limit to imaginations, and one glance at actual works will prevent a thousand fancies. I think this point should receive serious consideration, for a great work is now before the Bengal authorities and professional men, the controlling and regulating these vast Deltas.

The confusion that arises, the mistakes that are made, and the time that is lost in explanation by the local Officers, when the head of a De-

partment, is entirely without personal knowledge of the matters under consideration, are most injurious to the public service. A few weeks' actual inspection of the works in Madras, and *free communication* with the many faithful energetic and experienced men in the Public Works Department there, would give the Secretary *some* power to deal with the papers which will come before him.

A second way in which the objections to the necessary Public Works is often stated, is this, "Bengal does not require irrigation." Then what means the cry at this moment from the West of Calcutta, and echoed back from the East, of most serious scarcity? Perhaps the very person who lays down this extraordinary proposition, in the next breath speaks of the present scarcity, and when asked the reason of it, readily accounts for it by the total want of rain for the last six months. The ryots of Cuttack tell me that if they had irrigation works, the land would produce six times what it does now. Mr. Perry, of Midnapore, tells me of the extraordinary results of irrigation on his estates at this moment. Mr. Smith, Executive Engineer of Burdwan, reports how another European Zemindar has, at an expenditure of 2,000 rupees, just now produced a crop worth 52,000 rupees. Rajamundry, with precisely the same seasons, soil, &c., produces three or four times as much as before, by means of the irrigation works. I have no doubt that, as I saw in Cuttack, so it is also in other parts, wherever water is *to be* got, the people are raising it at an enormous expence for irrigation by human labor. Everybody irrigates wherever he can, and yet, in the face of these notorious facts, men of long experience in Bengal, take such a proposition as this for their starting point.

But there is also a fallacy in this use of the word irrigation. Irrigation works include drainage of the country also. Does Bengal require no drainage? Are floods unknown? I have mentioned above 8,000 persons drowned, and 32 lacs value of crop destroyed in a single district in a single year. This is one of the strange difficulties that we have continually to encounter in dealing with these questions. Assertions are made directly opposed to notorious facts, by men of long experience in India, and it seems incredible that they can be without foundation. An old Revenue Officer wrote a pamphlet in which he asserted that black soil could not be irrigated; he had been for 30 years in various districts, in every one of which every kind of soil was irrigated. There is not a single acre of land in Bengal, in all India, or in the whole world, that would not be more productive if it were irrigated at one time and drained at another. The increase of produce in Cuttack would certainly be ten times the

amount of the present Revenue. How is it, that men can live their official life in the midst of a country, of the real circumstances of which, they have such strange misapprehensions? It seems as if it would be advisable that one man should manage the office in India, should be, that a man should possess an estate in it and manage it himself. If it were, it is impossible that such unaccountable misapprehensions should exist.

A third objection, is to the use of water for navigation. It is said continually, "why use an inferior mode of transit, when a superior one has been discovered?" meaning Railways. A sufficient answer to this is, that the money that has been spent on the Railway to Ranecunge, would have given all Bengal first class water communication to be worked at the same speed as the Railway, and one-fifth or one-tenth the charges for both goods and passengers. It is by such gross fallacies as this, calling a canal an inferior means of transit, &c., that such monstrously false conclusions are arrived at. This of spending 1½ lacs of rupees on a single mile of communication in a country like Bengal, where there are such extraordinary facilities for water lines that they can be made at from one-tenth to one-hundredth of the cost of a Railway. The new Banka Canal, 40 feet broad, cost 1,500 rupees a mile. The high level canals from the Kistnah and Godavery, carried across the lay of the country out of the Delta, 40 yards broad, have cost 2,000 rupees a mile. For speed, the boats on the Hudson river in New York, run at 22 miles an hour, and for cost of carriage on the Rajamundry canals, it is one-twelfth anna per ton per mile for short trips. Were there one-fiftieth part of the Engineering talent and capital employed upon the water communications in Bengal that there are upon land, every village in the province would be accessible all the year at any required speed, and at charges little more than nominal. And the whole of this is got rid of by the use of a single false expression, "an inferior mode of transit." There are indications, at length, of this part of the subject being examined. The Court of Directors lately sent a Commissioner to inspect the river navigation of the Continent and their report, now, I hear, published in England. One of the facts they mention is, that a fleet towed 4,000 tons up a stream on one of the rivers, equal to 30 or 40 railway trains. Compare the apparatus of a single steam tug and 10 barges, with 30 or 40 locomotives and 700 railway waggons, with all their complement of machinery of the most expensive workmanship, more than 3,000 wheels, 3,000 springs, 1,500 axles, all turned and fitted to the 10th part of a hair, and let it be judged which is the "inferior" mode of conveyance for the great traffic of a country; and especially in a country which has every natural facility for water lines, and has great natural objections to rail-

ways, and the results correspond. Compare the 1,50,000 tons passing along the Cochin Canal in Rajamundry, to a town of 12,000 inhabitants, with the 20,000 tons, the average traffic between Calcutta and Ranecunge, (exclusive of coals) to a city of 6,00,000 inhabitants.

I have thus met the principal objections that are so recklessly made against water, and the very life of the country, upon which every thing in its future management depends, for this cost is the main element of calculation in every part of the question of the future Government of India. Whether the question is, about troops, or police, or education, every thing depends upon the means at our disposal. If Tanjore or Rajamundry were separated from the rest of India, what ample means they would possess for every purpose of Government.

If the Government do not choose to borrow money for the rapid restoration of Cuttack, so as to allow of an expenditure of 10 or 15 lacs a year, or to allow a Company to undertake it by guaranteeing the interest of four or five per cent., there will still remain the plan of carrying on the works more slowly, allowing three lacs a year for a few years, till they pay for themselves, which they will very soon do. And, in the mean time, from the very first moment that the works are begun, the relief to the districts will be very great, both by the removal of some of the worst evils, and also by the expenditure itself.

Surely the time is come when we ought to give these borderland districts a proof that we are not merely able to fight, but that Christianity teaches us other things, both to care for the people subjected to us, and so how to benefit them. Certainly, if there is any legitimate way of consolidating our power, this is one, to let them feel some substantial advantages in a Christian Government over a Heathen one. A Missionary told me that, in Rajamundry, it was in every man's mouth that they never got the Godavery water on their land, till we Christians came there. How such an astonishing mistake should have been made in our management of the country, as to leave it without communications and other works absolutely essential, cannot conceive. I cannot think it possible that we can persist any longer in a system so shamefully unwise, and so suicidal, with such overwhelming proofs as we now have, of the direct result of it and of an opposite one. Look at the years of flood, and thought that have passed over Rajamundry since the new works, literally without checking the amazing progress of the district in Revenue, in exports, in internal traffic, in every thing which indicates prosperity. This very year, a year of dreadful drought and scarcity, the Delta Talooks are selling an immense crop (much less than two crops) at scarcity prices, and relieving the

from the securing out of the head of the Kujoree from Nafaj. And that, consequently, unless this point was attended to, all operations below would be of no avail. Nothing can be more satisfactory than Captain Short's statement of the case in this document, and to omit whatever, I believe, was made to refute his arguments, and as nothing can be said against them, there was no answer but that unfortunately has been too often the mode of proceeding in such cases, viz., not to allow the works to be executed. Three whole years have now passed, and a city has been during that time in the most awful danger, and was only saved by the able and intelligent efforts of the Local Officers, Captain Harris and Mr. Shore.

I do not know by whose fault it was that such a course has been pursued, but assuredly, whoever it is, he has very nearly had the responsibility of causing the death of 30,000 people, to say nothing of all the unknown and incalculable sufferings of the immense population in the Southern Delta.

Captain Short has tried every means he could think of to secure something being done, and a work was actually begun at Nafaj, but it was absolutely prohibited, in spite of the utmost efforts of Captain Beadle, the then Superintendent of Embankments, and Captain Harris, Executive Engineer. But while this work was prevented, nothing else was substituted or proposed, and the only course was pursued that was certainly destructive, viz., to do nothing.

I beg particularly to bring forward Captain Short as the Officer who thus first clearly and distinctly explained the case, and showed the plan to be attended to, and the principle on which the works should be executed.

Captain Short also most earnestly and strenuously persisted in pointing out the wretched state of the Delta generally, both from the neglect of the heads of the Kujoree, and the shameful state of the embankments in various places. In his letter 4th November 1857, he says,—"Here, however, I would particularly point out, that all parties centre their anxiety on Cinnack, whereas, as private and public property there is nothing to be mentioned when compared to the greater interests of a province and its inhabitants. What are the feelings of the well-to-do inhabitants of the town, as compared with those of the vast population scattered over a district whose lands are yearly desolated?" Again, he says;—"Mr. Shore states it is not right the people should every year be kept on the alert for two or three days and nights, waiting for a signal to fly to the highest attainable ground, and see their houses crushing around them. This is doubtless a terrible state of things."

"Keen sympathy is felt by every European (as my experience tells me so) during each year's crisis, because he feels he may be the first to be whirled away in the event of a catastrophe, but nobody thinks of the thousands in the district whose lives are dependent upon their reaching a spot of high ground, their thatches keeping them above water."

"I have seen terrible scenes in the district, where only one boat has been of use to many, and in the North, 90 or more lives were saved by the overseer and others, the poor people clinging to rafts or trees."

Again, in a Memo. written in the same month, Captain Short urges, that to leave things in such a state that money is continually and compulsorily expended in merely filling breaches, while the same money might be spent in preventing them, if voluntarily applied before hand to correct the evils, must be a mistake. So also in his letter of 20th May 1857.

These and many other passages show how earnestly this faithful officer pressed upon the Government the state of things. In times past, men who thus showed their care for the honor and interests of their masters, and for the safety and welfare of the native of the districts under their charge, were not the men approved of, and it is too well known that those who pursued such a course of faithfulness did it at their personal risk; it was not the road to good appointments, but directly the contrary. I trust that those times are now past, or, at least, are rapidly passing away, and that such men will be called to the posts for which their faithfulness, energy, and intelligence qualify them.

I have spoken of the amount of expenditure. I must also refer to the Superintendence. The state of this corresponds, in inefficiency, with that of the money allowed. The present Department is utterly insufficient for the care of the province. It is insufficient even to see that the present expenditure is judiciously and faithfully applied. I find one Officer, without a single Assistant, for the embankments of all Bengal, from Ganjam to Dinapore. And there is one Executive Officer, without a single European Assistant, not even an European Overseer, for the Collectorate of Cinnack. Those superior Officers are thus of course occupied, for parts of their time, in doing the work which ought to be done by men on 1th or 10th of their salaries. This is not economy. Economy requires that no work shall be paid for, more than is necessary; to employ a man on 1,000 rupees a month in doing work that could be done by men on 100, is contrary to the plainest principles of economy, and the consequence of this system is, that here are men training up for the superior appointments. I am told, as is in fact, must be the case, that men have been put in charge of the embankments, who never before saw a

land; of course where a state of things is permitted, there can be nothing but confusion and waste. My experience has brought me to the conclusion that not more than 10,000 rupees a year, on an average, can be economically expended for every European employed. That is, that in the present state of things, while natives experienced and otherwise fitted for managing Public Works are so rare, if a lac a year has to be expended, there ought to be 10 Europeans, suppose three educated men and seven subordinates, and less than this is only false economy, and unless there is thus a sufficient Department, there cannot be really experienced men from whom to select for the superior appointments. I also may state here that I am convinced it is a mistake to have two or three officers running over the same ground, one looking after one thing, and one after another. In Madras this system was tried, especially in appointing an officer to the general charge of the roads of the whole Presidency. The plan broke down so notoriously that now each district officer has the charge of all the works of every kind in his own district, and, consequently, there is always an officer at hand in every emergency. What can become of the embankments of Cuttack if the officer nominally in charge of them is sometimes on the other side of the Ganges? and of course it is impossible that he can be at hand, as he ought to be, in every district at once, during the critical time of the great freshes.

I cannot say less than that justice, mercy, and economy absolutely require a total change of system; to say nothing of the personal interest of the public servants generally, for their pay must come out of the earth, and to "equalize our income and expenditure," either the pay must be diminished, or the produce of the earth increased.

This case of Cuttack puts in a strange light the difference between the state of the Public Works Department as respects the river management here and in Madras. Here is a matter upon which there have been years and volumes of correspondence expended; it is ten years since the ludicrous recommendation of Mr. Simms was made, that 18 lacs should be spent on the River, and the discussion had then been going on for some time.

In such a case, in Madras, I would be the exact statement of what would take place. The district Engineer on hearing from an overseer that the river was making an injurious set on the head of a branch river, would go some morning, inspect the spot, give directions to the officer or overseer stationed in that part of the district, and without waiting to refer to Madras, have the work executed within two or three weeks, that would be necessary at once to check the scour, and turn the stream back

into its proper direction. Such cases continually occur, and are attended to as the most matter of course, and they are never very expensive. I can safely say that instead of 18 lacs, 1,800 rupees would have been sufficient for this work, if it had been taken in time.

I must conclude as I began. At the bottom of the whole matter, is that abominable and directly false principle, that "there can be no doubt that the difficulties of India are owing to too great expenditure." Till this is brought to the test, till it is considered, examined, and clearly seen and acknowledged to be false, there can never be any thing but endless discussions about the finances, shame and disappointment to us as rulers, and poverty and discontent to the poor people under our

Cuttack and Tanjore are the types of the two principles—"India's difficulties arise from its great expenditure," and "India's difficulties arise from false economy."

And now we have in Rajamundry the effect of a far more liberal expenditure than in Tanjore, and a rapid carrying out of a system of improvement of the most complete kind.

What I insist upon is, that nothing like this change in Rajamundry has ever been seen in any other district in India. An increase in 12 years of eight and half lacs a year in Revenue.

Of Exports, three-fold.

Of Imports (exclusive of opium) four-fold.

Of Internal Traffic, 30-fold in five years.

An entire stopping of the drain of bullion from the district, which used to average 10 lacs a year; the Revenue 16 per cent. higher, and the exports of produce four and half fold greater now, in a year of severe drought, than in an abundant year before the works.

Seventy lacs of extra Revenue have been received, while about 40 lacs have been spent on works, including repairs, and 180 lacs of additional income received by the people, in payment for produce exported by sea only, in excess of the former year.

And this increase of Revenue notwithstanding that by far the greater portion of the lands have yet not been reclaimed. If any case can be produced that will surpass this, (caused by diminishing the expenditure) I will allow that it is good economy to neglect the works.

* Now in 1858-9, 10 Lacs.

† Now in 1858-9, 10 Lacs, and of produce (excluding cloth) eleven-fold.

Whatever is ultimately done, it would be advisable to commence immediately upon the preparation of apparatus and materials, unless it is still deliberately determined to do nothing.

One of the first things should be to build a small steamer, to enable the officers, both Revenue and Engineers, to get about the Delta in the freshes. This could be done at £10,000 or more. They have two excellent small steamers there now, but the engines of one of them were brought from England. A iron boat drawing 15 inches, with a speed of nine or ten miles an hour, could be built there entirely, engines and all. Some river cargo boats should also be ordered, steam should be quarried, and light rails and waggons prepared for quarry railways. Timber also should be purchased, and workshops erected, &c. All these will be required whatever is done.

Let us now just consider what we have before us. A company ~~pro-~~
treating to be allowed to spend capital on Public Works in India. Dis-
tricts with the greatest possible natural advantages, in the most wretched
condition, waiting for the execution of such works.

Thousands of men of all classes in England pining from want of employment. Thousands of natives perishing from drought or flood for want of regulation of the water.

The finances in disorder and incurring debt for want of produce from the soil.

Undeniable proof of the cost and effect of irrigation and navigation works. The Local Officers, both Revenue and Engineering, continually pressing upon the authorities the necessities of the people.

Missionaries and others petitioning the Government to try and do something to rescue the great mass of the people from this object state.

In a district where *our* Western knowledge and energy *have* been brought to bear, the people freely acknowledging that it is to us Europeans and Christians, that they are indebted for benefits which they never received from their own Government and their own gods.

Every thing ready, every class of people, black and white, to be benefited, and all prevented by the thoughtless adoption of a false principle, without a vestige of foundation. "The India suffers from too great an expenditure."

I cannot but be well assured that the hurricane that has now swept over India, and removed so many abominations, will sweep away this ruinous principle also, and lead in a thorough trial of *the opposite*, and that Orissa may be the first to feel the effects of its general adoption.

(Signed) A. COTTON, Colonel,
Commanding Madras Engineers.

REPORT
ON THE
WATER COMMUNICATION
BETWEEN
Calcutta and the Ganges.

AGREEABLY to orders received from the Government of Bengal, I proceeded early in May by land to Rampore Boleah, thence by steam to Rajmahal, and returned by land to Calcutta, having been accompanied by Major Sale, of the Bengal Engineers, whom the Deputy Governor had been pleased to appoint to this duty, and from whom I received all the help I needed.

At Berhampore I had the advantage of communicating with Captain Layard, an Officer of long experience in the Public Works' Department, and also with Lieutenant Forbester, the Superintendent of the Nuddea Rivers, who allowed me to Rampore Belah and gave me much information and assistance, especially in taking sections of the river. At Rajmahal, the Deputy Commissioner of the Santhals, Mr. Brown Wood, was most obliging, accompanying me about the neighbourhood, and taking a great deal of trouble in forwarding my objects in various ways. In the course of my journey I also received the greatest kindness and valuable information from several gentlemen in charge of Silk or Indigo Factories, especially Mr. Cockburn, of Rampore, and Mr. Bashford, of Suzdah. I had also the great advantage of several communications with the Dewan of His Highness the Nawab of Moorshedabad, a very superior gentleman, well acquainted with that part of the country. I was introduced to him by the Government Agent, Engineer Colin McKenzie, from whom, also, I received every possible kindness and help.

On my return to Calcutta, I had conversations with several of the principal merchants of Calcutta, to whom I am also greatly indebted for much information.

From these various sources, besides that of the Revenue Officers I met with, I am in hopes I arrived at correct conclusions respecting the state of the case, as respects both professional and non-professional points.

I must also beg to be allowed here to acknowledge the exceeding kindness that I received from His Excellency the Lieutenant Governor, and his free communication to me from the great stores of knowledge of Bengal, that he has accumulated, and also his earnest care to further my personal convenience, and facilitate my operations in every respect.

In my paper on the Mahanuddee, in Orija, I have endeavoured to lay a foundation for all such projects as these, and I therefore need not here repeat what I have said there.

It is evident that there can be no end to discussion on such questions as these, while the very fundamental principles involved in them are unexamined, and so unsettled. The question is not, whether we are to be economical or not, but, What is economy? Whether leaving every thing connected with the material state of the country to chance and nature, is economy? or whether this neglect and slovenliness are the very opposite of economy. It is universally acknowledged that in every thing else, without exception, you have only to take no care of a thing, and waste and destruction will follow as a matter of course. Economy is inseparably connected with care, foresight, and a timely and proportionate expenditure of labour and money. Now it even came to be imagined that care, and attention, and expenditure were not required in respect of the control of the waters of a country, I cannot imagine.

The comparison given in the Cuttack paper of actual results in two districts, one taken care of, and yielding 50 Lacs of Revenue, and its land worth 50 rupees an acre; and the other neglected, and yielding eight Lacs, while its land is worth about 15 rupees an acre, seems sufficient to show that the management of the material state of a country is not an exception to this generally acknowledged principle. And the districts of the Gangetic valley are, if possible, still stronger proofs that neglect and non-expenditure are not economical. Some of these rich Delta districts, with every possible natural advantage, naturally far superior to Tanjore, yield, in proportion to their area, one-seventh, or less, of the Revenue of the latter, and yet, with this small Revenue, the lands are of less salable value; and those districts, too, within a moderate distance of the great market of the Capital. I may here repeat my fundamental principle, that "on the regulation of the waters of a country, and especially of a tropical country, depends incomparably more than upon any thing else, the material state of that

country. That is, that money, skill, and labour expended in regulating its waters, will produce incomparably greater results than any other way of applying those things.

If this is true in general, it is certainly especially so of the tract of country between Calcutta and the Ganges. It is certain that this is, or ought to be, the one of the lines of greatest traffic in the world. No port but Calcutta is the sole outlet of a population of about 100 millions of people, occupying one of the most fertile countries in the world; and the traffic, even now, depends entirely upon its water-carriage. Imperfect as it is, were the present river transit stopped, three-fourths of the present trade of Calcutta would be destroyed.

Of 600,000 tons, given in a statement of the Nuddea river traffic per annum, 420,000 consists of the following articles, viz. Firewood, Straw, Coal, Chundin, Hay, Grain, Pulse, Salt, Gunny-bags, and Jute, articles of the value of from five to 50 rupees a ton, and even more valuable goods, often could not bear the expense of several hundred miles of land carriage.

But upon the produce of the country arriving at Calcutta at an exportable cost depends the trade of the port, both in imports and exports, the power of the country to pay its present Revenue, and the whole material welfare of the people. The importance, therefore, of water-carriage here can hardly be over-estimated; but the question remains, what are the evils of the present lines, and what could be gained by such improvements as the case seems to admit of?

The losses of the present lines may be thus stated:—

By the Nuddea Rivers.

- 1st. They are only open part of the year; for the last few years, for about four to six months.
- 2nd. They are very winding, which increases the distance.
- 3rd. From their sharp bends, and consequent uncertain depths, they cannot be worked at night.
- 4th. They have no regular tracking paths, and the upwards route is consequently very laborious and expensive.

By the Soonderbund route, to which the traffic is reduced for six months of the year.

- 1st. This is far more circuitous than the other, the distance being more than three times the direct distance.
- 2nd. The boats have to pass through more dangerous parts of the river and creeks, from which the risk is greatly increased.
- 3rd. There can be no effective Police in such a labyrinth of channels as the Soonderbunds, and I am informed that there is much loss from

the wilful acts of the crews, so that the cost of insurance would be very considerable could insurance be effected; but, owing to the great uncertainty, I understand that there are few persons who will insure cargoes on either line, a very serious evil.

4th. The great length of time occupied in the voyage, which is so considerable, as to be a very serious drawback, and to cause a great loss in interest even in the great mass of the trade, notwithstanding the small value of the goods.

From the various statements I have received of actual cost of freight, loss of interest from time consumed, and risk, I think the average cost of transit is not less than three pie per cwt per mile, which, on an average distance of 450 miles, between Rajmahal and Calcutta, taking the mean of the two routes, is seven rupees per ton. The quantity passing through the Nuddea Rivers, according to the statement received from Toll Officers, is 600,000 tons per annum. It appears, from the Monthly Statement of Tolls, that almost the whole of this passes in six months. From such information as I could obtain, which, however, was by no means decisive, I should think not less than as much more passes by the Soondabund route, in the remainder of the year, which would make the total traffic 12,00,000 tons, and the cost 84 lacs. I think this estimate is substantially correct. But leaving out the valuable goods, and reckoning the great mass of the traffic to cost five rupees a ton for this transit, it is evident that it is quite sufficient most materially to limit it. A reduction to one rupee a ton would surely open the way for a very great traffic in goods which would not bear five rupees. For instance, hitherto Calcutta has been supplied with lime from the Behampooter side, while there is excellent lime near Rajmahal, and no doubt could be brought down, at one rupee a ton, a very large quantity would be conveyed to this one article. In a reduction of freight and expenses to one-seventh of the present average rate would probably very soon double the traffic, and, more probably, increase it three or four-fold.

If a perfectly fair water-communication were formed for this line, capable of passing large boats worked by steam all seasons, I think that we may safely reckon that it could be worked at one rupee a ton for the whole distance of 200 miles, in which case the saving on the present traffic would be one not less than 72 lacs, and including that on the new traffic, not less than 100 lacs a year. The loss by interest and risk, would, of course, in such a work, be reduced to a nominal sum. The supposed rate of one pie per ton per mile is taken from the actual cost on Rajamundry Canals and various other water-communications, and is much above the calculation, when the length of trip and size of boats proposed are con-

sidered. In this calculation no account is taken of the saving on passenger traffic between Calcutta and the great towns on the line, which would be a very large item. Upon the whole, therefore, I consider that when I estimate the total saving on such a work at 100 lacs, it is certainly under the mark.

The following are the actual cost of conveyance by different water-lines:

From the State Engineer's Report, New York, Nov. 1853.

Lakes	1 to 2	Pie.
Hudson River	1	Pie.
Erie Canal	3	Pie.
Ordinary Canals	2	Pie.

In Rajamundry.

Short trips of 30 to 50 miles, 1 Pie.

In the American prices, it must be remembered, that the value of money is much lower than in India, and the price of labour is much higher.

The cost stated on the Erie Canal was before its enlargement, for the last few years they have been spending several millions sterling on it, and the cost of working it will be much reduced. The cost on the Rajamundry Canals is that by very small boats, exceedingly ill adapted to their work. With suitable boats, and of larger size, and for long trips, the cost would be reduced to one-third of the above. What thoroughly good water transit is, is shown by the cost on the Hudson River, about six pie per ton, corresponding with perhaps quarter pie in Bengal.

I may also state, that the cost of the present river steamers, taking an average up and down, is about eight pie per ton per mile, and their dividends are only 50 to 70 per cent. From the information I obtained, I conclude that the actual cost to the Companies is one-third of their receipts, or about two and half pie a ton a mile, working with all the delays and disadvantages of the shallow winding river, and by day only. And I must state that I am satisfied the Companies have yet much to learn of the subject of river navigation. From what I have seen on the Godavery and on the Rhony, I have no doubt that this river could be worked by steam at half the present cost with good management. The above two and half pie does not include risk and interest value of goods, but these items are not very large by the steamers, and the latter would be greatly reduced if the steamers were worked more effectively, for they certainly work below the most economical speed, as well as in other respects in a manner that causes needless expense.

Besides these advantages, which can be estimated in money, we must allow considerably for the great convenience of a short and certain time being occupied in the transit. The heaviest goods could be conveyed in large boats with very low steam power in 30 hours from Rajmahal to Calcutta, and the return voyage with the boats only lightly loaded in 40 or 50 hours, and they could be moved by night as well as by day. From my calculations I reckon that if steam power is used, a speed of about six miles an hour through the water, would be the most economical pace, on a canal with a current of one or two miles an hour.

From these calculations, I think we may safely conclude, that a perfect water-communication on this river would be one of the most important works that could be executed, even supposing that it were used only for navigation, and that the same work would equally convey water for irrigation and for the use of the City of Calcutta.

And I think this result is conclusive as to the question of an important communication, such as that by the Nudda rivers, however much they might be improved. I have no doubt that they could be kept open all the year at a small expense, but it seems to me that it would only be a waste of time to go into detail upon this point. If there is a line in the air, it will be found, and justifies as perfect a communication as can be obtained, surely this is it. I proceed, therefore, on the supposition that a complete Steam Boat Canal is the work that is clearly pointed out, by the circumstances of the case, to be done, which it is desirable to establish, independent of its use for other purposes than navigation.

Before examining into the practicability and cost of such a work, I would now consider to what uses it may be applied. And, first, for irrigation. It would, of course, make this paper much too long were I to attempt to answer in it all the objections that can be urged to such a work as this. It will be better to leave this part of the subject to future papers, excepting one or two leading points which I must here shortly notice. One is a fundamental one, "Irrigation is not required in Bengal." I have written about this in my Cuttack paper. I would only ask such an objector, whether, if he had a garden or farm in the Delta of the Ganges, he would use water for it or not? He could get it for a trifle. Every acre of land in the world requires both irrigation and drainage. Not a year passes that there are not both excess and deficiency of water at different times. From my experience, and from information obtained in Oude and Bengal, I conclude that the increase of produce from irrigation of the water would certainly exceed 10 rupees per acre.

There is another point in this question, still, that is not so obvious. It is this, that in proportion as the harvest is uncertain, and liable to diminu-

tion from drought or flood, the ryot is, of course, compelled by prudence to risk as little as possible in the expenses of cultivation. One main reason why Tanjore is so very productive, though the soil of a great part is very poor, is the thorough cultivation that is usual, because the harvest is so certain. This is a most important point, and it affects the well-being of the ryot in many ways, directly as well as indirectly, for uncertainty produces despondency, and its consequence, slovenliness in every thing he does. When he has a tolerable certainty of reaping the full results of his labours, he sets about his work with spirit, and invests in his cultivation such capital and labour as it really requires.

The question, then, remains, whether irrigation can be advantageously combined with navigation. This seems to be fully answered by the Godavery works. After several years' operation, no essential objection has been found to the combination of the two, and the expense is thus very small in comparison of the results. It is evident that where the great proportion of the traffic is in one direction, a moderate current in that direction is an advantage to the navigation, as the fully loaded boats have the benefit of it, while only lightly loaded ones have to be drawn up against it; water will thus be conveyed down such a channel, which may, of course, be applied to the land. It does not seem necessary to go into more detail on this point here. Then, the supply of Calcutta with water. There will be no question about the importance of this point, and of its possible combination with navigation; it need only be said that, as before stated, the current is required for the latter, and the water is therefore actually conveyed to Calcutta in performing that duty, and is, as it were, thus obtained for nothing, and the only expense will be its distribution over the city. So much has been said, and written of late about this supply of Calcutta, that I need not say much here. I only observe, that the water may be used for water-power as well as for cleansing the city. If the surface of the canal is 10 feet above mean tide, the power from 1,00,000 cubic yards per hour would be about 500 indicator horse-power day and night (throughout the year). By means of this, water could be raised to any height, and the whole city supplied by pipes with water under a pressure which would command the highest buildings, and also work any machinery. I understand that the Mint will soon have 250 nominal horse-power of steam, equal to about 500 indicator horse-power, and if this works for eight hours a day, it costs, according to my information, must be about 60,000 rupees a year, which represents a capital of 15 lacs at four per cent. Almost the whole of this might be saved by the use of water, besides many other advantages, such as the absence of the heat, the less liability to be out of order, &c. In this way the three chief re-

quirements of Bengal could be combined in such a work as a Canal from Rajmahal.

We come next to the question of the practicality of the work. This is decisively answered by the facts that similar works have been executed and are in effective operation in precisely similar situations. There is no more room for "doubt" about this than there is whether a steam engine can be constructed. Its impracticability is indeed asserted by some, but mainly by those only who have never seen such works; and this assertion is supported by such "facts" as these—

The Ganges is ten miles broad.

You cannot see one bank from the other.

The weir must be 100 feet high.

The river alters its course two or three miles in a season.

It rises 34 feet in the rains.

The current is eight miles an hour, and nothing can resist it.

What are we to think of a conclusion from such premises as those, all of which are pure imagination. 1st.—The Ganges from Rajmahal to Rampore Boleah is from one and a quarter to five and a quarter miles broad, the latter including three miles of *chur*, either above or only one foot or two feet below the extreme flood, and in most years not flooded at all, so that the proper width of the river is from one and a quarter to two and a quarter miles. 2nd.—You can everywhere see one bank from the other. 3rd.—The deepest place at Rajmahal was for a short distance 30 feet, but in general it was only a few feet deep, so that if the weir is made 15 feet above the summer level, there would be a short length 45 feet high, but in general it would be from 10 to 25. 4th.—The changes of the course of the river are in some places, and in some seasons, more rapid than others, but nothing approaching to such a cutting as two or three miles in a season. At Rajmahal, it has not cut at all in any year. At Rampore Boleah, it seems to have been cutting at the rate of 100 or 200 yards in a year. And there are many other points where it either does not cut at all or very slowly. 5th.—The rise of the river at Rajmahal and Rampore Boleah was 27 feet in the extreme flood of 1863. 6th.—The current due to the fall and depth is under four miles an hour; it is impossible that this can be exceeded in general, though at particular points, where there are sharp turns, it will be more for a short distance. With respect to its irresistible power, has any thing heavier than a grain of sand been tried to resist it? The current could not move a stone of a pound weight.

I merely give these specimens of the ordinary way in such assertions are made, and which are then treated as if they were ascertained and established facts. And, were they all true, they would not in the least prove the

impracticability of the project. The question is, not whether it is possible when the river is totally neglected, but what will happen when the proper means are used to control it. Surely it ought to be quite sufficient to establish the practicability of the thing, that it has been done in several other instances. But in answer to this it is said, just in the same reckless way—but those cases are quite different, an assertion without a shadow of foundation.

A Delta is a Delta, whether in Bengal, or in the Peninsula; sand and mud and water, its three constituents are the same everywhere. There is no essential difference. So far as the differences do go, they are all in favour of the Ganges. The following is a comparison of the Ganges, Kistnah, Godavery, and Cauvery:—

	Ganges.	Kistnah.	Godavery.	Cauvery.
Extreme breadth, including <i>chur</i> land,	54 M.	14 M.	4 M.	1 M.
Extreme breadth of channel,	2½	1½	2½	¾ M.
Least do.,	1½	1	1½	½
Fall per mile,	5 in.	14 in.	13 in.	3½ ft.
Rise in Monsoon,	27 ft.	35 ft.	30 ft.	12
Greatest depth in dry season,	30	10	10	6
Surface current in floods,	34 M.	7½	4½	6
Bed and banks,	Sand & mud.	Do.	Do.	Do.
Section of water in flood,	32,000 Sq. Yds.	7,000	21,000	4,200
Discharge in floods,	150 M. c. yds.	200 M.	200	40 M.
Least discharge in dry season,	6 M. c. yds.	150,000	300,000	None.
Duration of flood,	40 days.		10 days.	

It is thus seen that so far as natural differences go, every one is in favor of the Ganges in respect of the practicability of the work, while it has also the prodigious advantage that it has twenty times as much water in the dry season as the best of the others, and its quantity is only for a very short time, not a month, while in the others the quantity continues very small for several months. The comparative regularity of the flow of the Ganges makes it a much more valuable river than the others for irrigation. When I measured the water about the 20th May, there was already 10 m. c. yards of water per hour in it, and it had begun to rise about the beginning of the month.

As to retaining the river in its place, it is certainly not easily imagined by persons who have no practical knowledge of the matter, at how small an expense this is accomplished. But the fact that the *Chaur* and *Colleroon* have been kept in the same channel for 50 years at an insignificant expense, though at the head of the Delta, the fall is no less than three and half feet,

* The greatest depth is given at the sites of the *Chaur*, the Kistnah, &c., and at Rajmahal on the Ganges. The *Chaur* is all these rivers of much greater depth, and in the Godavery, I measured one 15 ft.

mile, or eight times that of the Ganges, while the materials of its bed and the sides are just the same as the latter river, ought to satisfy any person that a Delta river can be controlled.

The fact is that, the most insignificant means will turn such a river about, and if a river is easily turned, it is of course easily restrained by the same means.

However, though the few speak about this question of practicability, the multitude of others who hear of the project are quite satisfied, that what has been already done must needs be practicable, and will no more require further arguments than they do that it is practicable to draw a train by means of a locomotive.

I therefore proceed to the question of cost. It is strange that my mode of estimating this, from the actual cost of similar works in a similar tract of country, should be objected to. I should have thought, this would have approved itself to every one; it is so obvious, that the difficulty is to find grounds for an argument about it. The irrigation of a similar Delta will have cost, at most 4 rupees per acre, that is, all the heavy works have been executed, and 700,000 acres irrigated for 35 lacs; and there seems no room for doubt, that the whole 12,00,000 acres of the Godavery Delta will be irrigated before 50 lacs are expended. In Bengal, we have a precisely similar Delta to irrigate, and the only difference as to cost there that I have discovered is that masonry is about double the cost that it is in Rajahmundry. The earth-work is just the same. The above four rupees does not include superintendence. Adding therefore, two rupees for masonry, one for superintendence, and one for contingencies, we have eight rupees an acre for the Delta of the Ganges, and if a million of acres are irrigated, the cost will then be 80 lacs. What better ground we can have for a rough estimate to enable us to judge, whether it is worth while to proceed to a detailed survey and estimate I cannot conceive. If the question is about a railway, every body instinctively ascertains what the railways already constructed have cost, and form their judgment from them as to that of the proposed one.

However, in this case we stand upon this extraordinary good ground, that the probable results both from navigation and irrigation are so great, that we are in no danger, so far as we can judge from our data, of the works not being abundantly remunerative. I estimate the gross results of such a work thus:

Saving by navigation	100 lacs.
Increased produce from 1 mn. acre at 10 Rs.	100 "

Total 200 lacs.

—and this is besides the gain from the passenger traffic, and from the supply of water to Calcutta. As to the direct profits that it may be advisable for the Government to appropriate, they might be—

Tolls to the amount of one-tenth of the total benefits	
on navigation	10 lacs.
Water-rate at two rupees an acre	30 "
Total	40 lacs.

If we suppose such a rate of taxing those who use the water, we shall have a return of 37½ per cent. on the above estimated cost; or, allowing five per cent. for repairs and management, 32½ per cent. net returns to Government, besides 160 lacs, or 200 per cent. to the public. I feel satisfied that these figures are not imaginary, but based upon very good data. I argue from them, that this is not a project about which there is any possible doubt of its making abundant returns, even though the cost were double or treble this rough estimate, and, consequently, that it is hardly possible we could have a stronger case, for proceeding to a detailed survey and estimate.

We may compare the above proposed amount of tolls, with those at present levied in the Nudda rivers. The average of the last four years is two and a quarter lacs of rupees on 6,00,000 tons of goods, or about six annas per ton. Supposing, including traffic, the tonnage is two millions, on the Canal open throughout the year, the above 10 lacs would be equal to a toll of only eight annas per ton, or very little more than it is now, when the boat owners receive no benefit in return for the tolls levied, or none of any consequence.

Respecting the probable increase of traffic, the following statement of collections, during the months of July, August and September, when the rivers were always open, shows that even without any improvement in the communication there has been a great increase of traffic.

Average collections of the years, of the three rivers, during the months of July, August and September,	Rs.
1836 to 40	74,000
41 to 45	86,000
46 to 50	93,000
51 to 55	101,000
1856 to 60	114,000

Thus, in seventeen years, the traffic has increased 60 per cent. We may, then, safely conclude that if the cost is reduced from seven rupees to one and half (including toll) the traffic will very soon increase, from

12,00,000 ~~to~~ millions, so that ~~it~~ of the canal ought to be less than calculate the tolls on the latter traffic. In the canal, it must be observed,

Respecting the precise works that must will cost no more to make navigation, would require, I should say, ~~no~~ part of the water will be far as any present information counts, ~~so~~ much earth will be excavated across the Ganges, ~~to~~ form the embankments, whether they are now the vast for 100. For the cutting at the head, it will, of course, be a question as to how high to make the weir and how deep to make the cutting; this must be decided upon various considerations, after the levels are ascertained. If the weir is made 15 feet above the summer level of the river, the cutting at the edge of the river will be seven yards deep, to give a depth of water in the channel of three yards. But it must be observed, that in all Delta rivers the level of the country falls as you recede from the bank, so that this deep cutting is only for a very short distance. I should think, from what I saw at Rajmahal, that within a mile or two the cutting would be reduced to three yards, so that from thence only a depth of four yards would be required. The channel, at first, will have a less fall than the country, so that after some miles further cutting, the surface of the water in the channel will be above the country, and after that it will be carried with the same fall as the land, and this is so moderate all the way to Calcutta that no locks will be required. The fall will be five or six inches a mile, and the current about one and half or one and three-fourth miles. It is evident that a broad canal of this sort, as good as straight, with ample depth of water, without locks or any obstructions, a moderate current in the direction of the principal traffic, with towing paths on both sides, and also quite fitted for steam power for any speed, would be a communication the value of which one of the lines of greatest traffic in the world can hardly be estimated. And it must be remembered, that there is no such present communication in the world excepting the present Ganges Canal, which has not yet been fairly brought into use for navigation. The only other work like this is the Erie Canal, of 366 miles, from Lake Erie to the Hudson at Albany, 100 miles above New York. This is now being widened to 80 ft. with eight ft. of water, and I believe is not yet completed. But it will not have a canal to suit its principal traffic. The proposed work would, therefore, be the first work of the kind, and its full effects cannot be easily judged of at present. One of the great hindrances to the adoption of such works is the idea of a canal fixed in people's minds taken from the old canals of England. A little narrow canal, 30 or 40 feet wide, and four feet deep, excessively winding, with very short locks, so ill-constructed that they take a quarter of an hour to fill or empty, and on which the powerful aid

of steam cannot be employed is no more an example of such a work as is here advocated, than an old horse railway. That cost £1,000 a mile, is a representation of one of the modern locomotive railways. Such a work as this, has the following remarkable advantages:—

Everything can be carried at the speed best suited to it, from ~~an~~ an hour down to two, without interfering with the rest.

Everything can be conveyed in its own most suitable kind of boat, worked by any kind of power—men, animal, or steam.

Everything can be carried in its most suitable size of boat. For short trips from village to village, the poor people may use their canoes, while, for long distances, and for the great staples of trade, the carrier may use boats of 600 tons if he pleases. Goods, or passengers, can be landed or shipped at every point along the whole line.

Everything can start at any hour of the day or night.

By means of steam, or double crews, or post-horses, or bullocks, the boats may pass throughout, without stopping, day and night.

It can be connected with the different rivers and the circular canal, at any point, by means of locks, so that goods can be conveyed by it, which are to be shipped or landed at any point at the various present water-lines.

Stores can be built along its bank, in which goods can be kept, and conveyed from them afterwards to the ships without any carting.

The benefits which would thus indirectly as well as directly be brought to the city and port of Calcutta are immense, and such as no other port in the world enjoys, except New York.

The line of this work should be from Rajmahal, nearly parallel with the Ganges, to the Bhagiratty, which it would cross, probably not many miles below its head, and thence be carried near to that river, passing to the cities of Meherabad and Berhampore, to Kishnagar, crossing the Jellingree near that city. It would then be continued near the Hooghly to Calcutta, crossing the Matabunga, and passing near the town of Sanipoor. I cannot, at present, see any object in keeping open the Bhagiratty, and I would therefore erect it by throwing embankments across it, and supply it only with a small stream of water from a sluice in the canal, so as to keep it navigable for small boats, and to supply the villages on it with fresh water. The other two rivers I would cross by aqueduct.

I consider it essential that the canal should actually touch the great towns; to carry any communication three or four miles from such centres of traffic, is contrary to a fundamental principle of transit. The great

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 landed or shipped at any point along the whole line.
 Everything can start at any hour of the day or night.
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mass of the tray, as from the area towns, only go a few miles altogether, and a work which is three or four miles distant, is as useless to them as if it were 20 or 100 miles off.

It will be recollected that the line proposed for the Rajmahal Canal ~~was~~ even such a work was under consideration, was close under the Southal hills. My reason for preferring the line here proposed is, first, the grand one, to which, in my opinion, every thing else should give way, that is, that that is the line where it is wanted, where the great population is, both rural and urban. And, further, the western line is in the undulating country, and crosses the drainage from the hill country, both ~~not~~ engineering objections. Of the facilities of carrying canals through a Delta country we have had abundant proof in the Peninsula. On the Godavery, there are now about 1,500 miles of canal, varying from five yards to fifty in breadth, and all the money expended, including the weir, locks, aqueducts, embankments &c., is only 30 lacs, or at the rate of 2,000 rupees a mile. This also includes several hundred miles of drains, from 20 yards wide downwards.

From the main canal, I would carry a branch parallel and near to the bank of the Ganges, to the head of the Jellingee and over that river. One division of this branch would run on each side of Jellingee, till they fall again into the main canal near Kishnagar. This would be connected, near the head of the Jellingee, with the Ganges by a lock, and would provide for the river traffic to that point and some miles below it. I need not go further into the detail of branch canals and drains for distributing and carrying off the water throughout the tract to be irrigated. A lock should be provided at Kishnagar, to allow of the traffic of the Hoogly, ~~Calcutta~~ Calcutta, entering the canal.

The canal surface at Calcutta, should be 10 or 15 feet above mean sea level, both for the irrigation of the neighbouring land and to afford water-power.

As to the supply of water, this is most abundant. According to my measurement the Ganges, at the lowest, contains six millions of cubic yards per hour, sufficient, as I suppose, for the irrigation of six millions of acres at that season: and this lowest quantity is only for a very short time.

It will be observed, that in my estimate I only suppose that one million of acres are watered, and that the navigation is provided between Rajmahal and Calcutta, but the same weir would provide for a canal being carried along the north bank of the Ganges, to near Dacca, to provide for the traffic and irrigation of all that part of the country, and also for a high level branch to be carried close under the Southal hills, to irrigate the land between it and the Bhagirathi.

To remove the traffic altogether from the Ganges, and especially from the lower and wide part of it, is certainly a very great object. One of the most remarkable facts connected with its navigation is the utter unsuitableness of the boats, the nature of the river. To look at them we would suppose that every squall would sink them; and at Rajmahal, I had an opportunity of seeing how the case was. In an ordinary North Wester, of no particular force, about 12 boats sunk in the distance of about two miles. What the loss of life and property and the loss throughout the river in the many squalls that occur every year cannot be estimated. That the people should continue to use boats so incapable of encountering the dangers of the river is a remarkable characteristic of the natives of Bengal.

I cannot also help remarking here on the prodigious traffic of the river. I have counted more than 50 boats of from 30 to 100 tons in a few miles of the river, and under weigh, and I suppose that more than 10,000 tons often pass in a single day. If there is now such traffic, with all the prodigious disadvantages and risks of the river, what would there be on a canal which was entirely free from risk and difficulty?

The only remaining point seems to be the time that will be required for executing these works. On this I should observe, first, that in such a work as this, calculated to afford such very great returns, time is the most important element in the matter. If the question is, whether a work will yield three per cent. or six, that is, whether it will be a positive loss or a small gain, every thing depends upon the work being executed as economically as possible, and the delay of a year or two is quite a minor point, but when the gross returns of a work may be 200 or 300 per cent., and the direct profits to the shareholders 30 or 40, it is evident that time is the main point, and a saving in the cost of construction quite a minor one. The loss of a year loses to the community much more than the whole cost of the work, and to the projectors a third of it. In such a case a very considerable increase of expenditure may be incurred in order to procure earlier returns. In the Godavery works an aqueduct was built to convey the water over a branch of the river half a mile broad to 60,000 acres. The value of increase of produce on this land is not less than nine lacs of rupees, and the water-rate to be received by Government will be about one and half lacs. The work has cost about three lacs, or only one-third of a year's increase of produce, and only 10 years of the Government dues. In this case had half the cost been saved by taking another year to execute it, there would have been no saving at all, and a loss of seven lacs to the community. Hence in arranging for the execution of

these works, I would use every means for expediting it, even at the expense of a great additional cost of the works if it were necessary. I would therefore make mountains and plains in fact, every substitute for human labour that the most ingenious man could think of. The most important thing would be to have abundance of steam-transit apparatus, so as to lay as great an extent of country as possible under contribution, both for men and materials. In any way the works may be greatly expedited. In this respect we start with an immense advantage in Bengal from the vast extent of water-transit already available, though it is imperfect. I have no doubt that, under good arrangements in this way, a large portion of the expenditure may be paid for apparatus and materials, and the amount to be expended on human labour greatly reduced. To effect the great object of saving time, I would not hesitate to spend 20 lacs in addition to the estimate of 80 lacs above given, if necessary, as the apparatus and materials would be of some value, when none were, especially, the steamers and other boats would be available for the navigation of the canal.

Further the execution of the works should be so arranged as to bring the navigation into operation as soon as possible. All the work that would be required for this would be—

- 1st. The Weir, not completed to its full height by four or five feet.
- 2nd. The Lock and Shute at the heads of the canal.
- 3rd. The canal, (not cut at its head to its full width) as far as Kishnagar.
- 4th. The Lock into the Hooghly, or Jellingee at Kishnagar.

As soon as these works were executed the canal would be available for navigation throughout the year, which would be the main point, and the progress of the remaining work would be of much less consequence.

The Officers of the Public Works Department told me they thought there would be a very large amount of labour available; they did not seem to apprehend much difficulty on this score. It must be remembered that there would be a great length of work, and, consequently, it would pass within a short distance of a great number of villages, and in every village there would be a large number of coolies procurable for work within reach of their homes. In Rajamundry now that the work is distributed over a large surface they can send a lac of rupees a month in a single district, and about one-third of another.

I would also pay very liberal rates, and if necessary, would have steamers ply, and give an advance round to bring labourers free of charge to the works. I am very sure, from what I heard in that part of the

country, as well from my own experience, that with a good system, treating the coolies liberally, providing them with food, a very large body could be collected in the heart of the District, and offered at a small cost of country.

In this way I should hope that the navigation might be opened in two years from the time of beginning the work. To complete them would, of course, take several years more.

It must be remembered that a village in one locality does not take away much labour from another at a distance. If a work is in the midst of a large population, there are always many labourers, who would take employment on it from the neighbouring villages, who would not leave their homes, for the sake of employment at a distance.

I must add two remarks on the above rough estimate.

1st. No estimate which is not based upon actual cost of similar works can be much depended upon. The first estimates for Railways in England, framed from adding together the estimates of the various details, were enormously wrong, not exceeding perhaps half or quarter of the actual cost. It was not till the Companies had the check of the actual cost of such works, after they were in operation, that the estimates could be relied on. Thus, no estimate of details of these large works could be depended on, unless checked by the actual cost of those of other Districts. But actual cost of similar works is the soundest foundation for an estimate that we can have, and surely the data we have are amply sufficient to show that we are running little risk of wasting money in proceeding to a thorough survey and estimate for these works.

2nd. There are two sources of error in estimating. The first is, the overlooking some work which turns out eventually to be necessary to the effect of carrying out of the original design. The other is, that in the progress of the work it is so often perceived that certain additions, though not essential, will be of great advantage, and hence much more work is executed than forms part of the original design. It is evident that the latter does not show that the original estimate was fallacious. In the present case, for instance, very extensive wharves, warehouses, &c., and many other things, might be very advantageous additions to a canal, and for such things a sum might or might not be added to the estimate.

3rd. I have already spoken of the saving of time in this work, and have shown, that if working against time, a separate allowance should be made for it. In this case I would certainly use the most complete apparatus that money could procure.

Concerning the cost of working the canal, I may add, that in a report of the State Engineer of New York, it is stated, that the charges for transport of freight by the canals there in 1853, including tolls, averaged one cent, and one mill per ton (of 2000 lbs.) per mile, equal to rather more than a half-penny, or four and half pie, per English ton. That the total sum paid was seven million dollars, and of this three and a quarter millions were for tolls, and three and three quarters for charge of transit; so that the cost of transit was under two and half pie, leaving the carriers' profit. This traffic is all moved by animal or human labour, and the value of money here is not more than one-sixth or one-eighth what it is in India. This is an excellent proof of the low cost of water-carriage. These canals are encumbered with numerous old-fashioned locks, of very small dimensions, and taking long to fill and empty. Allowing for

- 1st.—An open canal, without locks, except at the ends.
- 2nd.—Boats of five or ten times the size.
- 3rd.—Steam-power.
- 4th.—A current in the direction of the heavy traffic.
- 5th.—The great difference in the value of money.
- 6th.—The carriers' profit.

it is evident that we may safely conclude that the actual expense of working this canal will not exceed half a pie or one-sixteenth penny a ton a mile. This also agrees very well with the actual cost in India. In Rajamundry it is one pie a ton a mile for very short trips, with small boats of 20 tons, and very ill-adapted to canal navigation. In fact, such a canal once established, we shall have made a very fair approximation to the desideratum, the annihilation of the cost of transit. If the whole of this system of works costs 80 lacs, and three-fourths of this is charged to irrigation, the cost of the canal per mile for navigation will be about 10,000 rupees, and allowing eight per cent. for interest, repairs, &c., of which one-half to be paid by passenger boats, it leaves only 400 rupees a year for tolls on goods; and as I suppose we may safely conclude that at such charges, the traffic would soon increase to three millions of tons per annum, it would amount to only one-fortieth pie a ton per mile, or not half an anna per ton for the whole distance, showing that the tolls necessary to provide interest, &c., would be scarcely perceptible.

I have not before stated that the irrigation of the tract includes the embanking of the south side of the Ganges, to protect it from river floods, and ample drainage channels to carry off the local rains.

The effect of such a system of works on the agricultural population of the work area. Lieutenant Forbes, in his report of 5th September

1857, shows how terrible are the effects of a Ganges flood in the present state of the country. In the Nuddea district alone, which, however, was the one that suffered most, the returns furnished by the Collector show a loss of 8,000 lives, 2,000 houses, 40,000 cattle, and two lacs of acres of crops, worth 32 lacs of rupees. This district contains inhabitants, according to the Surveyor General's Map, 500,000 male, or perhaps 1,200,000 in all, so that the loss, including that of houses and cattle, must have been more than three rupees head, or 15 rupees per family. Here, in a single year, and a single district, was an estimated loss equal to half the estimated cost of the proposed works, to say nothing of the loss of life.

To show the ordinary state of this Delta, we have only to compare the population, &c., with that of Tanjore. The area of Nuddea is 3,600 square miles, the population is stated at 313 per mile, and the Revenue rupees 12,01,853 (for 1856-57). Those of Tanjore are, area (excluding a tract of land not in the Delta) about 3,600 square miles; population 470 per square mile; Revenue 52 lacs. I consider the quality of the land in the Ganges Delta rather superior to that in Tanjore, on an average. The great difference arises from the state of the Public Works. In Tanjore the whole of the rice is transplanted and highly cultivated, I conclude, chiefly because of the certainty of the harvest. All the rice crops I saw in the Ganges lands were sown broad-cast. In Tanjore there is no summer water, and a deficiency more or less always in the cultivating season, while in the Ganges there is abundance of water to supply the land all the year round. Again, in Tanjore, there is very little water-carriage. Thus the Ganges Delta has immense natural advantages above that of Tanjore, while the actual state of the former is prodigiously superior to that of the latter. I have no doubt, from what we have seen in Rajamundry, that the stimulus which the works proposed will give to those districts will have a great effect upon the character of the people, rousing them from their state of despondency, and tending to a far superior style of cultivation. I have no doubt indeed, that very much of the character of the people is owing to the depressing effect of the Zemindary system, and that were each man really his own master, as in the Ryotwary districts, it would have a great effect; but I understand this difficulty, also, is about to be removed in Bengal. But whatever the nature of the land tenures, security of the harvest and easy means of carrying it to market, must inevitably put new life into the population, and have the most gratifying effect upon their condition. I have no doubt that the execution of these works will lead to; the extension of canal navigation throughout the valley of the Ganges.

A line of 550 miles, at perhaps 20,000 rupees a mile, or 110 lacs in all, would connect this with the Grand canal at Cawnpore, completing a line of 1,200 miles to Hurdwar, and another of 200 miles branching off from the Grand canal, would connect it with the Sutlej, and unite the system of navigation in the Punjab with that of the Ganges. The water-communication would then be complete from Kurrachee to Calcutta, 2,300 miles, and if the Orissa works are executed, this would be extended to Ganjam, a total distance of 2,700 miles, and it may easily be continued on to Madras and the Western Coast, in all 4,000 miles. There is not a single obstacle to this, and the results would be far beyond any calculation. It is certain that in this way two or three millions sterling would unite the whole Indian Empire together by a tie that would admit of the cheapest products being conveyed from one end of it to the other. The British States are thus encircled by water-communication from the mouth of the Mississippi to New York, and it is this which gives it its immense advantages. Had it not thus the means of conveying its products at from one to four pice per ton per mile, it would be completely paralyzed; all its vast mineral and agricultural wealth would lose its value, and its population would be reduced to a state of torpidity. The population of the Mississippi valley and other parts of the interior, instead of being in a state of intense activity, from their being connected by trade, &c., with all the rest of the world, would be just vegetating on their farms.

In conclusion, I beg to bring to the notice of the Government the hearty and effective aid afforded me by the officers of the Public Works Department before mentioned, Major Sale, Captain Lyard, and Lieutenant Forbes. It was a great pleasure to me to meet with these intelligent officers, so capable and willing to give me sound information. Captain Layard kindly took for me a line of levels near Berhampore, to ascertain the fall of the country, and Lieutenant Forbes took for me the section of the Ganges which accompanies this report.

I trust these officers may be employed on the proposed works, and I am sure they would be very valuable if so employed.

I append comparative sections of the Malabar, Ganges, Godavary, Kistnah and Cauvery, also a Statistical Table for Rajamundry, filled up to the present time.

There is no reason whatever why the same work should not produce the same results in every district in India. And nothing can be more obvious than that increase of revenue of 40 per cent., of exports five-fold, and of internal traffic ten-fold, if it extended to every district, would be a state of prosperity such beyond what perhaps any body has imagined;

30

Statement of Revenue, Exports, &c., of the District of Rajamundry, from Ten Years before the New Works of Irrigation and Navigation, to 1853-54, taken from Returns furnished by the Collector and Civil Engineer.

Years.	TOTAL REVENUE OF DISTRICT.		Price of Rice per Ton.	BULLION RE-CIRCULATED FROM TREASURY.		BALANCE OF BULLION.		IMPORTS BY SEA.		EXPORTS BY SEA.					Expenditure on Public Works.	No. of Boats passing the Mouth of the River Godavari, from the Port of Cuddalore.	No. of Boats passing the Mouth of the River Godavari, from the Port of Cuddalore.	COLLECTOR'S REMARKS ON THE SEASONS.
	Annual.	Averages.		Annual.	Averages.	Annual.	Averages.	Annual.	Averages.	Total Imports.	Cloth.	Other things.	Averages.	Total Exports.				
1833-7	216,000		1	121,000		92,000								69,000	8,900			Insufficient rain. Unseasonable rain.
7-8	214,000		1	111,000		103,000								65,000	599			Unseasonable rain. Floods and inundation of the sea, causing much damage. Extreme distress these two years.
8-9	172,000		5	78,000		95,000								42,000	1,690			Scanty rain. Seasonable weather. Abundant crops. Ordinary season.
9-10	174,000		5	74,000		100,000								19,000	1,980			Severe distress. Great distress from severe (river) floods. Favourable year.
1840-1	174,000	196,000	5	74,000	95,000	100,000	98,000							20,000	4,080			Scanty rain. Seasonable weather. Abundant crops. Ordinary season.
1-2	210,000		3	89,000		121,000								46,000	1,720			Severe distress. Great distress from severe (river) floods. Favourable year.
2-3	195,000		3	95,000		101,000								57,000	1,220			Scanty rain. Abundant produce. Direct do. Two Talooks received water. Heavy (river) floods and inundations. Considerable loss. High floods. Penna failed. Rice crop abundant. Ordinary year.
3-4	172,000		2	109,000		67,000		9,000	22,000	23,000	10,000	63,000		73,000	3,420			Scanty rain. Abundant produce. Direct do. Two Talooks received water. Heavy (river) floods and inundations. Considerable loss. High floods. Penna failed. Rice crop abundant. Ordinary year.
4-5	233,000		2	182,000		102,000								91,000	4,470			Scanty rain. Abundant produce. Direct do. Two Talooks received water. Heavy (river) floods and inundations. Considerable loss. High floods. Penna failed. Rice crop abundant. Ordinary year.
5-6	200,000		1	109,000		94,000								137,000	24,400			Scanty rain. Abundant produce. Direct do. Two Talooks received water. Heavy (river) floods and inundations. Considerable loss. High floods. Penna failed. Rice crop abundant. Ordinary year.
6-7	212,000		1	151,000		89,000								110,000	34,500			Scanty rain. Abundant produce. Direct do. Two Talooks received water. Heavy (river) floods and inundations. Considerable loss. High floods. Penna failed. Rice crop abundant. Ordinary year.
7-8	250,000	237,000	3	159,000	150,000	91,000	87,000							110,000	22,000			Scanty rain. Abundant produce. Direct do. Two Talooks received water. Heavy (river) floods and inundations. Considerable loss. High floods. Penna failed. Rice crop abundant. Ordinary year.
8-9	233,000		3	132,000		101,000								115,000	25,500			Scanty rain. Abundant produce. Direct do. Two Talooks received water. Heavy (river) floods and inundations. Considerable loss. High floods. Penna failed. Rice crop abundant. Ordinary year.
9-10	221,000		3	157,000		87,000								96,000	30,500			Scanty rain. Abundant produce. Direct do. Two Talooks received water. Heavy (river) floods and inundations. Considerable loss. High floods. Penna failed. Rice crop abundant. Ordinary year.
1850-1	212,000		3	119,000		94,000								140,000	21,900			Scanty rain. Abundant produce. Direct do. Two Talooks received water. Heavy (river) floods and inundations. Considerable loss. High floods. Penna failed. Rice crop abundant. Ordinary year.
1-2	245,000	245,000	2	159,000	107,000	86,000	48,000							163,000	20,000			Scanty rain. Abundant produce. Direct do. Two Talooks received water. Heavy (river) floods and inundations. Considerable loss. High floods. Penna failed. Rice crop abundant. Ordinary year.
2-3	250,000		2	172,000		90,000								163,000	30,000			Scanty rain. Abundant produce. Direct do. Two Talooks received water. Heavy (river) floods and inundations. Considerable loss. High floods. Penna failed. Rice crop abundant. Ordinary year.
3-4	214,000		5	117,000		17,000								183,000	18,540			Scanty rain. Abundant produce. Direct do. Two Talooks received water. Heavy (river) floods and inundations. Considerable loss. High floods. Penna failed. Rice crop abundant. Ordinary year.
5-6	251,000													163,000	3,000			Scanty rain. Abundant produce. Direct do. Two Talooks received water. Heavy (river) floods and inundations. Considerable loss. High floods. Penna failed. Rice crop abundant. Ordinary year.
6-7	259,000													176,000	18,540			Scanty rain. Abundant produce. Direct do. Two Talooks received water. Heavy (river) floods and inundations. Considerable loss. High floods. Penna failed. Rice crop abundant. Ordinary year.
7-8	288,000													175,000				Scanty rain. Abundant produce. Direct do. Two Talooks received water. Heavy (river) floods and inundations. Considerable loss. High floods. Penna failed. Rice crop abundant. Ordinary year.
8-9	275,000													293,000				Scanty rain. Abundant produce. Direct do. Two Talooks received water. Heavy (river) floods and inundations. Considerable loss. High floods. Penna failed. Rice crop abundant. Ordinary year.

- A Some small improvements commenced this year.
 B The great works commenced this year.
 C These sums show the amount of Bullion paid out of the Treasury on account of first, Government Establishments; second, Public Works; third, Private Debts granted for money paid into the Treasury at Madras.
 D These balances are the amount of Bullion sent out of the district by Government.
 E This is the first balance in favour of the district.
 F From this it appears that the district has nearly ceased to buy food from foreign countries.
 G The smallness of the imports shows the inability of the district to purchase foreign articles still. If the increase of wealth indicated by columns 4 and 15 continues, we may expect an increase of imports shortly.
 H The cloth trade has declined through the competition of England, and is not much affected by the state of the district.
 I The articles exported are almost exclusively the produce of the district, viz., sugar, tobacco, rice, edible oils, &c. The increase, comparing the average of ten years preceding the works with the last year, is £1,26,000.
 K These sums represent the total amount expended, including repairs, &c. The total sum expended, from 1840-1 to 1853-4, is nearly £1,30,000, from which, deducting £10,000 for repairs, &c., it leaves about £1,20,000 actual expenditure on the new works up to the date of the last expenditure, which affects the return of revenue in this statement.
 J These two years' expenditure are not known certainly.
 M This is the number of boats. There were besides, in 1851-2, 929 rafts of timber and bamboos, on the main channel to Cuddalore, and 2,200 on all the three main channels. By estimate and partial returns, I reckon that the total traffic on all the canals last year may be equal to 180,000 tons carried thirty miles, the saving on which, as compared with land carriage at three pence per ton per mile, would be about £70,000 a year. This present traffic must be greatly under what it might be, because the scarcity of boats compared with the demand, and the charge for freight is consequently ten times what it used to be.
 N Seven. Inland transit duties.
 N. B.—Besides the increase of Revenue in Rajamundry, there is about £11,000 per annum in that part of the Delta lying in Masulipatam.

* They are already (1853) seven and half Lacs.

† Lsd. carried now 18 mns. Tons 1 mile, upon which the saving would be £225,000.

From this table we may reckon the results on the New Works as follows:—

Cost of New Works up to 1853.	£1,80,000
Increase of Revenue by comparison of years preceding the work, with the last four years in Rajamundry.	49,000
Add in Masulipatam.	11,000
Returns to Government.	£60,000 or 32 per cent.
Increase of Exports.	£1,26,000
Diminution of Import of Food.	20,000
Saving by Water-Carriage.	70,000
Annual increase of Property.	£2,16,000 or 120 per cent on the outlay

BULLION.

Average Export of Bullion before the Works.	98,000
Import of Bullion in the last year.	3,000
	£1,01,000

At the increased consumption of their own produce, as shown by the great improvement in the clothing, feeding and housing of the people, and also of the increased exports by land. The last year was also a year of very severe drought, as shown by the high prices of grain, when, under the former state of things, the district would have been importing food, and would have had hardly anything to export.

Comparison of the two years 1840-1 and 1853-4.

Years.	Price of Rice per Ton.	Revenue.	Exports of Produce.	Collector's Remarks on the Seasons.
1840-1	£5 2s.	£172,000	£ 9,000	Scanty rain.
1853-4	5 11s.	244,000	167,000	Drought and consequent high prices.
Increase.		71,000	158,000	
Or per cent.		41½	1,750	

That is, in a similar unfavourable season the Revenue is now 41½ per cent. higher, and the Exports 17½-fold greater than before the new works.

Comparison of the years 1841-2 and 1851-2.

Years.	Price of Rice per Ton.	Revenue.	Exports of Produce.	Collector's Remarks on the Seasons.
1841-2	£2 17s.	£196,000	£ 41,000	Ordinary season.
1851-2	2 17s.	245,000	112,000	Ordinary year; rain abundant.
Increase.		49,000	77,000	
Or per cent.		25	187	

That is, in a similar ordinary season, when such works have the least influence, the Revenue in these years was 25 per cent. higher, and the exports of produce 187 per cent. higher than they were before the works.

Comparison of years 1841-2 and 1853-4.

Years.	Price of Rice per Ton.	Revenue.	Exports of Produce.	Collector's Remarks on the Seasons.
1841-2	£3 3s.	£210,000	£29,000	Seasonable weather; abundant crops, but large imports of grain from Arracan.
1853-4	5 11s.	244,000	167,000	Drought and consequent high prices.
Increase.		34,000	138,000	
Or per cent.		16	475	

That is, in a year of severe drought the Revenue is now 16 per cent. higher, and the Exports of Produce four and half fold greater than in an abundant season before the works.

55. 32

indeed, it would be a state of things diametrically opposed to the almost universal desponding ideas of Indian statesmen, respecting the prospects of this part of the Empire.

And this 40 per cent. on the revenue, I have stated in my Cuttack paper, by no means truly represents the state of things.

I have there stated the extraordinary non-collection of the water-rates by the Revenue Authorities. At this moment, at least as much more revenue ought to be collected from lands now fully irrigated, which are not paying a rupee. The water-rates are very light, and if levied on all the lands watered, the increase would be already at least 80 per cent., and only main works are required for the lands not yet watered. If the works are completed, the revenue will, in a few years, be much more than double what it was. The Madras Government have now sent a special Revenue Officer to Rajahmundry to be associated with the Engineer, and form a Committee to report particularly on this point. It almost seems that it will be necessary, as in the North-West, to appoint Public Works Officers to collect the water-rates. Probable 50 lacs have already been lost to the Treasury in this way, but this is a very small evil compared with the mischief that may be done to all India by the absence of such an extraordinary proof of the effects of hydraulic works. An increase of Revenue of 40 per cent., is no small matter, but one of 80 or 100 would have been a much more striking evidence. If the Madras Government follow up their present proceedings, several lacs in addition will be collected in the current official year.

The subject of the effects of Irrigation and Navigation works, has lately been brought specially under the notice of the Madras Government, both by a discussion which has been carried on officially between the Revenue and the Public Works Officers, and also by Despatches from the Honorable Court, calling for their opinion upon the subject of the Madras Navigation and Irrigation Company, which has lately obtained an Act of Parliament. The Madras Government, in their Despatch to the Honorable Court, dated May 15th, 1858, say, Para. 3.—“Further, the Government “question whether, considering that the returns from navigation works “are always considerable and so immense, the assistance of a third party “is really needed. What advantage, they would ask, is gained by making “over those undertakings to private Companies, when difficulties and “complications will certainly follow, while capital and skill can be obtained both cheaper, and be employed more usefully for the country “and the people, if the Government were to act for themselves? Is it “advisable to sacrifice any portion of the profits of great Irrigation Works

"when the Government of India have so many calls for the employment of all the funds that can be obtained? The Government are further of opinion that very great objections exist to the guarantee of a minimum rate of interest; the measure acts at once as a premium upon extravagance and delay, and the interference of the Government which is a necessary attendant on the measure, is repugnant to a private Company, and is a constant source of irritation." Para. 10. "While the Government agree with the Board of Revenue, in pronouncing against the transfer to private Companies the execution of these Irrigation works, they are free to confess that should it be found impossible to adopt a bold, resolute, and persevering course, which shall give full scope to every improvement, and which shall continue through all difficulties, and ensure the rapid execution of works when once resolved on, then it becomes a consideration whether it will not be better to encourage private Companies, notwithstanding the many difficulties which may attend them, rather than allow the progress of the country to be indefinitely retarded." Para. 11. "But the Government anticipate no such impossibility. Financial difficulties are the only obstacles, which can stand in the way, and the plan recommended by the (Madras) Commissioners of Works of raising loans when the Revenues of the State are insufficient, is so obvious and ready a reply to arguments founded on the question of such impediment, that nothing more need be added." Para. 12. "There are, however, certain schemes, such as the Navigation of the Upper Godavery, the East Coast, the West Coast Canal, and Back-water-communications, and in fact any project of internal navigation unconnected with the Land Revenue, which may with manifest advantage be trusted to private enterprise, and the Government would be quite prepared to advocate the acceptance of affairs which embraced objects purely treating of navigation."

Para. 14. "It is finally resolved that when pointing out to the Hon'ble Court Directors, the several difficulties which have been reviewed in these Proceedings (about the collection of the dues, &c., if great hydraulic works are executed by such private Companies) the Government express their unanimous, strong and earnest advocacy, that all irrigation works, which on a comprehensive view of the wants of the country may be deemed necessary to develop its undoubtedly great resources, be commenced at once, boldly and on a large scale; be pressed forward throughout all times and under all circumstances, and be looked on and practically treated as in fact they really are, as the most economical, because the most profitable undertakings in which the Govern-

ment could possibly engage. It is needless, now, again to bring forward the innumerable instances in which they has, in this Presidency, been most advantageously invested in irrigation works. The proceedings of Government have been only too costly, and too vacillating, and it is confidently asserted that India could be placed in a position to pay all her own expenses, and gradually discharge her debt far more readily, and speedily, at a just and less expenditure, than by any scheme of retrenchment or reduction."

With respect to the views of the Madras Government on the subject of private Companies, there is no call for me to enter upon it here, further than that I may be allowed to state my opinion, that the objections they make to them can be perfectly answered and removed; and that, on the other hand, there would be very great and almost incalculable advantages, in getting a large body of shareholders in England deeply interested in the welfare of the country. The railways have certainly entirely failed in accomplishing this object; but that was simply because they are unprofitable.

It is, however, essential that I here rectify the difficulty about the collection of the water-rate. The expression used in the above Despatch, Para. 12—"Any project of internal navigation, unconnected with Land Revenue," shows clearly where the misconception arises. It is from imagining some connection between the ~~land~~ tax and the purchase of water. The two things are totally distinct. Nobody dreams of interfering with a man in supplying his land with water by a picottah, because he pays a tax for the land, and what possible reason can there be, why he should not obtain water by any other means? Nobody thinks of stopping a man with a skin-full of water in the streets of Calcutta, because of the "Permanent Settlement," and what is the difference if another man sells water by the canal-full instead of a skin-full? A gentleman at Benares is considered quite at liberty to pay 100 rupees a year for supplying his garden with water from a well; what possible objection can there be to his paying two rupees for the same quantity of water to the owners of the Calcutta canal? What can either have to do with the rent, or tax he pays for the land? In Burmah, a man pays a Government tax for his own person, does it make any difficulty as to his buying of a shopkeeper a cloth to cover it with? The land and the water, the tax on the former, and the price of the latter, are two distinct things, as a man buys his clothes, as a poll tax, and the price of a piece of cloth. If one merchant may sell the goods of Nawabgunj, Manchester piece goods without interfering with the "Permanent Settlement," surely another

may sell them at a price for water, and equally leave untouched the question of land tax between them and the Government. The Revenue Officers may occupy themselves with some imaginary difficulties, but what difficulties will the ryot himself discover when he is offered water for two rupees that is worth to him 40 or 20? Surely nothing more need be said on this head as to the theory of the case, and in practice the matter has been settled for years in the North West. Here the Revenue Officers go on collecting the land tax just as they did before, while the canal Officers deal in water.

But as to this testimony of the Madras Government, respecting the results of irrigation and navigation generally, it surely ought to have the greatest weight. The whole subject has been brought before them, in every possible shape, for many years; in the late discussions every conceivable effort had been made to explain away the astonishing progress of Tanjore and Rajamundry, in comparison with the other districts of the east side of the Madras Presidency, and in this Despatch of the Hon'ble Court of Directors, we see the deliberate conclusion of the Government's Council on the important question; and it must be remembered, that, excepting the Governor, every Member of the Government, both Councillors and Secretaries, are Revenue Officers, whose bias, if they have any, must naturally be against attributing the progress of districts to works executed under another Department. Certainly, no persons could have had better opportunities of judging of the results of hydraulic works, and no persons could be fairer judges in the case, considering that the bias would be against, rather than in favour of the conclusion they have come to. The absence of any person who has ever been employed in the P. W. Department, from both the Council and Secretariat so that in all *decisive* discussions there was no person present whose bias was naturally in favour of the hydraulic works, or who could even have set them right on any mistaken point, leaves the conclusion of the Governor in Council without any possible ground of question, when they say, "it is confidently asserted that India could be placed in a position to pay all her own expenses (and gradually discharge her debt far more readily and speedily, by a judicious expenditure, than by any scheme of reform or reduction."

I cannot but hope that this expression of opinion by the Madras Government, will go far to satisfy that of Bengal, that the calculations which I have here made have no subtle fallacy in them, but that they are sound and sober, and fully supported by facts accumulated during a long series of years, and over a great extent of country. And it is particularly to be noted, that this Government have never had before them

case at all equal to the present one. Their hydraulic works indicate nothing approaching to the communication between Calcutta and Rajmahal. In the main canal of the Godavary, we did not begin with a goods traffic of 12,000,000 tons a year, but with one of 5,000 tons; nor had we a country to drain containing 100 millions of people, but one containing less than one million. The canal did not end at the Capital of India, the principal port of India, exporting to the value of Rupees 18,741,178 per annum, the seat of both the local and the Indian Governments, and containing 10,00,000 inhabitants, but at an insignificant town of 17,000 inhabitants, boasting only of a Collector's Office; ports exporting only, on an average, six lacs of rupees per annum, and without any communication worth mentioning with the distant interior or with Europe. The present case is an incomparably stronger case than any of those which have produced this expression of opinion.

There are some very important observations to be made, bearing directly upon this subject, from the results of the Grand Canal Works. I refer to the most interesting and valuable reports of Col. Baird Smith on them for 1855 and 1856. I have not any later ones. It appears that Col. Smith estimates the value of increase of the rubber crop at 10 rupees an acre. If that of the khurreef is the same, it will be 20 rupees an acre per annum in that part of the country for the effect of water. His present charge for this is only 12 annas an acre for one crop, or one-thirteenth of the benefit derived from it. This seems an extremely light water-rate. He speaks of raising it hereafter, so that the Government are not engaged to the present rates. They are now levying (nominally) in Rajamundry is about one-eighth of the estimated increase (two rupees out of 15) I am not quite certain about my calculations of the quantity of water used by Col. Smith, but the rate of one pytanah (rather more than one cubic foot per second) for 147 beegahs (Page 37, Para. 55), or 92 acres, gives 12,500 cubic yards per acre for the whole year, or 6,250 for half-year. If the crop is only four months, 4,300 cubic yards per crop, which at 12 annas per acre is 5,700 cubic yards per rupee. At the rate of two rupees an acre for one crop in Rajamundry, we reckon that it is about 550 cubic yards per rupee. Colonel Smith thinks the whole of his works will cost 200 lacs, and if they distribute 8,000 cubic feet per second, the quantity calculated at first, which will give 9,000 million cubic yards per annum, the cost in capital will be one rupee for 450 cubic yards per annum; so that if it is sold at one rupee for 5,700 cubic yards, the return will be eight per cent. If the rate is ultimately doubled, which it seems would be still exceedingly light, three rupees per acre per annum (Captain Meadows

For instance, that the average cost of watering from wells in Bombay and Hyderabad is 27 rupees per acre; the returns would be 16 per cent, besides the receipts for water-powers and for tolls, which last ought to be very large, at least 2,000 miles of irrigation; from which must be deducted the cost of repairs and maintenance. A toll of two pie a ton a mile on 100,000 tons only, on 2,000 miles would be 200 lacs a year, or 10 per cent, per annum; and I should think that the traffic would far exceed 100,000 tons a year. Upon these data and considerations I cannot see why this magnificent undertaking should not yield at least 20 per cent, net, when in operation, which would be equal to extinguishing eight millions of the public debt; and if it irrigates 80 acres per cubic foot per second, and distributes 8,000 cubic feet, it will water 6,40,000 acres, which at 20 rupees an acre for both crops, is 128 lacs; and deducting 32 lacs for water-rates, it would leave a benefit to the cultivators of 96 lacs, besides the benefit of water-carriage on 2,000 miles, at about three pie a ton a mile, including toll, which, on the extent of traffic there, will be probably as much more. The cost of these works will greatly exceed the Delta works. We hope to distribute about 8,000 million cubic yards at a first cost of 50 lacs, or at one rupee for 1,350 cubic yards per annum: so that in case the water costs the Government three and half times as much in the North-West as in the Godavery. It must be observed, that in Rajamundry the water-rate includes the navigation tolls; that is, no tolls are levied on the boats.

If a million of acres are supplied with water at 1/100 cubic yard per hour, in the Ganges Delta, or 8,500 million cubic yards for 80 lacs, the cost will be 1060 cubic yards per annum per rupee of capital, or less than half that of the Grand Canal and one and a half times that of the Godavery Delta. Taking into consideration the very heavy works at the head of the Grand Canal, and the excessive excavation in consequence of the water being all carried by the surface of the ground, there seems no improbability in the difference of cost in comparing the Ganges Delta works with them. This comparison is very useful in assisting us to judge of the present scheme, it is evident that the returns from the Ceylon canal ought to be far greater than from either of the others, on account of the immense importance of the line of communication, and the enormous traffic it is certain to have.

In the course of this paper I think I have answered every thing said in the papers on this subject by the Officers who were called upon to report their opinions in 1854, with reference to the suggestion I had before made, urging such a project as the present one. I need not delay this

paper by answering specially their remarks. Their papers are such as might be expected from intelligent men. About the smallest experience on the subject they were writing about; though surely they might have had some doubt about their own opinion, that a scheme was impracticable in its nature, when the thing had already been done in several cases. The conclusion was only what might have been expected when the proposal of a man speaking entirely from the long and ample experience of himself and hearing others, is referred for the final decision of Officers who had never seen in single instance such works as they were called upon to give their judgment about.

In Major Lang's paper, there is a great deal of sound information about the breadth, depth, volume, &c., of the Ganges; but, of course, he could not give any opinion on a matter with which he was entirely un-conversant. Had a man of his qualifications had a few weeks run through the improved Nelas, he would have perfectly comprehended the whole matter. And had the above papers, before being decided upon, been submitted for the remarks of any officer who was acquainted with Delta works, the Government would have been quite satisfied with his replies. All sorts of impossibilities are uttered, every one of which is removed by the simple fact that the thing has been done. All the arguments a man could bring, to prove the impossibility of a locomotive drawing a train, would not stop the working of the railways, nor will any arguments to prove that it is impossible to build an annulet across a river flowing through alluvion sweep away all those that have been standing for many years in such a situation.

The Honorable Court have lately had a report supplied by a Committee in Europe, on the best form of boat for internal navigation, and the Madras Government, have referred the subject to a Committee here. They had previously ordered a series of experiments to be made on the resistance of boats, especially with reference to the friction, and the apparatus for it is now almost ready, but it requires that an officer should be sent off for the purpose. I should mention that in the course of our experience on the Godavery, we had come to the conclusion that the friction was the principal source of resistance, and we could find nothing satisfactory on this point in books: till this point was cleared up we could not proceed satisfactorily in building our boats for different purposes, and as the subject was becoming a matter of vast importance, it was laid before Government. The project now under contemplation has given a tenfold importance to the question. I hope that our Government will allow an officer for this purpose, and as it is such a vital point in Bengal, where

water is the natural means of communication almost throughout the whole Presidency, I mention, it here. It is evident that the Calcutta canal would afford the Government an opportunity for introducing any improved form of boat for general use, which nothing else could, as they may not otherwise permit them in use; but by a diminished toll, or some other means, give a premium upon their adoption by the public.

I have extensive acquaintance with what has been done in improving countries, and I cannot say less than that I feel sure there is not a place in the world where money could be expended to the same extent of benefit as the tract, and I find it literally untouched (excepting one line of unmetalled and unbridged road) from the day we received possession. No roads, no canals, no improvement of the river navigation, no works to save this immense population from being drowned, or ruined by floods; not even a Government flotilla on the river, nor even such a thing as a suitable cargo boat, but the Government dependent upon the totally unsuitable and dangerous native boats; no advantage taken of the wonderful natural facilities for water communication by a cut made here and there to complete what nature had almost completed for us, coal-mines, lime-stone, bricks, forests, but no cheap direct access to them.

It is impossible to imagine what a garden the Delta of the Ganges may be made, if we only once set ourselves in earnest to the work. Such an opportunity was never afforded before to a Government to enrich itself and benefit so many millions of its subjects, and had we but set about it at the slowest pace when we took possession of it, a native would, by this time, be reminded at every step that he was under a Christian Government. And for the finances, how wonderful it seems that the ablest men should be employed to explore every corner, to see how a few laes may be saved in the expenditure, while these unbounded sources of income are utterly neglected, the fountain to which millions can easily be obtained.

I have no doubt that this one little patch of a million acres, when improved, will yield two million sterling, at a moderate calculation; of which, the Government make the people a present of one and a half millions, and take only half a million; it will be 12 or 15 times the interest of the money expended, and be equivalent to paying off 12 millions of the debt.

If the Grand Canal yields only 20 per cent, it will be equivalent to paying off eight millions; and the Godavery and Kistna works, if they water two million acres at two and half rupees, another half million, it would provide for 20 million more; 32 millions of the debt thus disposed

of by improving about 12,000 square miles of country out of the seven or 800,000 square miles that we rule over.

I trust that the improvement of the Gangetic Delta will now be begun, and with God's blessing will be fully carried out, till every village is protected from flood and drought, and accessible all the year by safe water-transit.

And the money required for the works, this very year 1853, has been found to carry a Railway over six miles of distance at the Bhore Ghaut. How can it possibly be said that it cannot be found to form 180 miles of by far the most important line of communication in India, and irrigate a million acres at the same time? When the Bhore Ghaut is finished, perhaps 50,000 tons of goods and as many passengers will pass along it per annum, and then to pay the bare interest at five per cent, they ought to pay four rupees per ton per head for the six miles, or 10½ annas a ton a mile; the bare charge for interest, on one mile, is more than the whole cost of carrying a ton of goods the whole length of the Calcutta Canal—180 miles. At the ordinary rates of charge this piece of Railway will not nearly pay its expenses, and the whole interest of the capital will be a burthen upon the State. Shall money be found for such a purpose as this, and then can it be said that 12,00,000 tons shall be conveyed by the Nuddea rivers, or all round by the Sunderbunds, and another traffic of probably two million tons prevented altogether, besides the transits of some hundreds of thousands of passengers, and a million of acres left to flood and drought for want of a similar sum. The same means will just as easily provide money for the one as for the other, and the one will leave a dead burthen upon the country of four laes a year, while the other will afford benefit of the value of probably at least 200 laes a year. Which of these two works is the real way of relieving the country? I think few can doubt.

I may further observe, that if water is supplied to this tract throughout the year, I cannot see any reason why it should not become the first sugar country in the world, or at least equal to the Peninsular Deltas for that produce.

G. COTTON, Colonel,
Commandant, Madras Engineers.

MADRAS, July 3rd 1853.

MEMORANDUM ON THE PROPOSED LARGE TANK,
NEAR HERRIOOR, IN MYSORE, TO BE CALLED
THE MARI CANVAI TANK.

The leading points in this project seem to me to be these:

1st. **THE SITE.**—In one respect, this is extremely unfavorable, viz. that there is a very narrow opening in the range of hills to be closed, with a broad basin behind them. The hills come close to the river, which is only 70 yards broad, while the level of about 200 feet above its bed, the Tank above would be five or six miles broad. But on the other hand, in respect of the fall of the valley, the site is, in comparison of most sites, very unfavorable, having a fall of about 13 feet a mile, so that a bund of 200 feet would only make a tank 15 miles long. As specimens of other valleys I may mention those of the Toonga and Dadra, which have a rise of only about 200 feet from the confluence of the W. tanks to near the Western Ghats, a distance of 200 miles, so that a bund of 200 feet would make a lake of the whole valley. Even in the Northern Wurdah, in the basin of the Godavery, there is a part, where a bund of 30 feet would form a tank 50 miles long.

On this account, though as respects quantity of water to be stored by a certain sized bund, this is not an unfavorable site, yet it is far inferior to many others that might be found.

In minor points, the site is very favourable. There are very convenient saddles on both sides of the river, and at some distance from it, in the chain of hills on which the bund would rest, both for the sluices and for the Caligula or waste weir. The whole valley is also very thinly inhabited, so that there will not be much property destroyed in consequence of its being filled with water.

There is plenty of good earth for forming the bund at the spot; but it is all on a low level by the side of the river, and consequently would have to be raised a great height. There is none to be obtained from the hills on a level with the top of the bund. There is plenty of stone for facing the bund, &c.

There is also a remarkable advantage in the site, in the circumstance that a second line of hills above the bund will greatly shelter that work and diminish the swell which would otherwise break upon it; a material point in a tank of such great depth and area, with the severe Western winds blowing against it.

2nd. **THE SUPPLY OF WATER.**—It has been feared that a very large Tank might not always fill in this valley; it is the worst supplied tract of the whole Peninsula in respect of rain. This, however, so far from being an objection to the site, is the stronger possible reason in favor of the work. In proportion to the danger of the local supply failing, is the necessity of storing water. In the worst seasons, of course, every drop should be secured, and, in some years, there is hardly any rain, it is imperative that the rains of the previous season should be stored to supply a following year of failure. This appears to be the case with this valley. I am informed that during July and August of last year, in the very height of the monsoon, scarcely any water passed down the river, and very slight freshes afterwards. Of course, a Tank of this largest practicable dimensions is what is wanted, and it should certainly be emptied excepting in a year of drought. From the information I received, there is generally an enormous supply of water in the river in the course of the season, though as usual in such rivers, it is extremely irregular. It must be observed, that the river does not rise in the Western Ghats, but in the Red Boode hills, an isolated range lying a long way to the eastward of the Ghats, in consequence of which the supply is far less continuous, than in those rivers whose sources are in the Ghats. The area of country above the site is stated to be about 2,000 square miles, so that, with an average fall of rain of only two feet, there would be a total supply of water in the basin of 4,000 millions of cubic yards, and if three-quarters of the whole flowed off, 3,000 millions would be available for the tank. In such a steep country, much of it stony and with rain falling in such heavy torrents, I should, however, think that as much as three-quarters of the whole rain-fall must pass down the river. During the last great flood, there must have been 300 millions of cubic yards a day passing down it. I am satisfied, therefore, that a Tank of almost any dimensions might be advantageously constructed here, and that the larger it is, the better it will pay.

3rd. **LAND FOR IRRIGATION.**—There is an enormous area of suitable land within a moderate distance of the bund, fit for Rice, Sugar, Wheat, Raggy, Choolu, and, indeed, a great variety of produce; for the land being about 2,200 feet above the level of the sea, the climate will answer for a vast range of products, including both intra and extra tropical plants.

In all essential points, therefore, this site appears to me to be, without any question, an advantageously situated one for a great work of this kind.

The most important questions are the cost, and the value of water, if stored in this place.

I have not sufficient data to make these calculations accurately; but I believe I have sufficient to give a substantially true view of the case.

1st. **WATER.** I believe, now proposed to make the bund 110 feet high, and the bottom of the sluices about 85 feet above the bed of the river, or 45 below the level of the Tank when full. The plan of the Tank which I have, does not show the area of the basin at this level, and I therefore only estimate its contents from the area shown in the plan, at a depth of 200 feet. From this I judge that the contents of the reservoir, at 130 feet, will be about 1,000 million cubic yards, and the contents below the floor of the sluices about 300, leaving 700 million cubic yards available. But of course, besides this quantity, which should be left in the Tank at the conclusion of the monsoon, the sluices would be kept discharging throughout the rains, for about 120 days, during which time, supposing that eight million cubic yards are discharged per day, or 330,000 cubic yards per hour, the Tank would supply 1,700 million cubic yards per annum, excepting what was lost by evaporation. I do not know the actual evaporation at that level of the country (2,000 feet above the sea); but it is probably about the same as in the low country, or eight feet during the dry season; and taking the mean area of surface between that of the Tank, (about 20 square miles,) and its lowest rate (about 10 square miles) at 15 square miles, or 45 million square yards, the evaporation would be 120 millions of cubic yards, leaving 1,580 million cubic yards as the net produce of the Tank, supposing that the whole of the water is used in one year, and none reserved in case of a failure of the following monsoon. In this part of the country, where the monsoon is so liable to fail, I conclude, it will always be advisable to retain 500 millions of cubic yards for the second year, when it would be so very valuable as matters now stand, that is, while the country is unprovided with cheap transit; when it is, it would be a question whether it would be more economical to use the 500 millions of cubic yards every year and purchase grain from other parts once in, suppose, 10 or 20 years, or to lose that quantity of water nine years out of 10, or 19 out of 20, in order to have the use of it in the year of failure. I could not obtain any thing approaching to sufficient information on the subject of the supplies of water in this tract, to enable any one to decide this question, but of course, from this time, accurate observations will be made, and, in a few years, a judgment can be formed of the most economical mode of using the Tank. Taking, however, the contents of the Tank at 1,700 millions of cubic yards, the question is, how does this compare with the probable supply of water. The area of the whole basin of the Haggry above Heerod is stated to be about 2,000 square miles, or

6,000 million square yards, so that 1,700 millions of cubic yards would require an average fall of water to the mean depth of only 28 inches, or a mean fall of rain of about 13 inches. Over a great part of this basin, it is alleged that the fall of rain is very scanty, but in a part of it, viz. the Babu P. Sen Hill, the fall is generally heavy, though even there it some times fails, as it did last year. On the other hand, at times, there are very heavy floods. In the level of the river in the last flood, as shewn to us on the spot, I reckon there must have been at least 12 millions of cubic yards per hour, or 800 million per day, passing down the river, equal to a mean rain-fall of $1\frac{1}{4}$ inches per day over the whole area of the basin.

Upon this view, there can, I think, be little doubt that in most years, much more than 1,700 millions of cubic yards would be supplied.

2nd. **COST OF TANK.**—This also must be a rough calculation. I reckon that the contents of the bund will be under one million cubic yards. The earth, a good tough alluvial clay, will be got on both sides of the river, above and below the bund, at the rate of labour in this part, probably two annas per cubic yard, which is a high rate to allow. This would give $1\frac{1}{2}$ lacs for the earth of the bund. A stone covering for the inner slope, from top to bottom, at a mean thickness of two-thirds of a yard, would contain 16,000 cubic yards of stone, which, at two rupees, would be 32,000 rupees, making rupees 157,000 for the whole bund. The sluices must be very capacious, to allow of a discharge of 330,000 cubic yards per hour, and the length of cutting or embanking is considerable; but I think they cannot cost above a lac.

The Calingula also should be very capacious, but it will not be an expensive work. There is one work, however, which I have no materials for calculating, viz., that of conducting the waste water from the weir to the river. The side of the hill is so rocky, this must be effected by a succession of masonry falls. The materials that I have for forming an estimate are thus very imperfect, but I think it will be quite safe to allow that the whole will not exceed four lacs, and it may probably be much under that. This would give for the cost of storing the water 250 rs. per million cubic yards per annum, or 4,000 cubic yards per annum per rupee of capital, or 80,000 cubic yards per rupee of interest. The cost of management and repairs of a work of this sort would be, perhaps, $2\frac{1}{2}$ per cent., or rs. 10,000 per annum, making the whole cost of storing the water 50,000 cubic yards per rupee.

3rd. **VALUE OF WATER.**—We know, from a great variety of sources, that water in the Peninsula is worth more than one rupee for

Land tax.....	7	rupee.
Water rate.....	12	"

27 rupees.

4th. We have to add to the above cost of storing, that of *distributing*. In Rajahmundry, if ultimately 24 laas are expended in the distribution over 12 laas of acres, (deducting from the whole cost of those

The storing 50,000 cubic yards...	1 rupee.
Distributing " do. " do.	12 " "

2d. The second question is, what is the use of producing more than the people can consume?

It is perhaps almost past the time when it is necessary to answer this climax of Indian arguments. The answer is that nobody is going to produce more of any thing than will be consumed. When men find there is no sale for what their labour produces, they always have sufficient instinct to turn to something else. If on dry land 30 people out of 100 are employed in raising the necessities of life, and if on irrigated land 40 out of this, the 40 who are thus employed will grow luxuries for the local community, or articles for foreign trade, requiring foreign luxuries in return, or they will be employed in building, handicrafts, &c., in all these things by which the comfort of the community is increased; or a large proportion will be at liberty to attend to the arts, to literature, &c. In Tanjore, the whole agricultural community, with trifling exceptions, is employed in growing rice. Is Tanjore bartered from one end to the other with rice rotting for want of consumers? Is it, without any comparison, the most wealthy and comfortable population in the Carnatic?

It will be high time to begin to consider how to get over this difficulty, when some district is sunk in poverty and misery in consequence of irrigation.

This is quite sufficient were the population perfectly isolated, but it is not to be imagined that the country will be much longer without water carriage, by which the interior will be opened to foreign markets. The produce of this tract would by canal be conveyed to the coast at two or three rupees a ton, which would be quite low enough to give it access to the markets of all the world.

I may mention here that a Company has been formed in England for carrying out irrigation and a system of internal navigation throughout the Peninsula, and if the guarantee of 5 per cent. is granted, as it is to the railways, they will instantly commence operations. One of their projects is to carry a canal from Bellary to the Eastern Coast, and there is not a single engineering difficulty in the way of cutting a canal at a very moderate cost from Bangalore to Bellary. Indeed, I think the cost of a small canal capable of carrying goods at one pie per ton per mile of the charge on the Madras Railway could not cost more than 5,000 rupees a mile. It would take only half a million cubic yards of water per annum, per mile, to supply for evaporation and leakage for 100,000 tons, which at the rate above calculated as the cost of water in the proposed Tank, 8 pice for 4,000 cubic yards would amount to 125 pice per mile, an insignificant portion of the cost of the work. I have ascertained that from the foot of the hill to the Commission's house at

Bangalore, there is a constant fall, so that water may be stored any where between the tank and let into the head of the canal in the midst of the station. It should be observed that the charge by the railway is 16 pice per ton per mile, so that if 1½ pice is charged by the canal it would cost only 4½ rupees to carry goods from Bangalore round by Bellary, Kurnool, and Cuddapah to Madras, while it would cost 24 pice to send them direct by rail, even if a Rail were laid. The charge for interest would be exceedingly small by canal. Supposing half the interest were paid by passenger boats and half by goods, and that 100,000 tons were carried per annum, the charge to pay 5 per cent. for interest, repairs and management would be, on a canal of 5,000 rupees a mile, 10,000 rupees or half pie per ton per mile. The high level canals, carried across the drainage of the country, in connection with the Godavery and Krishna Anicuts, and 30 to 40 yards broad by six feet deep, are costing 7,000 rupees a mile, from which I conclude that a small canal fitted for 30 ton boats would be cut in such a country as that between Bangalore and Bellary for 5,000 rupees a mile. I need hardly point out how greatly such a work would increase the value of the irrigation under the proposed Tank, even if it merely gave access to the local markets of Bangalore and Bellary.

The total charge for these works, as a whole, would thus be:—

Tank.....	4 lacs.
Distribution of water, 1,000 million cubic yards —	
at 2,500 per rupee.....	4 „
Canal 200 miles, at 5,000.....	10 „

18 lacs.

I merely mention this Canal, because I think this an excellent line for such a work. The boats would be 100 feet × 8 × 2 to carry 30 tons, and would certainly be worked at about one pie per ton per mile. The canal would be worked by steam for passengers at 10 or 12 miles an hour. I am fully assured that this is the kind of communication for Mysore, and that the idea of laying down rails at 28,000 a mile, (which is at 16 times the cost of a canal,) which would be worked at 10 pice, that is seven times the charge by water, (and they will yield two per cent., as they certainly would not, for the railway on the first 80 miles out of Madras does not say that)—the idea of such a work for Mysore would be a mere five minutes' calculation in comparison of such a canal.

To return to the Tank. I have given above a calculation of the comparative cost and total value of the water from such a work.

remains to estimate the direct returns from it, so as to make it a remunerative work to the State.

If we allow 1,000 millions only to be disposed of annually, or sufficient for one crop on 470,000 acres of rice, at 6,000 cubic yards per acre, the difference between the rent of dry and rice land in this part of the country is at present 5½ rs., at which rate the return would be

170,000 acres at rs. 5½ 900,000

And deducting 70 per cent. on eight lines for repairs

and maintenance 60,000

Profit *à* annum 840,000

or cent. per cent. And if instead of rice, the dry grains were cultivated, and one-third the above water rate levied, that is 1½ rs. per acre, while three times the area was cultivated, the profits would be the same. This would be equal to a charge of one rupee per 1,100 cubic yards of water.

There is nothing absurd in the conclusion that such a work might yield 100 per cent. in direct returns to the state. Many of the Madras works yield much more than this.

The water rate now being levied on the Godavery Delta lands, a ridiculously low rate in comparison of the tax on all other irrigated land in Madras, is two and three rs. per one and two crop land; while the total cost of all the works, when completed, will not exceed four rs. an acre, and this gives the people all the water carriage free. So, also, it is evident, from the estimated cost of the water, as compared with that now incurred by the Ryots every where in raising it from wells, viz., one rupee per 20,000 cubic yards, against one rupee per 500 cubic yards, that the profits on it must be enormous.

Whether it would be advisable to lay so high a water rate is another question; it is clear that the rate might be greatly reduced, but it would perhaps be hardly just to charge a much lower rate than what is levied in the old irrigated lands. Perhaps the best thing would be to lay only seven lacs, and instead of laying nine lacs on the whole, lay only seven lacs; and at the same time reduce the old rates to the extent of two lacs, for instance, so that the actual profit in this work would be five lacs, which would still be 60 per cent.; for which I should consider far more politic, cut the canal and leave it entirely free, so that the water rate (18½ lacs) would then be about 45 per cent. on the whole 18 lacs. It is evident that when a Canal is cut, as working it does not wear out the water for the advantage of the community that the greatest possible use

should be made of it, and the abandonment of the toll of ½ pie a ton per mile would lead to a greatly extended use of it, both for goods and passengers.

Respecting the supposed traffic of 100,000 tons a year, I may mention that on the principal line of canal in Rajahmundry, the traffic is already 150,000 tons a year, and it is increasing with extraordinary rapidity, (60,000 tons last year), and this notwithstanding the following disadvantages as compared with the canal here spoken of.

1st. It has no connexion with any town of more than 17,000 inhabitants, while Bangalore besides being the principal Cantonment of the Presidency, contains, I suppose, 100,000 inhabitants.

2nd. The supply of boats hitherto has so entirely failed to keep pace with the demand, that the charge is 3 or 4 pie a ton a mile, while the cost of conveyance is only about 1 pie.

3rd. The extent of country affected by the canal is very insignificant, and only a small portion of that which a canal 200 miles long would affect.

I would most strongly recommend that this subject of small canals for Mysore should be carefully considered. I am certain it is impossible to examine it without full proof that it is that which Mysore requires in the way of communications. After the enormous expenditure on Railways in England, and when, of course, most goods carried by them pay the least possible rate above the mere cost of carriage, (vast quantities, indeed, at a positive loss,) probably ¾ of all the goods moved there, are still carried by water, either by coast, the rivers, or the canals; and with respect to passenger traffic, while the Madras Railway charges 4 pie per mile for the lowest class of passengers, the charge on the Rajahmundry Canals is 1 pie in boats worked by men, and with this there is a profit of about 25 per cent., and it is now proposed to lower the charge to ½ pie, as it is found that the principal part of the travellers in this country cannot afford even 1 pie a mile. So that if a railway is laid in Mysore, the mass of poorer travellers, nine-tenths of the whole, will receive no benefit from it whatever, as is now the case with the Madras Railway, where every one of them is taxed to pay the toll, so that the melancholy results of such a work is that the few rich travel luxuriously, and the many poor pay for them.

There is one point which I beg most earnestly to press upon the notice of both the Mysore Commissioner and upon the Madras Government, that must be well considered in this case.

It is evident that the construction of this Tank will go

of it entire command of the Huggry river, so that they will have it in their power to give or withhold water from those tracts which are beyond the bounds of Mysore, just as they please.

I think it cannot be denied that the inhabitants on the lower part of the Huggry, and on the Poombudra and Kistnah, have a prescriptive right to a share in its waters, and that they cannot be deprived of all the share without injustice. Further, all future plans for the improvement of the irrigation in the Madras territories from those rivers, must absolutely depend upon the use that is made of the Tank. The owners of it may pursue one of two plans.

1st. They may, by allowing a portion of water to flow down the river from the Tank *shutes*, keep a certain stream of water in it throughout the monsoon, or for five months in the year, and thereby greatly improve the lower irrigation; or

2nd. They may allow none to pass down it excepting after the Tank is filled, when in the heavy bursts of the monsoon the water flows over the Calingula, and this would entirely ruin all the present irrigation of the Huggry and greatly injure that of the Poombudra.

This is, therefore, a point that must be attended to.

I have no doubt that this right of water would be acknowledged in any Court of Law.

What I would beg to suggest is, that the Madras Government and Mysore Commissioner should each nominate some person to consider this together, and propose a plan of procedure with respect to the quantity of water to be allowed to flow down the river.

There is one benefit that all the country below must necessarily receive from this work, and that is, the preservation from floods. In the case of the Kistnah Delta, I have been satisfied, from Captain Ory's arguments, that Tanks for at least 1,500 million of cubic yards must be constructed to secure these important works from injury from such a flood as that of 1853, and were there no other point to be gained by this Tank than this, I am convinced that it ought to be constructed. Indeed, I think it would be no more than right, that in settling the question of the water rights, the Madras Government should pay a certain portion of the cost of the Tank for this benefit: suppose 10 per cent; or 40,000 Rupees, for a Tank of the capacity of 1,000 million cubic yards. At this rate, it would be possible to obtain 10 Tanks for 10,000 million cubic yards for four lacs, a very trifling sum for such an advantage.

There are also one or two other points, in the construction of the Tank, which I wish to refer to. The first point of course, is, of course, the security

of such a work. The destruction in the country below, from its breaching, would be terrible.

I do not consider the bund, at the point most to be looked to in this respect. A bund of very moderate thickness is many times too strong to be breached by the mere pressure of the water. The one thing to be attended to in respect of the bund is to see that it is not overtopped. In this case there is the great advantage of having a saddle quite detached from the bund over which the waste water can be discharged. The only point is to have the Calingula of sufficient capacity. Nothing but a calculation would give any clear idea of the extent of work that is required in a case like this. There are the remains of many vast bunds in such situations in different parts of the Peninsula. I believe that they were all breached because their constructors had no idea of what was wanted in this way. In the present case, in the flood of 1854, there must have been, according to information, 12 million cubic yards per hour passing down the river at this point. If such a flood occurred when the Tank was full, and we must allow for a possibly greater flood than this, it would take a Calingula 400 yards long, flowing 2 yards deep, with a clear overfall to discharge the waste water. Happily there is a very long saddle, so that a very extensive Calingula may easily be constructed. But so far as my data go, I do not think that a less capacity of Calingula should be allowed than 400 yards long, by 3 deep. This is the point of the whole matter that must be looked to, and it as much concerns the Madras Government as that of Mysore; in fact, not only ought this point in the construction to be settled in communication with the Madras Government, but, after construction, that authority ought to have the work regularly visited and reported on by one of its own officers.

Another point to be looked to as respects the safety of the Tank, is the shutes. It must be remembered that we have not yet had to deal with the discharge of such large bodies of water under such heavy pressures as a head of 50 feet. Neither are there any precedents in other parts of the world. In England there are cases of discharge under heavy pressures, perhaps more than 100 feet of water, but then they are very insignificant as respects quantity, the water only being required for towns or navigation canals. There is nothing approaching to a discharge of a million cubic yards per hour. This, therefore, is a point which I think should be very carefully discussed by two or three experienced engineers. And I would strongly urge that three or four considerable premiums should be offered, in England, France, America,

for plans and sections of sluices, to discharge, suppose, from 100,000 to 500,000 cubic yards per hour, under heads of water varying from 5 feet to 150 feet.

I must here observe that this site has the further advantage of having rock to be cut or tunnelling through, where the sluices are constructed, so that there will be no danger of a breach occurring from any failure of a sluice. At least, I saw one cutting making through rock, and I believe rock will be found at the site of the other.

The quantity that these sluices must be made capable of discharging ought to be carefully calculated. If 1,000 millions are discharged during the monsoon in 150 days, it will be at the rate of 300,000 cubic yards per hour, and if there are two sluices, this will require that they shall each be capable of discharging 150,000, with a very small head of water. The cuts through the saddles are of considerable length, 4 or 500 yards, and if a current per hour of 10,000 yards, or 5 miles is allowed, it will require so large a section as 15 square yards, or suppose 5 yards x 3 for each channel. I believe the principal part of the land for irrigation will be under the Northern sluice, but if 50,000 cubic yards are allowed for irrigation on one side and 50,000 on the other, and 100,000 are left to flow down the river, the two sluices might be made of equal capacity.

The only point remaining seems to be the stone revetting of the bund. This, happily, is much sheltered by the parallel lines of hills in the bed of the Tank. But still, a stone revetment I consider absolutely necessary, and I would recommend an inner slope of 3 to 1 to the bund, and that the stone should be simply laid on the slope, as is done in England. There will be no occasion for stone much below the level of the sluices, but the level near the highest water mark should be laid with large stones.

With respect to the capacity of the Tank, I would strongly recommend that, considering the precarious nature of the monsoon here, and the suitableness of this site, the Bund should be made as high as possible. I understand that the saddle is 150 feet above the bed of the river, or 15 feet above the proposed level of the water. I think it is a great question whether it would not be advisable to make a Calingula, suppose 9 feet above the saddle, raising the water of the Tank 8 yards and increasing its capacity about 600 millions of cubic yards. I think it would be well worth while to obtain this additional capacity and to provide more perfectly against a chance of failure of monsoon. I estimate the capacity of 2,300 millions, and allowing for a discharge of

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1,000 millions during the monsoon, making a total of 3,300 millions, equal to a rain-fall of 18 inches over the whole basin, besides what was evaporated from the land, it would often not fill and overflow at all, but it would be a great thing to have it in one's power to store the water of superabundant seasons.

It will be observed that none of my data are at all exact, but I feel assured that the calculations I have given afford a view of the case substantially correct.

I need only further say that I look upon this work as one of the utmost importance to all India. The storing of water on a large scale, I believe to be one of the fundamental points for its material prosperity, providing at once for the three great objects, viz.:

- 1st. Irrigation.
- 2nd. Navigation of its rivers.

3rd. Protection of the low country generally, and especially of the vast Delta works, from injury by floods. I would venture to say that I cannot think the Commissioner could have taken a more important work in hand.

COTTON, Colonel,
Comdt. of Engineers.

CUTTACK, 12th April 1858.

IRON. OR WATER

FOR

INDIA:

FROM COLONEL A. COTTON, *Commandant of Engineers.*

To T. WYCKOFF, Esq., *Chief Secretary to Government.*

SIR,

I have the honor to transmit a Memorandum, on the proposed Railway in the Southern Mahratta country, in obedience to the orders of Government dated 17th September 1858, No. 1878.

I have in many late papers respectfully requested the earnest attention of Government to this fundamental question, the question on how money should be expended for the material improvement of India.

This proposal of the Bombay Government seems to bring us fully to an issue on it.

Will three millions expended on a Railway from Hyderabad to Beikul, relieve that tract of country from its principal material evils, on the one hand? or on the other, will it (as I think I prove) be the most effectual step that could be taken to prevent that tract from ever obtaining the essential benefits of cheap production and cheap transit?

Most certain it is, that if the latter is the effect of spending money upon a Railway there, every additional million that is spent in this way, is an additional obstacle thrown in the way of the relief of India generally from its main material evils! The Railway interest is already very considerable, and its very existence depends upon its succeeding in depriving India of cheap transit, and it is absurd to expect that its influence will not be courted to resist that which is certainly directly antagonistic to it. And so also with respect to the other great fundamental point of finance.

Will this three millions if spent on a Railway afford a great and important relief to the at present insolvent state of the Government? or will it add another permanent burthen of £150,000 a year? (for I doubt whether this Railway will pay its expenses.)

This Government has in its most important Despatch of the 15th May last clearly declared the conclusion, which its ample experience had brought it to, that expenditure on Hydraulic works was extraordinarily remunerative, and would afford a complete relief to the finances.

Such a declaration from the only authorities in India, who could give it from their own knowledge and experience, seems to me to be of the very first importance, but not second to it (I think) will now be as decided a protest against the proposed extension of the railway system to the Southern Mahratta country, if, as I cannot but hope, the facts and arguments of this Memorandum are sufficient to satisfy them, that my conclusions are in the main sound, as to the effects of such a work in that locality.

I look upon this opportunity as one of the most valuable that could be offered to India's authorities. A decision now made will certainly secure at length a real examination of this vital point, and I am quite sure nothing more is required than a real examination to satisfy every body who is willing to be satisfied about it.

The late Secretary to the Government of India, the D. P. W. was certainly right when he protested against "adverse discussion" on the Railway question; nothing but its suppression could secure the further expenditure of millions of works which would shut out India from cheap production and cheap transit, and thus effectually prevent it from meeting other lands on equal ground in the markets of the world.

MEMORANDUM OF COLONEL A. COTTON ON THE BOMBAY MINUTES OF THE MEMBERS OF COUNCIL ON A RAILWAY FROM BEITKUL HARBOUR TO HYDERABAD, PREPARED IN OBEDIENCE TO ORDERS OF THE MADRAS GOVERNMENT, 13TH SEPTEMBER 1858.

The order transmitted to me with these Minutes so clearly requires my explicit opinion on this subject, that I trust I shall be excused stating opinions so entirely opposed to those expressed in all the Bombay Minutes. I regret that I should differ so entirely from those so much superior to me both in office and knowledge of other matters, but as my whole attention has been given to Engineering matters, and especially to this subject of communications, and I have had such peculiar opportunities of investigating the subject both from the information sent me and from that I have obtained from works with which I have been more or less connected, I am in hopes that I may be allowed to give an opinion without presumption on such a matter, even though contrary to the views held by those who have not such professional knowledge and experience.

I may premise that all these Minutes are written on the grounds, as already established, first, that railways in India will be profitable speculations; 2nd, that they will be more profitable upon the whole, that is, directly and indirectly, than any other way of spending the same money; 3rd, that they will answer the purposes of the country as communications, that is, that they can carry the great traffic of the country, that they can do what is required for that purpose both in respect of goods and passengers, and in respect of cost and quantity.

The Minutes take it for granted that railways are such communications as will meet those three evident demands. What I beg to submit, is, that they thus in fact, beg the whole question.

This is certainly in accordance with what has been done by others respecting railways. They were entered upon without the slightest

investigation on either of the two latter points. On the first, indeed, there was a sort of enquiry, but no "adverse discussion" was allowed, and in consequence the calculations were never tested, and in my opinion which is supported by present results, they would not have stood any test. I have not seen even a calculation of the cost of working a railway in India, and I have every reason to believe that there was no careful investigation of this fundamental point. I have not the original papers about the Bengal railway with me, but to show how loosely the whole subject was handled, I may mention that in the calculation of the present cost of transit by the river, two of the items allowed were interest and insurance on an average value of goods at £40 a ton, for the whole traffic, the great mass of the traffic being grain, &c., value from £3 to £5 a ton, so that probably the average does not exceed £6, thus making a miscalculation in these items of 7 to 1.

As to the great question whether railways were the communications that were suited to the particular circumstances of India generally or of certain parts of it, it was never, I believe, raised at all.

It seems to be a peculiarly suitable time to examine these points, so intimately connected with the material welfare of India, now that actual results of the working of some railways in each Presidency afford in some measure some grounds for our conclusions.

The question immediately before me seems to be, is it expedient to construct a railway (of course for high speed like those already constructed) from the proposed harbour of Beikul to Hyderabad?

I conclude that this question may be fairly divided into the three above proposed, viz.:-

1st. Will a railway answer as a speculation?

2nd. Is it a more beneficial way of spending money on that tract of country than any other?

3rd. Will it answer its purpose, that is, will it carry such quantities and at such cost as the country requires?

The comparison of such a communication with other kinds, viz., with common roads, light railways, and waterways, will necessarily be examined in the course of these enquiries.

With respect to the 1st question, in one of the Minutes, it is given as an opinion, "that it would be a very profitable undertaking as regards the Company who carry it out," and in another, that "of the financial *** value of it *** there can be no doubt."

Matters have now so far advanced that we may best form a judgment on this point by the actual results of the lines now in operation.

In Bengal the line from Calcutta to Bardwan, 120 miles, has been open 3 years. I give in the appendix returns of receipts and expenditure up to the end of last year.—They were

	Rs.
For 1857, Receipts - - - - -	14,50,000
Expences - - - - -	5,90,000
	120,8,60,000

Profits per mile - - - - - 7,000

I don't know exactly the cost of this line up to the present time, but I believe it is about 1,20,000 Rs. a mile, including rolling stock, &c., on which the apparent profit has therefore been 6 per cent.

But I must observe that the publication of the accounts in this way, though true in the letter, is calculated to convey an entirely false impression of the financial results; the two great items of the current expenditure on railways do not appear in them, viz., depreciation, and repairs. For the first nothing at all is allowed, and for the latter a mere trifle, because there is not an old locomotive, or carriage, or rail on the line; every thing is new. It is therefore quite certain that this 6 per cent. does not represent the true profits on this line. What the actual cost of repairs and renewal will be in India we have no positive data, we can only form an estimate of it from such data as we have.

A very complete account of the expenses, &c., of all the railways in the State of Massachusetts in the United States, the best railway accounts I have been able to obtain, the average cost of repairs and renewal of the road only on 1367 miles, is 2½ per cent, and the total locomotive expense is 1½ per cent, so that adding for rolling stock, the total cost of repairs and renewal cannot be much under 3 per cent there.

The report from which this is taken adds, "This experience of 9 years' working cannot be very flattering to railway proprietors. The expense of keeping up the track, that is, of maintenance of way, has greatly disappointed expectation in America, as it has there" (in England). I should think, considering the great heat and heavy rains of Bengal, the cost under these heads will be greater than in Massachusetts. Allowing the same, it reduces the profits to 3 per cent.

Now in considering this result, we must remember that this, the first 120 miles out of Calcutta, is, without any comparison, the line of greatest difficulty of any line that could be formed in India. Nothing

like the great mass of passengers that go for a moderate distance to and from the most wealthy city of India, can be found at any distance from the great cities.

This is therefore an extreme case.

On the Bombay line, I have not the traffic for any length of time, but the traffic receipts for the last half of June 1858, were 330 Rupees per mile open (130 miles) or at the rate of 8,600 Rupees per annum; $9\frac{1}{2}$ per cent if the road has cost 90,000 Rupees, but I have no statement of the actual cost. I cannot however, I believe, be very far wrong in that sum. The per-centage of expenses upon gross receipts was, in 1857, about 47 per cent, allowing the same for 1858, it will leave for profits just 5 per cent. This line is like that of Bengal, it is the first 140 miles out of a great city, and the accounts include no sufficient sum for repairs and renewal in consequence of everything being new. But this calculation also omits the cost of the Bhore Ghaut. I hear about 80 lacs, which would add about 60,000 Rupees a mile to the cost of the whole 140 miles of which the road will then consist; and the above profits on 150,000 Rupees a mile would be only 3 per cent, and deducting from this 3 per cent, for repairs and renewal, there would remain no profit on this, one of the great lines, the first 140 miles out of one of the capitals of India. If the cost of the Bhore Ghaut is distributed over a greater length of line, then we must enjoy diminished receipts; for the average receipts of 400 miles, from Bombay, cannot equal the average of the first 130. On the Madras line, 150 miles out of Madras, the present receipts are on an average about 90 Rupees a week or 4,700 Rupees a year, 7 per cent on 70,000 Rupees a mile, and allowing the same proportion of expenses as last year, the net profits would be $3\frac{1}{2}$ per cent, and deducting here also 3 per cent for renewal and repairs, $\frac{1}{2}$ per cent.

It is, in my opinion, impossible to mistake in the conclusion to be drawn from these actual results on three different lines, immediately adjoining three of the capital cities of India.

It is commonly said that the traffic will increase as the lines extend. It will undoubtedly increase on the part now worked, but the average of the whole will diminish. It cannot be imagined that the traffic on the 2nd and 3rd 100 miles from a capital will not be greatly less than on that of the 1st, and therefore if the whole of such traffic were added to the 1st, it would not very greatly increase the average, but in point of fact by far the greater part of the traffic of each portion will be local traffic, and will not affect that of the other portions. It is, up to

a certain distance, the average traffic will increase, because an extremely short line will not draw the whole traffic even of the tract through which it passes, but it is impossible that the average of 500 miles from a capital can equal that of the first 100 miles.

I therefore submit that these results are alone quite decisive as to the question of great railways being profitable speculations in India, while in its present state of wealth, and consequently that we have far stronger proof that on the particular line here proposed, not leading to a capital, even anything like interest for the capital can be obtained.

Further, we have the results in England. The net profits, according to the returns, are now just 4 per cent on the capital, and the average cost about £35,000 per mile. Certainly the average cost of railways in India will be only about a quarter of those in England, but if we compare the enormous disproportion of wealth in the two countries, it is also certain that nothing like one quarter of the number of travellers could afford to use railways here at English charges. We cannot be wrong, therefore, in concluding that throughout India railways will not make such profitable investments as in England.

Again, in Massachusetts, where the average cost was only £9,000 a mile, the profits were $6\frac{1}{2}$ per cent, and the wealth of the community there is of course many times that of India. Also the value of money there is much less than in India, and the £9,000 a mile represents a less capital than 90,000 Rupees invested in India.

I must also observe, that there is great doubt thrown upon English accounts, as there must be still there are independent Government Inspectors appointed to examine them. Almost all the lines are making very small dividends, some, as the Great Western at this time, none at all, and of course in such a state of things, there is a strong bias on all concerned to put as much as possible of the expenditure to the item of new capital, and also to have large sums under the head of unadjusted accounts, both which must necessarily cause considerable doubt as to the reality of the sums set apart for dividend.

Thus, the following railways have added these sums to their capital account in the last half year;

London and North Western.....	454,000
South Western.....	225,000
Great Western.....	62,000
Brighton.....	35,000

And the following are outstanding accounts.

London and North Western.....	469,000
Manchester and Lincolnshire.....	258,000
Lancashire and Yorkshire.....	230,000
Great Northern.....	143,000

While such enormous items as these appear in accounts which are not inspected and publicly reported on by Government Officers, there must be great uncertainty that the present dividends will be supported.

By a letter in the Railway Journal, 15th May 1858, it appears that 20 millions have been added to the capital of the Great Northern in 10 years; that while the gross receipts had increased by £730,000, the dividends had fallen from 10 to 4½ per cent, the goods traffic having increased from 900,000 tons to 5,000,000. Of course no other possible conclusion can be drawn from this than that even after charging £20,000,000 to capital in ten years, the increase of goods traffic has still caused an enormous loss. Without, therefore, a strict inspection of accounts by officers publicly responsible and totally unconnected with any individual railway, we cannot be certain that current expenses are not charged to capital. From all the information I have been able to obtain, I have myself no doubt that the real profit on English railways is considerably under 4 per cent.

I must also particularly notice the fact above stated, which is common to many English railways, viz. continual increase of receipts with a constant diminution of dividends. There is, of course, also a strong bias in all concerned, in order to keep up the appearance of prosperity, to show an increase of receipts, and hence to carry at losing rates, and that this is done, is certainly proved by the above fact. Consider also the following admission in an editorial in Herapath's Railway Journal, the great advocate for railways, "In many railways we have noticed that during the last half dozen years (and in some cases longer) they have spent each half year (as capital) 'sums about as large as the profits paid away in dividends'."

The Consulting Engineer of the Madras railway showed in his last half yearly report that there had been a clear loss both on 1st class passengers and on all goods, though the latter are carried at an average rate of 10 P. (1½d) per ton per mile, and though nothing is allowed for depreciation, and of course only a small proportion for repairs; as all is new there also. The results of the Madras railway up to the end of 1857, were as follows:—Length 81 miles, east without

rolling stock, for a single way, 53,000 Rs. Receipts 104,000 Rs. for the half year, expenses 56,000 Rs. or 51 per cent, which, on a supposed total cost of 70,000 Rs. a mile, would be a *nominal* profit of 2½ per cent, or for the year 1½ per cent, and allowing 3 per cent for renewal and repairs, a loss of 1½ per cent.

It seems to me impossible that there can be any question, after this investigation, as to the line from Beikool to Hyderabad being profitable. If none of the lines immediately adjoining the three capitals pay even merely the guaranteed interest, we have the most certain grounds for concluding that this line, in an out-of-the-way part of the country, will not do much more than pay its expenses, if it does that. I don't see how we can be mistaken on this point. These data are surely quite sufficient to establish it.

Before proceeding to the other two points, I may here properly refer to a minor one started in these Minutes, viz. as to how *any* can be laid out, so as not to compete with the Bombay line. It seems to me most certain that whatever line is laid to Beikool must be a directly competing line with that to Bombay. Beikool will become a large port and city, and will, even with a railway, draw off a very large proportion of the traffic both in goods and passengers from the Bombay line. I cannot see how there can be any question about this. Any line running from a certain tract of country to a port must compete with all other lines in that part, whether it runs nearly parallel to them or perpendicularly. The only question with the producer and the merchant is, how he can get his goods cheapest to the port; and the passenger traffic must follow the line of the goods traffic in India, and it does not matter to them whether the line runs to a port due north, or due east or west. Thus, the north and south canals at Madras compete directly with the railway, although they run perpendicular to it, because the people of Madras don't care whether their consumable articles come from districts west of Madras, or north and south.

The proposed line, therefore, while it will not yield profit itself, will undoubtedly greatly diminish the traffic on the Bombay line.

My second question is, Is this railway a more beneficial way of spending money on that tract of country than any other?

Surely this is only a question of common sense. The grand object is to promote the material improvement of the country, it is for this that capital is spent on public works. Surely if we are going to spend a million on a certain tract, we should all conclude that we had made a great mistake, if we afterwards discovered that, as we had spent

it, it had only yielded 1 per cent of total benefits, while a more judicious mode of spending it would have yielded 100 per cent.

I append to this Memoir a report on the traffic on the Bengal railway, with some remarks I made upon it, at the desire of the Lieutenant Governor of Bengal, together with a comparison of the actual cost and results of that railway and an estimate of those of a canal on the same line. I give this as a striking illustration of the effects of taking a ^{note} in hand without properly examining this point. From this it will be seen that there is good ground for believing that even on the present traffic there would be a saving of 15 lacs a year, taking together the profits to the shareholders and the diminished cost of transit, to the public, and probably, including the new traffic, would be produced by the lower rate of transit, not less than 25 lacs a year, had a canal been constructed on this line instead of a railway, and that ~~and the same money~~ that has been spent on this 120 miles of railway, been spent on water-ways, it would have been ample to provide all Bengal with a complete system of such water-ways of several thousand miles, conveying both passengers and goods at $\frac{1}{3}$ or $\frac{1}{4}$ of the railway rates.

I cannot but think this is a sufficient example to warn us against entering upon such an expenditure as is now proposed without first examining the matter ^{on} this point of view. What possible object can there be in spending money upon the country in a way that will yield 1 per cent, if we could spend it in another that would yield 100, and of course we are liable to do this if we do not first make enquiry.

Even if it were settled that the most profitable expenditure would be on communications, it would remain to ~~consider~~ ^{decide} on the kind of communications in that particular tract of country: for instance,

Whether on Common Roads,

Light Railways,

Heavy do.

Canals,

or Rivers.

It will be sufficient for our present purpose that for the cost of a mile of heavy railway, we might have

16 miles of Road,

or 1 of Light Railway,

15 or 25 of Canal,

or 25 of improved River Navigation.

Now, surely this is a real question. Tried by the test of direct and indirect profits, which I am convinced is the only true test of such expenditure, nobody could doubt that any one of these works would be many times more profitable than the same money expended on a heavy railway, in the actual circumstances of that tract of country. And I must again observe that no road or railway can carry the quantity required on a main-road in India.

But there is also the question of irrigation, particularly as that can be combined with navigation in the same works. Suppose that 400 miles of railway were to be laid at 30,000 Rupees a mile, costing 3½ millions sterling, and that for the same money at 10 Rupees an acre, 3½ million of acres could be irrigated. The cost per acre in Rajahmundry is only about four Rupees; and with respect to the value of the increase of produce, Captain Meadows Taylor shows that in these districts, the ryots water their lands at an average cost of 2½ Rupees an acre per annum, showing that the value of produce must exceed that. In Rajahmundry we reckon an increase of 16 Rupees on one crop. At this latter rate, the increased value of produce on 3½ million acres would be 560 lacs a year. But this would at the same time provide, probably, at least 2000 miles of canal navigation, besides connecting, perhaps, 4000 miles more of navigable rivers. Can there be any comparison between the benefits to be derived from the money so expended and that of the same money expended on a railway, and what can possibly be said why a railway should be constructed in preference?

As I have stated the case of the Bengal railway, so also I may mention the case of the Ghore Ghaut. It is said to cost 80 lacs; the direct distance is about six miles, but it is lengthened to 13 to obtain the required gradients. Now compare the results obtained in this way with the same sum to be expended on irrigation from the Kistnah and Godavary. The results there will be 20,00,000 of acres irrigated, and more than 2,000 miles of navigable canal and river. The increase of produce alone will be on an average of 20 Rs. an acre, including some two crop land, 600 lacs a year, besides 2,000 miles of communication conveying goods at 1½ to a ton a mile.

I cannot but believe that when these things are pointed out, it will be acknowledged that in future they warn us to consider this question. Whether under the circumstances of India it is wise to spend money in one way rather than another? This one Ghaut has supplied India permanently with a charge of four lacs a year, while the same money might have certainly yielded a relief of 40 per cent or

32 lacs a year to the finances, and have left an enormous amount besides in the hands of the land-owners. Were India like England, overloaded with wealth and covered with almost every kind of public work; it might be a question whether we might not amuse ourselves with spending three quarters of a million upon six miles of Ghaut, but while the country is so poor, almost entirely without public works of any kind, and insolvent in its finances, I must insist upon it that the question whether we are going to spend our money to something like the best advantage, is an essential one in every proposed work. Whether the work we are setting about will, like the Bhoire Ghaut, be a great addition to the burthens of India, or whether like the same sum spent in the hydraulic works for irrigation and navigation in Rajahmundry, Masulipatam and Guntoor, will be both an immense relief to the poor of the country improved by it, and at the same time not only provide its own interest, but also afford a very large relief to the finances of India, already at least 10 lacs a year; and there is every reason to believe when the works are completed, much more than half a million sterling a year.

I come now to the 3rd question I have proposed, *viz.*, Will this railway answer its purpose? that is, will it carry such quantities and at such cost as the country requires?

Is a railway the kind of work that will effectually carry the great traffic of a country?

This I urge is the question. Not—Will it carry a small portion of the passengers and goods that ought to be moved at a high speed and a high price, and that only at the cost of taxing the country in other ways to pay for this advantage? From the data and calculations above offered, I conclude certainly, that supposing on the 350 miles now at work at Bombay, Calcutta, and Madras, 21 millions sterling have been spent, and that the bona fide profit does not on an average exceed 2 per cent, there is already a clear addition to the burthens of India of 7½ lacs a year, which must be paid by additional taxes of some kind. And every additional million, as it is expended in such works at a greater distance from the capitals, must entail greater loss. On the 30 millions already guaranteed, we cannot suppose less than an average loss of 3 per cent, or nearly a million sterling, thus doubling the previous average deficit in the finances.

I return, therefore, to the question I put to myself.

Let us on this point go upon the same safe ground as in answering the former questions, *viz.* the results on the Indian lines already open.

First, the Calcutta line. The total number of passengers per annum is something above a million, but they travel, on an average, only about 30 miles or a quarter the length of the road (vide appendix A,) so that the average number travelling the whole length is 2,50,000 or 800 a day, on the first 120 miles out of the chief city of India, on the main line leading to the interior. From the vast numbers who travel in the populous parts of India even without any facilities, we cannot be wrong in supposing that on such a line as this, if they were carried cheap enough to meet the actual necessities of the people, this is not a tenth part of the number that could and would travel along it. On one of the four main approaches to Madras, 3,000 a day travel on one of the main roads. In Tanjore, a way from the great city, 1,200 men a day; over a bridge three miles from the temple, a city of 100,000 inhabitants, 20,000 people a day pass. We may confidently conclude that if on these lines there were cheap facilities for travelling, numbers would be greatly increased. I cannot think, judging from these and many other such facts, that less than 10,000 would travel on the first 120 miles of the Great North Western Line out of Calcutta, if they could be conveyed at prices suited to the state of the country.

On the Madras line, the number is 250 per day on the average of the whole line, and the Consulting Engineer says in his report dated 15th December 1850—"If Mr. Pancher will take a trip any new morn on his own responsibility will find ocular demonstration to the contrary. He will find many travellers of both sexes, but very few of them on the rail, though the charge is reduced to 4 pie a mile." Again—"how does he account for all these crowds of people walking or driving in bullock carriages along the road to Trivelloor on occasions of festivals? The railway authorities are prepared to give and give any amount of special accommodation on those days, yet the people walk. They give them the means of going and returning the same day, yet they walk 26 miles and back, and probably lose three whole days in doing it."

Again, "the rate (4 pie) is altogether too high. It is too high, whether we consider the condition of the people, the value of money, or the cost of the lines." Again, "the mass of the people do not travel on the line, yet they do travel—on foot or in bullock carriages." Again, "the actual results are notorious. As a rule, none but the wealthier classes of the native community have availed of this rail. On all occasions of feast, at Trivelloor, which lies close to the rail and at 26 miles from Madras, a common and very inferior road, running nearly parallel with it, has presented to the railway officials the unsatisfactory spectacle of

thousands of people, some in bullock carriages, others on foot, passing to and fro between that town and Madras." All these quotations are not from opponents of the railways, but from one of their strongest advocates. Colonel Pears wrote a book two or three years ago, strongly advocating railways as the works which were best suited to the country.

That is the railway so far from accommodating many who could not travel before, carrying only a small proportion of the numbers of previous travellers.

On the Bombay line the numbers were 2,000 a day and as the average distance travelled was 24 miles, or rather more than a quarter of the whole length of the line, the average number for the whole distance was about 550 a day, of which the 1st and 2nd class together were only $\frac{1}{10}$ th part, or about 55 a day.

The results of the Bombay line up to the end of 1857 were, length 130 miles, of which double 33, single 97 miles. Average cost 91,000 Rs. a mile. Receipts per mile 4,000 Rs., expenses 1,900, nominal profits 2,100 Rs., which on 91,000 Rs. gives per annum $4\frac{1}{2}$ per cent, and deducting from this 3 per cent for renewals and repairs, it leaves $1\frac{1}{2}$ per cent for the probable real profits.

Captain Rivers, the Consulting Engineer's remarks on this are: "the ordinary traffic for this half year is 21,000 tons. The railway had, at the close of this report, been open more than 18 months to the foot of the Ghats, and yet on 89 notes there is shown an average of 60 tons each way daily, a traffic insignificant considering either the trade of Bombay or the cost of the line or the expectations which Government and the originators had in constructing it. But this remark supposes that the 21,000 tons were carried the whole length of the line. Probably they were not carried half of it, so that the average quantity carried along the whole distance could not have been 30 tons a day each way, or at the rate of under 20,000 tons per annum, a quantity insignificant indeed on the only land line leading into one of the capitals of India, and had it been 50 times as great, or 1,000,000 tons, which a communication on such a line ought to carry, it would still be of no consequence, while the goods are carried at a charge only a shade below that of the old means of transport."

The remark of the Bombay Government on this is "the returns continue to show that the Company have succeeded in diverting only a very inconsiderable portion of the goods from the old mode of transport, and strengthen the opinions of Government that the present rates operate injuriously to the Company's interest." But this remark supposes that the

Company could afford to carry cheaper than it does, of which we have no proof. It is certain from the lowness of the profits, (probably not more than $1\frac{1}{2}$ per cent) of which by far the greater part must be derived from passengers, that the profits on the goods even at the present rates, are insignificant, but it is much more probable, that on this railway also (as the Consulting Engineer has shown to be the case in Madras) there is an actual loss in the goods traffic. The fault is not in the passengers of the railway, but in the appliances. After all this enormous expenditure, goods cannot be carried by it so cheaply as by the old means, without allowing anything for interest.

Compare these quantities carried by the railway on all the three most important lines in all India: the proposed entrances into each of the three capitals, 20,000 to 30,000 tons a year on each, with the 150,000 tons already carried on the Gomutra canal, though it runs hundreds of miles from any one city, and has not a town of 20,000 inhabitants anywhere near it, and though the supply of boats is so far from keeping pace with the demand, that the charges are three times as high as they need to be. There are no discussions there as to why the goods are not carried by the canals in preference to the old modes.

I must especially notice the utter insignificance of the number of 1st class passengers, those for whom all this enormous expense has been incurred. In Calcutta the average for the whole length of the line is 15 a day, in Madras 3. Now we may safely say that, excepting these, almost the whole of the remainder would prefer, if they could obtain it, a lower speed and lower charge. They only travel in this way because they have no choice, therefore speed is not a benefit to them, but because necessarily united to a high charge, a real loss. Probably nine-tenths of these travellers, if they could, would travel at half the speed, and half the charge.

I must also notice that after all this expense has been incurred, even the proposed object is not attained, viz., high speed. These railways are all worked at from 10 to 18 miles an hour less, after all, than the speed which the Hudson river is worked by steamers. The reason is, that after the expense of constructing has been incurred, it is necessary, in order to keep the bare cost of transit down even to the present high charges, to work at a moderate speed. Were there a steam boat canal by the side of these railways, they might be worked very cheaply at a higher speed than the latter. The charge on the Hudson is 2 1/2 p. a mile for 1st class passengers, and 1 1/2 p. a mile for goods, without allowing for

the difference in the value of money in America and India, which is 6 or 8 to 1, so that 2½ P. there, is not equal to ½ P. here, $\frac{1}{3}$ of the charge here. And so also in England, passengers are carried at from 1½d. to 2d. per mile from London to Edinburgh, with all the expenses due to a very bad sea navigation, equal to from ¾ to 1 P. per mile, and allowing for the difference in the value of money, from ½ to ¾ P. in India, and it is evident that on a steam boat canal, these charges might be still reduced. Such is the difference between land and water carriage even at high speeds.

It is thus clear that at present, the railways don't meet the wants even of the 2nd class passengers, and they scarcely touch the 3rd class at all.

Let us consider this point also by means of the charges themselves. In Calcutta the lowest charge is three P. (2½) this is equivalent to ~~as much as~~ as much as at home, or 2½d. nearly 2½ times the charge for the lowest class in England, and it is notorious that one that has money to spare here, there are ten there. To put the people of India on a par with those in England, the charge ought not to be reduced merely in proportion to the value of money, but below that. It ought to be under ½ P. per head.

On the Rajahmundry canals, the charge is one P. and it is fully ascertained that this excludes by far the greater part of those who would travel. It is now proposed to reduce the charge to ¾ P. in order to obtain greater profits. And if the boats were worked by steam instead of by men, they could afford to carry at ½ P. with a good profit. Worked by men and charging one P. they are yielding now 30 per cent.

How grievous it is to see this enormous expenditure incurred, and after all, the main wants of the country as respects even passenger traffic unsupplied by it. Even in the respect what is wanted is to convey from 5 to 10,000 persons a day at prices of from ½ to 2 P. whether they go at 10 or 20 miles an hour, whether it takes two or four days to travel 1,000 miles, is a matter of entire insignificance in comparison.

The certain consequence of the construction of a railway on the proposed tract will be, that an insignificant proportion of those who used to travel will be carried at these ruinous charges, and that for this even the country will have to be taxed in other ways to provide interest for the capital expended.

Secondly, let us consider the goods traffic. I urge that this is in reality the first point in the question of communication in the present state

of India. India is not in the position of the gentleman whose question is not about money, but how he may travel most speedily and with the greatest ease; but in that of the farmer with whom the grand point is how he may get his produce to market at a charge that will enable him to sell it profitably. When India has by means of obtaining access to markets, been enabled to sell its produce, and so secure more than the bare necessities of life, then it might entertain the question of travelling with ease and speed, if the two questions were really separable, but they are not; the same means that will provide them sufficiently cheap transit for their goods, will also provide them with speedy and pleasant transit for their persons.

We have then to consider the suitability of railways as respects goods traffic, using the actual results on present lines for this enquiry also. First, on the Calcutta line. The total quantity of goods last year (not coals) was 49,000 tons: supposing that they are carried 30 miles, the average for the whole length of line would be 20,000 tons. The distance carried may be more than 40 miles, but the average quantity cannot be above 25,000 or 30,000 tons, which supposes the average distance to be 60 or 70 miles. But the highest of these numbers is utterly insignificant, even as respects quantity. Compare it with the water traffic to Calcutta. Compare it with the reported traffic in four months on the Nudda rivers 600,000 tons. I cannot find a memorandum of the total traffic on the two Calcutta canals, but unless my memory fails, it is about 3,000,000 tons a year. The boats entering the circular canal alone were 170,000 last year, a year of confusion, probably containing 2,000,000 tons.

When we look at these quantities and see the railway carrying but 1/10th part, it is clear that even as respects quantity it is a matter of entire insignificance. But when we examine the prices we find that even if it carried fifty times as much, it would still be a matter of no sort of importance, because it carries at prices only just a hair's breadth under those at which the goods were previously carried. What does it matter whether the goods are carried by rail or by road, if there is no tangible reduction of cost. It has an appearance of being a point gained, when the rail succeeds in abstract the traffic from the old modes of conveyance, but the change is no real benefit to any body, that is, no benefit worth mentioning. In this case, suppose 50,000 tons have been transferred to the rail, and that there had been so great an actual reduction of cost as 4 A. per ton per mile, the total saving to the public is 500 Rupees a mile, or 10,000 Rs. a year, an insignificant sum in comparison of an expenditure of 150 lacs.

But there is also a traffic peculiar to this line, viz., the coal traffic. It is evident that there may be any where a peculiar mineral traffic of this kind, which in some important respects distinct from the general heavy traffic of the country, and each case requires separate consideration. This traffic was before carried entirely by the Damoodah, a small river flowing only a short distance, liable to sudden changes, and never affording a steady navigation; a river navigation, in short, of the lowest kind, for a great part of the year with water, and in the monsoon alternately in flood and very low. It also enters the Hooghly so near the sea that that river there is very shallow and exposed, and the distance is 40 miles more than the direct line. The expense of transit on it is accordingly very high for water transit, viz. 6½ P. per ton per mile of distance carried, and 8½ P. per mile of direct distance, while the cost on the Nudda rivers is about four P. per mile of distance, and by the river and Sagherbunda two P. for grain, and it would be less for minerals. The trade up river to the Ganges is carried at 1 P. per ton per mile. The total quantity carried last year was 90,000 tons by rail, and 50,000 by water. The charges were 3 As. a maund = 5½ Rs. a ton by the latter, and, 2 As. 10 P. = 5 Rs. nearly by rail. Thus, as was stated for goods, the least possible difference is made, and were the whole of this saved, it would, only amount to 22,500 Rs. a year; but it is not, for at Howrah the coal has to be discharged into boats to be conveyed to the different points where it is required, so that the saving must be quite insignificant, and this is further proved by the fact that the difference of charge is not sufficient to transfer more than ⅓ of the whole to the rail. There is thus the least possible benefit to the public by the change.

It is no fault of the railway management; it is the defect of the apparatus itself; it is like a man cutting up firewood with a knife, he must of course charge high. The fact is, the railway is not suited for this work. A canal on this line could certainly carry the coal at one P. a ton a mile, or 10 As. for the 120 miles, and thus save 4½ Rs. 6 As. per ton, or 5½ lacs of Rupees on the whole present quantity, and as such a reduction amounts to 60 per cent, on the cost of the coal at Calcutta, it would certainly cause a very great increase of consumption; and probably a saving to Calcutta of 10 lacs a year would thus be produced on this one article, were a suitable means of transit afforded, instead of which under 22,500 by the railway. By the present arrangement it is, in fact, just as if all the grain on a gentleman's estate was carried to market in carriages instead of in waggons.

This is a striking proof of the entire unsuitableness of railways for the

heavy traffic of India, and is surely a warning to us in planning future communications.

We may safely say that Calcutta is paying ten lacs a year in this one item for the privilege of having a magnificent railway to Ranceegunge; and this is only a part of the loss, for a reduction in the price of coals from 9½ Rs. to 5 would give a vast stimulus to her in all sorts of ways, both to her internal trade, and to her external commerce. And what also is the loss to the coal owners by this mistake? What the effect of cheap transit will be in India, we have positive proof in the Rajahmundry canals. There the supply of new boats cannot nearly keep pace with the increase of demand. On the day I left Dowlaishwarum more than 80 boats had passed through the head of the main canal, 5 P. M., and 33 were waiting to pass the lock more than 110 in one day, containing probably 1,000 tons. In the first year about 700 boats passed, in the last month more than double that number of much larger boats, this increase is in seven years. And this in spite of increased charges, in consequence of the inadequate supply, and in a part of the country without even large towns and hundreds of miles from any city.

But there is another great point in this matter, and which is in fact one of the leading questions on the whole subject of Indian communications, it is no other than this, *what is the actual cost of carriage by railway?* Most strange to say, I have not seen any discussion of this essential point, in projecting these works, and yet most assuredly without a right decision of it, no right conclusion can be arrived at.

In the present case, how can we possibly settle the matter whether a railway ought to be constructed to Bellary, without knowing at what cost it can carry. Suppose, when we have made it, we see five-sixths of the old traffic still going by the roads, as we do in Madras? It is strange, indeed, that this point should not have been thoroughly investigated. In one of the Punjab Reports we have an example of the strange loose way with which this essential point has been dealt with. It is there said, "It will now be proper to state briefly what the advantages of this line are likely to be. But in the following discussion, it is only said, 'If the carriage by rail should be kept low, so as to attract commodities which can only afford to pay cheap transit;' and again, 'the present water traffic would preferentially take the railway, provided always the cost of transit be cheap,' and so on. But not a word is said on the subject of what the cost would actually be at which the railway could carry. The carriage by river, with the present clumsy organization by human power, is five P. per ton a mile,

and it is certain it can be reduced, probably more than half. Is there, from such data as we have, a probability that a railway would carry at two or three Pie.

On the Culcutta line, I have only these data. The receipts from coals were about 2,29,000, i.e. 44,000 tons at 2 As. 10 P. per maund, and the total receipts were 7,50,000, the former two-sevenths of the whole. Now, we may be sure that the profits on the coal were less than those on the passengers, the one carried at eight P. a ton, and the lowest passengers, at three P. a head, or five As. a ton. And as allowing for repairs and renewal, the profits could hardly have exceeded 3 per cent, on the whole it follows that that on the coal must have been much less than two-sevenths of 3, or certainly not $\frac{1}{2}$ per cent, that is, 60,000 Rupees on 44,000 tons, or 1 Rupee 5 As. per ton, equal to two P. a ton a mile, which would make the actual cost of carrying the coal, *exclusive of renewals and repairs*, six P. a ton a mile. It seems impossible that it can be less than this.

On the Madras line, there is a most careful examination of the actual cost by the late Consulting Engineer, and his result is above six P. a ton, without an allowance for renewals and repairs. And in the last Report on six months' traffic there, there is shown an actual loss on the goods traffic, though the average charge is ten Pie.

Judging from these things, from the very low profits on the railways, even as the accounts are now kept, from my knowledge of the cost of carriage in England and America (for instance, the above case of the great diminution of profits on the Great Northern, attending upon an enormous increase of goods traffic, showing indisputably a positive loss upon the goods traffic, at the rates there charged), judging from these and other things, I must say, that at present there is no indication whatever that these high speed railways in India will carry at less than eight Pie a ton a mile; more likely ten Pie, for bare cost of carriage, without any allowance for interest.

The one fact that the Madras Railway has failed after two or three years' trial, to take more than a small part of the traffic off the common road by the side of it, and that not a very good one, is a fact that speaks pretty plainly; and we may be quite sure that rather than suffer such an opprobrium, all the parties connected with the railway would strain every nerve and be under strong influence to carry at the lowest possible charge.

I cannot but think that these facts and reasonings will be conclusive as to the necessity of a careful investigation of this essential point, before the Beikul railway is decided upon.

But this is by no means the whole of the question. It is not whether the railways can carry at eight Pie or ten Pie, nor even at four Pie. It is, do we not require to carry at a much lower cost than the lowest of these? Even four Pie will not answer the purposes of the country. We have to carry goods of a very low value, hundreds of miles, and we *must* have very low rates, or India's resources will not be developed. A charge of four Pie on 500 miles is ten Rs. a ton, which would be thirty per cent. on the value of grain for instance, probably the great bulk of the traffic. Wheat in Coandwanah costs eight Rs. a ton; such a charge as four P. would more than double its cost. Thus we should throw away our peculiar advantage of cheap production if we only have a means of transport of eight or ten or even of four Pie a ton. We *must* have transit at half or one Pie a ton a mile if possible.

And further, this transit we *can* have; we have abundant proof that on a good steam barge, canal traffic can be carried on at a rate not exceeding one P. Even on the Hudson, where men earn $1\frac{1}{2}$ or 2 Rupees a day, the goods are conveyed at $\frac{1}{2}$ P. a ton a mile. And we have ample proof from the working of the river and canals in Rajahmundry, that for long distances with steam power at the extremely low cost of fuel in India, goods can be conveyed for less than one Pie. This cost of fuel is a particular point. On the Godavery we pay one Rupee a ton for wood, equal to $2\frac{1}{2}$ Rupees for coal, and I have every reason to believe that when the river is regularly worked, it will be lower than this. This is about one-fifth of the cost of fuel on the Ganges, where the actual cost of carriage up river by steam, according to such information as I have, is 4 P. a ton. The charge is from 2 to 3 times this, but the profits are enormous, 50 per cent and more. Every waterway in India will touch or approach some jungle, so that we may confidently reckon upon very cheap fuel, and this is particularly the case in the tract of country under review. I should think $\frac{1}{2}$ Rs. a ton for wood, equal to $1\frac{1}{2}$ Rs. for coal, might be calculated upon. We may not be aware of the extreme cheapness of water carriage when fuel can be obtained at such prices, till we make the calculations.

I am thus perfectly satisfied from actual results, that both in respect of passenger and goods traffic, these railways *can* answer the purposes of the country, in respect of cost of transit.

There remains the question as to numbers and quantities to be carried. I will not go so closely into this part of the subject as the last.

I have no doubt that a railway in India *will* be able to carry as great a traffic as *offers*, but this is *only* because its charges must be so high as to prevent $\frac{2}{3}$ or $\frac{1}{2}$ of the traffic there would be if carried at a

rails are necessary but it will thus effectually keep down the traffic, and the question, therefore, of whether it could carry such a traffic as there would be on many lines in India, is thus of small importance.

But on the line to the north-west from Calcutta for instance, where the traffic is even now so enormous, and rapidly increasing, with very low rates, I should think we ought certainly to provide for 10,000 passengers a day, and three millions tons a year, and it is quite certain not even a double railway could carry that. No railway in England carries one-fourth of this, and some of them are most seriously crowded, and, as in the case of the Great Northern, their expenses are so great in consequence of the speed they are obliged to push on the goods in order to escape from the passenger trains, the constant delays at sidings while other trains pass, &c., that there is an enormous loss on the goods traffic, as I have shown by the diminution of dividends.

I have no doubt that if Beikul is made a port, and if the upper country is thoroughly opened up by a great extent of very cheap communication, that the main line will in a very few years have an immense traffic on it, and for this we must be prepared.

But it is a matter of very little importance that railways can neither carry at the rates nor the quantities that India requires when we have a means in our reach, procurable at $\frac{1}{2}$ or $\frac{1}{10}$ of the cost of railways, that will in every respect most fully answer the purposes of the country, as a communication, and especially when it will not only do so, but will at the same time enable us to attain to an object of still greater importance even than communications, viz., both as far as possible securing the produce and greatly diminishing the cost of production.

One of the principles on which I consider that the examination of the present question should be conducted, is this, that in India, at present, communications are not the works of the first importance, but that works which will as far as possible secure the population from famine and scarcity, and afford the cheapest production are the first, and that communications are certainly second to this. What satisfaction would there be in a railway passing through a population dying of famine and in abject poverty, because their means of raising produce was so imperfect that almost the whole population was employed in raising food, as in the case at this moment in the Southern Mahratta country as well as in almost all India. I think away that railways were proposed as a means of preventing famine, and now that they would in a manner mitigate them; but, I urge first, that they would do it in a very small degree, because in famine, as in the great mias of those who perish, do not die for want of food.

not for want of money to buy it with; second, that when a population is suffering from famine, no communication can possibly rescue them; 10 millions of people would require 5,000 tons of food a day, costing, at such a time, probably seven lacs of Rupees a day. What was the state of Ireland with her sea-board providing the cheapest possible conveyance of food to within a moderate distance of every part of the interior? Was famine prevented? How many hundreds of thousands perished even on the very coasts? And if the monsoon failed, hundreds of thousands would perish in the Southern Mahratta country in spite of a railway that cost three millions. Further, the expense of carriage, as I have shown, is so great by a railway, that if the grain should be brought 3 or 400 miles, which it of course would, the cost of carriage alone would be at eight p. a mile, 12 to 16 Rupees a ton, or 60,000 to 80,000 Rupees a day for 5,000 tons. And could a railway bring the quantity, and could all this money be found, still this would only bring it to the line of the rails, it would not distribute it throughout the tract, which would therefore remain to be done by other means. So utterly ineffective would a line of railway be in every respect. There is one more point to be considered with respect to this proposed line of railway. When it arrives at the top of the Western Ghats, is it proposed to make a locomotive line down them, like the Deore Ghat? Though it would not be so expensive, yet it would certainly be an enormous addition to the cost of the line, and would make the average cost very high.

What is first required is to make the country, as far as its circumstances admit of, independent of other countries for food, and then, to provide it with communications which shall both be very extensive and also in some good measure permanent. A single line of communication through a country is not what is wanted, it is a net work of them, a mile of cheap transit to every 5 or 10 square miles of country.

I do not of course mean to say that we can absolutely secure the country from famine. If it pleases God to withhold rain for a certain time, all our works will be useless; but what I do say is, that beyond all comparison our first work in India should be for the purpose of securing a supply of water to the lands and happily in doing this, we cannot but at the same time gain our second grand point, the pervading the country with a network of the cheapest possible lines of transport, capable of carrying an almost unlimited quantity and at an extremely low cost.

With respect to such works in this particular tract, I need not here go into detail, because I have already done so in the Report, and have forwarded on the Beikul harbour.

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I will only here state the leading points. The first is the remarkable fact that many hundreds of miles of the rivers here have so slight a fall, that they are either now good navigations, or can be made so at a trifling cost. The Mootah Moolah, Decmah and Kistnah for instance form the line with a fall of 900 feet in 600 miles, to near Kurnool, being a fall of only $1\frac{1}{2}$ ft. per mile. Wherever the fall is so slight as this, one of two things is the case; either the fall is equally distributed and then the navigation is already good, or there are rapids where the fall is rapid, and then these can be corrected by anicuts and locks, at a moderate expense, and the principal part of the river must have a still less fall than that average. For keeping up the navigation during the dry season on such small rivers as this, it can be done at a very moderate cost by storing water in tanks. Thus there can be no doubt that many hundred miles, probably not less than 2,000, of good river navigation can be obtained there for probably 1 or 2,000 Rs. a mile, or 100, of the cost of a railway. The second point is that though a great part of this tract is liable to very scanty supplies of rain (there was a partial famine there only 4 years ago, and one threatens now) yet the rivers are as well supplied as any in India, because the sources of the Kistnah for a length of 400 miles are in the Western Ghats, and the poor country is thus traversed at every few miles by streams which therefore have never been known to fail. We have therefore as our grounds as we could have for hoping that an effective system of canals for irrigation and navigation led from these rivers would be completely effective, and would really in every way fully answer the purpose for that tract, both securing the production and providing every talook with very cheap transit. One grand line in the southern borders of this tract, viz. from the sources of the Toombuddra, past Bellary and Kurnool, and thence by Cuddapah and Nellore to Madras, has now been examined throughout, and it has been ascertained that it is a perfectly practicable line from the very summit of the Western Ghats, for a line of river and canal navigation. This line would unite with the Decmah and Kistnah line near Kurnool.

For the connection with Bellary, I have ascertained that the Kala Naiddie is capable of being made effective to about 140 miles from the coast, and from the information I have received, I have no doubt that a canal could be brought along the high country opposite to that point. I would then connect the two by a series of inclined planes, which could be done at a practicable expense.

Now it is a question whether under these circumstances it

is best to spend three millions on 400 miles of Railway here or on irrigating probably at least two millions of acres, yielding thereby an additional produce at 15 Rupees an acre only, of 300 lacs a year, and as far as possible providing for certain and cheap production, in addition to at least 3,000 miles of water communications to carry at small speeds for all our purposes, and at one-fifty or one-sixth the cost of railway carriage. Or rather I should say, can there be the smallest room for question about it?

I must most earnestly urge a real consideration of these facts and arguments before so fatal a mistake is made as to enter upon this proposed work. It will not be the mere cost of three millions; it will be incomparably worse; it will in all probability seal up this beautiful tract of country for an unknown time from all the blessings of cheap production and cheap transit. For men once committed to these unhappy railways in India, are under a sort of necessity to resist every attempt to give the country either of these two vital benefits.

I may just mention one most important point in this tract, viz. that it is perhaps of all India the best suited for European colonization. The situation of a great part of it so near the sea, and at the same time at an elevation of from 1,500 to 2,400 feet makes it a delightful climate, and perfectly fit for European occupation. In this respect it is perhaps the most important tract in India and worthy of the most particular attention from Indian statesmen.

I must again apologize for expressing myself so strongly and decidedly opposed to the views contained in my Minutes, but I feel that it is a vital question, which requires the most explicit avowal of opinion by those who have such opportunities as I have, however they may unhappily differ from those who sit at the other end of the table, and every thing else are so much their superiors.

We are all agreed so far as that the grand object now is to bring to bear the energy, science and capital of the west upon the fertile soil and vast population of the east, as regards material things. The whole matter is resolved into the question, Is the connecting link between these two, to be Iron or Water? Which of these materials will most effectually accomplish our object?

Shall we make use of a material which we have on the spot to the almost profusion, and which is procurable at an almost nominal cost in comparison of its value or shall we send to the other end of the world for one which is only procurable at a monstrous cost, and which when brought, will not accomplish the end of the journey?

Supposing we bring a ton of Iron into the interior for 150 Rupees we might for the same money apply to the land permanently at least 150,000 cubic yards of water a year, covering 30 acres, with an increase of produce of 450 Rupees, and providing the cheapest transit besides. But the total cost of the Iron including the actual application of it to the work for which it is intended is about 700 Rupees a ton, viz., 110 tons of rails per mile costing 80,000 Rupees, and for this 700,000 cubic yards of water may be brought to the land.

Spending our money on railways is in fact throwing away the greatest gift that God has bestowed upon India, and substituting for it that which can only be obtained at a cost entirely ruinous.

I am not surprised at these Minutes. They only partake of the almost universal misapprehension under which not only Indian statesmen, from the late Governor General downwards laboured, but even the mercantile community, who it might be supposed would have more readily perceived the necessity of cheap production and cheap transit.

There are happily strong indications that this misapprehension is now considerably weakened, and now that actual results of the Railways can be referred to, it seems to be a suitable time to make an effort to call attention to this great question, and to try to obtain for it a full investigation, of which there has not hitherto been a shadow. Everything as in these Minutes has been taken for granted.

Among many such indications I may mention three which seem to me calculated to lead men to entertain the question whether they are right in thus taking for granted that railways are the remedy for India's material evils.

The first is, that when I had the honor of meeting the commercial community of Calcutta on the subject of the Rajmahal canal, rather to my surprise, I was met by a single objection such as railway men usually make. I cannot but gather from this that the mercantile community generally have now great doubts about the railways answering the main purposes of the country.

Again, one of the witnesses before the late Colonization Committee, strongly advocate Irrigation and Navigation. Mr. Balston for instance says, "a canal even if it were to cost 50,000 £ a mile would be much more profitable in India than a Railway that cost 10,000 £." He was a railway contractor.

Having thus called in commercial men; I trust I may be excused so great a liberty as to produce the testimony of a leading statesman, viz., the Right Honorable the Secretary of the State for India.

The following is a passage from a printed Report of that nobleman's speech at a meeting of the Manchester Cotton Supply Association last year.

"It seemed to him one of the most practical functions the Association could perform to give information upon these points, and carefully avoiding being mixed up with human politics they should keep to the two great things, Roads and Irrigation. As to roads he feared we were in danger of being misled by the precedent and example of England. It seemed to be thought that because costliness of railway for high speeds were suitable for this country, if only a line was constructed we had a complete and adequate remedy for our heavy traffic, the same were equally suitable for India. He believed and so did more competent judges, that *that system of proceeding was a complete mistake*. What was wanted in India was not costly lines for rapid travelling laid down in a few parts, but a comparatively inexpensive though slow means of communication extending over the whole face of the country. In that matter we should follow the precedent of the United States rather than of England.*** It (the Association) aims at no victory but the victory of English knowledge, and energy and intelligence over apathy and ignorance and sloth. We do not ask of the State to conquer fresh territories for us, we simply ask it to make use of those it already possesses. We do not desire the political subjugation and humiliation of the native population of India; we do desire to compensate so far as is in our power the people of that country for the loss which we have caused of their political freedom, by enabling them to share in the material prosperity of the world that has conquered theirs."

I cannot but think that these indications of a different view being taken of the railway question from the almost universal one four years ago, are calculated to have a great effect in causing many others to pause before they proceed further in the same direction.

I might add this Government's very decided testimony about Hydraulic works, in a Despatch of the 15th May 1858, where among many other things they say—"Further, the Government questioned whether considering that the returns from irrigation works are *always considerable and often immense, &c.*" Again the Government express their strong unanimous and earnest advocacy that all irrigation works which on a comprehensive view of the wants of the country may be deemed necessary to develop its undoubtedly great resources, be commenced at once, boldly and on a large scale, be pressed forward throughout all times and under all circumstances, and be kept in

Nothing can be more probable than that if this scheme is undertaken, when a similar sum of 150 lacs has been spent upon it, a famine may take place and hundreds of thousands perish, without the slightest relief from that expenditure, while the same sum spent on hydraulic works would probably entirely prevent a famine.

I would venture to suggest that Committees composed of one Engineer and one mercantile man should be appointed at each of the Presidencies to investigate this important point, at what cost such railways as these will be able to carry goods in India. I think it essential that a non-professional man, but a good man of business should help in this enquiry. These three reports might then be remarked upon by the Chief Engineers of the railways and the whole of the papers published. It seems to me that we are now tolerable data for examining this point, and that it is of very great importance that something like a definite conclusion should be arrived at about it, if possible. At present all these schemes seem to be decided upon an *ad hoc* value of which if there is no knowledge whatever. Of course the important items of depreciation and repairs must be estimated for in making this calculation.

There are in this paper many things repeated which I have said in former ones, but it is necessary to make the paper in a sense complete in itself as it may come into the hands of those who have not seen the others.

To shew the effect of irrigation and navigation, I append to this paper statistical statements of the Rajahmundry district, showing its progress in Revenue, Exports, Internal Trade, &c. since the commencement of the works there. Certainly no other district in India ever made such progress in the same time.

APPENDIX.

COMMISSIONER'S OFFICE, BURDWAN DISTRICT,
HOLUR, THE 14TH APRIL 1858.

No.

TO THE SECRETARY TO THE BOARD OF RAILWAYS.

LOWER PROVINCES,

Fort William.

Sir,

In reply to your letter of the 5th January last, No. 6, I beg to submit the following remarks on the effect of the railway or other means of conveyance in the districts through which it passes, and

Report on the effects of the railway or other means of conveyance.

I greatly regret that the utter absence of any legal power to call for such statistical information, as may be easily obtained in more civilized countries renders me unable to submit a complete report.

The railway, commencing from Howrah, runs first through 5 miles of that district then through about 45 miles of Hooghly, and finally through 71 of Burdwan, altogether 121 miles to Rungta, close to which terminus are the great collieries of Bengal.

3. The number of coal boats employed by the Bengal and other coal companies in 1844 was 2,252, which could only carry during the height of the rains, when the Damoodah river was full. That number has now reduced (by about 30 per cent) to 1,594, and the quantity of coal conveyed by their means from 22,36,582 to 16,22,363 maunds, or from 77,886 to 54,312 tons. But the railway alone in 1857 carried 90,754 tons; far more than the larger number of boats used to transport.

Decrease of coal boats on the river Damoodah.

4. I have recently been informed that the very high price of provisions has led the boatmen to make an attempt to raise their demands for the conveyance of coals, which has hitherto been (3) three annas per maund; while the railway charge has been reduced from 3½ annas to 2 annas 10 pie per maund. This will of course yet farther decrease the

quantity of river borne coal, unless the river freight charge be speedily and considerably reduced.

Year.	No. of Carts.	Decrease.	Goods conveyed (maunds.)	Decrease.	Remarks.
1854	3,847	...	76,943	...	
1855	3,341	...	68,826	8,120	
1856	2,725	716	54,500	14,320	
1857	1,208	1,517	24,160	30,340	

whit a remarkable effect the railway has had in diminishing the demands at Howrah for carts, reducing it in 3 years to less than a third of what it was the year before the Railway was opened.

6. On the other hand, the number of carts starting from Burdwan to which place merchandise is brought by rail from Calcutta, is greatly and daily increasing. During last month I had them counted for several nights, in one halting place only, and found the number to be from 163 to 185 each night. The Burdwan carters refuse to go down to Howrah for the goods, and at Ranceunge terminates no carts are to be had. Thus the strange practice of taking their goods off the railway at its central station has, in many cases, been forced upon the merchants.

7. It is remarkable that, during 1857, not less than 220,000 maunds about (70,000) tons of salt have been carried by rail from Howrah, and I regret that I cannot ascertain its destination, as it could hardly have been consumed in the chowkees on the line of rail, and I fancy it still goes up the country in boats.

8. On and within easy reach of the line of rail, the goods traffic has increased greatly. Before the close of the first year of the railway working (1855), I myself have seen 1,000 bags of rice staid from Burdwan station in a day, whereas before the opening of the rail, I believe 1,000 never left Burdwan in a month.

9. The annexed statement showing the goods and passenger traffic of five half years is most remarkable. The steadily and large increase of traffic both of goods and passengers. Second class passengers were more numerous in the first half year than they have ever been since, though the number is steadily increasing again, and the coal carried on the 5th was a trifle less than that in the fourth half year, but still nearly double of the quantity carried in the corresponding half of

5. At Howrah, some rich Chowdhries, each of whom could command several hundred carts, almost monopolized the Calcutta trade with the Upper Provinces, as to transport by land. The marginal statement shows

the preceding year. With these two exceptions, every entry shows a great and steady increase and the shareholders must look with no small gratification to the fact that the outlay has not, in any one period, amounted to a half of the incomes.

10. The enormous number of third class passengers proves the wisdom of the resolve to reduce their rate of fare to the lowest possible limit. Our English Parliamentary rate is a penny a mile, while here a poor man is conveyed 121 miles for 45 pence, or nearly 3 miles for one penny.

11. I was surprised to hear a few weeks ago, from a most intelligent Native gentleman, that the railway has done great harm to the poor people in its neighbourhood! On asking for an explanation of his meaning, I was told that the mania for travelling by railway had become such, that thousands of poor people deny themselves common necessities, and pawn their petty jewels, or pots and pans, for the pleasure of being able to say that they whose ancestors never knew any conveyance but their own legs or a bullock cart, and that within a circle of half a dozen miles round their homes, have visited Calcutta in a *Five ship*, as the train is still very commonly called.

12. Again expressing my regret for the scantiness of my information, I must sum up my report thus.

13. There are parts of the three districts above named, such as the southern portion of Howrah, between the Hooghly and Reop Narayan rivers, and the North Eastern portions of Burdwan on the Hooghly, which are so well provided with water carriage, and so far from the rail; and other parts of all three districts in which the want of roads makes approach to the rail so difficult, that they have been little, if, at all, effected by the rail.

14. There are parts of all three district so favourably situated, close to, or easily accessible by road from the rail, that they have been greatly affected as to goods—but perhaps, most of all as to third class passenger traffic.

15. The transport of goods by carts, and yet more of goods and of passengers by water, along the first 30 miles of rail, (Howrah to Mungah) is so very cheap, the trouble and expense of shifting goods from the rail to carts, and *vice versa* tells so seriously in short distances, and the Natives are yet so incapable of ap-

preciating our English idea that "time is money," that the railway has not affected the means of conveyance hitherto, nor down goods traffic to itself so exclusively, as it doubtless would have done but for the aforesaid previously existing cheap means of transit; and as it will do where those means do not exist: and when the Company may be prevailed upon, as I hope they soon will be, to adopt the same enlightened policy, with regard to their rates of carrying goods, as they have done with regard to the third class passengers.

16. I have above stated that the low rates of conveyance by carts and boats have prevented so much use of the railway for goods traffic as might have been expected had those means been less cheap and accessible or had the rail distances been greater and the charges transit lower. It is also evident that on any short line, the trouble and expense of carting goods from a warehouse in Calcutta to the river side, of there unloading them, crossing them over the river, again moving them on cart or coolies to the Howrah goods station, forwarding them, say three miles by rail and lastly conveying them four or five miles on a cart to their destination will not be undertaken by any one, who can load them on a cart at his own office door, cross them on that cart over the ferry, and deliver them to the consignee without one charge of conveyance at less cost and in not much more time perhaps, indeed, in less time; for a cargo may be delayed 12 or 24 hours, or even more at the railway station.

17. But another cause seriously affects the rail at present. Those merchants who might avail themselves of it to send their goods for 121 miles, en route to stations 500 or 900 miles distant, do so at present to an extent scarcely noticeable, I believe because at Ranegunge it is almost impossible to procure carts. There has been during the last year a pressure on carriage for Military purposes, which may now be disappearing, but the country around Ranegunge yields nothing but the miserable cart called *ney sugar* (a very small cart with wheels formed of a circular plank) and it is far better to engage carts in Calcutta for the whole journey, or even in Bardwan as shown in paragraph 5, than to use the rail for a small portion of it, and then to fall into difficulty from a want of carts at Ranegunge.

18. I feel confident that even the great past success of the Railway will be eclipsed when it shall have been extended so far as to reach the great marts of the North Western Provinces and to absorb

Trouble and cost of shifting goods from carts to rail and vice versa, tell heavily on short distances.

Difficulty of turning carts at Ranegunge.

Fourth. Far greater success may be expected.

the vast traffic still carried on by carts along the Grand Trunk Road, and by boats on the river, which it cannot yet be said to have touched.

19. I have been very much and strenuously advocated road making, and I think the importance of multiplying roads as feeders to the railway and as promoting generally the political and social advancement of the people cannot be too much impressed on the Government and the community.

I have, &c.,

(Signed) W. ELLIOTT,

Commissioner.

Memorandum on Mr. Elliott's letter on the effect of the railway on other means of conveyance.

Paragraph 3. Coal traffic. The distance from Ranegunge by rail is 120 miles, by the Damoodah and Hooghly, 160.

The water charge of 3 Annas per munda is equal to 6 1/2 P. (12) per ton per mile, that by rail was 3 1/2 Annas or 7 P. (14) the reduced rate 2 Annas 10 P. is 8 P. (16) per ton, and Mr. Elliott states that the charge of 6 1/2 P. by water has become insufficient in consequence of the altered value of money of late. The quantity carried by water was 78,000 tons, it is now 54,000, by rail it is now 90,000 tons. The cost of carriage per ton for the whole distance was therefore 6 Rs. a ton by rail, and is now 4 1/2 Rs. and by water about 5 1/2 Rupees.

Remarks. 1st The water charge is increased by the short portion of the year, that it is open, by the increased distance 40 miles or 1/3 more than the railway, but doubtless most by the boats, having to go down to the broad part of the Hooghly, which prevents their being loaded as they could be in smooth water, and causes great risk. This charge of 6 1/2 P. per ton per mile is enormously high for water carriage. In a thoroughly good water line, it should certainly be under 1 P. with such a length of carriage. That is if the Damoodah were kept open nearly or quite the whole year, and connected with the Hooghly at Calcutta by a canal making the line direct, the charge per ton of coal should certainly not exceed 10 P. unless the present low value of money continues, when it might be 1 Rupee. Taking the present quantity at 1,44,000 tons the community are put to a needless expense of 5 1/2 lacs of Rs. per annum, and the consumption of coal will of course continue to increase, this is the

difference between 4 Rs and 10 As. It is certain that a very moderate expenditure, perhaps 2,000 Rupees a mile on the water line or 2½ laes would make it a good navigation direct to Calcutta, i.e. 1/10th part of the cost of the railway. In Rajahmundry the cost of carriage per mile in the canals is about 1 Pie for short distances.

2. There cannot be a greater mistake than thus to expend an enormous sum in improving land transit by which after all the cost of carriage must be ruinous while the water carriage is left in such a state of neglect of a mere trifle of expenditure, and when by no other means can the great traffic be carried cheaply.

Paragraph 5. The road traffic is so insignificant that it is matter of indifference how those goods are carried. It was under 3,000 tons per annum now under 1,000.

Paragraph 7. The statement of salt 70,000 tons does not seem to agree with the total quantity of goods mentioned in the table as being only 49,000 tons for the same year. This requires explanation.

Paragraph 8. Increase of goods traffic. The whole of it is a small matter, the total number of tons is stated at 49,000 tons, but it is not stated what is the average distance it is carried; probably not 50 miles, in which case the average quantity carried along the whole length of rail does not exceed 20,000 tons, quite an insignificant quantity in such a locality about 1/10th part of the river traffic, and one-seventh of the traffic last year on one of the Rajahmundry canals, which only connects towns of 15 to 17,000 inhabitants.

Paragraph 9. Passenger traffic. The total number of passengers for the year is above a million. The sum paid by each 2nd class passenger is 1 Rupee 3 Annas, and by each of the 3rd class ½ Rupee, shewing that the average distance travelled is about 30 miles or 1/4th of the whole length so that the average number of passengers on the whole line is 1/4th of the total number or 250,000 per annum, equal to 800 a day. To judge of this we must as in other points compare it with known passengers by other means. On the southern road out of Madras at 11 miles from the Port the numbers were found to be 3,000 a day. On a high road in Tanjore far from a city 11,200 men. On a bridge four miles from Trichinopoly a city of 100,000 inhabitants 20,000 a day. By the transit boat on the Rajahmundry Canal to Cocanada 100 per day, a canal leading to a town of 17,000 inhabitants. The number corresponding to this for Calcutta allowing 600,000 inhabitants should be 3,500 a day. It is evident from these that the railway only receives a small portion of the travellers just as it is in the

Madras Railway which does not convey 1/10th of the travellers on that line. Thus it is certain that even as respects passengers these expensive works do not suit the country. The charge of 3 Pie or 1 Anna or 3d. for the lowest class completely shuts out 1/10th of those who require conveyance. On the Rajahmundry canals the charge is one Pie and the manager states that even that charge is sufficient to keep away by far the greater part of the travellers. These boats are now yielding 25 per cent, and it is under consideration to reduce the rates to 1/4 Pie as likely to be more profitable. The profits were increased much since they were reduced from two to one Pie. Were these boats worked with steam instead of men, they would afford to carry very well at 1/2 Pie per mile, and no higher rate than that would bring the railway into the hands of the travellers.

Of course just at the entrance of a large and wealthy city like Calcutta, there is a large number who can afford to go backwards and forwards frequently a very few miles, but the numbers diminish rapidly as the distance increases. Probably, the average number on this railway being 800 per day, the numbers at each end are something like 1,400 at the Calcutta end and 200 at the other.

But the most important point to be observed on this subject is, that the total receipts are 7½ laes for a half year; out of which the 1st class passengers pay 25,000 or 1/10th part, showing that those for whom this enormous expense is incurred in order to provide them with high speed, are so far from paying their share of the expenses, that the profits from them, if any, are hardly perceptible. There cannot possibly be any mistake in concluding from this, that high speed is not what the country wants. The fact is, that the poor are paying for the rapid conveyance of a very few rich. They also travel quick themselves, but most assuredly they would much rather travel slower and pay less, but they have no option.

What the average passenger traffic will be as the railway extends further, we have no data to judge, excepting that we know that in England with all its wealth, there are few travellers of long distances, the average for all England being only 13 miles for each traveller.

Probably, as the railway extends, it will carry at these prices few besides that class who in this return appear as 1st and 2nd class passengers, excepting for a few miles out of the great cities. The proportion of people who can afford to pay 8 Rupees for a journey of 500 miles will be very small.

Paragraph 10. The charge of 3 of a penny here, is far higher than 1 in England. Even near Calcutta the proportional value of a penny is probably

4 to 1, and in the interior it is at least 6 to 1 compared with England. The price of carrying to that in England should not be more than $\frac{1}{2}$ Pie, merely allowing for difference in value of money, but the proportion of people at all well off in India, is far less than in England.

Paragraph 13. The greater part of the country will be totally unaffected by the railway. It is the greatest delusion to call making a single line of railway through a vast breadth of country "opening the country." Not a fiftieth part of the country is benefited by it. To open the country there must be a close network of communications. Tanjore with its 1,000 miles of just practicable roads on an area of 3,000 square miles, is incomparably more benefited than Burdwan with its 71 miles of railway, and the Deltas of the Godavery and Kistnah, with their 2,000 miles of water communication at $\frac{1}{2}$ to 1 Pie per head or per ton a mile, are really opened up. The southern part of Burdwan, and the other districts with their wretchedly neglected water lines, are immensely better off than the northern part with its one line of rail—and the cost of one or two miles of railway expended in improving the water lines would have had 100 times more effect than the whole line of railway. As a comparatively trifling sum would have given a first class steam boat communication at 15 or 20 miles an hour to Ranegunge, and at rates both for goods and passengers $\frac{1}{10}$ th of those paid on the railway, and ten times the number of people would have made use of it. The vast natural advantages of this country are thus thrown away because in England they had not what we have. The 150 lakhs that have been spent on one single line of 120 miles, worked at 10 pice a ton, and 3 pice a head would have completely pervaded almost all Bengal with a network of first class water-carriage to be worked at 15 miles an hour or more if wanted, and at from $\frac{1}{2}$ to 1 Pie per ton and per head. Probably 5,000 miles of such communication would have been obtained, besides that in doing it, an immense area would have been secured as far as possible from both drought and flood.

It is indeed most grievous to see so monstrous a perversion of means, entirely through a want of consideration of the circumstances of the country. If we saw the Egyptians busily employed in carrying the earth from the Delta to make land on the sands of the desert, because they had heard that in some barren country the poor people were compelled to fetch earth from a distance, we should clearly comprehend their mistake, but this is exactly what we are doing. People suppose that because they have spent a great deal of money, they have necessarily accomplished a great object, by the amount of money

expended may be simply the measure of the magnitude of the mistake they have made.

It is certainly no exaggeration to say that 5,000 miles of water communication carrying at rates that the poorest travellers, and the poorest goods could bear, would have conferred 1,000 times more benefit on the country than 120 miles of railway carrying at prices only a hair's-breadth below the old rates. For instance 2 As. 10 M. for coals against 3 As. by the boats. Even were the whole traffic transferred to the railway it would be no proof of great benefit; if the disbursement of charge is insignificant, the benefits are insignificant. With respect to coals also the railway has after all to discharge the boats to be conveyed to the other side of the Hooghly, and the various points where they are wanted.

Paragraph 15. The natives are at least as capable of appreciating "our English idea that time is money" as we are, but they are too quick to think it is, when it is not. The Manchester people send $\frac{1}{10}$ ths of their valuable manufactured goods at two miles an hour to Liverpool, by the canal with a railway carrying close to it, because they know that even in such goods 15 hours of time is not money; and the natives know well that a week in the conveyance of grain worth 3 lb. a ton, is not money, at least it is only 1 A. or $\frac{1}{2}$ Pie per ton per mile if it is carried 100 miles, allowing interest at 10 per cent, so that a difference of 1 Pie per mile in cost of carriage, would be eight times the loss in interest if a year of time were saved. The Americans also in this respect are far wiser than the Indians. While the Hudson and Lake Erie canal is closed by frost for five months together, 10,000 tons a month are carried by the railway, and as soon as the canal is opened again 300,000 tons a month are conveyed by road so that there it is thought that five months of the year the traffic is stopped in the winter, although it is at that time that all the common roads leading to the railway are in the finest working order.

With respect to the enlightened policy "of carrying cheap," the question is at how low rate the railways can carry. It is most certain that the bare expense of carrying by rail, where high speed trains run, is 8 or 10 times that by good water lines.

Paragraph 16. Almost all the causes mentioned in this paragraph accounting for the small traffic by the railway, which would be greatly increased, if they were removed, are the remediable objections to such

* On the Madras line, the Consulting Engineer showed that there had been a positive loss on the carriage of goods at 10 L. a ton, on the last half year of 1857.

a mode of conveyance inherent in the country. If goods could not be carried cheaper by water, even with human power, than by land with steam power; if there were no water carriage; if Calcutta and Howrah and all the great towns and cities were not at the water's edge; if the nature of the country did not offer the greatest facilities for improving and extending water carriage; if the same circumstances did not offer essential obstacles to railway, (as, for instance, neither goods nor passengers being able to enter Calcutta at all by this railway, &c., &c.) if all these *ifs* were away, it might have been wise under such unhappy circumstances to spend 10 lacs on a mile of railway, but these *ifs* are unremediable and impracticable, and the question with wise men always is, not "What should we do, if, &c.," but *rebus sic stantibus*, what is best to be done?

Paragraph 18. "When the railway absorbs the vast traffic carried on by carts along the grand trunk road and by boats on the river." With respect to the former, it is stated in paragraph 6 to be from 165 to 185 carts per night, supposing 100 of them loaded with $\frac{1}{2}$ ton each, it would give 18,000 tons a year. A small item for the Railway. The water traffic is carried at about $\frac{1}{10}$ th of the charge on the railway, how much of that will be transferred any body can judge, even supposing the unaccountable neglect of water carriage is continued, but it cannot be imagined, that under the new regime at least the immeasurable natural advantages of the country will continue to be entirely thrown away, as they have been under the old one. A mere trifle expended on even the present water lines will reduce the cost of carriage to half of what it now is, and a thorough system of water communications would reduce it to $\frac{1}{10}$ th of what it now is, or to $\frac{1}{10}$ th of the railway charge.

Paragraph 19. "Conprobabilities." All this is said in the comparison of water and rail is as true as the comparison of water and road. The natural circumstances which are in favor of water are against the roads. In Rajmahal and Guntoor, if 80 lacs are ultimately spent, and 2,000 miles of navigable canal are obtained, the canal will have cost only 4,000 Rs. a mile, supposing that the whole was charged to navigation, but at least $\frac{2}{3}$ ths should be charged to irrigation, leaving only 1,000 Rupees a mile of communication at $\frac{1}{3}$ or 1 Pie a ton a mile. Whether in a similar country it is preferable to spend 20,000 Rupees a mile on roads, to carry at two or three Annas a ton, can easily be decided.

It is nothing less than a vital question to India, what kind of communications are suitable to it. If a first class passenger could step into

a Steamer on the Calcutta side of the Hooghly and go direct to Rance-gunge at 15 or 20 miles an hour, he would accomplish his journey at $\frac{1}{3}$ rd the cost, far more comfortably and conveniently, and as quickly as by rail, while the capital expended in completing a first class Steamer boat communication would have been so ridiculously small—compared with that which has been spent on the Railway, that the shareholders might be receiving 50 or 100 per cent, and instead of 800 passengers a day, 8,000 would probably have had the benefit of conveyance. In no one single respect has even a first class passenger an advantage in travelling by the rail, that he would not have in going by water, while all parties concerned, the travellers, and especially the poor ones, the producers, and consumers of goods, the shareholders, the Government, the whole community, would have had enormous advantages which the present line does not afford. What has been gained? the grand sight of a Locomotive with its train of carriages. But was the object of this expenditure to produce something to look at? The object was to carry goods and passengers, 1st cheaply, 2nd, at a suitable speed, not to have something grand to look at. When the latter is the object, let the money be expended accordingly. But don't let us leave Calcutta with the object of going to Delhi, and travel on without observing in what direction we are going till we arrive at Madras.

It makes no difference to either the merchant, or the tea drinker, or the sugar grower, whether the sugar was carried in a grand procession, or in a poor looking canal boat, but it does concern them all whether it was carried cheaply or dearly.

And what is the difference to the poor $\frac{1}{100}$ th of the community. Suppose that in Rajmahal, instead of protecting a million of people from losing their lives and their property by floods or by drought, irrigating 12,00,000 acres, conveying water and the transit, throughout the year to every village, at a cost of 50 lacs, suppose instead of this, 50 miles of railway had been made, conveying 2 or 3 1st class passengers luxuriously, but leaving almost the whole population in every respect just where it was, liable to death by famine or flood, without communications, and in some places miles from drinking water in the hot weather. Would it have been a wise proceeding? What is applicable to one district is equally applicable to another. How awful it would be if we were to see 100,000 people in Burdwan die of famine next year, with its grand railway passing through it. It might help to bring grain to a small portion of the district, but it could not help the people able to purchase it. In general the people of India do not die of famine for want of grain, but for want of

money to purchase it. How poor a compensation it would be that the dying people saw daily a grand sight in the railway train, and knew that half a dozen gentlemen were travelling at a high speed. In Madras the number of first-class passengers on the first 80 miles out of the capital is thirty a day, and on this line it is on an average 15 a day on the first 120 miles out of such a city as Calcutta.

With respect to the profits of the shareholders, the present statement does not show what they are. The balance after deducting the stated expenses is 7,000 Rupees a mile, or 1 per cent on 1½ lac. But nothing is allowed for the two great items of repairs and depreciation. All the works being comparatively new, the present cost of the former is of course trifling, and nothing is allowed for the latter. I suppose these two items would considerably reduce the apparent profit.* As the railway extends, the traffic on the present part will of course increase but it by no means follows that the average of the whole will be greater than the average of the first 120 miles out of Calcutta, for the number of passengers going to and returning from the capital a few miles is enormous, compared with what it will be at a distance from any great city.

But we have now abundant data for this conclusion: that the returns, whether direct to the shareholders, or indirect to the community, will be utterly insignificant from a lac of Rupees expended on a mile of railway, compared with that from the same sum expended on 25 miles of irrigating and navigable canal. And it is equally certain that the amount of these returns direct and indirect is the true measure of the value of any works for the material improvement of the country. "But why not labour?" Surely reason requires that we should rather ask, "why should we do so?" If we know how to spend any amount of money, so as to yield directly and indirectly 200 per cent "why should we" waste a part of it on schemes which would not yield 20.

If a merchant discover a way of employing his capital so as to return 20 per cent does he say "why should I not" employ part of it in another scheme which he knows will only yield two per cent.

2ndly. But the case of the railways is far worse than this, because it keeps all parties under the delusion that they are "opening India," and thus prevents their doing any thing else. But for this unhappy delusion, something would certainly have been done during the last ten years towards "opening India". For instance, most assuredly we should have had large steam flotillas on the rivers which would have prevented 100th of the horrors and consequences of the late revolt.

*On the whole of the Railway in the State of Massachusetts in America, the repairs of roadway alone is 100 series of years 2½ per cent, to which must be added that of keeping up the rolling stock.

Undoubtedly so far as the material welfare of India is concerned, no question can compare with this in importance: what is to be done in future? will the Home Authorities continue to guarantee interest on any number of millions to be employed in making railways, while they continue to refuse the same to capital employed in navigation and irrigation.

The question is now before the Home Authorities in several ways, and they have so far given way, as to grant an annual sum for the navigation of the Indus, which was refused by them on the decision of the late Governor General ten years ago. The question is now becoming so urgent, that it will no longer be possible to defer a decision upon it.

A new case has now arisen. Which should be done; should a million be expended on a hundred miles of railway in the direction of Midnapur, or should the same sum be expended on a canal from Calcutta by Midnapur back and the Chilka, with the irrigation of 2½ millions of acres lying between that line and the sea; rescuing the magnificent Deltas of the Mahanaddee, Braminy, &c., with their two millions of inhabitants from their present shameful state of exposure to drought and flood, and giving them 2,500 miles of water transit?

Upon the Delta of the Godavery 30 lacs have been expended, the revenue this year is about 10 lacs above the average of years before the works, and more than 60 lacs of excess of revenue have been received since the works were begun, or 30 more than the whole sum expended; and only about 10 of the land watered yet pays any water rate, and the benefits to the people are of the value of a far larger sum. Compare this with the results of the Railways. What is the next excess of actual receipts over expenditure in their case? While 1½ millions have been expended on the part of the Calcutta line finished have three millions been received? The statement shows a total excess of receipts over current expenditure of 16 lacs up to the end of 1857 or 1/4th part of the sum, and certainly the proportion of benefits to the community are in a still smaller proportion. On the Madras line the results are far worse and on the Bombay certainly not better than in this. And in all these cases, it is the first piece out of a capital city on which all the traffic of various main lines of country is concentrated. What will be the result in some of the distant and thinly populated parts of the country? Most certainly they won't pay the expenses of stations.

It is surely high time fairly to consider this vital question. It cannot possibly be deferred much longer.

A. COTTON, COLONEL,
Commandant of Engineers.

EAST INDIAN RAILWAY.

STATEMENT OF TRAFFIC.

	No. of Passengers.			Tons of Goods.			Receipts of Passengers.			Receipts of Goods and Sundries.	Receipts of Coal and Goods.	Total Receipts.	Grants-in-Aid.
	1st Class.	2nd Class.	3rd Class.	Coal.	Sundries.	1st Class.	2nd Class.	3rd Class.	Sundries.				
Second Half 1855.	4,956	26,551	3,141	13,217	4,858	17,440	6	31,597	110	9	24,099	110	1,61,401
First Half 1856.	5,379	23,137	4,091	10,443	13,871	23,886	2	29,463	12	8	31,783	11	2,00,931
Second Half 1856.	5,562	26,570	4,301	12,581	20,897	26,459	14	32,073	10	7	34,037	8	2,18,944
First Half 1857.	5,562	26,181	3,326	12,462	23,142	29,089	6	32,874	9	7	34,823	7	2,03,215
Second Half 1857.	7,020	26,289	4,807	14,207	27,083	35,516	1	33,626	2	2	35,717	4	2,18,944

Hoghtly, 5th April 1858.

(True Copy.)

(Signed) EDWARD PALMER,

E. AND O. E.

(Signed) FRED. COX,

Traffic Manager.

(Signed) V. P. MONT,

Commissioner of the Eastern Division.

Comparison of a Railway from Calcutta to Rangoon with water communication in the same line.

	Railway.	Water Communication.
Length.	120 Miles.	120 Miles.
Cost per mile.	1,20,000 Rs.	
Do. improving Damoodah.		2,000 Rupees.
Do. complete Canal.		10,000 do.
Total Cost.	150	120 Laes.
Do. improving Damoodah.		21 Laes.
Do. complete Canal.		12 do.
Charge for interest at 5 per cent.	7 1/2 Laes.	
Do. in Damoodah improved.		12,500 Rupees.
Do. in complete Canal.		30,000 do.
Speed 1st Class Passengers.	17 Miles.	15 Miles.
2d.	17 "	12 do.
3d.	17 "	8 do.
Goods.		15 to 3 do.
Coals.		6 do.
Train.		
1st Class.	7	8
2d.	7	10
3d.	7	15
Goods.		8 to 40
Coals.		20
Engines.		66 P.
1st Class.	18 P.	
2d.	9	3
3d.	3	3
Goods.	8	11
Coals.	8	11
Total charge for 120 miles.		
1st Class.	111	31 Rupees.
2d.	51 Rs.	12 do.
3d.	2 "	4 do.
Goods.	5 "	1 do.
Coals.	5 "	1 do.
Nos. of 1st Class Passengers.	15 per day.	150
2d do.	49	500
3d do.	740	7,000
Tons of Goods.	20,000 per	200,000
Coals.	90,000	300,000
Profits deducting 2 per cent from the stated profit on the Railway for repairs and depreciation.	4 per cent	40 per cent

Comparison of Railway from Calcutta to Ranerghunge, &c.

	Railway.	Water Communication.
Saving to the Community on present traffic only.		
Passengers 1st Class.	...	35,000 Rupees.
2d	...	50,000
3d	...	4 Laas.
Goods	...	£ do.
Carts	...	34 do.
No. of places for receiving and discharging	...	Every point.
Terminus	one on the Howrah side.	Every point on the Hooghly, the Canal &c.

The estimated cost of construction and of working the water line is taken from the known cost of canals in similar situations, and the estimate of numbers of passengers and tons, is made from the reduction of charge. The cost of the Banka canal was 1,500 rupees per mile, the sum here allowed is 10,000 rupees. The tons of goods passing down the Rajahmundry canal to a town of 17,000 inhabitants is 1,50,000 and it increased by 60,000 tons last year; the quantity here estimated to a city of 6,00,000 inhabitants is only 200,000 tons.

(Signed) E. COTTON, Colonel,

Commandant of Engineers.

Statement of Revenue, Exports, &c. of the District of

Years.	Total Revenue of District.		Price of Rice per Ton.	Bullion re-circulated from Treasury.		Bal. Against.
	Annual.	Averages.		Annual.	Averages.	
	1	2	3	4	5	6
	£.	£	£ S.	£	£.	£
36-7	216,000	96,000	4-1	124,000	98,000	92,000
7-8	214,000		4-9	111,000		103,000
8-9	173,000		6-19	78,000		95,000
9-10	174,000		5-10	74,000		100,000
0-1	174,000		5-2	74,000		100,000
1-2	210,000	237,000	3-3	18,000	150,000	121,000
2-3	196,000		2-17	95,000		101,000
3-4	173,000		2-13	106,000		67,000
4-5	233,000		2-18	127,000		106,000
5-6	200,000		3-5	106,000		94,000
6-7	242,000	245,000	4-5	154,000	197,000	89,000
7-8	250,000		3-6	159,000		91,000
8-9	233,000		1-11	132,000		101,000
9-10	224,000		3-7	157,000		67,000
0-1	242,000		3-3	148,000		94,000
1-2	245,000	245,000	2-18	159,000	197,000	86,000
2-3	250,000		2-17	233,000		17,000
3-4	244,000		5-11	247,000		

Letter from Colonel A. COTTON, Commandant of Engineers; to
T. PYCROFT, Esq., Chief Secretary to Government, dated Jaulna,
8th December 1858.

Sir,

I have the honor to transmit an addition to my Memorandum on
the proposed Southern Mahratta Railway, and to request that the for-
mer part may not be transmitted any where without this.

*Addition to a Memorandum on the proposed Hyderabad and
Seelshgur Railway by Colonel A. Cotton.*

At the half yearly general meeting of the East India Railway
(Calcutta) Company of the 28th October 1858, the Chairman, Mr.
Crawford, stated that he calculated the cost of the 120 miles from
Calcutta to Ranugunj was about 1,200,000*£* or 120 lacs and that the
net Revenue for the half year was at the rate of $7\frac{1}{2}$ per cent. per
annum. This, as in all the other statements of this sort, omits the two
great items of Railway expenses, depreciation and repairs, the actual
expenditure on the latter being as before stated of course insignificant
while every thing is new. This $7\frac{1}{2}$ would give a sum of 90,000*£* or
9 lacs as the annual profit on the 120 lacs. The Chairman also stated
that they had determined to build Steam boats to carry their Railway
material by the river. A shareholder enquired what the cost of the
Steam boats would be; to which the Chairman replied "that 80,000*£*
(8 lacs) would cover the whole expense, and they hoped to save that sum
in the first year." (Overland Mail)

It seems to me impossible that no stronger testimony to the prin-
ciples I insist upon as to communications in India, could be afforded than
this striking fact affords. This is not the "theory" of an advocate for
water carriage, but the sober and sure judgment of the head of the
principal Railway undertaking in India. It is his deliberate judgment,
openly declared in the presence of a large assembly of Railway share-
holders, that while, after several years from the commencement of the
expenditure, on, by far, the most important line of Railway in India,
the first 120 miles of the line of greatest traffic, the north-west approach
to the capital of all India, the profit is $7\frac{1}{2}$ per cent. he expects that in
the first year the profit on capital expended on river Navigation will

